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(54) **Title:** ACTIVE COVER PLATES

(57) **Abstract:** A variety of active cover plate configurations with prongs configured to contact side screw terminals of electrical receptacles are described. In one illustrative embodiment, an active cover plate (2205) includes a multi-gang face plate (2214) configured to be installed over a multi-gang light switch installation, the multi-gang faceplate (2214) including at least two apertures (2206) sized to accept a manually manipulatable element of switches in the multi-gang light switch installation. Prongs (2202) extend rearward from the multi-gang faceplate (2214) around at least one of the apertures (2206).

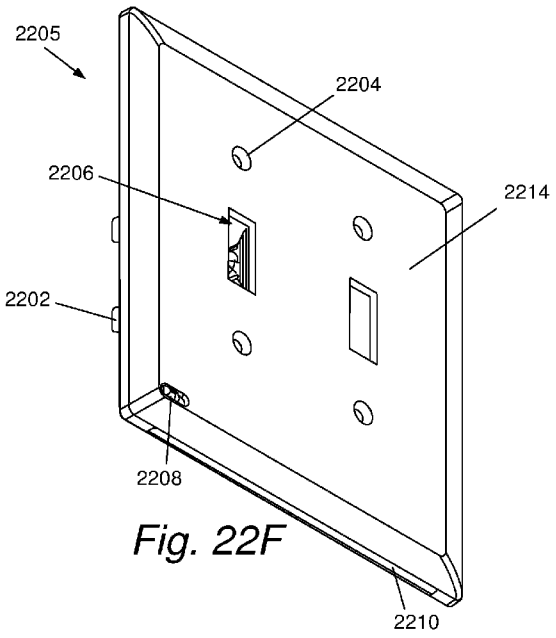

Fig. 22F

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ACTIVE COVER PLATES

RELATED APPLICATIONS

[0001] The present application incorporates the following applications and patents by reference in their entireties:

[0002] U.S. Provisional Patent App. No. 62/579,033, filed on 10-30-2017;

[0003] U.S. Provisional Patent App. No. 62/536,452, filed on 07-24-2017;

[0004] U.S. Provisional Patent App. No. 62/522,691, filed on 06-21-2017;

[0005] U.S. Provisional Patent App. No. 62/460,094, filed on 02-17-2017;

[0006] U.S. Provisional Patent App. No. 62/279,831, filed on 01-18-2016;

[0007] U.S. Provisional Patent App. No. 62/081,539, filed on 11-18-2014;

[0008] U.S. Provisional Patent App. No. 62/027,784, filed on 07-23-2014;

[0009] U.S. Provisional Patent App. No. 61/906,651, filed on 11-20-2013;

[0010] U.S. Provisional Patent App. No. 61/836,972, filed on 06-19-2013;

[0011] U.S. Provisional Patent App. No. 61/778,386, filed on 03-12-2013;

[0012] U.S. Provisional Patent App. No. 61/720,131, filed on 10-30-2012;

[0013] U.S. Provisional Patent App. No. 61/574,344, filed on 08-01-2011;

[0014] U.S. Design Patent App. No. 29/629,812, filed on 12-15-2017;

[0015] U.S. Design Patent App. No. 29/608,301, filed on 06-20-2017;

[0016] U.S. Design Patent App. No. 29/608,300, filed on 06-20-2017;

[0017] U.S. Design Patent App. No. 29/608,299, filed on 06-20-2017;

[0018] U.S. Design Patent App. No. 29/608,297, filed on 06-20-2017;

[0019] U.S. Design Patent App. No. 29/608,296, filed on 06-20-2017;

[0020] U.S. Design Patent App. No. 29/608,295, filed on 06-20-2017;

[0021] U.S. Design Patent App. No. 29/608,294, filed on 06-20-2017;

[0022] U.S. Design Patent App. No. 29/608,292, filed on 06-20-2017;

[0023] U.S. Design Patent App. No. 29/599,679, filed on 04-05-2017;

[0024] U.S. Design Patent App. No. 29/598,255, filed on 03-23-2017, issued as D819,426;

[0025] U.S. Design Patent App. No. 29/594,007, filed on 02-14-2017;

[0026] U.S. Design Patent App. No. 29/594,005, filed on 02-14-2017;

[0027] U.S. Design Patent App. No. 29/594,003, filed on 02-14-2017;

[0028] U.S. Design Patent App. No. 29/594,002, filed on 02-14-2017;

[0029] U.S. Design Patent App. No. 29/551,208, filed on 01-11-2016, issued as D809,899;

[0030] U.S. Design Patent App. No. 29/522,406, filed on 03-30-2015, issued as D810,697;

[0031] U.S. Design Patent App. No. 29/522,404, filed on 03-30-2015, issued as D781,241;

[0032] U.S. Patent App. No. 15/920,047, filed on 03-13-2018;

[0033] U.S. Patent App. No. 15/870,832, filed on 01-12-2018;

[0034] U.S. Patent App. No. 15/708,082, filed on 09-18-2017;

[0035] U.S. Patent App. No. 15/496,872, filed on 04-25-2017, published as US 2017-0229853 A1;

[0036] U.S. Patent App. No. 15/486,280, filed on 04-12-2017, published as US 2017-0222417 A1; issued as U.S. Patent No. 9,917,430;

[0037] U.S. Patent App. No. 15/486,277, filed on 04-12-2017, published as US 2017-0222414 A1, issued as U.S. Patent No. 9,899,814;

[0038] U.S. Patent App. No. 15/486,273, filed on 04-12-2017, published as US 2017-0222364 A1, issued as U.S. Patent No. 9,871,324;

[0039] U.S. Patent App. No. 15/481,318, filed on 04-06-2017, published as US 2017-0214229 A1. issued as U.S. Patent No. 9,882,361;

[0040] U.S. Patent App. No. 15/481,280, filed on 04-06-2017, published as US 2017-0214188 A1, issued as U.S. Patent No. 9,882,318;

[0041] U.S. Patent App. No. 15/428,099; filed on 02-08-2017, published as US 2017-0208663 A1, issued as U.S. Patent No. 9,832,841;

[0042] U.S. Patent App. No. 15/409,508, filed on 01-18-2017, published as US 2017-0208657 A1, issued as U.S. Patent No. 9,807,829;

[0043] U.S. Patent App. No. 15/406,404, filed on 01-13-2017, published as US 2017-0125947 A1, issued as U.S. Patent No. 9,742,111;

[0044] U.S. Patent App. No. 15/281,191, filed on 09-30-2016, published as US 2017-0018890 A1, issued as U.S. Patent No. 9,755,374;

[0045] U.S. Patent App. No. 15/280,491, filed on 09-29-2016, published as US 2017-0018897 A1, issued as U.S. Patent No. 9,774,154;

[0046] U.S. Patent App. No. 15/145,749; filed on 05-03-2016, published as US 2016-0248202 A1, issued as U.S. Patent No. 9,787,025;

[0047] U.S. Patent App. No. 14/678,746, filed on 04-03-2015, published as US 2015-0229079 A1, issued as U.S. Patent No. 9,768,562;

[0048] U.S. Patent App. No. 14/549,143, filed on 11-20-2014, published as US 2015-0075836 A1, issued as U.S. Patent No. 9,362,728;

[0049] U.S. Patent App. No. 14/066,637, filed on 10-29-2013, published as US 2014-0054060 A1, issued as U.S. Patent No. 9,035,181;

[0050] U.S. Patent App. No. 14/066,621, filed on 10-29-2013, published as US 2014-0054059 A1, issued as U.S. Patent No. 9,035,180; and

[0051] U.S. Patent App. No. 13/461,915, filed on 05-02-2012, published as US 2013-0032594 A1, issued as U.S. Patent No. 8,912,442.

BACKGROUND

[0052] Modern buildings include wiring to deliver electrical power to lights, outlets, and other devices. The electrical wiring terminates in an electrical box in a wall, ceiling, floor or connected to another structural element. Connections are made to the wiring in the electrical box. For example, electrical wiring may be connected to switches by stab-in connectors or with screw terminals on the sides of the switch body. After installation, a cover plate is placed over the switch body to cover the opening to the box while allowing access to manually manipulate the switches.

BRIEF DESCRIPTION OF THE DRAWINGS

[0053] The accompanying drawings illustrate various examples of the principles described herein and are a part of the specification. The illustrated examples are merely examples and do not limit the scope of the claims.

[0054] Figures 1A-1D are views of two different switches, according to one example of principles described herein.

[0055] Figures 2A and 2B are diagrams of electrical systems that include a switch and a load controlled by the switch, according to one example of principles described herein.

[0056] Figures 3A-3C show an illustrative active cover plate for a rocker light switch, according to one example of principles described herein.

[0057] Figures 4A-4C show an illustrative active cover plate for a toggle light switch, according to one example of principles described herein.

[0058] Figure 5 shows an active cover plate installed over a rocker light switch, according to one example of principles described herein.

[0059] Figures 6A-6E show one illustrative embodiment of a prong for an active cover plate, according to one example of principles described herein.

[0060] Figures 7A-7E show one illustrative embodiment of a prong for an active cover plate, according to one example of principles described herein.

[0061] Figures 8A-8E show one illustrative embodiment of a prong for an active cover plate, according to one example of principles described herein.

[0062] Figures 9A-9E show one illustrative embodiment of a prong for an active cover plate, according to one example of principles described herein.

[0063] Figures 10A and 10B are diagrams of illustrative circuits that include light switches, loads and active cover plates connected over the light switches, according to one example of principles described herein.

[0064] Figures 11A and 11B are diagrams of illustrative circuits that include light switches, loads and active cover plates connected over the light switches, according to one example of principles described herein.

[0065] Figure 12 is a diagram of a system for controlling loads with active cover plates, according to one embodiment of principles described herein.

[0066] Figure 13 shows one example of a three-way light switch, according one example of principles described herein.

[0067] Figure 14 shows one example of a four-way light switch, according one example of principles described herein.

[0068] Figures 15A-15C are diagrams of illustrative prongs and active cover plates for multi-pole light switches, according to one example of principles described herein.

[0069] Figures 16A-16E are diagrams of illustrative active cover plates and installation tools for multi-pole light switches, according to one example of principles described herein.

[0070] Figures 17A-17D are diagrams of illustrative active cover plates, prongs, and installation tools for multi-pole light switches, according to one example of principles described herein.

[0071] Figure 18 is a flow chart for installing an active cover plate over an electrical receptacle, according to one embodiment of principles described herein.

[0072] Figures 19A-19D include a flow chart of an illustrative method for installing an active cover plate using an installation tool, according to one example of principles described herein.

[0073] Figure 20 is an illustrative diagram of an electrical system that includes a double gang light switch installation that controls two separate loads, according to one example of principles described herein.

[0074] Figure 21 is another illustrative diagram of an electrical system that includes a double gang light switch installation that controls two separate loads, according to one example of principles described herein.

[0075] Figures 22A-22G show views of active cover plates for double gang light switches, according to one example of principles described herein.

[0076] Throughout the drawings, identical reference numbers designate similar, but not necessarily identical, elements.

DETAILED DESCRIPTION

[0077] Reference will now be made to the figures wherein like structures will be provided with like reference designations. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present systems and methods. It will be apparent, however, that systems and methods may be practiced without these specific details. It is understood that the figures are diagrammatic and schematic representations of some embodiments of the invention, and are not limiting of the present invention, nor are they necessarily drawn to scale. Reference in the specification to "an example" or similar language means that a particular feature, structure, or characteristic described in connection with the example is included in at least that one example, but not necessarily in other examples. Additionally, features shown and/or described in connection with one figure may be combined with features shown and/or described in connection with other figures.

[0078] Switches are a standard electrical receptacle/fixture in modern homes. Switches are typically placed near entryways or doors so that a person entering or leaving an area can easily turn on or off the lights or appliances. The position of the switch installations makes them ideal for incorporating nightlights, guidelights, or illuminated images. For example, if a switch installation incorporated a nightlight, the nightlight would illuminate the entry way, the floor around the entryway and the light switch itself. The nightlight would provide a valuable reference point to allow a home owner to orient themselves and properly navigate the area.

[0079] While the attractiveness of nightlights incorporated into switch installations is clear, there are a number of significant challenges in designing a nightlight that is easy to install and provides the desired level of illumination without adverse effects.

[0080] Standard switches in North America (Canada, United States, Mexico, etc.) have two standard styles: toggle and décor. Figures 1A and 1B show a décor switch (100), also called a rocker switch. The switch (100) includes a rocker paddle (105) and a body (110). To change the state of the switch and its controlled load, the user depresses either the top or bottom of the paddle (105). This changes the internal state of contacts within the switch (105) to either connect or disconnect the electrical load from a power source. The body (110) of the switch includes two screw terminals (115, 120) and a yoke (130). The screw terminals (115, 120) serve as attachment points for electrical wiring. For example, a "hot" wire may be attached to one of the terminals and a traveler wire may be attached to the other terminal. The hot wire supplies electrical power to the switch and the traveler wire connects the switch to the electrical load. When the switch (100) is in the ON position, internal contacts connect the first screw terminal (115) to the second screw terminal (120) and electrical energy is available to the load. When the switch is in the OFF position, the internal contacts do not make a connection between the screw terminals and there is no electrical power available to the load.

[0081] The yoke (130) provides a structure to connect the switch (100) to a housing such as an electrical box. In some switches, the yoke or bracket (130) is metal and may be connected to a ground screw terminal (125). A ground wire may be connected to the ground screw terminal (125) to ensure that if there is a fault in the electrical system and electricity is applied to the yoke (130), this electricity will be dissipated through the ground wire.

[0082] Figures 1C and 1D show an illustrative example of a toggle switch (150). The switch (150) includes a toggle (165), a yoke (160), two screw terminals (172, 175) and a ground terminal (155). To operate the toggle switch (150) a user moves the toggle (165) either up or down to change the state of the internal contacts in the toggle switch (150). As discussed above, this either connects or disconnects the internal electrical path between the two screw terminals (172, 175). The yoke (160) in this example is metal and can be electrically connected to a ground wire using the ground screw terminal (155).

[0083] One method of connecting the wires to the screw terminals (172, 175) includes loosening the screws and wrapping the electrical wire around the shaft of the screw, then

tightening the screw to sandwich the wire between the head of the screw and the switch body (170). Figure 1D also shows an alternative mechanism for connecting wires to the screw terminals. This alternative connection uses stab-in connectors (177, 179). The end of the electrical wire is stripped and forced into the stab-in connectors (177, 179) to make an electrical connection with the internal contacts without utilizing screw terminals. Even when stab in connectors are used the screw terminals (172, 175) remain part of the electrical circuit.

[0084] Figure 2A is a block diagram showing an illustrative electrical system (200) for controlling a load. In this example, the system (200) includes a switch (202), wiring (215, 210, 225) and an exterior load (220). In this case the exterior load (220) is illustrated as an overhead light, but the load could be any electrical load that can be controlled by a switch, including lamps, motors, fans, air conditioners, etc. Terminal A (217) of the switch (202) is connected to a hot wire (215). The hot wire (215) is part of the power distribution in the house or building and delivers electricity to the system. The switch (202) includes internal contacts (235) which control the flow of electrical current through the switch. In this case the internal contacts (235) are closed. This allows a current flow (240) through the switch to terminal B (218) which is connected to a traveler wire (210) that is connected to the load (220). The current passes through the load (220) and into the neutral wire (225). The neutral wire (225) acts as a sink for the electrical current.

[0085] Figure 2B is a block diagram showing an illustrative electrical system (200) for controlling a load (220) that has been modified by placing an active cover plate (205) over the switch (202). In this example, the internal contacts (235) are open so that no current flows through the switch (202) and the light (220) is nominally OFF. This creates a voltage differential across the terminals (217, 218), with terminal A (217) having a high voltage because it is connected to the hot wire (215) and terminal B (218) having a lower voltage because it is disconnected from the hot wire (215) and is connected to the neutral wire (225) through the load (220).

[0086] The active cover plate (205) contacts the terminals (217, 218) of the switch (202) to extract electrical power. Thus, in the configuration shown in Figures 2A and 2B, the active cover plate can only extract power when there is a voltage difference across the terminals (217, 218). When the internal contacts (235) are closed, the two terminals are electrically connected by the internal contacts and are at substantially the same voltage. There may be a very small voltage difference between the two terminals that is related to the contact

resistance of the internal contacts. Ordinarily, this small voltage difference does not provide a useful amount of current. Thus, the load (230) inside the active cover plate (205) in the configuration shown in Fig. 2B may only have access to substantial amounts of electrical power when the internal contacts (235) are open and the switch is OFF.

[0087] The bypass current (241) passes from terminal A (217) to terminal B (218) through the load (230) in the active cover plate (205). Thus, the active cover plate (205) bypasses the switch (202) and independently introduces a current into the traveler wire (210) that then passes through the exterior load (220) and to the neutral wire (225).

[0088] Figures 3A, 3B and 3C show a rear, side, and front view, respectively, of an illustrative active cover plate (300) for a rocker or décor light switch (see e.g. Figs. 1A, 1B). Fig. 3A shows that the active cover plate (300) includes a face plate (305), a back plate (310), and two prongs (315) extending rearward from the face plate (305). The prongs (315) are configured to contact the screw terminals (115, 120; Fig. 1A) of the décor light switch (100; Fig. 1A). A circuit board (311) represented by the dashed shape is sandwiched between the face plate (305) and the back plate (310). The circuit board (311) is connected to the prongs by conductors (312) represented by the dotted lines. When electrical power is available at the prongs (315) (i.e. when there is a voltage difference between the prongs) the circuit board (311) can produce illumination (314). In this case, the illumination (314) extends downward from a bottom edge of the active cover plate (300). There are a wide variety of other ways that the active cover plate (300) could be configured. For example, the illumination may project out of different locations and/or be presented in different patterns. The illumination may be a continuous bar or may be segmented into two, three or more segments. The illumination could be produced by individual LEDs, LED filaments or other light sources. The location and size of the circuit board is just one example. In other embodiments, the circuit board may be a different size such as a simple rectangle and/or may be divided into multiple sections or may be in other locations with respect to the cover plate. Further, the prongs may have different shapes, quantities and locations. For example, there may be two, three, four or five prongs at various locations and with various shapes on the cover plate. Several illustrative examples are described below.

[0089] Figure 3B shows a side view of the active cover plate (300) with the prongs (315) extending rearward from the face plate (305). Figure 3C shows a front view of the active cover plate (300) with the prongs (315) visible through the rectangular aperture of the face

plate (305). The prongs (315) include contacts (322) that may be configured to contact the side screw terminals of a light switch (see e.g. 115, 120; Fig. 1A-1B).

[0090] In general, users of active cover plates may desire some amount of control over the light output or other functionality within the active cover plate. For example, the user may install an active cover plate over a light switch in an entry way and another active cover plate over a light switch in an adult bedroom. The user may want high levels of illumination near the entry way, but lower levels of illumination in the adult bedroom. Additionally or alternatively, the user may wish to turn the illumination function off for a period of time. Further, the user may wish to perform any number of other operations, including changing the color or color temperature of the illumination. The switch/lens cover (320) can provide this control by allowing the user to manually select various functions of the cover plate (300).

[0091] Figures 4A, 4B and 4C show a front, side, and rear perspective view, respectively, of an illustrative active cover plate (400) for a toggle or standard light switch (see e.g. Figs. 1C, 1D). Figure 4A shows a front of the active cover plate (400), including the face plate (405) and the switch (420) in the lower left corner of the face plate. Figure 4B shows a side view of the active cover plate (400) with prongs (415) extending rearward from the faceplate (405).

[0092] Fig. 4C shows that the active cover plate (400) includes a faceplate (405), a back plate (410), and two prongs (415) extending rearward from the face plate (405). The prongs (415) are configured to contact the screw terminals (172, 175; Fig. 1D) of the toggle light switch (150; Fig. 1D). The prongs (415) include insulating hoods (412) and contact surfaces (422). The insulating hoods (412) provide for smooth installation and prevent undesired electrical contact with surrounding conductors when the cover plate is installed over the switch (150, Fig. 1C). The contact surfaces (422) are configured to contact the screw head or other conductors of the side screw terminals (172, 175; Fig. 1D) on the light switch.

[0093] Figure 5 is an end view of an active cover plate (300) installed over a décor switch (100). The faceplate (305) of the active cover plate fits around the rocker/paddle (105) of the light switch (100). The prongs (315) extend rearward around the shoulder (111) of the switch body (110) so that the contact surfaces (322) electrically contact the screw terminals (115, 120, Figs. 1A, 1B). The contact between the contacts (322) and the screw terminals (115) supplies electrical power to the circuit in the active cover plate (300). This is only one example of a technique for extracting power from the switch or wiring. A variety of other

techniques could also be used. For example, the cover plate may have wires with a stripped portion or spade connectors that could be attached to the screw terminals on the switch or directly to the wiring that supplies electrical power to the switch.

[0094] Figures 6A-6E show one illustrative embodiment of a prong (600) for an active cover plate. Figure 6A is a top view of the exemplary prong (600). Figure 6B is a front view, Figure 6C is a bottom view, Figure 6D is a side view and Figure 6E is a rear view of the prong (600). This prong (600) may be used in any of a variety of active cover plates, including active cover plates for rocker/décor light switches that have two or four prongs. For example, this prong or other prong may be used for both toggle and rocker light switches. As discussed above, the prong may be attached to the faceplate/back plate and extends rearward from the faceplate.

[0095] In this example, the prong includes both front (608) and rear insulation (604). This insulation may protect the conductive elements of the prong from contact with other conductive elements that may be present during installation or operation of the active cover plate. The front insulation (608) may insulate against electrical contact with the metal yoke of light switches or other elements and the rear insulation (604) may insulate against electrical contact with electrical conductors in the electrical box and against contact with conducting electrical boxes.

[0096] In this case, the insulating cover (617, Fig. 6D), comprising the rear insulation (604), front insulation (608), side ramps (606) and main ramp (612), may all be formed as a single piece of insulating material, with the front insulation (608) connected to the rear insulation (604) along a bottom edge(s) by a living hinge(s) (610). The living hinge (610) in this example is a thin piece of plastic that bends to allow the front insulation (608) and rear insulation (604) to sandwich the flexible conductor (603) between them. The front and rear insulation (608, 604) can be joined using any of a number of techniques, including sonic welding, adhesive, heat pressing, cold pressing (such as compressing a stake or post that connects the front and rear insulation), or other suitable technique. In this example, the top portions of the front and rear insulation are joined by a sonic welding joint (613) as shown in Figure 6E. The rear insulation (604) includes a depression (618) that mates with the backside of the contact (622). This produces a join line (616) between the front and rear insulation.

[0097] In this case the flexible conductor (603) is a flexible metal strip that forms both the base (602) which is secured to the faceplate, backplate or other element, and the contact (622)

which is formed in the flexible metal strip. A variety of other conductors could be used including wire, flexible circuitry, conductive plastic or other appropriate conductor. The prong may have any of a variety of shapes, including the shape shown in Figures 6A-6D. For example, the prong (600) may have an elbow or bend (607) that allows the prong to reach around the shoulder of a rocker/décor light switch (see e.g. Figures 5, 17B).

[0098] The contact (622) protrudes out of an aperture in the insulation. The contact may be formed in any of a number of ways. It may be an integral part of the flexible metal strip or it may be a separate piece, such as a rivet or other appropriate conductor that is electrically connected to the flexible conductor (603). The contact (622) in this example has a generally oval or elliptical shape. This shape allows for contact with screw terminals with different locations/sizes on a range of different light switches. In this example, the primary or major axis of the contact is at an angle with respect to a vertical line of symmetry of the prong and with respect to a vector that is perpendicular to the rear surface of the face plate. This rotation may serve a number of purposes, including preventing arcing between structures on the light switch.

[0099] The prongs may also include a number of ramps (606, 612) surrounding the contact. As discussed previously, the ramps (606, 612) allow the active cover plate to be installed more easily. The side ramps (606) allow for vertical motion of the active cover plate to align the prongs with the screw terminals and the aperture in the face plate with the light switch toggle and/or rocker. The main ramp (612) in this case is a short, curved shape. This shape is sufficient to guide the prongs around the outlet and outward when the screws in the screw terminals are screwed out. In other words, the main ramps (612) are just long enough not to catch between the head of the screw and the body of the outlet when the screws are out. The length of the main ramp (612) in this example is significantly shorter than in some other embodiments. The length of the main ramp (612) may be short to prevent interference with other elements in the box. In light switch installations, the body of the light switch is often narrower than outlets which tends to have the prongs protrude into the central area of the box rather than along the walls in outlet installations. This brings the prongs into closer proximity to (and potentially into contact with) wires in the box. This may be for a number of reasons: first, there may be a number of wire bundles, wire nuts and other elements in the receptacle box. In some instances, it was found that long main ramps may contact these elements in the receptacle box and lift the contacts away from the screw terminals. This can be mitigated by

shortening the main ramps and rapidly curving the main ramp away from the switch body (outward). Second, when these prongs are used in two prong configurations (see e. g. active cover plates shown in Figures 3A-4C) because both prongs are on the same side of the switch body, there may be reduced need for the prongs to guide the light switch cover plate around the body of the light switch. The prongs can be inserted on the appropriate side of the light switch and then the cover plate moved into place to align the aperture in the face plate of the cover plate with the toggle or rocker of the light switch.

[00100] Figures 7A-7E show one illustrative embodiment of a prong for an active cover plate. Figure 7A is a top view of the exemplary prong (715). Figure 7B is a front view, Figure 7C is a side view, Figure 7D is a rear view and Figure 7E is a perspective view of the prong (715). This prong (715) may be used in any of a variety of active cover plates, including active cover plates for toggle light switches that have two or four prongs. As discussed above, the prong (715) may be attached to the faceplate/back plate and extends rearward from the faceplate (see e.g. Figures 16B-16E).

[00101] In one illustrative embodiment, four of these prongs (715) may be used in an active cover plate with four prongs for a toggle light switch as shown in Figures 16B-16E and 19B-19D. This configuration will work with a variety of light switches including single pole switches (two screw terminals and a ground terminal), three-way switches (three screw terminals and ground terminal) and four-way (four screw terminals and ground terminal) light switches. Illustrative examples of these light switches are shown in Figures 1C, 1D, 13 and 14.

[00102] As shown in Figures 7A-7E, the prong (715) in this embodiment may be different in some respects than other illustrative prongs described herein. In this configuration, the prongs (715) may be straighter than in other embodiments. This may be for a number of reasons. The toggle light switches (see e.g. Figures 1C, 1D, 13 and 14) vary in width but typically do not have the wide shoulders and recessed screw terminals of the rocker/décor switches. Consequently, the bend or elbow in the prongs more specifically designed for rocker light switches may not be needed (see e.g. Figures 6A-E and Figures 9A-9E for examples of prongs specifically designed for rocker light switches). Further, the straight/upright configuration of the prongs (715) may allow for an easier installation over the lights switches.

[00103] In this example, the prong (715) includes a flexible conductor (711), a base (702) with mounting apertures (720), rear insulation (704), front insulation (708), an off-axis contact (722), side ramps (706), and a main ramp (712). The front and rear insulation (708, 704) may be separate pieces that are joined to each other or may be formed as a single piece that is folded or formed around the contact (722). As shown in Figures 7A, 7C, and 7D, the front and rear insulation (708, 704) may be joined by a joining post (724) that can be swaged, heat staked, cold staked, glued, etc., to join the front and rear insulation. A variety of other techniques could also be used to join the front and rear insulation (708, 704), such as sonic welding, mechanical fasteners, etc. As discussed above, the front and rear insulation (708, 704) may be designed to protect the conductive elements of the prong from contact with other conductive elements that may be present during installation or operation of the active cover plate. In this case, the insulating cover, comprising the rear insulation (704), front insulation (708), side ramps (706) and main ramp (712) may all be formed as a single piece of molded material, with the front insulation (708) connected to the rear insulation (704). This connection could be formed in a variety of ways, including using a living hinge(s) (710). The main ramp in this embodiment, is generally angled away from the contact and relatively straight and short. This shape can assist in guiding the prongs around the outlet and outward when the screws in the screw terminals are screwed out. The length of the main ramp (712) may be short to prevent interference with other elements in the box. In light switch installations, the body of the light switch is often narrower than outlets which tends to have the prongs protrude into the central area of the box rather than along the walls in outlet installations. This brings the prongs into closer proximity to (and potentially into contact with) wires in the box.

[00104] Figures 8A-8E show one illustrative embodiment of a prong (815) for active cover plates. Figure 8A is a top view of the exemplary prong (815). Figure 8B is a front view, Figure 8C is a bottom view, Figure 8D is a side view, and Figure 8E is a rear view of the prong (815). This embodiment has some similarities with the prong described above and shown in Figure 6A-6E and includes an elbow (821). The prong (815) can be used in any of a variety of active cover plates, including active cover plates for rocker light switches that have two or four prongs. However, as with other prong designs, the prong and/or principles that it embodies may be used in conjunction with a variety of other configurations of light switches, including toggle light switches.

[00105] In this example, the prong (815) includes a base (802) with mounting apertures (820), rear insulation (804), front insulation (808), an off-axis contact (822), side ramps (806), and a main ramp (812). The front and rear insulation (808, 804) may be separate pieces that are joined to each other or may be formed as a single piece that is folded or formed around the contact. As shown in Figures 8A, 8D, and 8E, the front and rear insulation (808, 804) may be joined by a joining post (824) that can be swaged, heat staked, cold staked, glued, etc., to join the front and rear insulation (808, 804). A variety of other techniques could also be used to join the front and rear insulation, such as sonic welding, mechanical fasteners, etc. As discussed above, the front and rear insulation (808, 804) may be designed to protect the conductive portions of the prong from undesirable contact with other conductive elements that may be present during installation or operation of the active cover plate. In this case, the insulating cover (817), comprising the rear insulation (804), front insulation (808), side ramps (806) and main ramp (812) may all be formed as a single piece of molded material, with the front insulation (808) connected to the rear insulation (804). This connection could be formed in a variety of ways, including using a living hinge(s) (810) and securing it with the joining post (824).

[00106] The main ramp (812) in this embodiment generally has a forward/inwardly curving profile. This forward leaning profile may place the tips/ends of the ramps closer together than the contacts. This profile may be counter intuitive, particularly in four prong configurations (see e.g. Figure 17A) because the main ramps of the opposing prongs obscure the opening between the prongs and would interfere with the switch passing between the prongs. However, when the prongs are installed with the aid of an installation tool (see e.g. Figure 17E) the prongs and main ramps are positioned outward and the ramps become more vertical and assist the user in guiding the cover plate over the electrical receptacle (see e.g. Figs. 17C, 18, and 19).

[00107] Figures 9A-9E show one illustrative embodiment of a prong (915) for an active cover plate. This prong is similar in many respects to the prong shown in Figures 6A-6E and Figures 8A-8E. Figure 9A is a top view of the exemplary prong (915). Figure 9B is a front view, Figure 9C is a side view, Figure 9D is a rear view, and Figure 9E is a bottom view of the prong (915). In this example, the prong (915) includes a base (902) with mounting apertures (928), rear insulation (904), front insulation (908), an off-axis contact (922), side ramps (906), and a main ramp (912). The base (902) may wire attach features (926) and

mounting features (928) such as apertures. The front and rear insulation (908, 904) may be separate pieces that are joined to each other or may be formed as a single piece that is folded or formed around the contact. These are only examples. Prongs could have a number of variations and alternative features. In this embodiment, the contact (922) may be round, rectangular, or some alternative geometry instead of an off-axis oval. In this embodiment, the prong (915) includes an indentation in the rear insulation (932) that conforms to the back side of the contact (922). In this example, the front insulation (908) uniformly covers the front of the prong and wraps around to the rear insulation. The joint/joining line (930) between the front and rear insulation occurs on the back side of the contact. The front and back insulation (908, 904) can be joined together along this joint/join line (930) using a variety of techniques including sonic welding.

[00108] As discussed above, when secured to a faceplate as part an active cover plate the main ramps are very close in their relaxed position (without the install tool in place). The elbows (921) allow the prongs to fit around the shoulders of décor light switches. It should be noted, that although these prongs are specifically designed to be used with décor/rocker light switches, they may be used with toggle light switches or in other situations as well.

[00109] The prongs shown and described above and in other locations in documents incorporated by reference are only illustrative examples. A number of different geometries, materials, and configurations could be used. For example, the geometry of the prongs could be changed to any appropriate configuration that was adapted to fit or contact the screw terminals of the light switches. For example, as discussed in previously filed documents, there may be one or more contacts on a prong. The insulation configurations may be different. The conductors used may have different geometries, including using wires as the strip conductors. The number of prongs may be adapted to specific or general electrical receptacle configurations. These and any of a number of other modifications could be made within the teachings and principles described herein.

[00110] Figure 10A shows a block diagram of an electrical system (1004) that includes an active cover plate (1012) that is installed over a switch (1005) which is connected to a hot wire (1010) and controls an external load (1006). When the switch is in the open position (as shown), one terminal of the switch has 120V and the other terminal has a lower voltage (shown here as 0V). In this configuration, the active cover plate (1012) has access to the voltage difference between the two terminals and can extract power from the switch by

passing a current from a first terminal of the switch, through the circuit (1014) and into the lower voltage terminal (labeled "0V"), through the external load (1006) and into the neutral wire (1008). As mentioned elsewhere, there may be a limit to the amount of current and/or power that can be utilized by the circuit (1014) before the external load (1006) reacts in an undesirable way (for example a light bulb may flash or illuminate).

[00111] Figure 10B shows the same electrical system (1004) with the light switch (1005) in the ON position. In this position, the hot wire (1010) is connected to the traveler wire (1011) and electrical current flows directly to the load (1006) and out the neutral wire (1008). The two terminals are electrically connected in the switch and have the same approximate voltage at each terminal. In this case the circuit (1014) in the active cover plate (1012) does not have access to power because the two terminals have the same voltage potential (120V).

[00112] The examples given above are only illustrative circuit designs. There are a number of other configurations and circuit designs that could be used in accordance with the principles described. There may be additional techniques that provide larger amounts of power from a switch without causing undesirable behavior by the load controlled by the switch. For example, users who turn on a light switch typically want the area to be illuminated immediately. This is because the user is typically stepping into a room and needs the illumination to help them navigate and/or see the contents of the area. However, users may not particularly care that lights immediately turn off when a switch is turned off. For example, upon going to bed, a user may appreciate that the lights don't immediately turn off, because the gradual dimming of the lights provides their eyes time to adjust to the darkness and gives them time to get to the bed before the room is entirely dark.

[00113] This desirable "dimming" effect can be utilized to extract energy from the light switch circuit and store it in an active cover plate or other device. According to one embodiment, after the light switch is turned off, the circuit in the active cover plate allows relatively large amounts of current to flow through the circuit so that the light gradually dims. A capacitor, battery, or other storage device can tap into the current that is still flowing through the circuit and light as it dims. In one example, the mechanical switch itself is disconnected, but a significant amount of current passes through the parallel circuit in the active cover plate, charging the capacitor or other storage device. As the device charges, this current flow decreases and the lights gradually dim. In one embodiment, an ultra-capacitor is charged over the course of several seconds while the lights dim. The ultra-capacitor is then

discharged to charge a lithium ion battery. However, this is only one embodiment. A variety of other embodiments could be used. For example, a fast charging battery could be charged during the dimming of the light and be used as a battery source to supply energy to the circuit at a later point or when the lights are on.

[00114] Other implementations for extracting power from light switch circuits includes never turning the light on and simply allowing the parallel circuit in the active cover plate to conduct all the power required by the load connected to the switch. Thus, when the light is on, the circuit could extract a significant amount of power from the current flow without disrupting the lighting. This creates the significant challenge of handling up to the maximum rated circuit capacity through the prongs or other contacts. Several approaches could be used individually or in combination to address this. For example, one approach would be to monitor current flow through the prongs and cover plate circuitry and throttle the flow if it became excessive or exceeded the current draw the prongs or circuitry were rated for. A similar approach would be to monitor the temperatures of the prongs and/or circuitry. If the temperatures were high, the circuit could shut down or reduce the amount of current. Other approaches may include circuitry that detects arcing or excessive contact resistance at the prongs. If arcing, heating or an increase in contact resistance was detected, the circuitry could shut down or throttle the current flow.

[00115] Figures 11A and 11B an illustrative electrical system (1004) that includes an active cover plate (1012) that is installed over a switch (1005) connected to a hot wore (1010) and a traveler wire (1011) and typically controls an external load (1006). In this example, the electrical system (1004) includes circuitry that allows the active cover plate (1012) to obtain power when the light switch is on or off. As shown in Figure 11A, when the switch (1005) is in the open position (as shown), one terminal of the switch has 120V and the other terminal has a lower voltage (shown here as 10V). In this configuration, the active cover plate (1012) has access to the voltage difference between the two terminals and can extract power from the switch by passing a current from a first terminal of the switch, through the circuitry and into the lower voltage terminal (labeled "10V"). The current then passes through the external load (1006) and into the neutral wire (1008). As mentioned elsewhere, there may be a limit to the amount of current and/or power that can be utilized by the active cover plate circuit before the external load (1006) reacts in an undesirable way (for example a light bulb may flash or illuminate). To obtain power regardless of the on or off state of the

load, the active cover plate (1012) includes an internal switch (1102), a regulator (1106) and a load (1108). The internal switch (1102) includes three nodes (A, B, and C). Node A is the input node and the internal switch can connect node A to either node B or node C. When there is a voltage difference across the switch terminals (nodes A and E) the internal switch (1102) may make a connection from node A to node C. This connects the voltage to the regulator (1106). The regulator is also connected to node D/E. The regulator (1106) can modify/condition the voltage/current that is available and supply it to the load (1108). In this configuration, the transformer (1104) is not electrically connected and does not have substantial current passing through it.

[00116] Figure 11B shows the same electrical system (1004) but the load (1006) is ON and receiving power through the active cover plate (1012). In this example, the two terminals A and E of the switch (1005) remain open and have different voltages. Terminal/node A has the input line voltage (nominally 120 V). The internal switch (1102) connects node A and node B. Node B is connected to one leg of a transformer (1104). The electrical current flows from node A to node B, through the transformer and out to node D and node E. In this case there is some voltage drop through the transformer leg BD. This was arbitrarily selected to be a 10 volt drop, which is reflected in the 110 voltage at node E. The opposite leg of the transformer (1104) is connected to the regulator (1106) which uses the power transferred by the transformer (1104) to power the load (1108). Consequently, the electrical power supplied to the load (1006) passes from node A to node E through the cover plate (1012).

[00117] The configurations shown in Figures 11A and 11B allow the active cover plate (1012) to obtain power whether the load is off or on. This is significant because it allows the active cover plate (1012) installed over a light switch to support a wider range of loads, including loads that need a constant power source. For example, loads that may need a constant power source include networking, sensor, and actuation loads. In one embodiment, the light switch may include a motion or other occupancy sensor(s) that communicate wirelessly to other devices and/or cover plates. The active cover plate (1012) may include any number of additional components, including capacitors or batteries to better accommodate transient power events.

[00118] Figure 12 shows an illustrative system (1200) that uses various active cover plates (1202, 1203, 1208, 1217) to control various loads, provide illumination and/or sense environmental conditions. In one embodiment, several of the active cover plates (1202,

1203) contain a circuit that includes the principles described with respect to Figures 11A and 11B. Specifically, the active cover plates (1202, 1203) are capable of activating a load without changing the position the manual switch. In this example, a first active cover plate (1202) has activated the load (1206) by routing the current through the cover plate while the manual light switch remains off. The second active cover plate has switched the load (1207) off. Thus, control of the internal switch (1102, Figure 11A, 11B) in the active cover plates (1202, 1203) provides for control of their respective loads (1206, 1207). The active cover plates (1202, 1203) may have wireless or wired interconnectivity to send and receive signals from other devices. In this example, the active cover plates (1202, 1203) connect to a mesh network (1204) as represented by the nodes adjacent to the active cover plates. The mesh network may be of any appropriate type, including Bluetooth Low Energy (BLE), Thread, Zigbee, Z-Wave, 802.11 based mesh networks, or other appropriate or future developed network. Although the network is illustrated as being a mesh network, other network topologies and protocols may be appropriate. For example, master/slave networks may be used. A second WiFi network (1206-1 to1206-6) is also shown. However, because the WiFi network consumes a large amount of power, power constrained devices such as battery powered sensors (1216) and active cover plates (e.g. 1202, 1203) connected to light switches may use the lower power mesh network protocol (1204). In other embodiments, the active cover plate(s) mounted over light switches may actuate to manually change the position of the switch mounted in the electrical box upon receiving an externally or internally generated command.

[00119] In the system (1200) may also include various mobile devices (1220), routers (1214), various smart devices such a Google Home (1212) or Amazon's Alexa (1210) devices, various home security devices (e.g. 1215), motion active cover plates (1217), and various sensors (1216). In one embodiment, an active cover plate (1208) can be used as a bridge to translate/relay data from the mesh network (1204) to devices that use other protocols. For example, if the network uses Zigbee or Z-Wave, the bridge active cover plate (1208) could translate the communications into another protocol such as Wi-Fi or BLE so that more devices could participate. One significant consideration of which protocol to use for the mesh network is the power consumption required to participate. It may be beneficial for devices that have limited power input or reserves for the network/protocol to have lower power requirements. Examples of devices with more limited available power may include

battery or solar powered sensors, mobile devices, active cover plates connected to sensitive loads, etc. Network protocols that have lower power requirements may include BLE, Zigbee, security communications in designated or other bands (e.g. 433 MHz, 900 MHz, 1800 MHz, etc.) and Z-Wave networks. Future arising networks and custom networks may also be used. In this example, the bridge active cover plate (1208) is shown as a cover plate that is configured for outlets, where there are fewer power restrictions than light switches. Consequently, it has access to more power and can transmit and receive at multiple frequencies and with higher powered protocols than other devices with more limited power.

[00120] In one example, a user may wish to turn off a light (1206) but is out of the house. Using their mobile phone, the user communicates over the internet/cell network to the router (1214) which may not have direct access to the low power protocol/mesh network to control the BLE lighting control active cover plate (1202). The router sends a Wi-Fi signal which is accepted by the bridge active cover plate (1208) and translated into BLE protocol and passed through the mesh (1204) to the lighting control active cover plate (1202) which then changes the configuration of its internal switch or other element to turn the light (1206) off. For example, the configuration of the internal switch may be changed from making a connection between terminals A and B (as shown in Figure 11B) to making a connection between A and C (as shown in Figure 11A).

[00121] The previous examples are directed to single pole switches that have two screw terminals for connection of hot and neutral wires and one additional screw terminal for connection of a ground wire. These single pole switches are used where only one switch controls the exterior load. However, the principles described herein also apply to situations where multiple switches control the load, multi-pole switches are used. For example, three-way and four-way switches are used in rooms with multiple entrances, such as hallways, stairways, and larger rooms. One light switch is located at each entrance so that a user entering from any entrance can control the overhead lights. The electrical system is configured so that changing the state of any switch results in a change in the load state. Consequently, the lights can be turned ON or OFF from any entryway/switch.

[00122] The embodiments described above are only illustrative. The network may have more components or less components than illustrated. For example, a group of active cover plates that contain motion detectors (e.g. 1217) or other sensors may communicate between each other without other components or networks. For example, there may be a network of

motion sensing active cover plates that include one or more cover plates with motion sensors. There may be additional active cover plates that are connected to the network or receive commands from the network that do not have motion or other sensors. When motion is detected by an active cover plate, it may send a signal to other active cover plates that signals them to take an action. For example, a motion sensing active cover plate (1217) may be located near an entrance to a home. When the motion sensing active cover plate (1217) senses motion, it may take an internal action (such as illuminating the surrounding area or turning on an exterior light) as well as sending a signal to other active cover plates that are connected to its network or subnetwork. These active cover plates may then respond by taking appropriate actions such as illuminating, increasing illumination, decreasing illumination, turning off illumination, forwarding the command/signal to other active cover plates, etc. In some embodiments, a subnetwork or channel may be manually or electronically selected by a user to group the cover plates. For example, a user may select a "group 1" designation for an entry way motion detector active cover plate and hallway guidelight active cover plates. This can be performed manually by moving a switch on the selected active cover plates to a position labeled "1". After this grouping, when the motion detector guidelight at the entry way detects motion, it will illuminate and signal other guidelights in the group to also illuminate. This signaling could be accomplished through electronic, sound, optical or other communication techniques. Guidelights that are not in "group 1" will not illuminate. In another example, the user may have two motion sensing active cover plates in different entryways to a kitchen, with illuminating active cover plates mounted over the kitchen counter. The user designates this group of active cover plates as "group 2". If either of the motion sensing active cover plates detects motion, they send a signal that causes the illuminating active cover plates over the kitchen counter to brighten for a specific amount of time after motion ceases to be detected. There are a variety of other implementations. For example, each active cover plate in a group may be configured to detect motion. Upon sensing motion, a first active cover plate sends an optical signal to any other guidelight in its group by flashing its lights in a manner that isn't detectable by the user. Any active cover plate in the group that detects this optical signal then illuminates and repeats the signal. In this situation, the active cover plates in the group may sequentially illuminate as the optical signal spreads throughout the group. In this example, grouping may not be necessary.

[00123] Figure 13 is a front view of an illustrative three-way switch (1304). This three-way switch (1304) includes a body (1318), and a yoke/mounting bracket (1312) attached to the body. A ground screw terminal (1314) is connected to the bracket (1312). The bracket (1312) also includes various apertures and threaded holes for mounting of the switch (1304) to an electrical box and for mounting a face plate over the switch. The switch (1304) also includes three screw terminals (1316, 1320, and 1324). These screw terminals allow electrical wires to be mechanically fastened and electrically connected to the switch. A toggle (1322) allows the user to mechanically change the position of internal contacts to change the electrical configuration of the switch. For example, a first screw terminal (1324) may be electrically connected to a second screw terminal (1320). However, when a user mechanically moves the toggle upward to a new location, the internal contacts may be reconfigured to connect the first screw terminal (1324) to a third screw terminal (1316).

[00124] This is just one embodiment of a three-way switch. A variety of other three-way switch configurations may also be used in conjunction with the principles described. For example, the three-way switch may have a rocker rather than a toggle, or the wiring may be connected to stab in connectors on the rear of the switch body rather than directly to the screw terminals. The three-way switch and other switches described herein may also include various sensors and actuators. For example, the switches may include motion detectors and/or actuators to remotely/automatically control the loads/lights connected to the switch.

[00125] Figure 14 is a front view of an illustrative four-way switch (1308). The four-way switch may include many of the same features as a three-way switch. For example, this four-way switch (1308) includes a body (1318), and a yoke/mounting bracket (1312) attached to the body. A ground screw terminal (1314) is connected to the bracket (1312). However, in additional to the three screw terminals (1316, 1320, 1324), the four-way switch (1304) also includes a fourth screw terminal (1326). Although the toggle (1322) allows the user to mechanically change the electrical configuration of the switch, the internal contacts are different than in a three-way switch. In this example, in a first configuration a first screw terminal (1324) may be electrically connected to a second screw terminal (1320) and the third screw terminal (1316) may be connected to the fourth screw terminal (1326). However, when a user mechanically moves the toggle upward to a new location, the internal contacts are reconfigured to connect the first screw terminal (1324) to the fourth screw terminal (1326) and the third screw terminal (1316) is connected to the second screw terminal (1320).

The above example is only illustrative of the principles described. Different switches may have various other implementations.

[00126] Examples of electrical systems that include three-way and four-way switches are given below. Unlike illustrative single pole switches shown and described in Figures 1A-1D, these multi-pole switches do not have a preferred orientation. For single pole switches, it is standard practice to mount the switches so that moving the toggle upward turns the light ON and moving the toggle downward turns the light OFF. Mounting a single pole light switch upside down would result in counterintuitive operation for the user. Because single pole light switches have a consistent mounting configuration, the location of the screw terminals is also fairly consistent (typically on the right of the switch when facing the front of the switch). Thus, the two prongs on active cover plates intended for use with single pole switches (see e.g. Figs. 3A, 3B, 3C, 4A, 4B, 4C, 5) can be located to consistently contact the screw terminals. However, for three-way and four-way switches, simply repositioning the toggle/rocker of any switch in the electrical system will change the state of the load/lights. Thus, three-way and four-way light switches can be mounted upside down or right side up without interfering with the user's operation. This makes the locations of the screw terminals less predictable.

[00127] Further, as the configuration of the electrical system changes as a result of users reconfiguring various light switches, the electrical interconnections between the various screw terminals also changes. A pair of screw terminals that can supply electrical power to an active cover plate in a first configuration may not be able to supply electrical power in a second configuration. Thus, for an active cover plate to reliably receive electrical power, the active cover plate may be configured to contact multiple screw terminals and select the screw terminals that have electrical power for a given configuration.

[00128] Figure 15A is a diagram of a rear view of an active cover plate (1330) that includes four prongs (A, B, C, D) and is configured to be compatible with both three-way and four-way light switches. When the cover plate (1330) is placed over a three-way switch, one of the prongs will not connect with a screw terminal. For example, the cover plate (1330) may be placed over the three-way switch (1304, Fig. 13) and prong A may contact the first screw terminal (1324), prong B may contact the second screw terminal (1320) and contact C may contact the third screw terminal (1316). Prong D will rest on the body (1318) of the switch (1304) and will not make contact with a screw terminal. If the three-way switch

(1304) is mounted upside down, prong C may contact the second screw terminal (1320), contact B may contact the first screw terminal (1324) and prong D may contact the third screw terminal (1316) with prong C resting on the body (1318) and may not contact a screw terminal. Thus, this configuration, which includes more prongs on the active cover plate than there are terminals on the light switch accommodates multiple light switch mounting orientations.

[00129] For four-way switches, the prongs (A, B, C, and D) of the active cover plate (1330) may contact all four of the screw terminals when the light switch is mounted upside down or right side up. However, there is no requirement that each of the prongs contact a screw terminal. The active cover plate can extract power from the light switches if there is a voltage difference between the screw terminals that will support electrical current flow.

[00130] Figure 15B shows an alternative configuration of an active cover plate (1332). In this configuration, a fifth prong (E) has been added to the other prongs (A, B, C, and D). This prong will make electrical contact with the ground screw terminal. It may contact the yoke of the light switch (which is connected to the ground wire) or directly contact the ground screw terminal.

[00131] Figure 15C shows a rear view of an active plate (1332) installed over a four-way switch (1308). For purposes of illustration, electrical wires are not shown connected to the screw terminals but are assumed to be in place. In this example, prong A may contact the first screw terminal (1324), prong B may contact the second screw terminal (1320) and contact C may contact the third screw terminal (1316), and prong D may contact the fourth screw terminal (1326). Prong E contacts the conductive bracket/yoke (1312) that is electrically connected to a ground screw terminal (1314).

[00132] In general, an active cover plate for installation over a multi-pole light switch may include a face plate and at least three prongs extending rearward from the faceplate to electrically contact terminals of the multi-pole switch. A circuit in the active cover plate is connected to and draws power from the prongs. However, as discussed above, there may not be a voltage difference between a given pair of these prongs that will support electrical current flow. Thus, the circuit in the active cover plate will have to select or reselect the screw terminals that have a voltage difference each time the electrical system is reconfigured.

[00133] However, the inclusion of four prongs can make installation more difficult. All four prongs are placed around the light switch body, with two prongs on each side of the light

switch body. To correctly install the active cover plate the prongs are directed into the space around the light switch but inside of the receptacle box.

[00134] Figures 16A, 16B, and 16C show an install tool (1600) and its use in spreading the prongs apart. Figure 16A shows an install tool (1600) that may be used to spread the prongs before installation. This install tool (1600) is inserted between the prongs. In this example, the installation tool (1600) includes body (1603), a handle (1602), stand offs (1606), a toggle slot (1612), and tapered extensions (1608). The handle (1602) is configured to be grasped by the user and is used to manipulate the install tool (1600) during an installation.

[00135] The stand-offs (1606) are configured to contact the rear surface of the face plate of the active cover plate and locate the tapered extensions (1608) at a correct height off the rear surface. The tapered extensions (1608) are configured to be inserted between the prongs, with the tips of the extensions being closer together than the prongs. When the install tool (1600) is inserted between the prongs, the prongs slide along the tapered outer edge of the extensions (1608), gradually spreading apart as the tool (1600) continues to be inserted between the prongs. When a shoulder (1604) contacts the prongs, the install tool is fully inserted between the prongs and the cover plate is ready to install over the light switch. The fully inserted install tool is shown in Figures 16B and 16C.

[00136] Figure 16B is a perspective view of a toggle install tool (1600) installed between the prongs (1616) of a toggle style active cover plate (1614). The aperture (1618) is configured to receive the toggle light switch handle. The handle can extend through the slot (1612) and can pass into the aperture (1618).

[00137] Figure 16C shows the shoulder (1604) contacting the prongs. The prongs (1616) are bent outward to fit over the switch body.

[00138] Now referring to Figures 16D and 16E of the four-prong toggle active cover plate (1614), Figure 16D shows a bottom view of the active cover plate (1614) with a profile side view of the prongs (1616). The prongs are connected to the faceplate (1620) and/or the backplate. As shown in Figure 16D the prongs may be angled inward. In other embodiments, the prong may have an even greater angle. Consequently, it may be difficult to spread and maneuver all four of the prongs around a light switch while lining up the cover plate to interface with the light switch.

[00139] When the install tool (1600) is installed (Fig. 16E) the prongs (1616) move/bend outward. The standoffs (1606) position the install tool (1600) at the correct/desired height.

The install tool/active cover plate (1600/1614) are then ready to be installed over the toggle light switch.

[00140] Figures 17A-17E are pictures showing an illustrative embodiment of a four-prong active cover plate (1705) for installation over a décor/rocker light switch (1708, Fig. 17B). The prongs (815) in this embodiment may be different in some aspects than shown in other examples. In this configuration, the prongs include a bend or elbow (821), with the prong extending more directly upward as it leaves the back of the cover plate and then bending inward. As discussed above, this bend (821) can allow the prongs (815) to reach around shoulders (1712, Fig. 17B) on décor light switches (1708). These shoulders (1712) are present in at least some décor designs as a result of the wider face of the rocker/paddle (1709) that is exposed for user interaction. This larger/wider rocker (1709) may be desirable for a number of reasons, including easier manipulation of the rocker by the user. However, behind the rocker face there is no need for the width to continue. To save materials, expense and weight, the designers of the light switches decrease the width of the switch body (1711). This results in a design where the screw terminals (1713) are recessed behind the shoulder. In some cases, the width of the body (1711) where the screw terminals (1713) are located can be significantly narrower than the face of the switch. This is reflected in Figure 17A, where the prongs in their relaxed position have a relatively narrow gap between the contacts on the opposing prongs to accommodate the relatively narrow switch body (1711) and closely spaced screw terminals (1713). However, the prongs have the flexibility and configuration to also contact more widely spaced screw terminals (i.e. screw terminals of three and four-way light switches which tend to have wider bodies).

[00141] The main ramps (812) of the décor prongs are different in some respects than other prongs. As shown in Figure 17A, the main ramps (812) extend inward with a reverse curve, so that the tips of the ramps on opposing prongs may actually be closer together than the contacts. This may be counter intuitive because one of the functions of the main ramps (812) is to guide the active cover plate over and around the light switch body. However, with the tips of the ramps (812) very close together in the four-prong cover plate, it could be difficult to manually spread the prongs apart and around the light switch body during the installation of the cover plate. Figure 17A is a bottom view of the illustrative four prong active cover plate for décor light switches. This image also shows the tips of the prongs coming very close to each other. Also shown in Figures 17A, 17B are various additional

elements of the active cover plate, including the face plate (1704), the switch/sensor cover (1702), the light pipe (1710), and back plate (1706).

[00142] As discussed above, the inclusion of four prongs can make installation more difficult. All four prongs are placed around the light switch body, with 2 prongs on either side of the light switch body, in the space around the light switch but inside of the receptacle box. In one embodiment shown in Figures 17C and 17D, an install tool (1714) is used to spread the prongs before installation. This install tool (1714) is inserted between the prongs (815). In this example, the install tool (1714) for the décor light switch active cover plates (1705) is different in some respects than the install tool (1600, Figs. 16A-16C, 16E) for the toggle active cover plate (1614). In this example, the decor install tool includes a body (1703), handle (1716) on one end of the body, a tapered extension (1720) on the other end of the body, and shoulders (1718). The décor install tool (1714) may not need standoffs because it is secured in place by the bend/elbow (821) in the prongs (815). Further, the décor install tool (1714) does not need a slot or space in the extension because the extension will not interfere with the relatively low-profile rocker (1709, Fig. 17B) on the light switch. The handle (1716) is configured to be grasped by the user and is used to manipulate the install tool (1714) during an installation. When the install tool (1714) is inserted between the prongs (815), the prongs slide along the tapered outer edge (1722) of the extension (1720), gradually spreading apart as the tool (1714) continues to be inserted between the prongs (815). When a shoulder (1718) contacts the prongs (815), the install tool (1714) is fully inserted between the prongs (815) and the cover plate (1705) is ready to install over the light switch.

[00143] The inserted install tool (1714) is shown in Figures 17C and 17D. The install tool (1714) has been inserted between the prongs (815) and has spread the prongs apart with the shoulders (1718) contacting the edges of the prong. With the install tool (1714) in place, the main ramps (812) (the portion of the insulation that extends farthest rearward from the cover plate) are nearly vertical and are configured to guide the cover plate (1705) over the décor/rocker light switch (1708, Fig. 17B). The edges of the insertion tool rest in the elbow of the prongs. Specifically, Figures 17D and 17E are diagrams of the install tool (1714) being inserted between the prongs (815). The prongs (815) move outward as the install tool (1714) is inserted.

[00144] Figure 18 is a flow chart showing one illustrative method for installing an active cover plate over a receptacle such as a light switch. At some point in the process, the install

tool may be inserted between the prongs on the back of the cover/cover plate (step 1802). This may occur at the factory where the install tool may be inserted between the prongs prior to packaging the cover plate. Alternatively, a user may insert an install tool that is separate from the cover plate. For example, an install tool may be provided separately and used to install multiple cover plates. The step of inserting an install tool may be performed at any time prior to the placing of the active cover plate over the electrical receptacle. For example, the install tool may be placed between the prongs prior to packaging of the active cover plate.

[00145] The power is turned off at the breaker and the light switch is tested to be sure that the power is off (step 1804). For example, the light switch could be flipped on and off after the breaker is shut off to determine if the light or other load receives electrical power. The original cover plate is then removed (step 1806). Additionally or alternatively, a meter or other sensor could be used to check for power at the light switch after the original cover plate is removed.

[00146] After the original cover plate is removed and the power is off, and the active cover plate with the install tool in place is placed over the light switch (toggle, décor, or other) (step 1808). The install tool is between the prongs and holds the prongs apart so that the light switch body can be placed between the prongs. As the active cover plate is moved over the light switch body and the prongs are on either side of the light switch body, the install tool can be removed by sliding the install tool upward/downward from between the prongs. This allows the prongs to relax somewhat and contact the sides of the light switch body. While removing the install tool, the active cover plate/active cover plate can be pushed farther over the light switch until the toggle or rocker of the light switch engages with the corresponding aperture in the cover plate (step 1810). The active cover plate can then be secured in place with screw(s) to connect it to the light switch body (step 1812). With the active cover plate in place, the power can be turned back on (step 1814).

[00147] The method given above is only an illustrative example. There may be a number of variations to the method shown. For example, the order of the steps may be changed, additional steps may be added, and some steps may be removed. For example, the cover plate may be installed without turning the power off if the installing individual is an electrician who is both comfortable and knowledgeable about working with live circuits. In some embodiments, the active cover plate may not include fasteners such as a screw. A variety of techniques may be used to secure the active cover plate over the switch. For

example, the active cover plate may snap into place or use magnets or other connection elements. An additional step that could be added is testing the active cover plate to determine if the lights in the cover plate illuminate when the area is dark and the mechanical control switch on the cover plate (if any) is in the ON position. In some situations, the step of pulling the install tool to remove it may be separate from the step of pushing the functional wall plate over the light switch. Although these steps can be performed together the steps could be performed sequentially or the prongs themselves may pull the cover plate into position over the light switch. Additionally, in some situations an installation tool may be configured differently or not used at all.

[00148] Figures 19A-19D show one exemplary method for installing the active cover plates (1614) over light switches. In this method, the install tool (1600) is inserted between the prongs (1616) on the back of the active cover plate/active cover plate as shown in Fig. 19B (step 1902). The active cover plate (1614) with the install tool (1600) in place can be installed over the light switch (step 1904). This step can be the same for both toggle and décor light switches. Figure 19C shows the active cover plate (1614) with the install tool (1600) being placed over a toggle light switch (1304). The install tool (1600) holds the prongs (1616) apart so that they pass around the body of the light switch (1304). In this case the toggle extends through the slot in the install tool (1600). The installer then pulls up on the handle of the install tool (1600) to remove it from between the prongs (1616) and pushes the active cover plate farther onto/over the light switch (step 1906). This is shown in Figure 19D. In some situations, the active cover plate (1614) may simply snap over the light switch (1304) without any additional action from the user. In other situations, the user may push the active cover plate over the electrical receptacle or light switch until the active cover plate is flush with the wall and/or the desired portion of the electrical receptacle protrudes through apertures in the active cover plate. The active cover plate can then be secured in place with screws (step 1908) or other fastening technique.

[00149] Double gang light switches are used where it is desirable for two different loads to be separately controlled from the same location. For example, at an entry way, it may be desirable for there to be a first switch to control an exterior light and a second switch to control an interior light. Typically, these lights switches are single pole, three-way or four-way light switches that are installed adjacent to each other in a double sized outlet receptacle box. A double gang configuration is only one example; the principles described can also be

applied to triple gang light switch configurations, quadruple gang light switch configurations, etc.

[00150] Figures 20 and 21 show two different double gang switch installations. In a first installation shown in Figure 20, the switch (2002) on the left controls a porch light (2006) and the switch (2004) on right controls an interior room light (2008). A user may wish for the porch light (2006) to remain on at night while the interior room light (2008) is switched off. To install an active cover plate over this switch installation, it can be desirable for the active cover plate to draw power from the room light switch (2004) on the right instead of the porch light switch (2002) on the left. As discussed previously, this is because there is no voltage difference across the screw terminals of the porch light switch when the porch light switch is on. The users may want to have the interior illuminated by the active cover plate at night but still leave the porch light (2006) or other exterior light on. This can be accomplished by having the active cover plate draw power from the right light switch (2004) which is switched off when the room is dark.

[00151] Figure 21 shows an opposite light switch configuration. In this case, the left light switch (2018) controls the room light (2014) and the right light switch (2020) controls the overhead fan (2016). The light switch (2014) in the room may be off at night but the overhead fan (2016) may continue to operate (i.e. overhead fan switch (2020) may be left on a significant portion of the time). Thus, in this case, it is desirable for the active cover plate placed over the double gang light switches (2018, 2020) to draw power from the room light switch (2018) on the left instead of the overhead fan switch (2020) on the right because this light switch is off when the room is dark. Consequently, to be suitable for a broad range of situations and users, an active cover plate for multi-gang light switches may be able to draw power from one light switch or the other, or from both. There are many approaches that could be used to resolve this issue. In one embodiment, the double gang active cover plates could be reconfigurable during manufacturing without additional or specialized parts for any given configuration. This approach is further described with respect to Figures 28A-28H and 29A-29I.

[00152] Figures 22A-22E show one example of an active cover plate (2205) for double gang light switches. Figure 22A shows a top view of the active cover plate (2205) with the prongs (2202) extending out from the rear of the faceplate (2214). Figure 22B shows a side view of the active cover plate (2205) and the rear/outboard side of the prongs (2202). Figure

22C shows a front view of the active cover plate (2205). In this embodiment, the active cover plate includes a faceplate (2214) with apertures (2204) for connectors and apertures (2206) to accept the toggle light switch handles. This example shows a switch/light sensor cover (2208) in the lower left-hand corner. The shape, size and location of the switch/light sensor cover could be selected in a variety of ways. For example, the switch/light sensor cover (2208) may be in the center, right or higher up on the plate. It could also have a variety of shapes including round, oval, or any other suitable shape.

[00153] Figure 22D shows the right side view of the active cover plate with prongs (2202) extending from the faceplate (2214). Figure 22E shows a bottom view of the active cover plate (2205) and prongs (2202) with the light pipe (2210) on the bottom edge of the faceplate (2214). As discussed above the light pipe allows for light from the LEDs to be conducted out of the active cover plate. The light pipe (2210) could have a variety of different shapes and sizes. In this example, the light pipe (2210) has a length that extends across the majority of the bottom edge of the face plate (2214). As discussed and shown below, the light pipe could have a different length and/or geometry.

[00154] Figure 22F shows a front perspective view of the active cover plate (2205) with the light pipe (2210) along the bottom edge of the faceplate (2214). Visible in this view are the apertures (2206) to accept light switch toggles, fastener apertures (2204), light sensor/switch (2208) and some portions of the prongs (2202). Figure 22G shows a rear perspective view of the active cover plate (2205). Visible in this is the rear surface of the faceplate (2214), the prongs (2202) mounted to the back of the faceplate, the light pipe (2210) and the back plate (2212). The back plate may covers/encapsulates the internal circuitry, wiring and may helps secure at least some of the prongs in place. The prongs (2202) shown are only illustrative and could have a variety of other configurations. For example, the prongs could be mounted in a different location (e.g. mounted on the other side of the rear of the face plate to contact the screw terminals of the other light switch). Further, there could be a different number of prongs, for example, there could be one prong (used in conjunction with a separate conduction mechanism), two prongs, three prongs, or five or more prongs. The prongs could have a significantly different shape and configuration than shown in Figures 22A-22G.

[00155] The preceding description has been presented only to illustrate and describe examples of the principles described. This description is not intended to be exhaustive or to

limit these principles to any precise form disclosed. Many modifications and variations are possible in light of the above teaching.

CLAIMS

WHAT IS CLAIMED IS:

1. An active cover plate comprising:

a multi-gang face plate configured to be installed over a multi-gang light switch installation, the multi-gang faceplate comprising at least two apertures sized to accept a manually manipulatable element of switches in the multi-gang light switch installation; and

prongs extending rearward from the multi-gang faceplate around one of the apertures.

2. The active cover plate of claim 1, wherein at least two of the prongs are configured to contact screw terminals of a light switch when the active cover plate is installed over the multi-gang light switch installation.

3. The active cover plate of claim 1, further comprising a first light bar along a first edge of the face plate.

4. The active cover plate of claim 1, wherein the at least two apertures comprise a left aperture and a right aperture and wherein the active cover plate is configurable such that the prongs can be secured around either the left aperture or the right aperture.

5. A method for installing an active cover plate comprising:

inserting an installation tool between prongs on the back of the active cover plate; and

placing the active cover plate over the switch installation so that the prongs are on either side of a switch.

6. The method of claim 5, further comprising removing an old cover plate from a switch installation.

7. The method of claim 5, further comprising pulling the installation tool from between the prongs after placing the active cover plate over the switch installation.

8. An installation tool for spreading opposing prongs on an active cover plate.

9. The tool of claim 8, further comprising:

a body; and

a tapered extension.

10. The tool of claim 9, further comprising a handle extending from a first side of the body and wherein the tapered extension extends from a second side of the body.

11. The tool of claim 9, wherein the tapered extension is configured to fit between the opposing prongs of the active cover plate and gradually spread the prongs as the installation tool is further inserted between the prongs.

12. The tool of claim 9, further comprising at least one stand off to position the installation tool relative to the active cover plater.

13. The tool of claim 9, further comprising shoulders in the body, wherein the shoulders are configured to position the installation tool relative to the opposing prongs.

14. The tool of claim 9, further comprising a slot to receive a manually manipulatable element of a switch.

15. An active cover plate comprising:

at least two prongs configured to contact screw terminals of a light switch; and

a circuit comprising an internal switch and a transformer;

wherein a first prong is connected to the internal switch, wherein the internal switch controls current flow through the transformer.

16. The active cover plate of claim 15, wherein the internal switch comprises a first configuration comprising a connection between a first prong and a leg of the transformer.

17. The active cover plate of claim 16, wherein a second prong connected to the leg of the transformer, such that an electrically conductive path is formed from the first prong to the second prong through the internal switch and the first transformer leg.

18. The active cover plate of claim 15, wherein the active cover plate is configured to control a state of an exterior load by configuring the internal switch to control current flow through the transformer.

19. The active cover plate of claim 15, wherein the active cover plate is configured to be fastened over a switch controlling a load, wherein the first prong and a second prong are configured to make an electrical connection with screw terminals on the switch and to allow electrical current to bypass the switch and pass through the active cover plate.

20. The active cover plate of claim 15, wherein the active cover plate is configured to supply power to an exterior load by changing a configuration of the internal switch to allow current to flow from the first prong, through the transformer and to a second prong.

21. The active cover plate of claim 15, wherein the active cover plate is configured reduce power supplied to an exterior load by changing a configuration of the internal switch to prevent electrical current from flowing through the transformer.

22. The active cover plate of claim 15, further comprising a wireless module to receive signals to control the state of the internal switch.

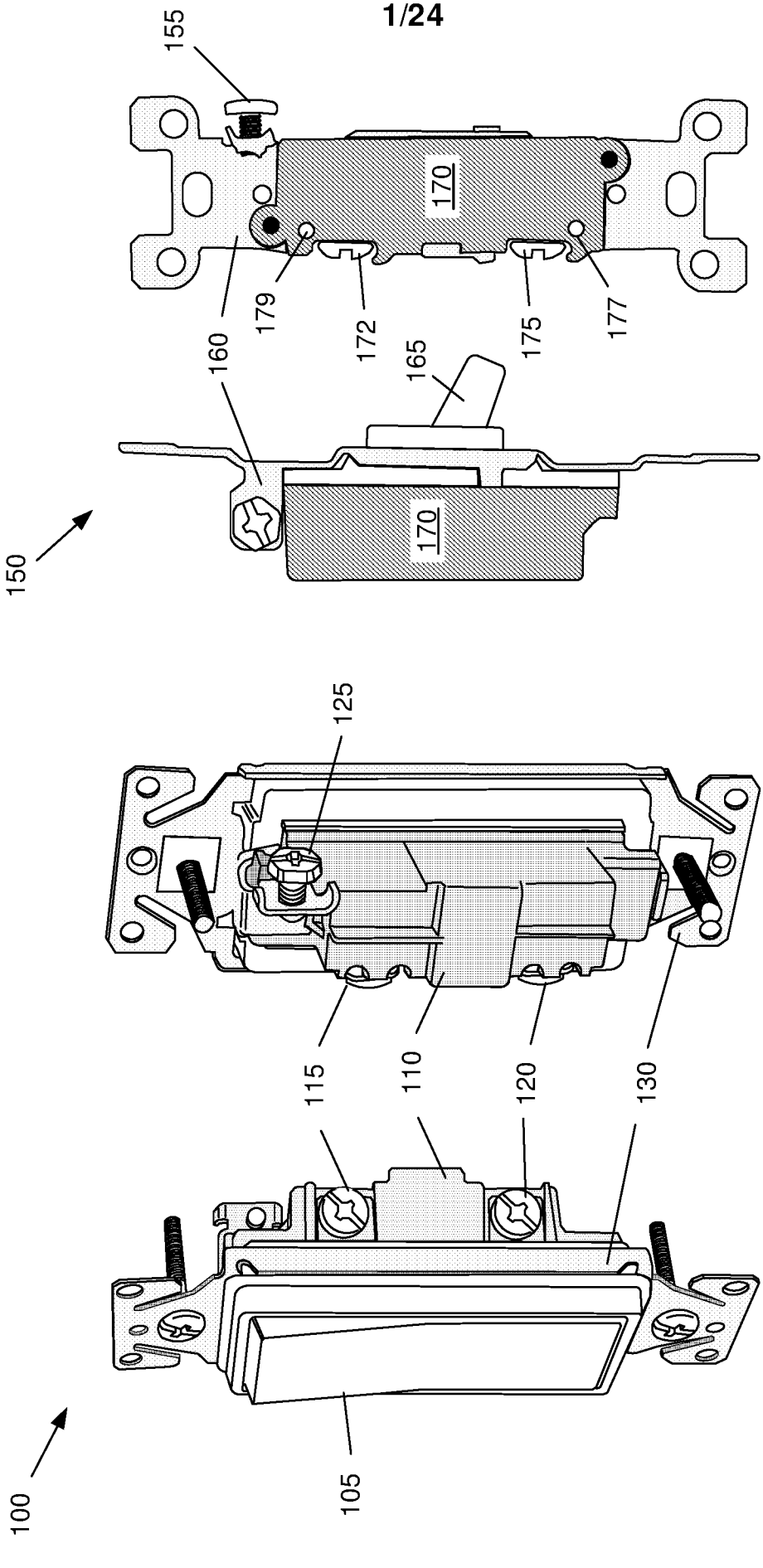

Fig. 1D

Fig.1C

Fig.1B

Fig.1A

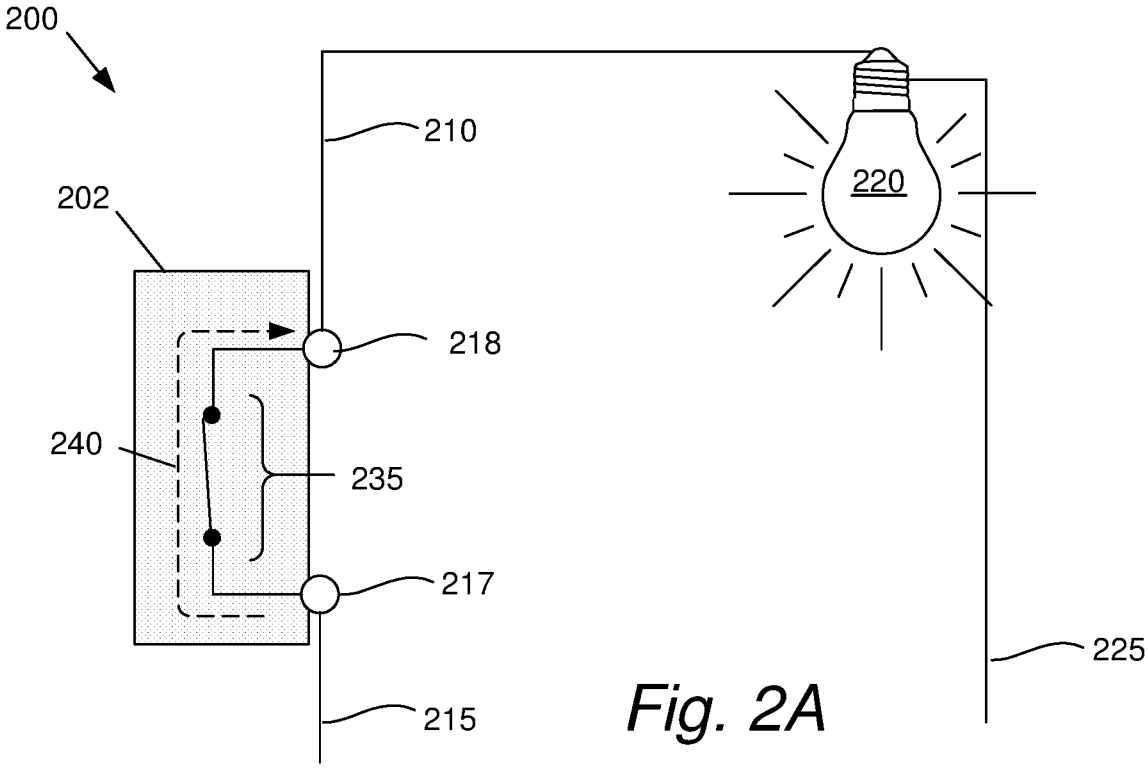
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Fig. 2A

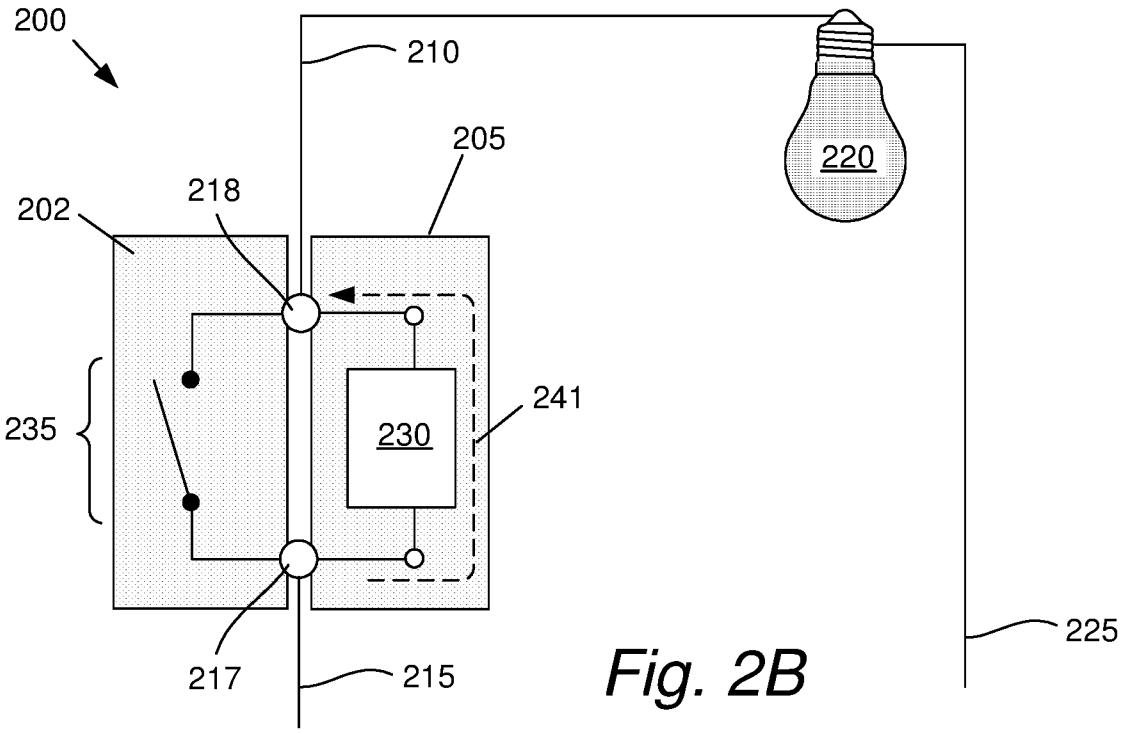
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Fig. 2B

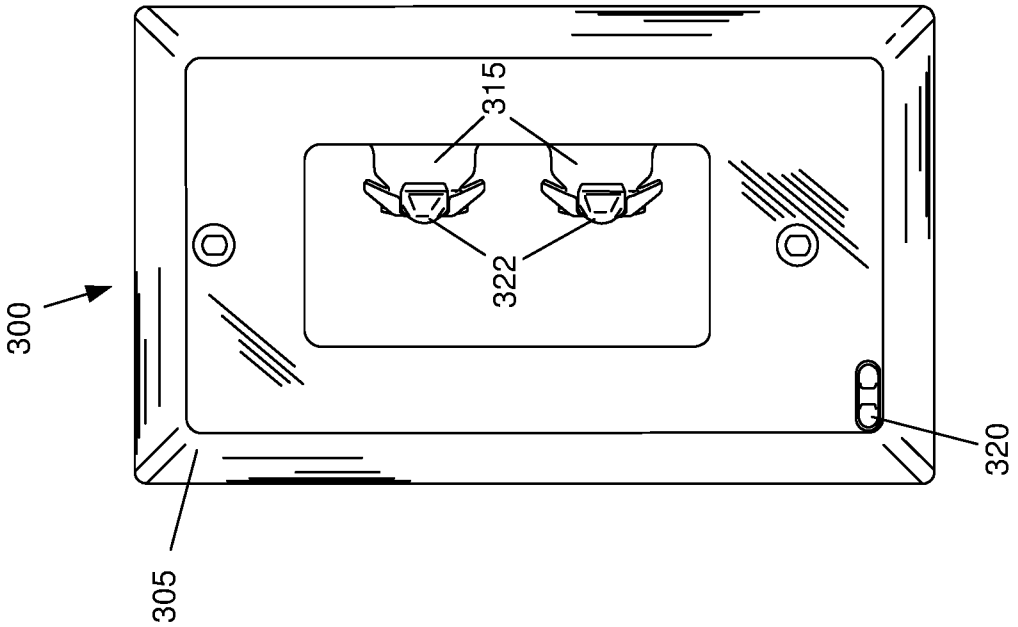


Fig. 3C

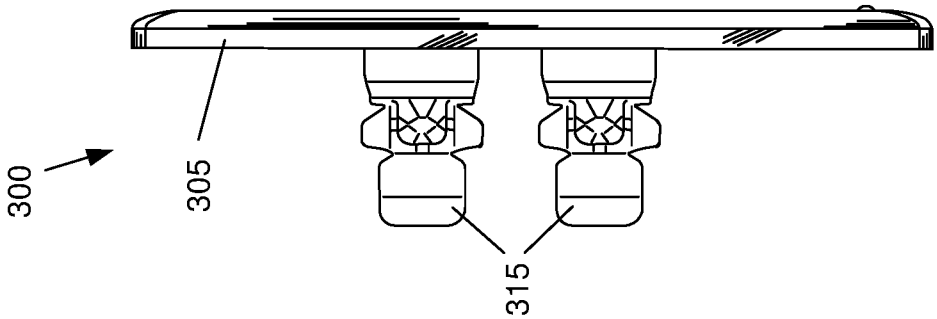


Fig. 3B

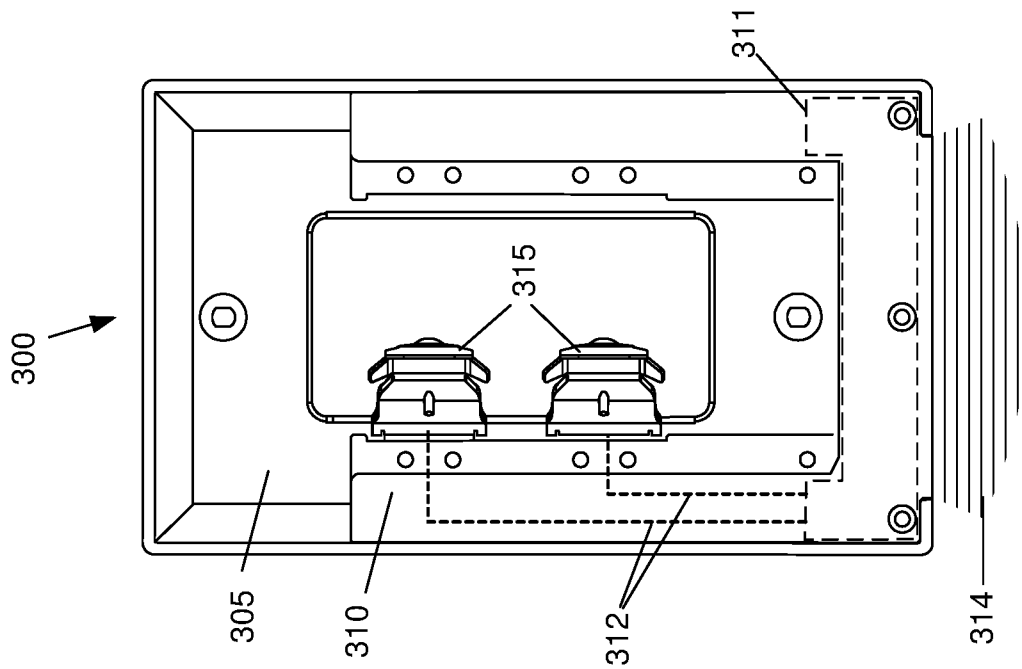


Fig. 3A

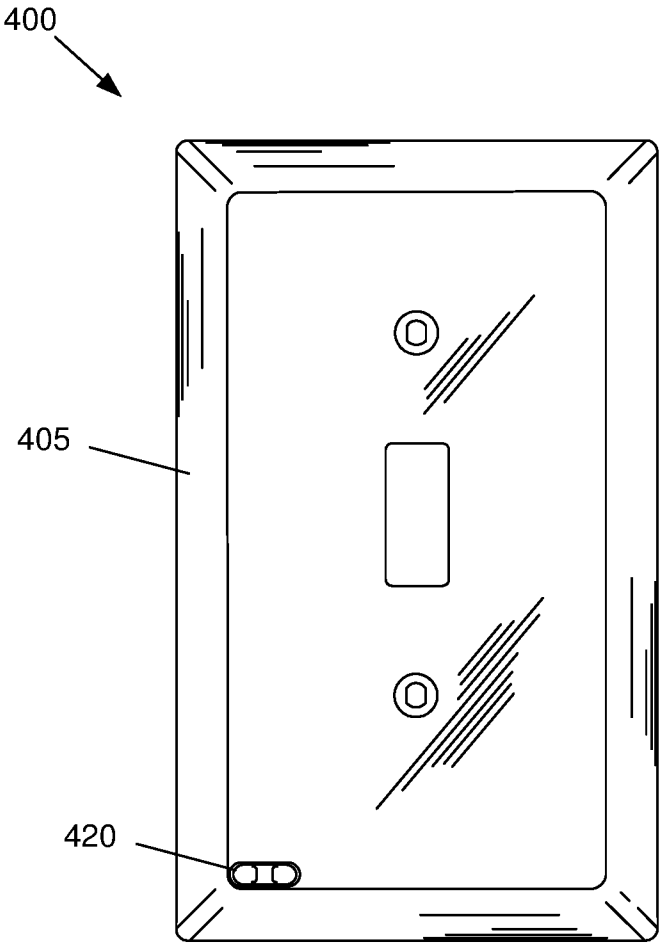


Fig. 4A

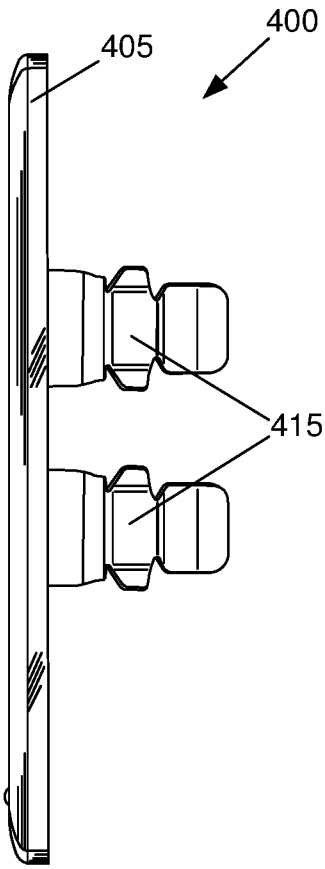


Fig. 4B

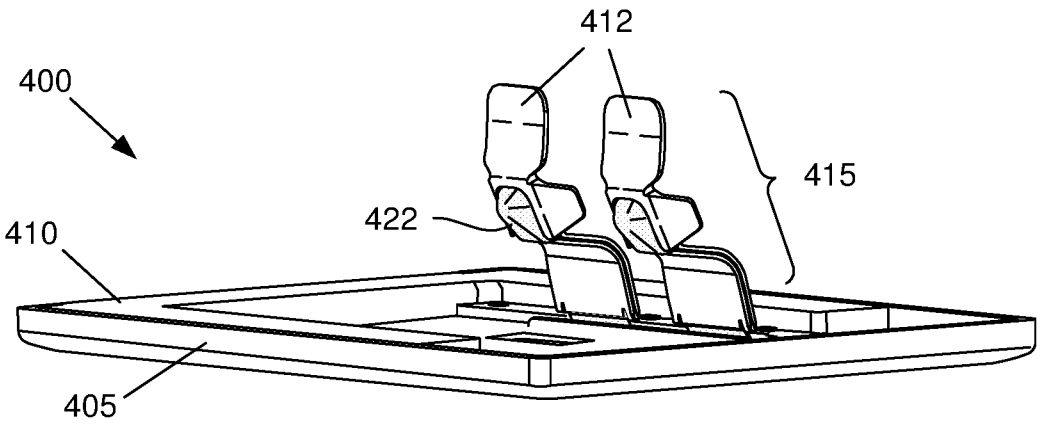


Fig. 4C

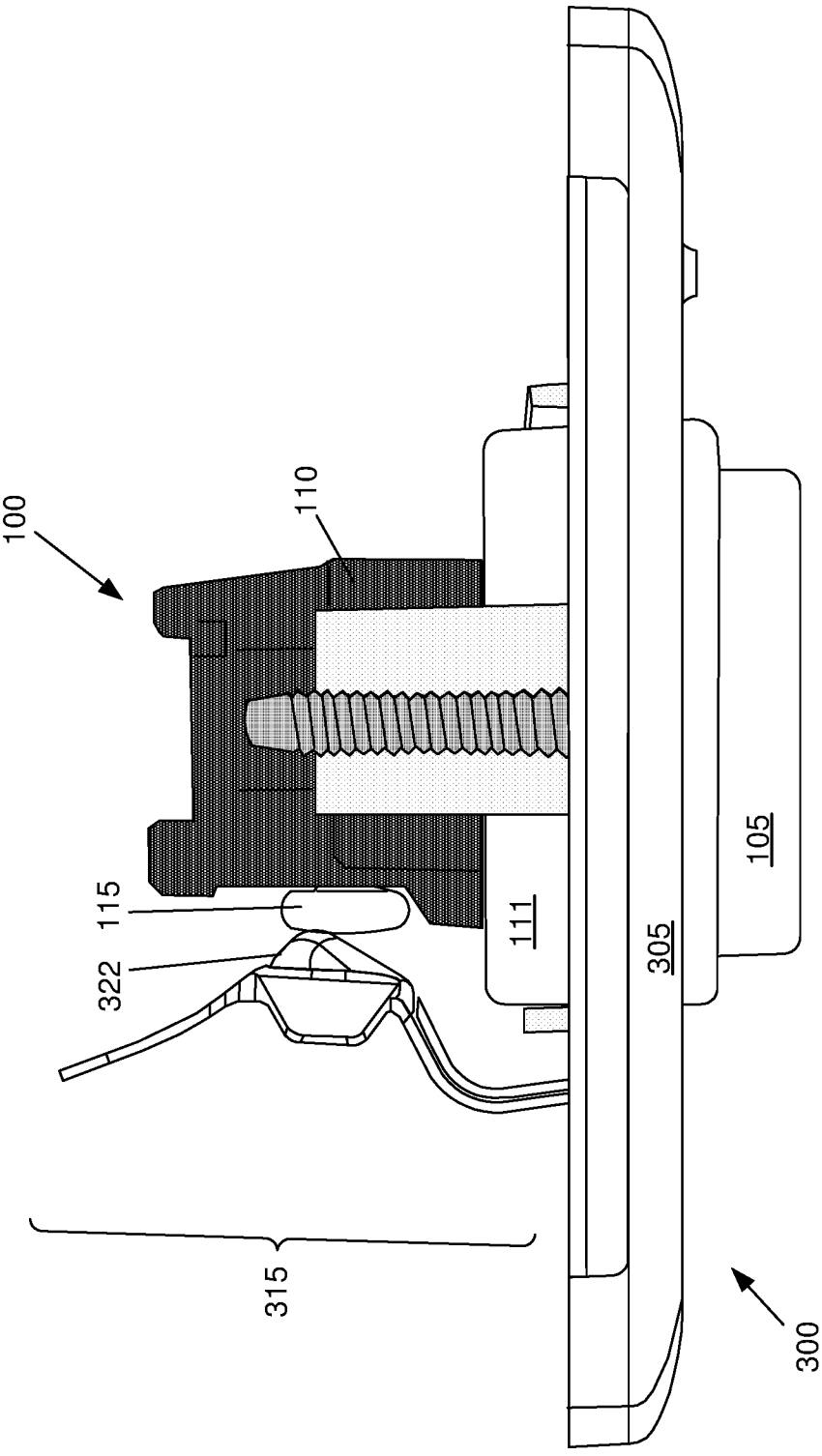


Fig. 5

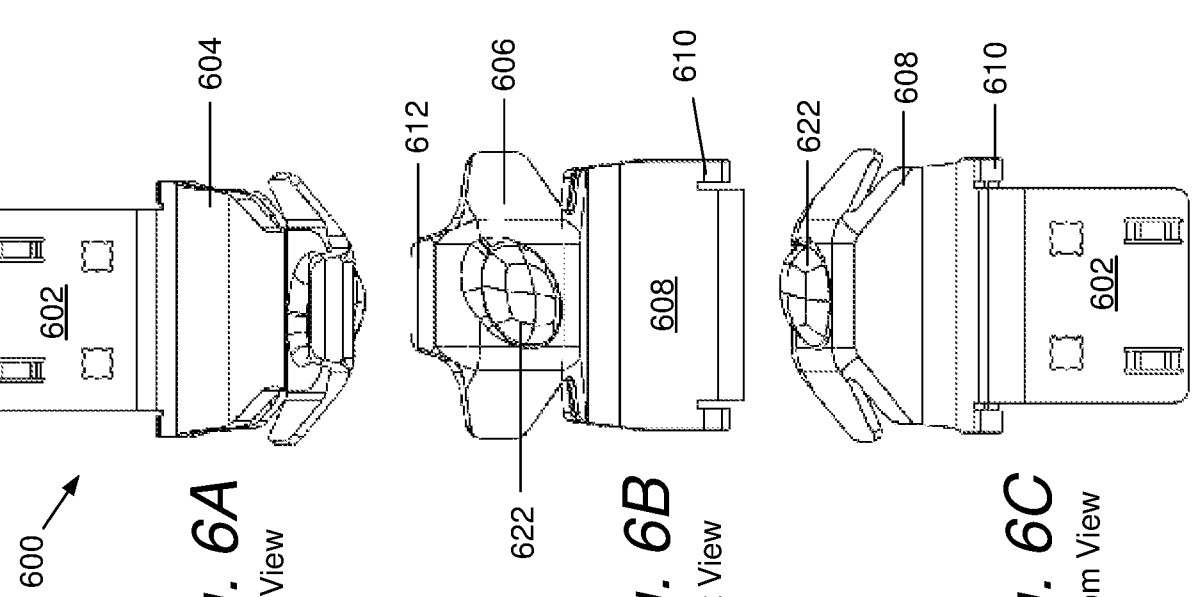


Fig. 6A Top View

Fig. 6B Front View

Fig. 6C Bottom View

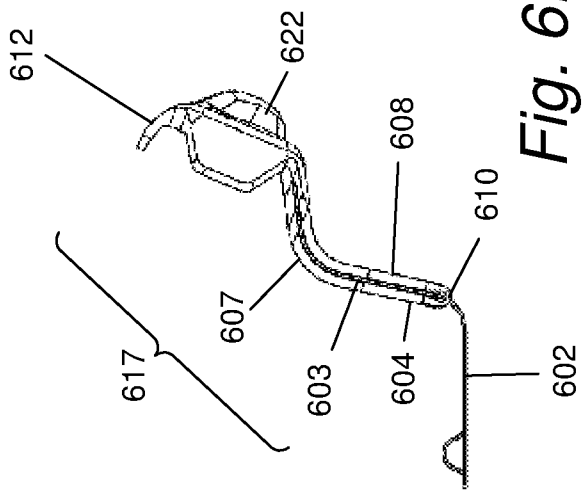


Fig. 6D Side View

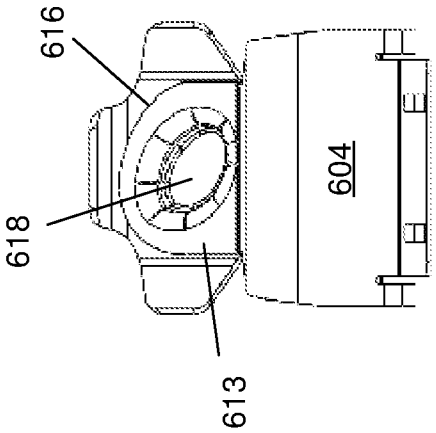


Fig. 6E Back View

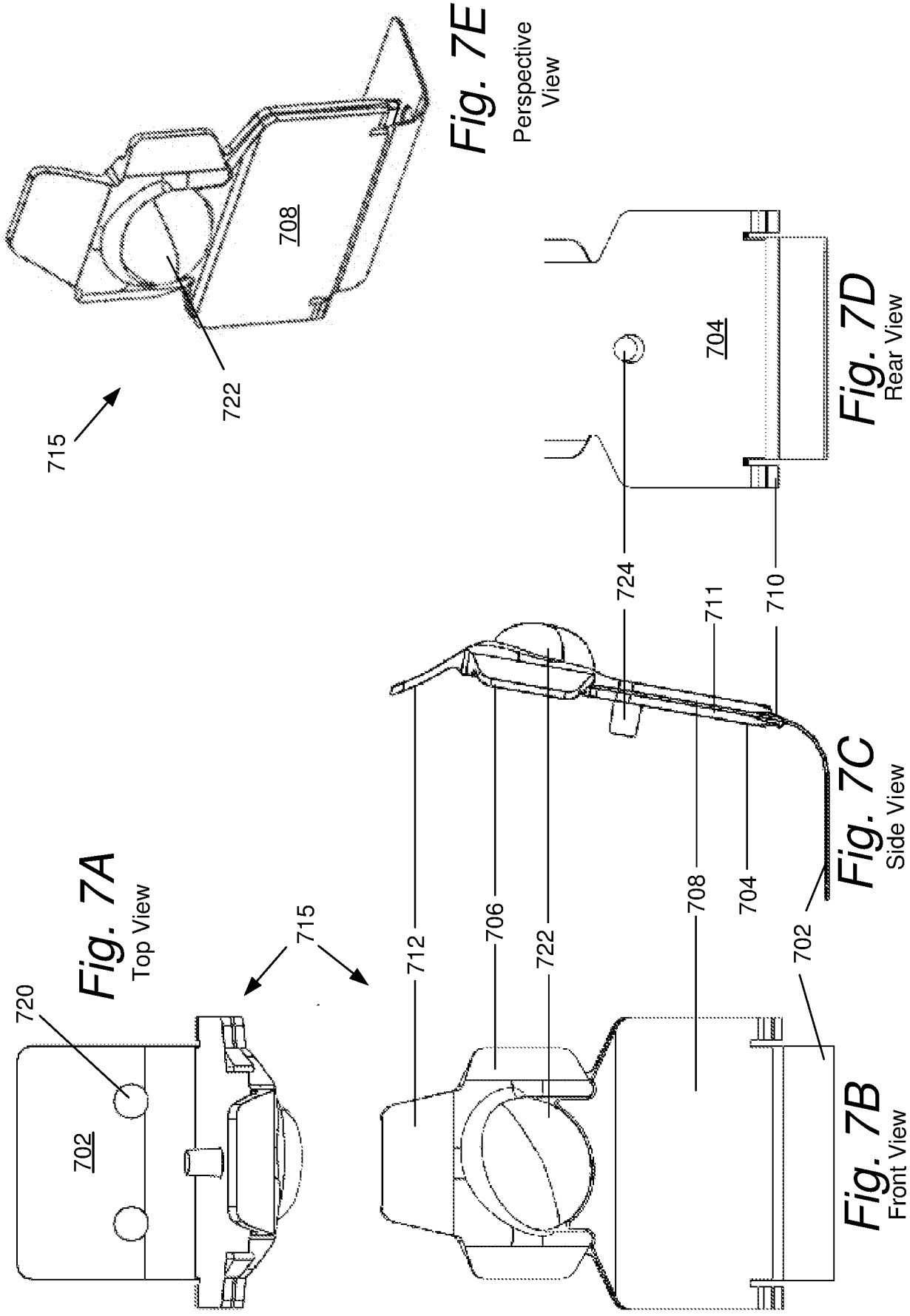


Fig. 7A Top View

Fig. 7B Front View

Fig. 7C Side View

Fig. 7D Rear View

Fig. 7E Perspective View

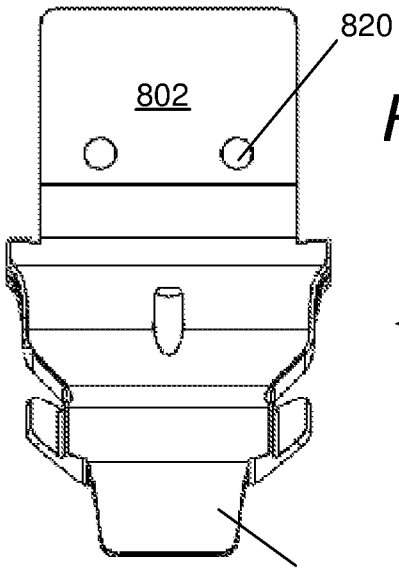


Fig. 8A
Top View

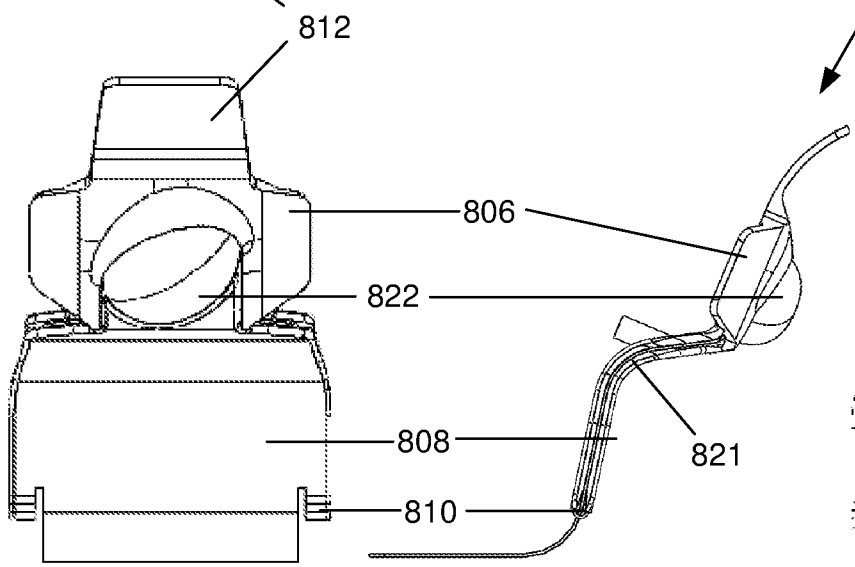


Fig. 8B
Front View

Fig. 8D
Side View

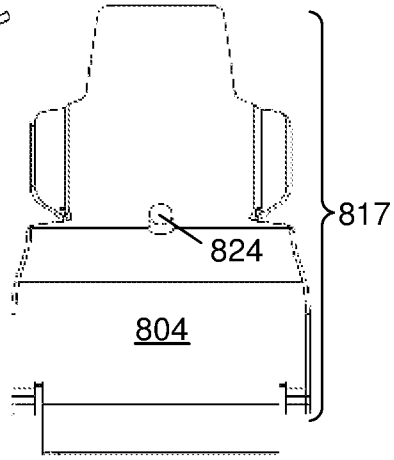


Fig. 8E
Rear View

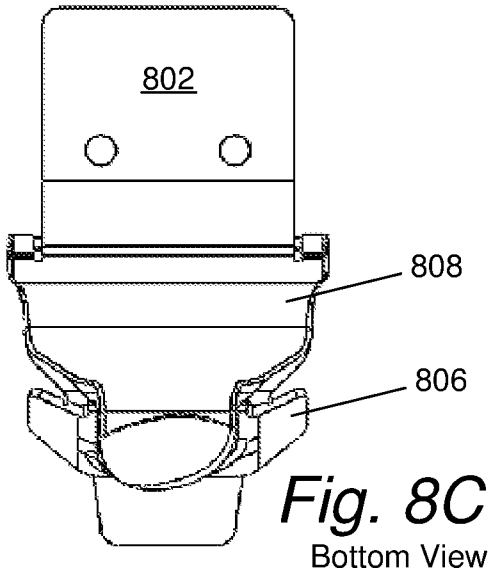


Fig. 8C
Bottom View

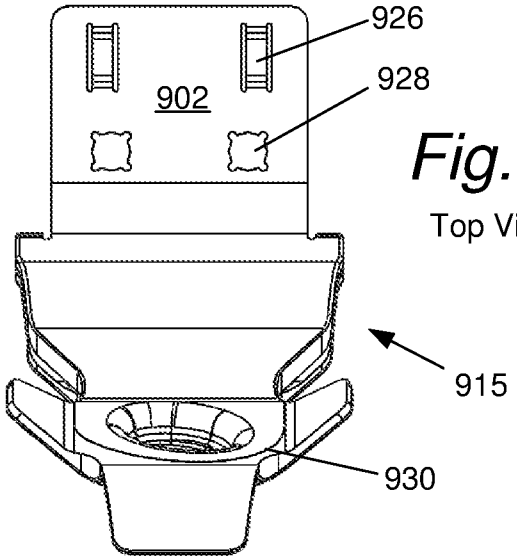


Fig. 9A
Top View

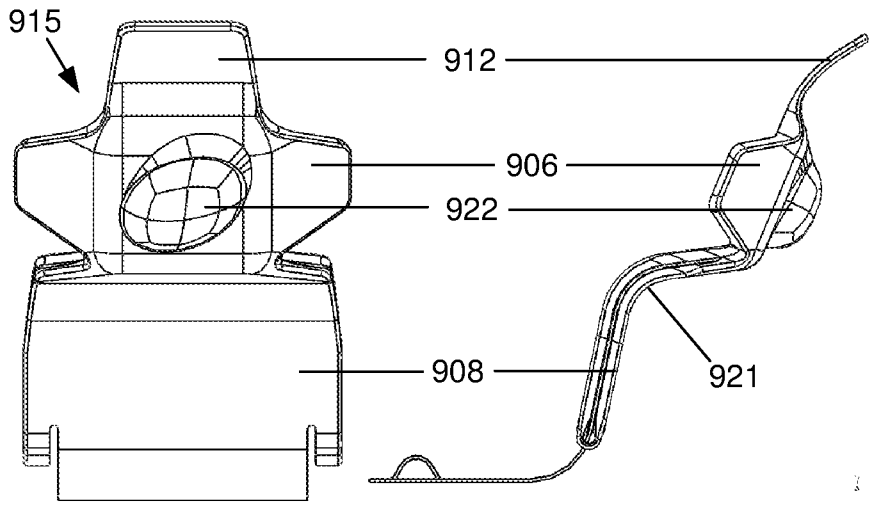


Fig. 9B
Front View

Fig. 9C
Side View

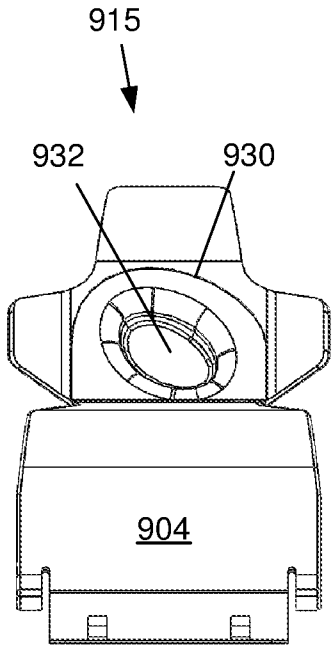


Fig. 9D
Rear View

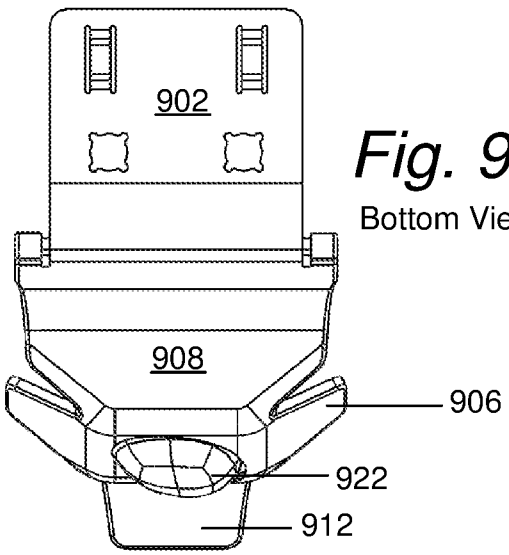


Fig. 9E
Bottom View

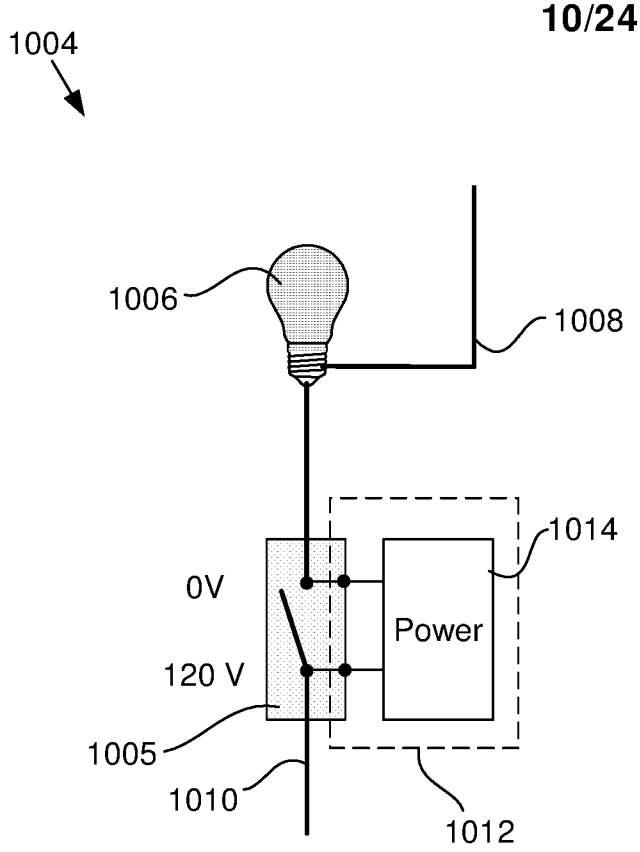


Fig. 10A

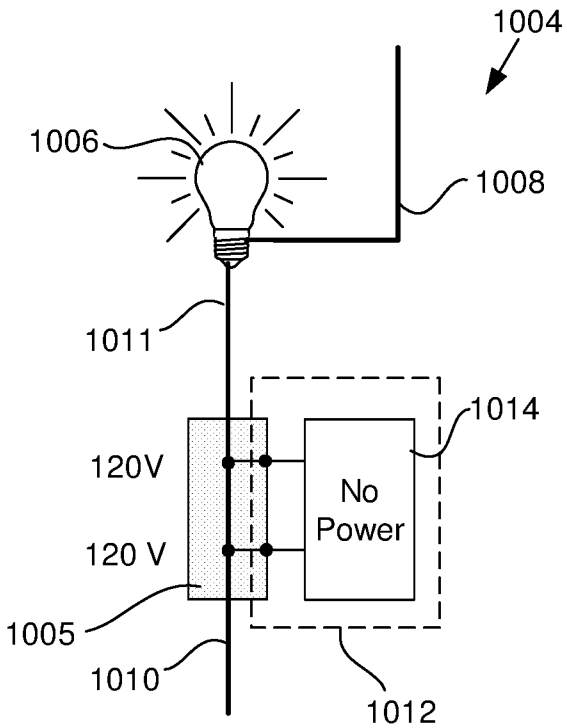
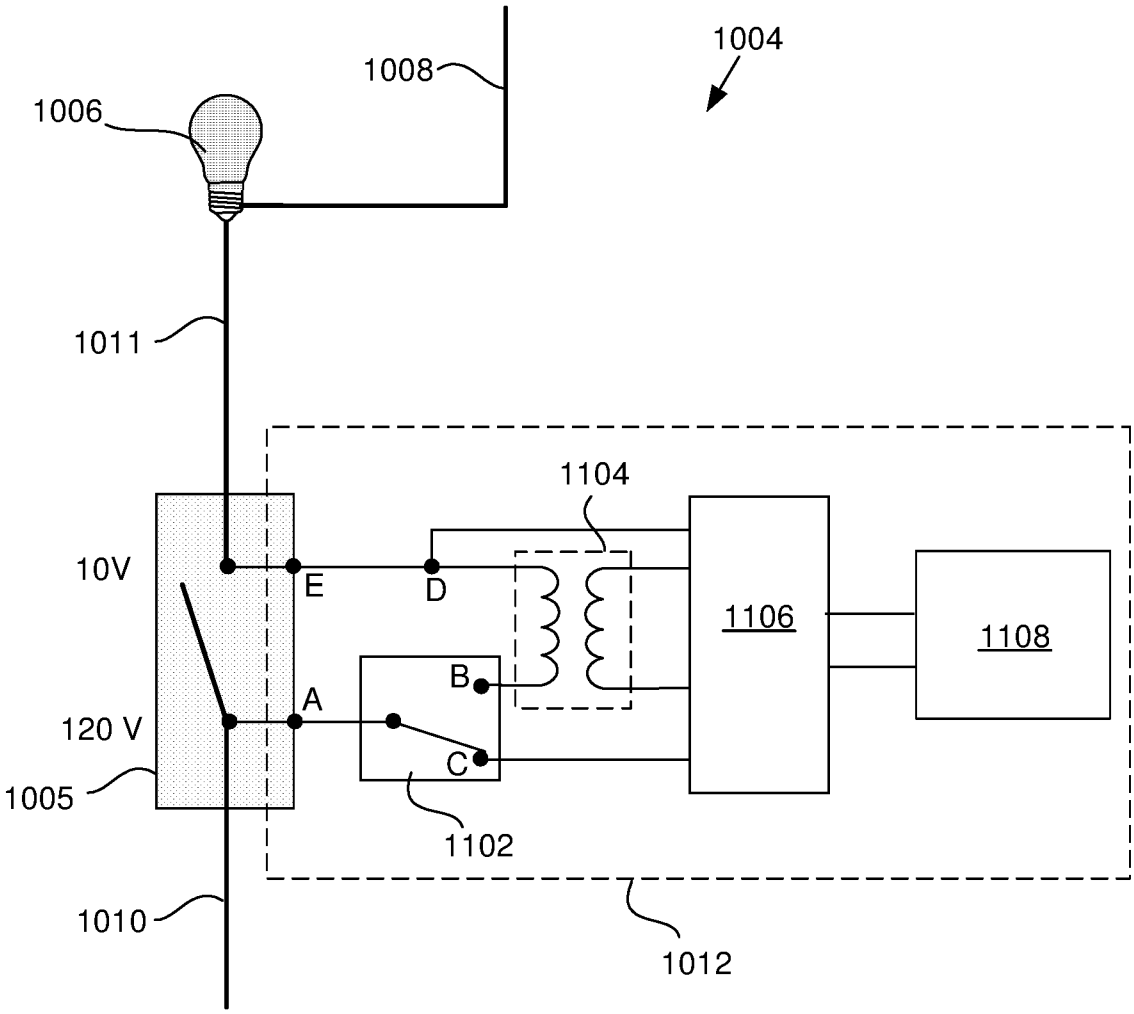


Fig. 10B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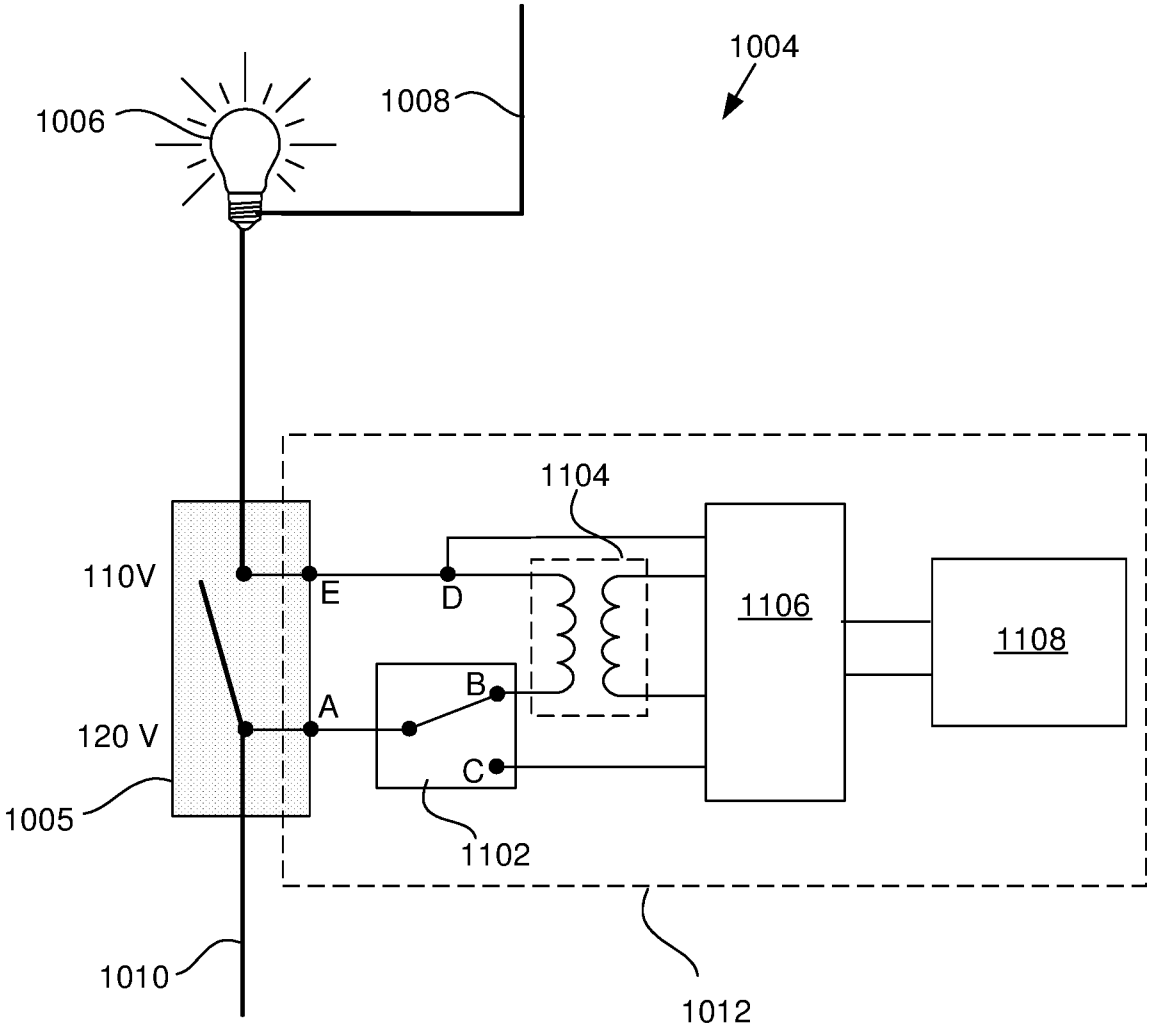
1008
1006
1011
1104
10V
E
D
1106
1108
B
A
120 V
C
1005
1102
1010
1012

Fig. 11A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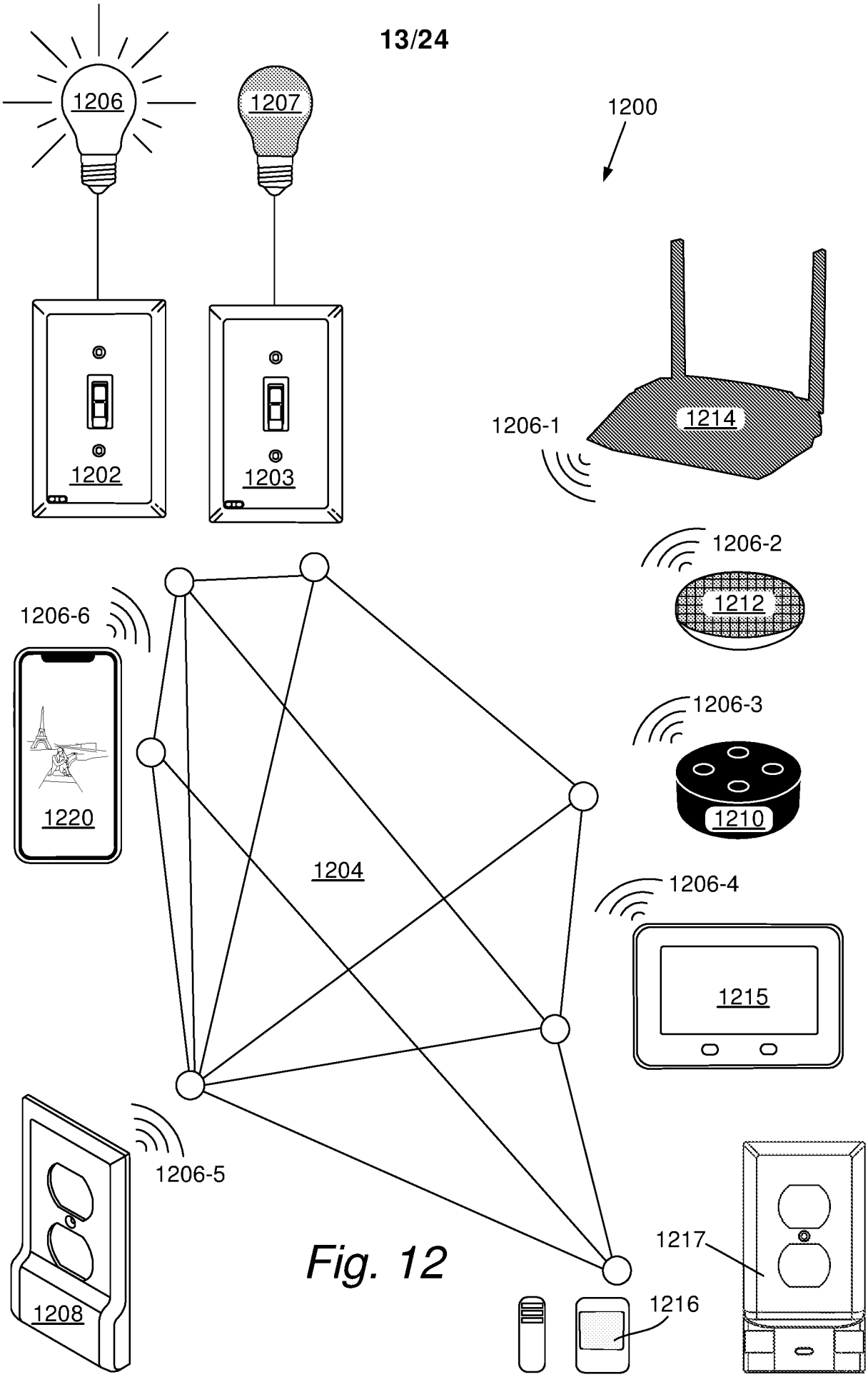
1108
B
A
120 V
C
1005
1102
1010
1012

Fig. 11B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1206-5
1208
1217
1216

Fig. 12

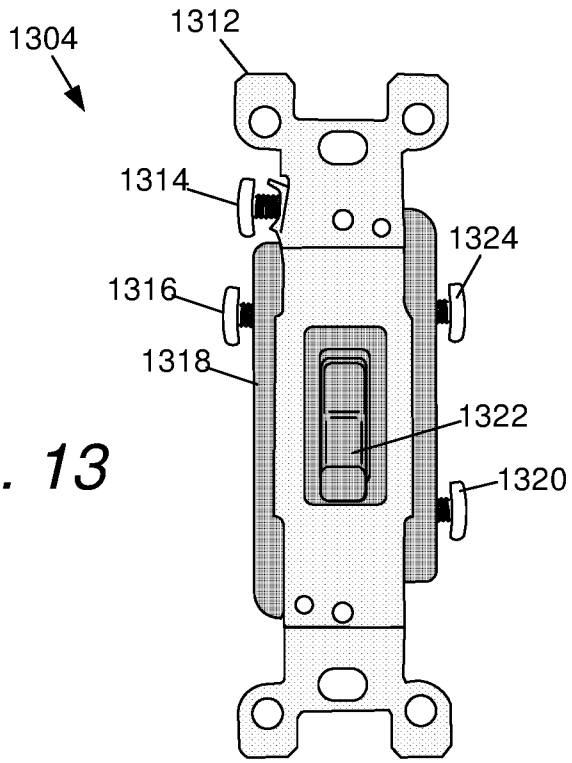
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Fig. 13

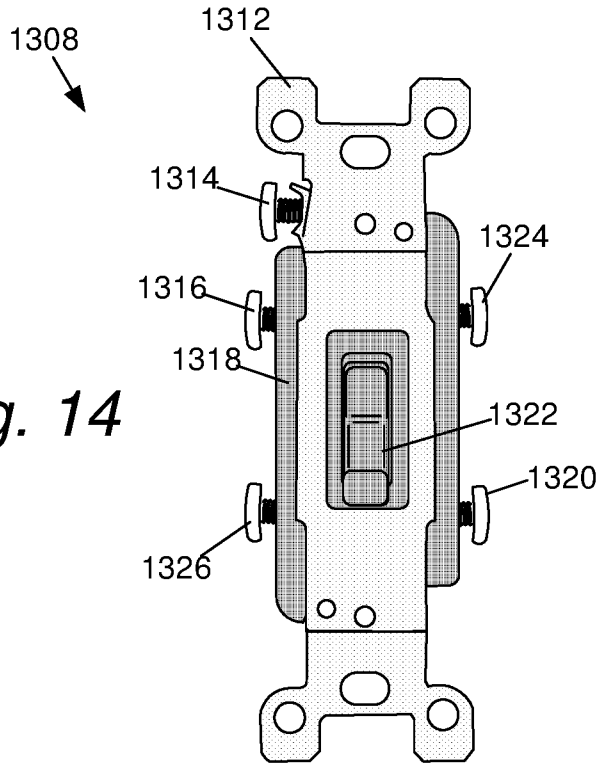
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Fig. 14

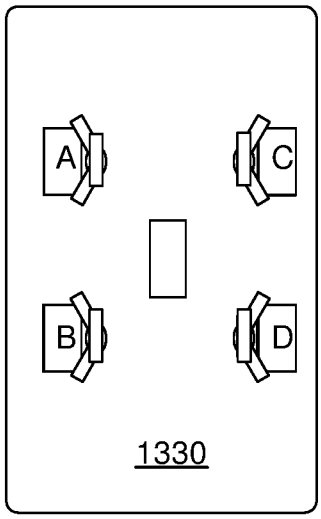

Fig. 15A

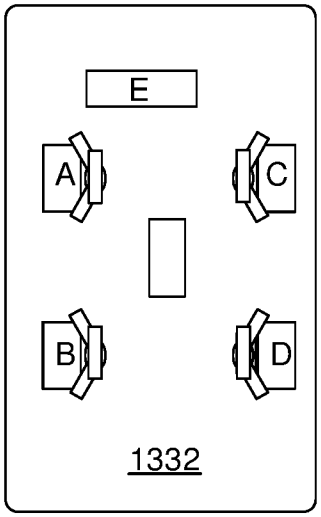

Fig. 15B

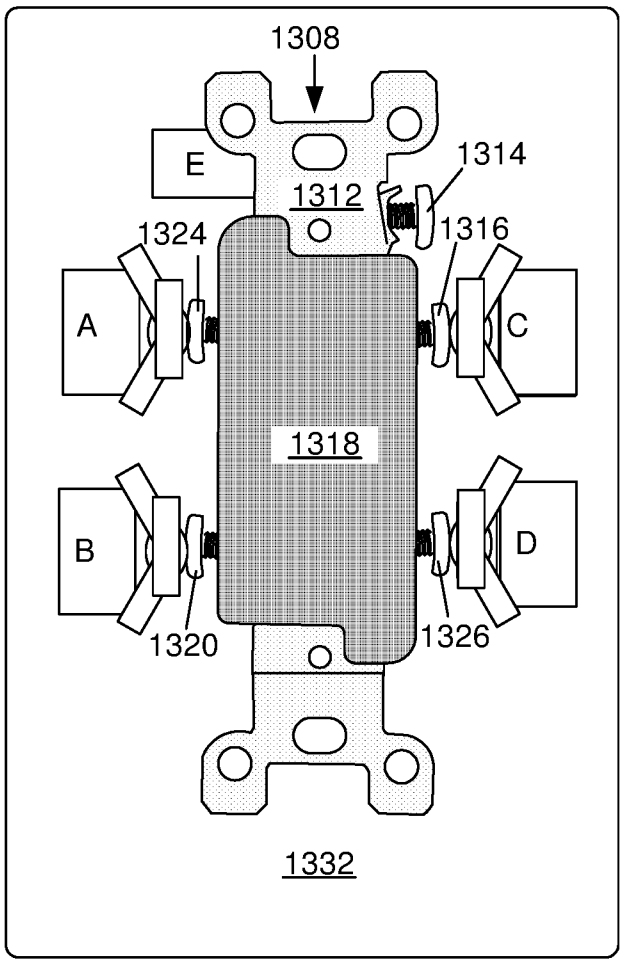

Fig. 15C

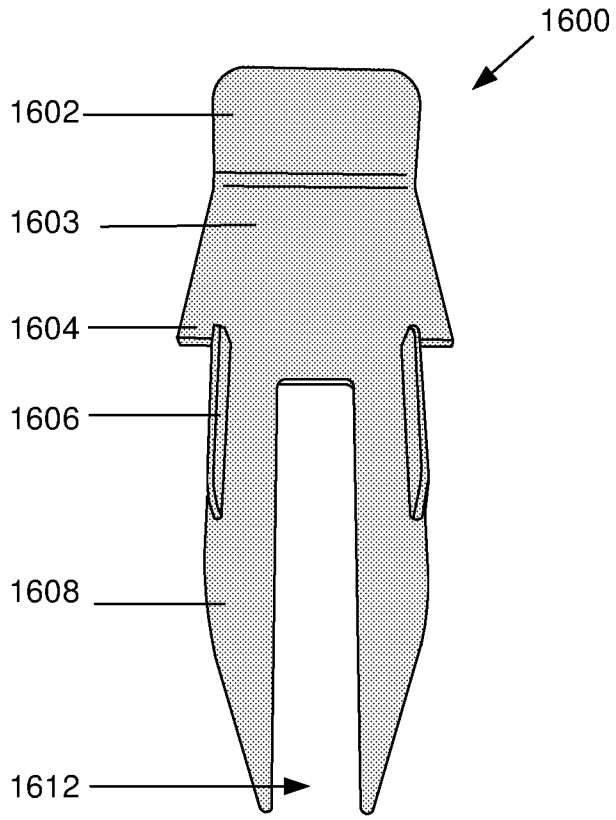

Fig. 16A

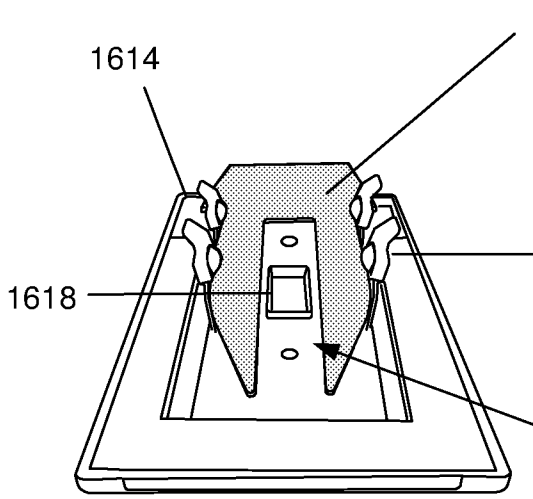

Fig. 16B

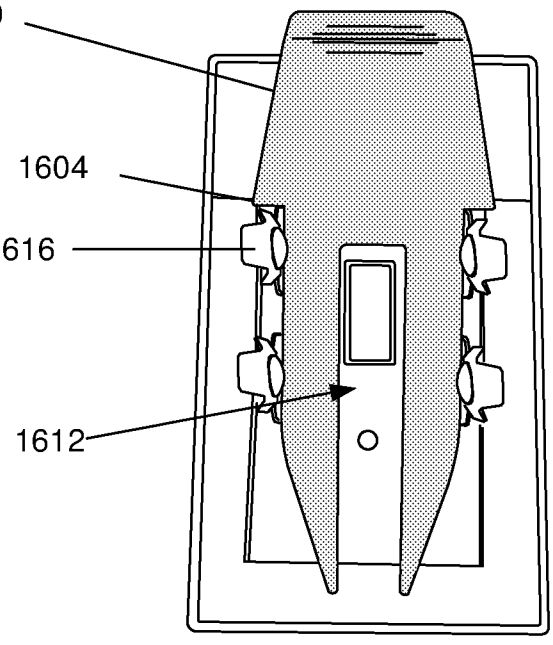

Fig. 16C

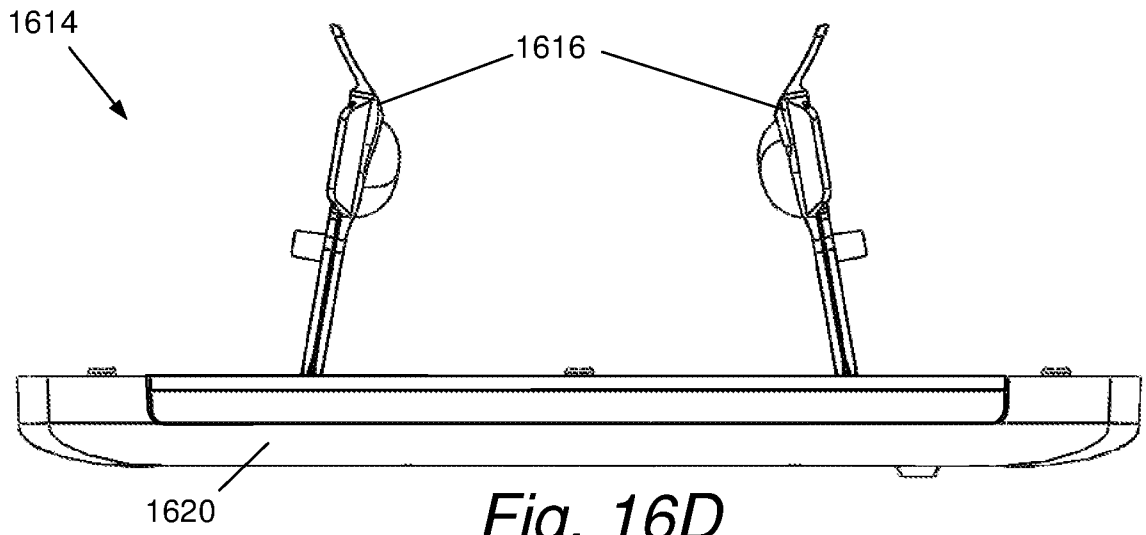

Fig. 16D

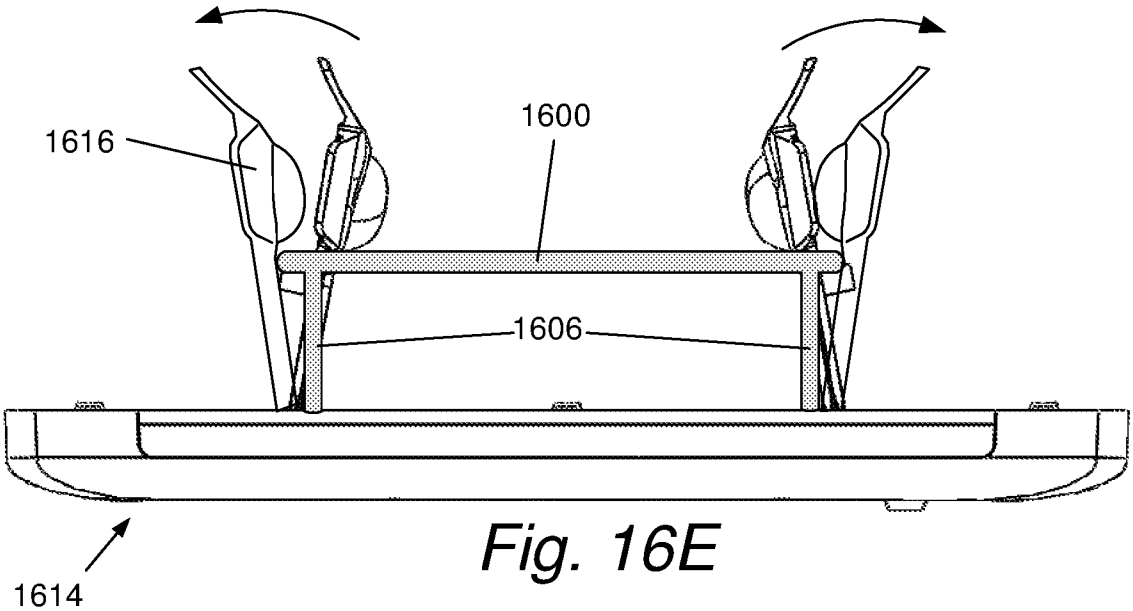

Fig. 16E

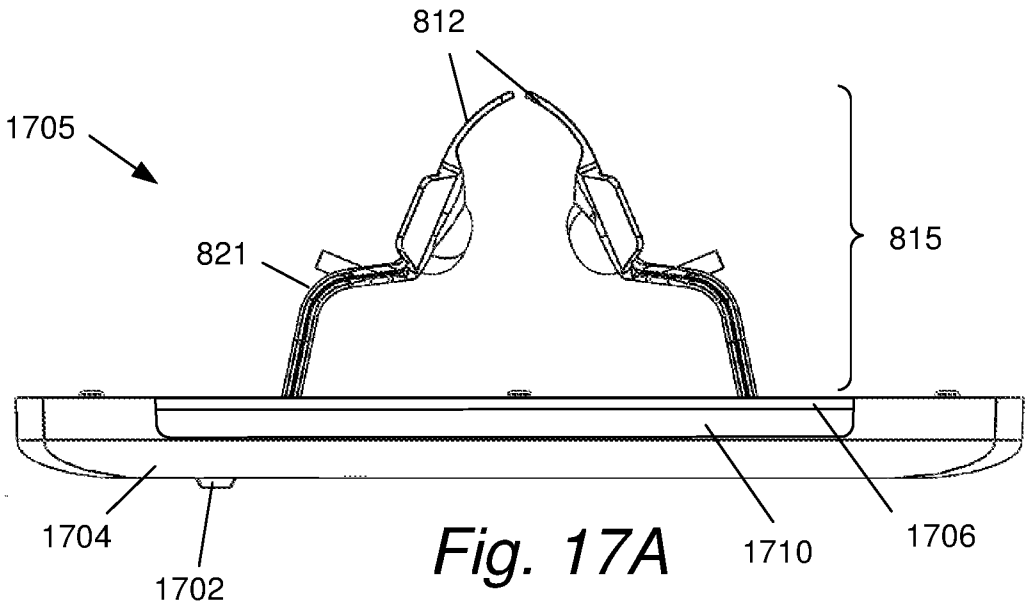

Fig. 17A

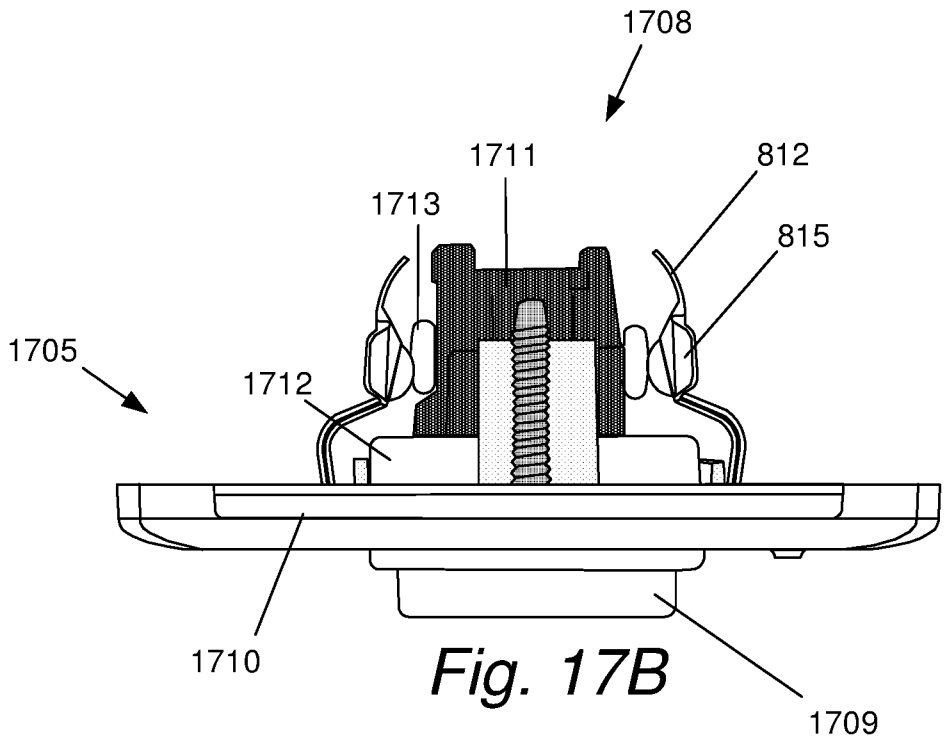

Fig. 17B

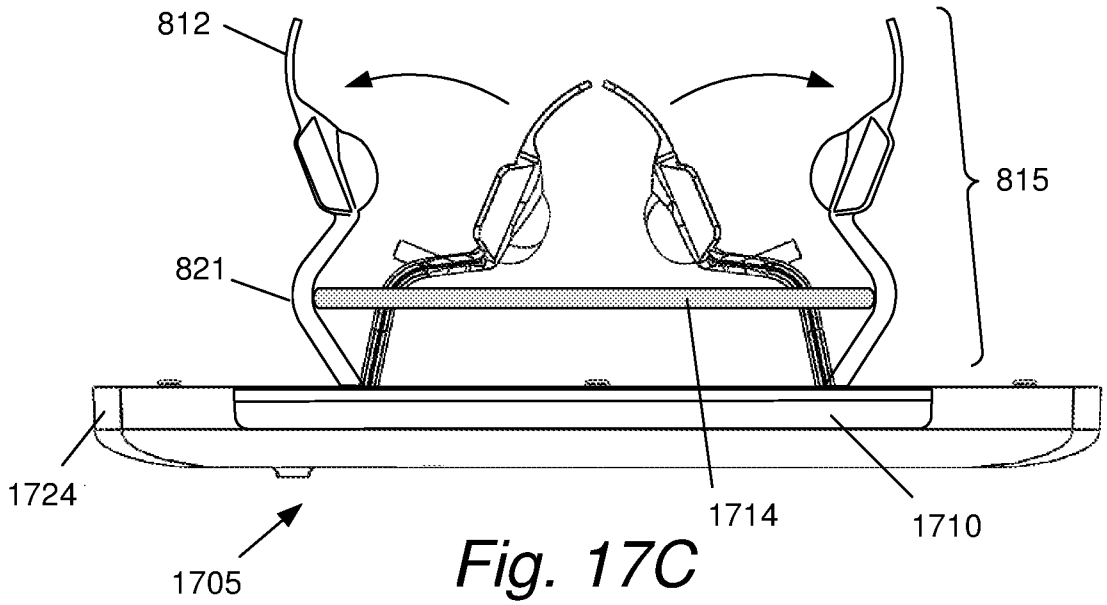

Fig. 17C

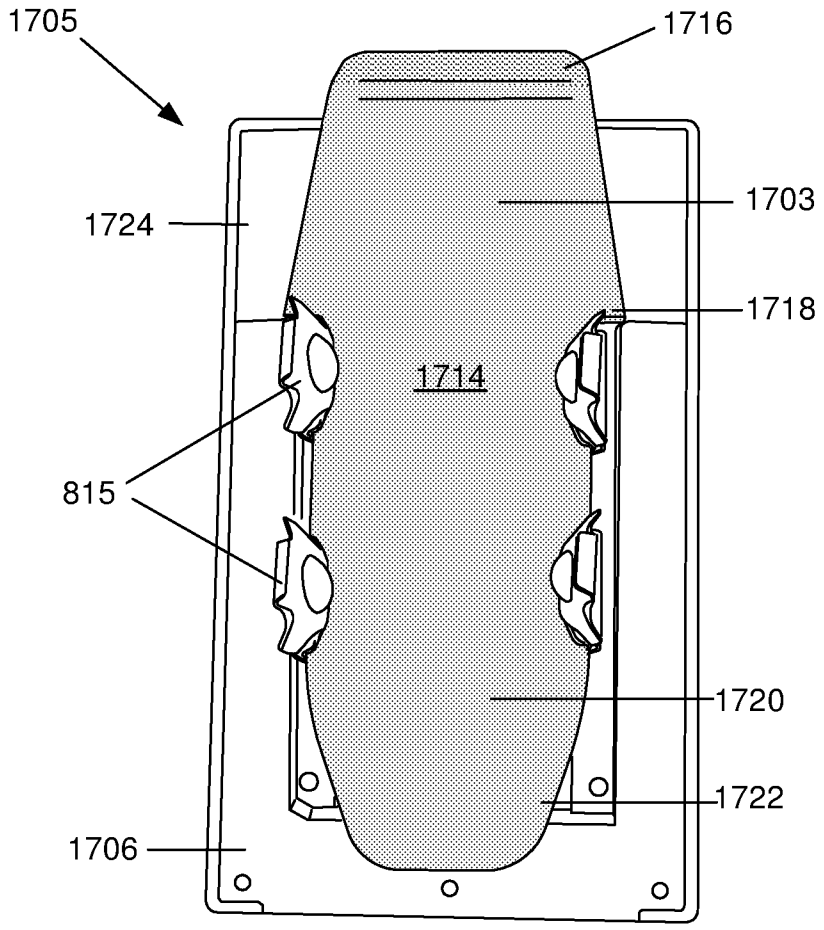

Fig. 17D

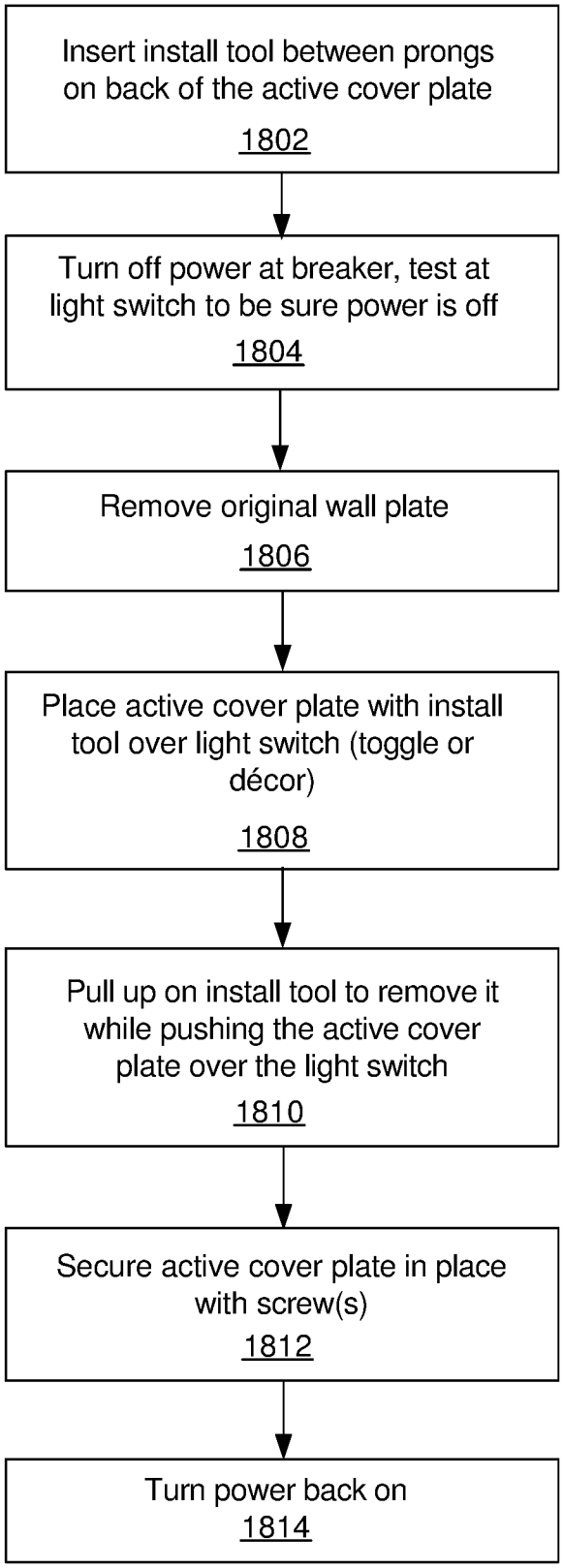
Insert install tool between prongs on back of the active cover plate
1802
Turn off power at breaker, test at light switch to be sure power is off
1804
Remove original wall plate
1806
Place active cover plate with install tool over light switch (toggle or décor)
1808
Pull up on install tool to remove it while pushing the active cover plate over the light switch
1810
Secure active cover plate in place with screw(s)
1812
Turn power back on
1814

Fig. 18

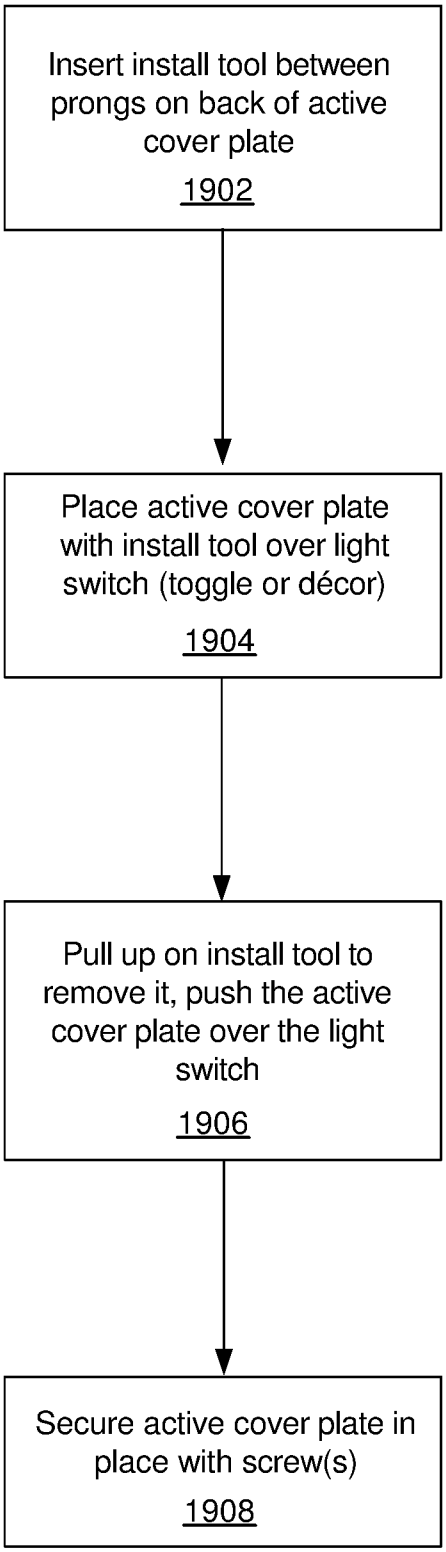

Fig. 19A

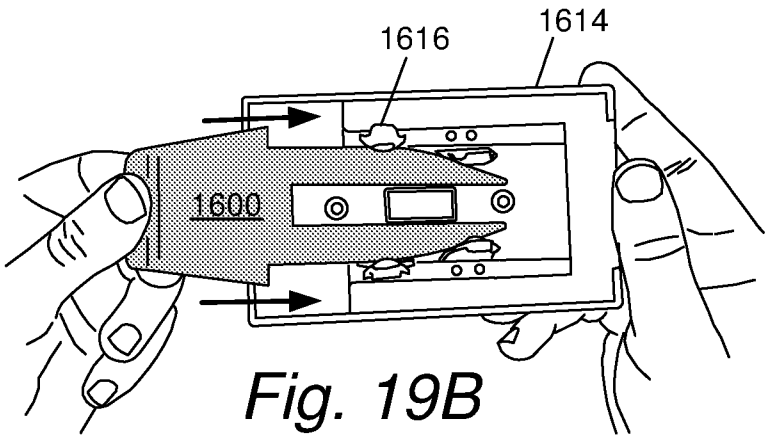

Fig. 19B

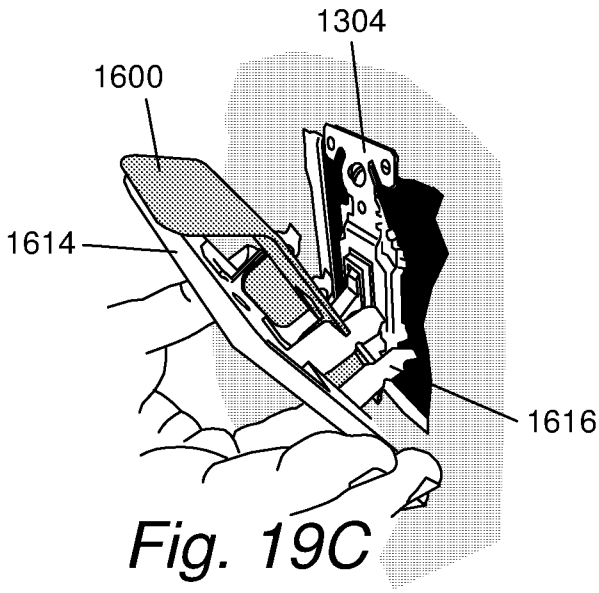

Fig. 19C

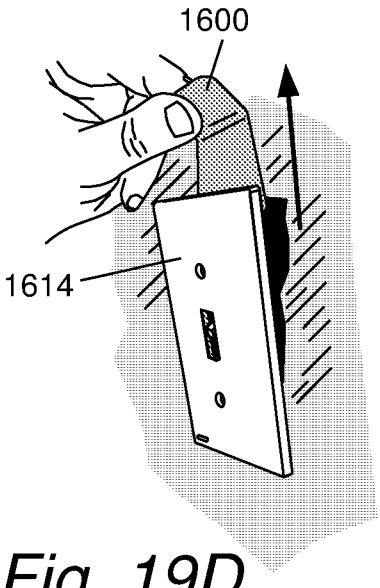

Fig. 19D

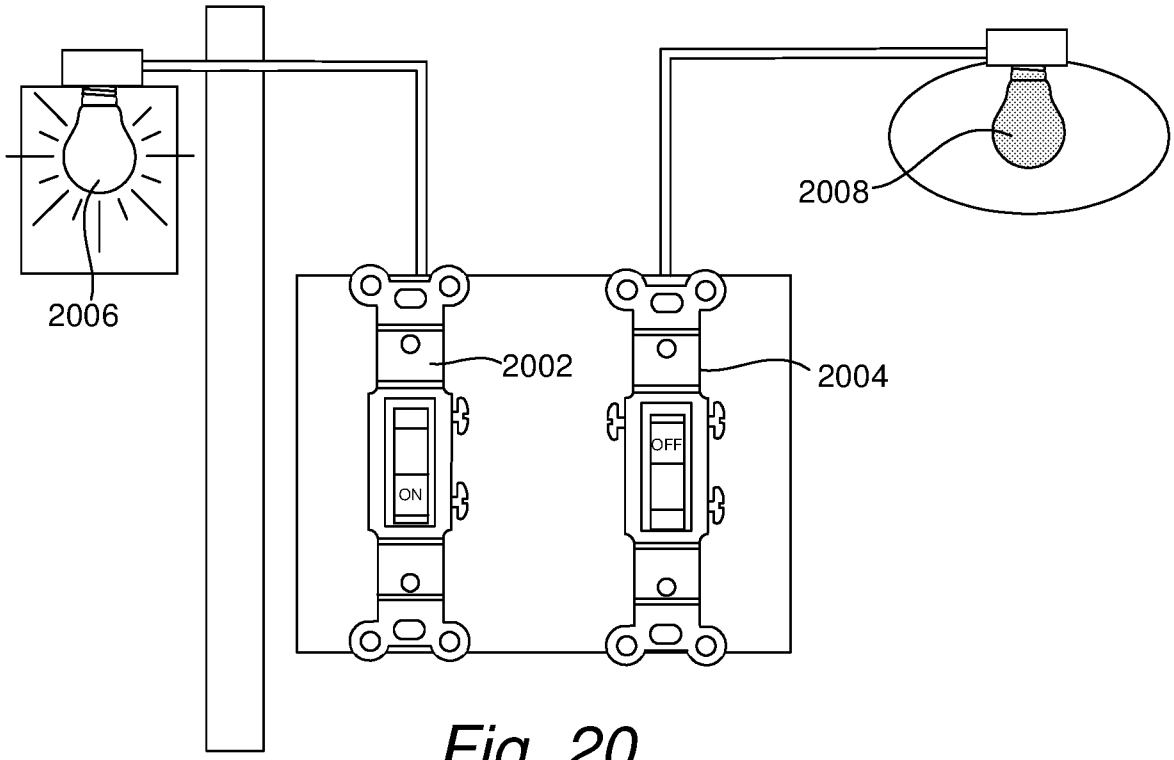

Fig. 20

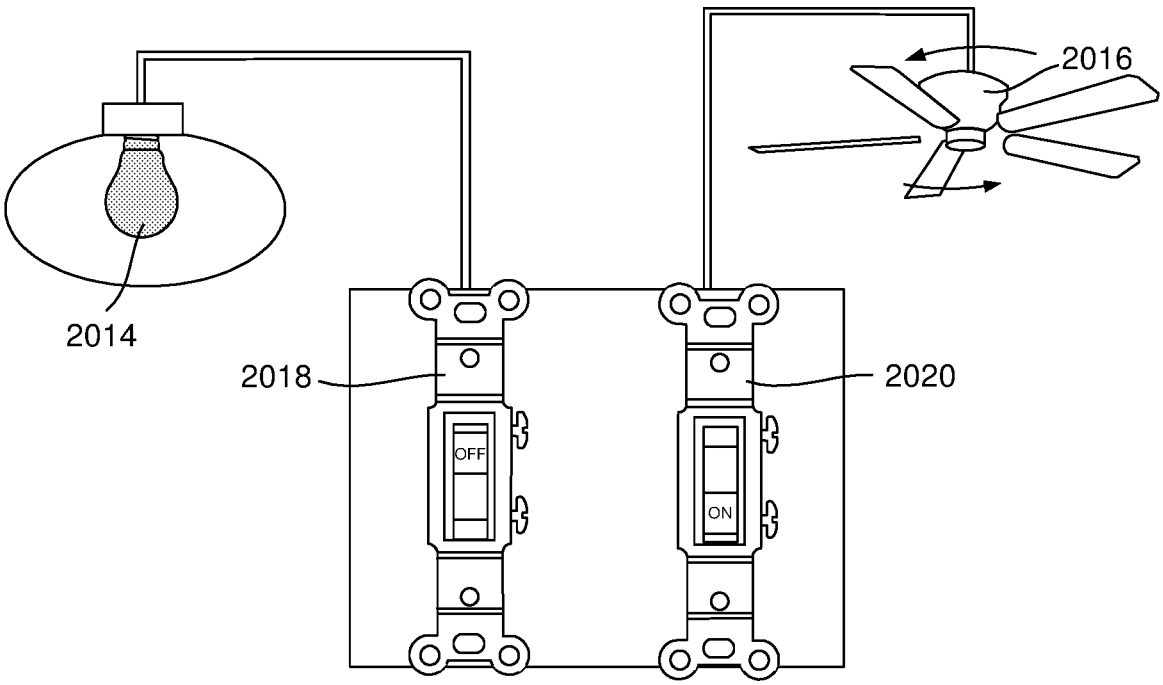

Fig. 21

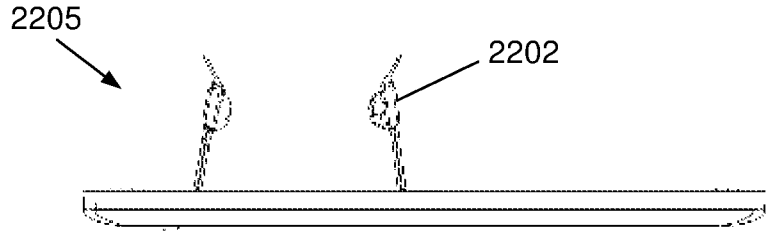

Fig. 22A

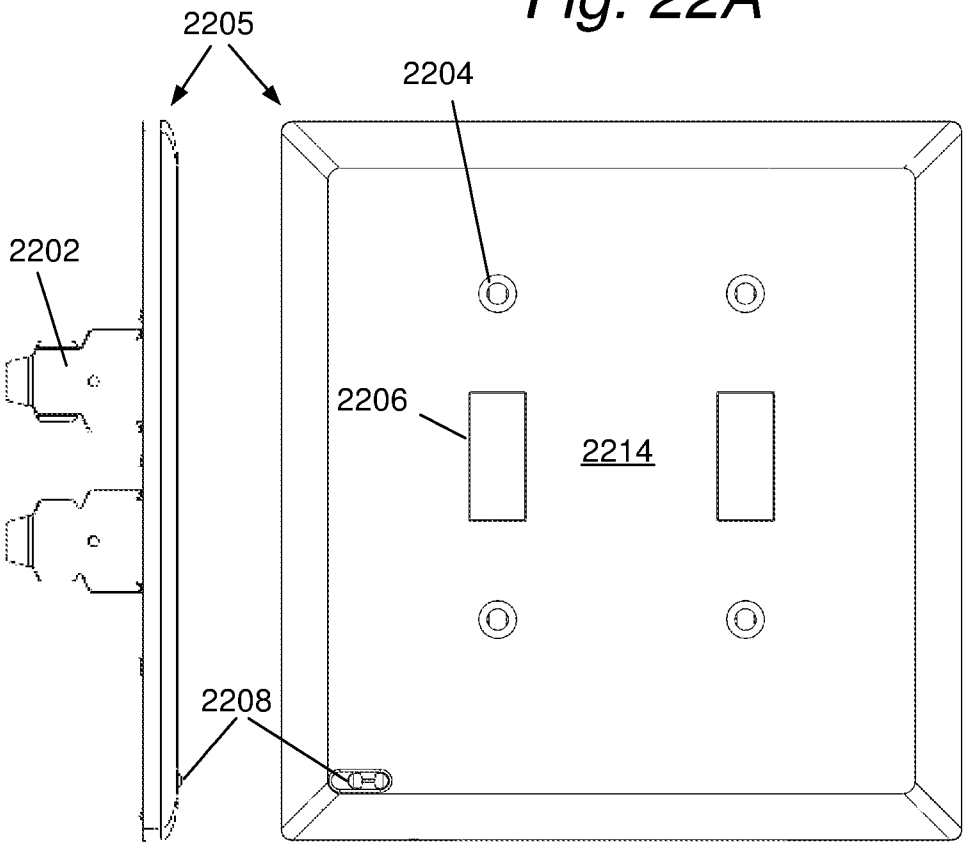

Fig. 22B

Fig. 22C

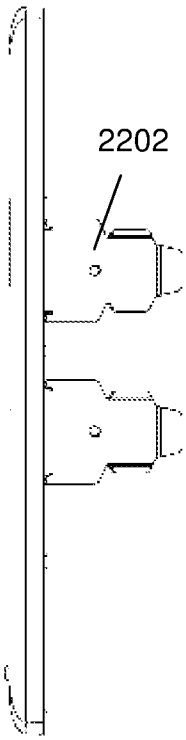

Fig. 22D

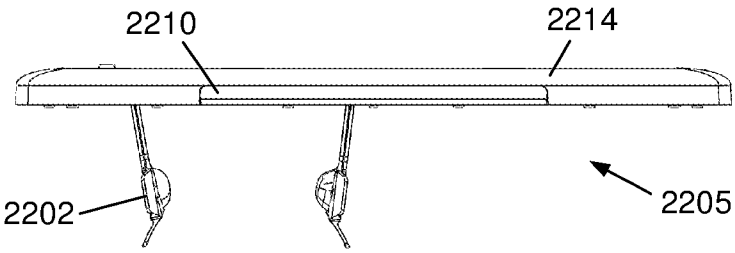

Fig. 22E

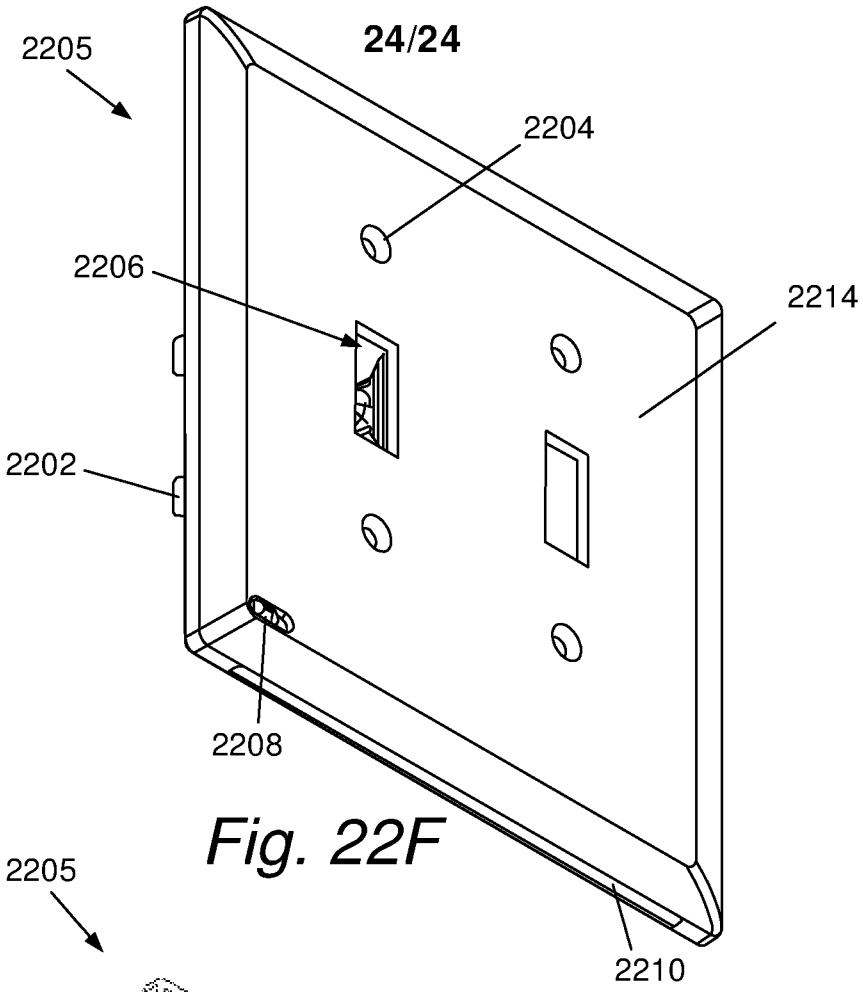

Fig. 22F

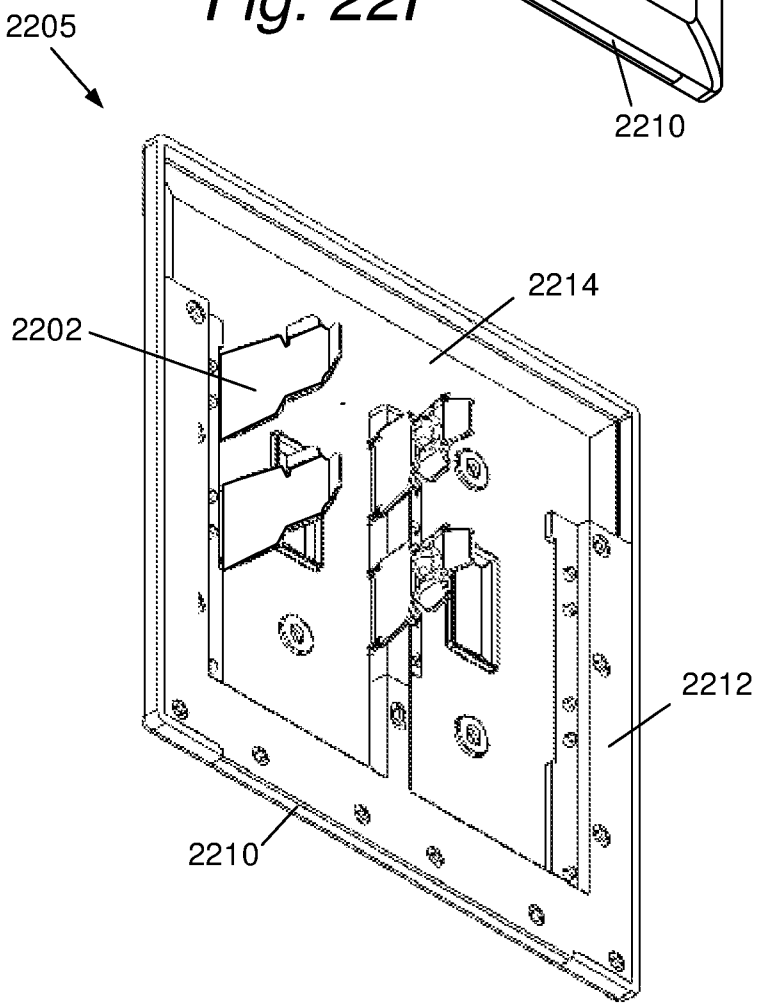

Fig. 22G

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 2018/058040

A. CLASSIFICATION OF SUBJECT MATTER

H01R 13/66 *(2016.01)*

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01R 13/00, 13/02, 13/15, 13/66, 13/717, 25/00, H05K 5/00, 5/02, 5/03, H01H 9/00, 9/18

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatSearch (RUPTO internal), USPTO, PAJ, Esp@cenet, DWPI, EAPATIS, PATENTSCOPE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	WO 2013/019394 A1 (SNAPRAYS, LLC) 07.02.2013, fig. 3A, 3B, 4A, 4B, 9A, 9B, 18A, 18B, [0007],[0065]-[0067],[0072],[0078]-[0079],[0083],[0086]-[0088],[00109]-[00110],[00155]	
X		1-4
Y		5-6
A		7
	US 4886469 A (TSENG LIANG CHUAN) 12.12.1989, fig. 1,2,3,4, col.1, lines 5-7, col. 2, lines 29-34, 48-50	
X		8, 11, 13
Y		5-6
A		7, 9-10, 12, 14
	US 2017/0013736 A1 (CORDELL ELDRED EBELING) 12.01.2017, fig.1,2,28, [0045]-[0070], [0105]	
X		15-21
Y		22
Y	US 6423900 B1 (TECHNICAL SYSTEMS CORP) 23.07.2002, col.9, lines 5-59, col. 10, lines 14-64	22

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 January 2019 (21.01.2019)	31 January 2019 (31.01.2019)
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37	Authorized officer O. Tsykanovskaya Telephone No. 8 499 240 25 91