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(54) SAFE LOCKING OF SMART PLUG ADAPTERS TO POWER SOCKETS

SICHERE VERRIEGELUNG VON INTELLIGENTEN STECKERADAPTERN AN STECKDOSEN

VERROUILLAGE SÉCURISÉ D'ADAPTATEURS DE PRISE INTELLIGENTE DANS DES PRISES
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Description

[0001] The invention refers to smart plug adapters according to claim 1.

Background of the Invention

[0002] In present times machines and electronic devices have become unavoidable to every aspect of human life. Most of these devices, such as laptops, desktop computers, lamps, music systems, electronic musical instruments, etc. use electrical energy drawn directly from a power source, such as a wall socket, a mobile socket connected to wall socket or a overhanging socket, and so on and so forth. The safety of plugging mechanisms nowadays of these devices is of utmost importance for avoiding electrical hazards and accidents.

[0003] In conventional plugging mechanisms, usually a plug from a device that needs power is inserted into a socket e.g. a wall mounted socket. The socket is connected to electrical mains of the establishment, such as electrical mains of an apartment. The socket includes conducting plates that are hidden inside the socket. The plug of the device has conducting poles or pins that are exteriorly exposed. The conducting poles or pins of the plug are mated with the conducting poles of the device plug thereby establishing an electrical connection between the socket and the device.

[0004] Another way of electrical plugging uses smart plugging mechanism. The smart plugging mechanism uses a smart plug adapter, also referred simply to as the smart plug, which includes a male member i.e. a plug part, and a female member i.e. a notch for receiving device plug. The male member of the smart plug adapter is connected to electric power by inserting the connecting pins of the male member into the power socket. Within a housing or enclosure of the smart plug adapter is present electrical circuitry that electrically connect the male member to the female member, and thus flow of electricity from male member to the female member within the smart plug adapter is established. At the female member of the smart plug adapter are conducting plates. An electrical connection can then be established between the conducting plates of the female member of the smart plug adapter and the conducting poles of the device plug for example by inserting the device plug into the notch of the female member. Smart plug adapters have various advantages, for example besides functioning simply as an adapter; they have other features such as switching mechanisms, wirelessly controllable switching mechanisms, increased safety, and so on and so forth.

[0005] However, while being used, such smart plug adapters often fall apart from the wall socket i.e. the power socket mounted on a wall, to which they are connected, under accidental impacts such as stumbling on the cord by a user, misfit between power socket and the smart plug adapter, excessive weight of the chord connected to the smart plug adapter, and so on and so forth, causing

undesirable separation between the smart plug and the wall socket. Furthermore, the smart plug adapter may fall on the surface and get damaged. On the other hand, when the user desires to unplug the device from the smart plug adapter, the user is required to hold the surface of the smart plug in order to be able to remove the device plug without unplugging the smart plug adapter. This is undesirable as there is a risk of electrical hazard when touching the smart plug adapter. Furthermore, the user may desire to ensure that smart plug is not unplugged from the socket while unplugging the device, for example some smart plugs may require reconfiguration once unplugged. Furthermore, if the user is not careful, the unplugging of the device plug may result into simultaneous unplugging and dropping of the smart plug adapter on the floor surface beneath the wall socket and damaging of the smart plug adapter.

[0006] Hence, there exists a need for a smart plug adapter that does not get accidentally unplugged from the wall socket while being used, i.e. for a duration when a device is in plugged state into the smart plug adapter. Additionally, the desired smart plug adapter should obviate accidental falling off of the smart plug adapter from the wall socket when the device is being unplugged. Furthermore, the smart plug is desired to be such that the device connected to the smart plug may be removed from the smart plug without touching the smart plug connected into the wall socket.

[0007] Document US 9,564,713 B1 discloses a detachable and lockable socket with a casing that is provided with a controller, a socket unit, and a pin. The pin may be moved by the controller to be locked.

Object of the Invention

[0008] It is an object of the present technique, therefore, to provide a smart plug adapter that at least partially, and preferably completely, obviates occurrences of accidental unplugging of the smart plug adapter from the wall socket while being used or when the device connected to the smart plug adapter is being unplugged. Furthermore, the smart plug of the present technique may enable unplugging of the device from the smart plug without touching the smart plug connected to the wall socket.

Description of the Invention

[0009] The aforementioned object is achieved by a smart plug adapter according to claim 1 of the present invention.

[0010] The smart plug adapter, hereinafter also referred to as the adapter or the smart plug, includes a housing within which are enclosed a controller and electrical circuitry. The smart plug adapter further includes a male member, a female member, a locking mechanism, a mechanical vibrations actuator and at least one vibration sensor.

[0011] The male member extends outwardly from a surface of the housing and is configured to receive electrical current when engaged with an external power socket, for example a wall socket. The male member may include conducting connector pins that engage with the power socket and thereby establish electrical connection between the electrical circuitry and the power socket.

[0012] The locking mechanism is disposed at the surface of the housing. The locking mechanism when actuated is configured to lock the male member with the power socket. The locking mechanism may be hydraulically actuated or pneumatically actuated, and may have electromechanical mechanism or electromagnetic mechanism.

[0013] The female member is formed on the surface of the housing and is configured to provide the electrical current to an electrical device, for example to a laptop, when a device plug i.e. a plug of the laptop or of the laptop adapter is engaged with the female member. The electrical current received from the power socket by the male member is thereafter conducted from the male member to the female member. The female member may be formed as a receptacle or notch on the surface of the housing. Additionally, the female member may include conducting connector holes that allow engagement with connectors of the device plug to establish electrical connection between the electrical circuitry and the device plug.

[0014] The mechanical vibrations actuator is positioned at the female member, i.e. superficially in the female member, and is configured to emit mechanical vibrations outwardly i.e. away from the housing or in other words towards the device plug when such the device plug is engaged with the female member. The mechanical vibrations spread over a lateral surface of the device plug, when the device plug is plugged into the female member of the smart plug adapter. The transmission of the mechanical vibrations over the lateral surface of the device plug is further facilitated owing to a solid construction of the device plug. The mechanical vibrations actuator may be, but not limited to, one of an electromechanical drive, a piezoelectric transducer, and an electromagnetic drive. Preferably, the mechanical vibrations actuator generates mechanical vibrations having a frequency value of less than 10 Hz (hertz), and more particularly less than 1 Hz.

[0015] The vibration sensor, for example a piezoelectric vibration sensor, that is generally disposed physically removed from the mechanical vibrations actuator and superficially within the female member is configured to determine the mechanical vibrations, when present, from the device plug, particularly from the lateral surface of the device plug over which the mechanical vibrations generated by the mechanical vibrations actuator is spread. The vibration sensor sends to the controller a signal corresponding to a determination of mechanical vibrations, i.e. the vibration sensor sends to the controller a signal indicative of presence of vibrations i.e. when the device plug is plugged into the female member. When

no signal indicative of the presence of vibrations is sent to the controller by the vibration sensor, it is indicative of a determination of absence of the device plug, i.e. no device plug is plugged into the smart plug adapter.

[0016] The controller sends an actuating signal to the locking mechanism when the controller receives the signal from the vibration sensor that corresponds to the determination of mechanical vibrations as present, i.e. when the signal sent from the vibration sensor is indicative of a state wherein the device plug is plugged into the smart plug adapter. The actuating signal actuates the locking mechanism, which in turn locks the male member of the smart plug to the power socket.

[0017] Thus the smart plug adapter of the present technique is physically locked with the power socket when the device plug is plugged into or engaged with the female member of the smart plug adapter, and more particularly the male member of the smart plug adapter of the present technique is physically locked with the power socket when the device plug is plugged into or engaged with the female member of the smart plug adapter. The smart plug adapter, particularly the male member of the smart plug adapter, of the present technique is not locked, i.e. is in unlocked state, with the power socket when the device plug is not plugged into or disengaged from the female member of the smart plug adapter.

[0018] Therefore, the smart plug adapter when being used, i.e. when the device plug is plugged into the female member of the smart plug adapter, does not accidentally unplug or fall off from the power socket, i.e. the wall socket. The smart plug adapter is locked with the power socket for the entire duration when the device is in plugged state into the smart plug adapter. Additionally, when the user wants to unplug the device plug from the smart plug adapter, chances of accidental falling off of the smart plug adapter from the wall socket is reduced. Furthermore, the smart plug adapter, being in a locked state, does not need to be manually contacted when the user is removing the device plug from the power socket.

[0019] In an embodiment, the smart plug adapter includes a plurality of the vibration sensors dispersedly arranged in the female member. Additionally, the controller may be configured to send the actuating signal to the locking mechanism only when the controller receives the signal from at least two of the vibration sensor corresponding to the determination of mechanical vibrations as present. Thus mechanical vibrations at multiple points of the lateral surface of the device plug are used to conclusively determine presence of the device plug.

[0020] Further benefits, goals and features of the present invention will be described by the following specification of the attached figures, in which components of the invention are exemplarily illustrated. Components of the devices and method according to the inventions, which match at least essentially with respect to their function, can be marked with the same reference sign, wherein such components do not have to be marked or described in all figures.

[0021] Further embodiments of the present invention are subject of the further subclaims and of the following description, referring to the drawings. The invention is just exemplarily described with respect to the attached figure in the following.

Brief Description of the Drawings

[0022]

Fig. 1 schematically represents an exemplary embodiment of a smart plug adapter according to the present invention,

Fig. 2 schematically represents a perspective view of an exemplary embodiment of a male member side of the smart plug adapter of Fig. 1,

Fig. 3 schematically represents a perspective view of an exemplary embodiment of a female member side of the smart plug adapter of Fig. 1,

Fig. 4 schematically represents a wall mounted power socket and a device that is desired to be connected to the power socket through the smart plug adapter of Fig. 1,

Fig. 5 schematically represents a perspective view of another exemplary embodiment the male member side of the smart plug adapter when no device is connected to the smart plug adapter,

Fig. 6 schematically represents a perspective view of the male member side of the smart plug adapter when a device is connected to the smart plug adapter,

Fig. 7 schematically represents a perspective view of another exemplary embodiment of the female member of the smart plug adapter,

Fig. 8 schematically represents a relative arrangement of mechanical vibrations actuator and a vibration sensor at the female member of the smart plug adapter,

Fig. 9 schematically represents a relative arrangement of the mechanical vibrations actuator and a plurality of the vibration sensors at the female member of the smart plug adapter, and

Fig. 10 schematically represents another relative arrangement of the mechanical vibrations actuator and the plurality of the vibration sensors at the female member of the smart plug adapter; in accordance with the present technique.

Detailed Description of the Drawings

[0023] Fig. 1 shows a smart plug adapter 1 of the present technique. The smart plug adapter 1, hereinafter also referred to as the adapter 1 or the smart plug 1, generally includes a housing 30. The housing 30 has a surface 32 forming the surface of the housing 30. The housing 30 is made of insulating material and may have varied shapes and sizes, for example the housing 30 may be box-shaped as shown in Fig. 1 or may be cylindrical in shape (not shown). The smart plug 1 includes a male member 10 and a female member 20, configured on the surface 32 of the housing 30. The male member 10 and the female member 20 are generally present on opposite sides, as depicted in Fig. 1 that shows a male member side 11 and a female member side 21. However, the male member 10 and the female member 20 may also be oriented differently from the depiction of Fig. 1, for example the female member 20 may be present on a wall of the housing 30 that is perpendicularly disposed relative to the male member side 11.

[0024] Fig. 2 shows the male member side 11 of the smart plug 1, and Fig. 3 shows the female member side 21 of the smart plug 1. Hereinafter, the smart plug 1 of Fig. 1 is explained in combination with Figs. 2 and 3 as well as Fig. 4. A use scenario of the smart plug 1 is depicted in Fig. 4. As shown in Fig. 4, the smart plug 1 is used as an adapter to connect a device 90, such as a laptop or a music player, to an electrical power supply such as a power socket 80, that is generally a wall mounted power socket 80. The device 90 has a plug 91 i.e. the device plug 91 that includes electrical connectors 92 such as connection pins or poles that are inserted into the female member 20 of the smart plug 1, and thus electrical connection or contact is established between the device 90 and the smart plug 1. The smart plug 1 is in turn inserted into or plugged into the power socket 80. The smart plug 1 thereby establishes an electrical connection between the power socket 80 and the device 90. The electrical connection established by the smart plug 1 is generally switchable i.e. the connection can be switched on and off. In an embodiment of the smart plug 1, the electrical connection can be switched on and off wirelessly, i.e. remotely. Such smart plug 1 includes suitable elements to enable wireless switching for example, includes an IR receiver, a Wi-Fi module, a Bluetooth module, and so on and so forth.

[0025] As shown in Fig. 1 and 2, the male member 10 extends outwardly from the surface 32 of the housing 30. The male member 10 is configured to receive electrical current when engaged with the power socket 80 shown in Fig. 4, for example the power socket 80 mounted on the wall 8. The male member 10 may include conducting connector pins or poles 12 that engage with the power socket 80, and more particularly that are inserted into socket holes 82 that have conductor plates there within. The housing 30 also includes within it electrical circuitry 52 such as electrical lines, conductor plates, etc that is

connected to the male member 10, particularly the connector pins 12 of the male member 10, and thus electrical current flows through the socket holes 82 into the electrical circuitry 52 via the connector pins 12 of the male member 10. The male member 10 may have varied shapes and sizes, for example the male member 10 may have a generally cylindrical shape as shown in Fig. 2, or may have cuboidal shape with rounded edges as shown in Figs. 5 and 6. It may be noted that shape and size of the male member 10 is dependent on standards and regulations governing power plugs in specific geographical jurisdictions. The shape and size of the male member 10 is also dependent on the shape and size of the power socket 80 into which the male member 10 is to be plugged in.

[0026] As shown in Fig. 3, the female member 20 is formed on the surface 32 of the housing 30. The female member 20 may be formed as a receptacle or notch 24, as shown in Fig. 7 or may be formed superficially on the surface 32 without receptacle shape. The female member 20 includes conducting connector holes 22 that allow engagement with connectors 92 of the device plug 91, as shown in Fig. 4. The connector holes 22 are connected at the inside of the housing 30 to the electrical circuitry 52 and thus, when the connectors 92 of the device plug 91 are plugged into or connected to the connector holes 22 electrical connection is established between the electrical circuitry 52 and the device plug 91, which in turn is electrically connected to the device 90, as depicted in Fig. 4. The electrical current received from the power socket 80 by the male member 10 is thereafter conducted from the male member 10 to the female member 20 via the electrical circuitry 52, and subsequently the female member 20 conducts the electrical current to the device 90 via the device plug 91.

[0027] As shown in Figs. 2 and 3 in combination with Fig. 1, the smart plug adapter 1 further includes a mechanical vibrations actuator 60, at least one vibration sensor 62, a locking mechanism 40 and a controller 50.

[0028] As depicted in Fig. 3, the mechanical vibrations actuator 60 is positioned at the female member 20, i.e. superficially in the female member 20, or in other words at the surface 32 forming part of the female member 20. Preferably the mechanical vibrations actuator 60, hereinafter also referred to as the actuator 60, is positioned in-between the connector holes 22 of the female member 20. The actuator 60 emits mechanical vibrations outwardly i.e. away from the housing 30 or in other words towards the device plug 91 when the device plug 91 is engaged with the female member 20. The actuator 60 may be, but not limited to, one of an electromechanical drive, a piezoelectric transducer, and an electromagnetic drive. Preferably, the mechanical vibrations actuator generates ultralow frequency mechanical vibrations, for example having a frequency value of less than 10 Hz (hertz), and preferably less than 1 Hz. As a result of the low frequency mechanical vibrations, no audible noise is generated and no mechanical damage or interference is caused to the

electrical connections established between the power socket 80 and the device 90 via the smart plug 1.

[0029] The mechanical vibrations spread over a lateral surface 94, shown in Fig. 4, of the device plug 91, when the device plug 91 is plugged into the female member 20 of the smart plug adapter 1. The mechanical vibrations so received by the device plug 91, and particularly by the lateral surface 94 of the device plug 91, spread over the entire lateral surface 94 of the device plug 91. The spreading of the mechanical vibrations is further facilitated owing to a solid construction of the device plug 91. Alternatively, when the device plug 91 is unplugged i.e. when the device plug 91 is not inserted or plugged state with the female member 20 of the smart plug 1, the mechanical vibrations generated by the actuator 60 just dissipate into the surrounding and are absorbed in the surrounding air.

[0030] As shown in Fig. 3, the vibration sensor 62, for example a piezoelectric vibration sensor, detects or senses vibrations and is generally disposed physically removed from the mechanical vibrations actuator 60 and superficially i.e. on the surface 32, within the female member 20. The vibrations sensor 62 is physically removed so that the mechanical vibrations from the actuator 60 are not directly detected by the vibration sensor 62. Other techniques may be used to inhibit direct detection of the vibrations generated by the actuator 60 and traveling through the surface 32, for example by placing vibration damping around the actuator 60 and/or around the vibration sensor 62 that inhibit the vibrations generated by the actuator 60 from traveling along the surface 32. Another way is to set vibration sensing by the vibration sensor 62 to a threshold limit, i.e. only vibrations stronger than a predetermined value can be detected. The vibration sensor 62, hereinafter also referred to as the sensor 62 determines the mechanical vibrations, when present, from the device plug 91, particularly from the lateral surface 94 of the device plug 91 over which the mechanical vibrations generated by the actuator 60 spread. The detection of the mechanical vibrations is facilitated as the lateral surface 94 of the device plug 91 is either in direct physical contact or in immediate proximity to the sensor 62, when the device plug 91 is plugged into the female member 20 of the smart plug 1. The detection of the mechanical vibrations by the sensor 62 may be tuned to sense or report only vibrations having certain predetermined characteristics, whereas other vibrations may be ignored.

[0031] The vibration sensor 62, as and when detects the presence of lateral surface 94 of the device plug 91 sends to the controller 50, positioned inside the housing 30, a signal corresponding to a determination of mechanical vibrations, i.e. the vibration sensor 62 sends to the controller 50 a signal that is indicative of presence of vibrations i.e. when the device plug 91 is plugged into the female member 20. When no signal indicative of the presence of vibrations is sent to the controller 50 by the vibration sensor 60, it is indicative of a determination of

absence of the device plug 91, i.e. no device plug 91 is plugged into the smart plug adapter 1.

[0032] The controller 50, for example a microprocessor, sends an actuating signal to the locking mechanism 40 as a response to the controller 50 receiving the signal from the vibration sensor 62 that corresponds to the determination of mechanical vibrations as present, i.e. when the signal sent from the vibration sensor 62 is indicative of a state wherein the device plug 91 is plugged into the smart plug adapter 1. The actuating signal sent from the controller 50 actuates or activates the locking mechanism 40, which in turn locks the male member 10 of the smart plug 1 to the power socket 80, for example to a support structure 84 of the power socket 80, shown in Fig 4, or to a side of a receptacle 86 of the power socket 80, also shown in Fig. 4. Fig. 5 shows a state of locking mechanism 40 when the locking mechanism 40 is in default mode, i.e. when no device plug 91 is plugged into the female member 20 of the smart plug 1, and Fig. 6 shows a state of locking mechanism 40 when the locking mechanism 40 is actuated. It may be noted that the depiction of locking mechanism 40 and the different states of the locking mechanism 40 represented in Figs. 5 and 6 are only for purpose of explanation, and not for limitation.

[0033] The locking mechanism 40 is disposed at the surface 32 of the housing 30, and preferable within the male member 10. The locking mechanism 40 may be any type of locking mechanism that may be actuated or activated on receiving a signal or command send from the controller 50 in response to the signal received by the controller 50 from the one or more of the vibration sensors 62. For example, the locking mechanism 40 may comprise hydraulically and/or pneumatically controlled locking pins, latches, clamps, clamping rings and/or hooks that lock into a corresponding notch (not shown) in or around the power socket 80. The hydraulically and/or pneumatically controlled locking pins, latches, clamps, clamping rings, and/ or hooks are actuated by the actuating signal or command send from the controller 50, when the vibration sensors 62 detect presence of vibrations indicative of a presence of the device plug 91 engaged with the female member 20 of the smart plug 1.

[0034] Another type of locking mechanism 40 may be an electromechanical system such as an electrical drive based locking mechanism, for example motor driven locking pins, latches, clamps, clamping rings and/or hooks that lock into a corresponding notch in or around the power socket 80. The electrical drive controlled locking pins, latches, clamps, clamping rings, and/ or hooks are actuated by the actuating signal or command send from the controller 50, when the vibration sensor 62 detects presence of vibrations indicative of a presence of the device plug 91 engaged with the female member 20 of the smart plug 1.

[0035] Yet another type of locking mechanism 40 may be an electromagnetic arrangement such as an electromagnet based locking mechanism, for example electri-

cally actuated electromagnetic locking pins, latches, clamps, clamping rings and/or hooks that magnetically clamp into a corresponding ferro-/ferri-magnetic member such as an iron plate in or around the power socket 80.

The electromagnetic arrangement components are actuated by the actuating signal or command send from the controller 50, when the vibration sensors 62 detect presence of vibrations indicative of a presence of the device plug 91 engaged with the female member 20 of the smart plug 1. The required energy for the actuation of the aforementioned locking mechanisms 40 may be directly obtained from the electrical supply of the power socket 80 or may be stored in a battery (now shown) rechargeable via the electrical supply of the power socket 80.

[0036] It may be noted that the aforementioned locking mechanisms 40 are for exemplary purposes only. It may be appreciated by one skilled in the art that other types of locking mechanisms 40, besides or in addition to the aforementioned locking mechanisms 40, are well within the scope of the present technique. Generally, any type of locking mechanism 40 that can secure or lock the smart plug male member 10 to the power or wall socket 80 on being actuated by receiving the actuating signal or command send from the controller 50, when the vibration sensors 62 detect presence of vibrations indicative of a presence of the device plug 91 engaged with the female member 20 of the smart plug 1 is sufficient for realizing the present technique, and thus is within the scope of the present technique. The locking mechanism 40 of the present technique unlocks the connection between the male member 10 of the smart plug 1 and the power socket 80 when another signal or command is send from the controller 50 to the locking mechanism 40 indicative of absence of vibrations that would have been present if the device plug 91 were engaged with the female member 20 of the smart plug 1. Alternatively, the locking mechanism 40 of the present technique unlocks the connection between the male member 10 of the smart plug 1 and the power socket 80 when the signal or command send from the controller 50 indicative of the presence of the device plug 91 engaged with the female member 20 of the smart plug 1 are absent for a predetermined time interval.

[0037] Thus the smart plug adapter 1 of the present technique is physically locked with the power socket 80 when the device plug 91 is plugged into or engaged with the female member 20 of the smart plug adapter 1, and more particularly the male member 10 of the smart plug adapter 1 of the present technique is physically locked with the power socket 80 when the device plug 91 is plugged into or engaged with the female member 20 of the smart plug adapter 1. The smart plug adapter 1, particularly the male member 10 of the smart plug adapter 1, of the present technique is not locked, i.e. is in unlocked state, with the power socket 80 when the device plug 91 is not plugged into or is disengaged from the female member 20 of the smart plug adapter 1.

[0038] Therefore, the smart plug adapter 1 when being

used, i.e. when the device plug 91 is plugged into the female member 20 of the smart plug adapter 1, does not accidentally unplug or fall off from the power socket 80, i.e. the wall socket. The smart plug adapter 1 is locked with the power socket 80 for the entire duration when the device 90 is in plugged state into the smart plug adapter 1. Additionally, when the user wants to unplug the device plug 91 from the smart plug adapter 1, chances of accidental falling off of the smart plug adapter 1 from the wall mounted power socket 80 is reduced. Furthermore, the smart plug adapter 1, being in a locked state, does not need to be manually contacted when the user is removing the device plug 91 from the power socket 80.

[0039] Hereinafter, further embodiments of the smart plug adapter 1 have been explained with reference to Figs. 7 to 10. The smart plug adapter 1 may include a plurality of the vibration sensors 62 dispersedly arranged in the female member 20 as shown in Figs 3, 9 and 10, or alternatively may include only one vibration sensor 60 as depicted in Fig. 8. When multiple vibration sensors 62 are present, the controller 50 may be configured to send the actuating signal to the locking mechanism 40 only when the controller 50 receives the signal from at least two of the vibration sensors 62 corresponding to the determination of mechanical vibrations as present. Thus, mechanical vibrations from multiple points of the lateral surface 94 of the device plug 91 are used to conclusively determine presence of the device plug 91 engaged with the female member 20 of the smart plug 1.

[0040] As indicated above, the smart plug adapter 1 includes a housing 30, a controller 50, a male member 10 to receive electrical current when engaged with a power socket 80, a locking mechanism 40 which when actuated locks with the power socket 80, a female member 20 to provide the current to an electrical device 90 when a plug 91 of the device 90 is inserted therein, a mechanical vibrations actuator 60 at the female member 20 and that emits mechanical vibrations outwardly from the housing 30, and a vibration sensor 62 at the female member 20 and that determines mechanical vibrations, when present, from the device plug 91. The controller 50 sends an actuating signal to the locking mechanism 40 when the controller 50 receives a signal from the vibration sensor 62 that is indicative of presence of mechanical vibrations i.e. indicative of the presence of the device plug 91 engaged with the female member 20. The actuating signal actuates the locking mechanism 40.

List of reference numbers

[0041]

1	smart plug adapter
8	wall
10	male member
11	male member side of the housing
12	connector pins of the smart plug adapter
20	female member

21	female member side of the housing
22	connector holes of the smart plug adapter
24	receptacle of the female member
30	housing
5 32	surface of the housing
40	locking mechanism
50	controller
52	electrical circuitry
60	mechanical vibrations actuator
10 62	vibration sensor
80	power socket
82	socket holes
84	support structure
86	socket receptacle
15 90	device
91	device plug
92	device connectors
94	lateral surface of the device plug

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Claims

1. A smart plug adapter (1) comprising:

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- a housing (30) having enclosed therein a controller (50) and electrical circuitry (52),
- a male member (10) extending from a surface (32) of the housing (30) and configured to receive electrical current when engaged with an external power socket (80),
- a locking mechanism (40) disposed at the surface (32) of the housing (30) and configured, when actuated, to lock the male member (10) with the power socket (80),

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- a female member (20) formed on the surface (32) of the housing (30) and configured to provide the electrical current to an electrical device (90) when a device plug (91) of the electrical device (90) is engaged with the female member (20), wherein the electrical circuitry (52) is configured to conduct the electrical current from the male member (10) to the female member (20),

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characterized by

- a mechanical vibrations actuator (60) disposed at the female member (20) and configured to emit mechanical vibrations outwardly from the housing (30),
- at least one vibration sensor (62) disposed at the female member (20) and configured to determine mechanical vibrations, when present, from the device plug (91), wherein the vibration sensor (62) is further configured to send to the controller (50) a signal corresponding to a determination of mechanical vibrations, and

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wherein the controller (50) is configured to send an actuating signal to the locking mechanism (40) when the controller (50) receives the signal from the vibra-

tion sensor (62) corresponding to the determination of mechanical vibrations as present, and wherein the actuating signal actuates the locking mechanism (40).

2. The smart plug adapter (1) according to claim 1, wherein the male member (10) comprises conducting connector pins (12) configured to engage with the power socket (80) and to establish electrical connection between the electrical circuitry (52) and the power socket (80). 5
3. The smart plug adapter (1) according to claim 1 or 2, wherein the female member (20) is formed as a receptacle (24) on the surface (32) of the housing (30). 10
4. The smart plug adapter (1) according to any of claims 1 to 3, wherein the female member (20) comprises conducting connector holes (22) configured to engage with connectors (92) of the device plug (91) and to establish electrical connection between the electrical circuitry (52) and the device plug (91). 15
5. The smart plug adapter (1) according to any of claims 1 to 4, wherein the mechanical vibrations actuator (60) is one of an electromechanical drive, a piezoelectric transducer, and an electromagnetic drive. 20
6. The smart plug adapter (1) according to any of claims 1 to 5, wherein the mechanical vibrations actuator (60) is configured to generate mechanical vibrations having a frequency value of less than 10 Hz. 25
7. The smart plug adapter (1) according to claim 6, wherein the mechanical vibrations actuator (60) is configured to generate mechanical vibrations having a frequency value of less than 1 Hz. 30
8. The smart plug adapter (1) according to any of claims 1 to 7, wherein the vibrations sensor (62) is a piezoelectric vibration sensor. 35
9. The smart plug adapter (1) according to any of claims 1 to 8, comprising a plurality of the vibration sensors (62) dispersedly arranged in the female member (20). 40
10. The smart plug adapter (1) according to claim 9, wherein the controller (50) is configured to send the actuating signal to the locking mechanism (40) when the controller (50) receives the signal from at least two of the vibration sensors (62) corresponding to the determination of mechanical vibrations as present. 45
11. The smart plug adapter (1) according to claims 1 to 10, wherein the locking mechanism (40) is one of a

hydraulically actuated mechanism, a pneumatically actuated mechanism, an electromechanical mechanism, a electromagnetic mechanism, and a combination thereof.

Patentansprüche

1. Intelligenter Steckeradapter (1), aufweisend:

- ein Gehäuse (30), in dem ein Controller (50) und elektrische Schaltungen (52) untergebracht sind,
- ein männliches Element (10), das sich von einer Oberfläche (32) des Gehäuses (30) aus erstreckt und dazu konfiguriert ist, einen elektrischen Strom aufzunehmen, wenn es mit einer externen Stromsteckdose (80) in Eingriff ist,
- einen Verriegelungsmechanismus (40), der an der Oberfläche (32) des Gehäuses (30) angeordnet und dazu konfiguriert ist, bei seiner Betätigung das männliche Element (10) mit der Stromsteckdose (80) zu verriegeln,
- ein weibliches Element (20), das auf der Oberfläche (32) des Gehäuses (30) ausgebildet und dazu konfiguriert ist, den elektrischen Strom an ein elektrisches Gerät (90) zu liefern, wenn ein Gerätestecker (91) des elektrischen Geräts (90) mit dem weiblichen Element (20) in Eingriff ist, wobei die elektrischen Schaltungen (52) dazu konfiguriert sind, den elektrischen Strom von dem männlichen Element (10) zum weiblichen Element (20) zu leiten, **gekennzeichnet durch**
- ein mechanisches Vibrationsantriebsselement (60), das an dem weiblichen Element (20) angeordnet und dazu konfiguriert ist, aus dem Gehäuse (30) heraus mechanische Vibrationen abzugeben,
- mindestens einen Vibrationssensor (62), der an dem weiblichen Element (20) angeordnet und dazu konfiguriert ist, von dem Gerätestecker (91) kommende mechanische Vibrationen, wenn sie vorhanden sind, festzustellen, wobei der Vibrationssensor (62) ferner dazu konfiguriert ist, an den Controller (50) ein Signal senden, das einer Feststellung mechanischer Vibrationen entspricht, und

wobei der Controller (50) dazu konfiguriert ist, ein Betätigungssignal an den Verriegelungsmechanismus (40) zu senden, wenn der Controller (50) das Signal von dem Vibrationssensor (62) empfängt, das der Feststellung entspricht, dass mechanische Vibrationen vorhanden sind, und wobei das Betätigungssignal den Verriegelungsmechanismus (40) betätigt.

2. Intelligenter Steckeradapter (1) gemäß Anspruch 1,

wobei das männliche Element (10) leitfähige Anschlussstifte (12) aufweist, die dazu konfiguriert sind, mit der Stromsteckdose (80) in Eingriff zu kommen und eine elektrische Verbindung zwischen den elektrischen Schaltungen (52) und der Stromsteckdose (80) herzustellen.

3. Intelligenter Steckeradapter (1) gemäß Anspruch 1 oder 2, wobei das weibliche Element (20) als eine Aufnahme (24) auf der Oberfläche (32) des Gehäuses (30) ausgebildet ist. 10
4. Intelligenter Steckeradapter (1) gemäß einem der Ansprüche 1 bis 3, wobei das weibliche Element (20) leitfähige Steckeröffnungen (22) aufweist, die dazu konfiguriert sind, mit Anschlüssen (92) des Gerätesteckers (91) in Eingriff zu kommen und eine elektrische Verbindung zwischen den elektrischen Schaltungen (52) und dem Gerätestecker (91) herzustellen. 15 20
5. Intelligenter Steckeradapter (1) gemäß einem der Ansprüche 1 bis 4, wobei das mechanische Vibrationsantriebselement (60) eines aus einem elektromechanischen Antrieb, einem piezoelektrischen Wandler und einem elektromagnetischen Antrieb ist. 25
6. Intelligenter Steckeradapter (1) gemäß einem der Ansprüche 1 bis 5, wobei das mechanische Vibrationsantriebselement (60) dazu konfiguriert ist, mechanische Vibrationen zu erzeugen, die einen Frequenzwert von weniger als 10 Hz haben. 30
7. Intelligenter Steckeradapter (1) gemäß Anspruch 6, wobei das mechanische Vibrationsantriebselement (60) dazu konfiguriert ist, mechanische Vibrationen zu erzeugen, die einen Frequenzwert von weniger als 1 Hz haben. 35
8. Intelligenter Steckeradapter (1) gemäß einem der Ansprüche 1 bis 7, wobei der Vibrationssensor (62) ein piezoelektrischer Vibrationssensor ist. 40
9. Intelligenter Steckeradapter (1) gemäß einem der Ansprüche 1 bis 8, aufweisend mehrere der Vibrationssensoren (62), die verteilt in dem weiblichen Element (20) angeordnet sind. 45
10. Intelligenter Steckeradapter (1) gemäß Anspruch 9, wobei der Controller (50) dazu konfiguriert ist, das Betätigungssignal an den Verriegelungsmechanismus (40) zu senden, wenn der Controller (50) das Signal von mindestens zwei der Vibrationssensoren (62) empfängt, was der Feststellung dessen entspricht, dass mechanische Vibrationen vorhanden sind. 50 55
11. Intelligenter Steckeradapter (1) gemäß einem der

Ansprüche 1 bis 10, wobei der Verriegelungsmechanismus (40) einer aus einem hydraulisch betätigten Mechanismus, einem pneumatisch betätigten Mechanismus, einem elektromechanischen Mechanismus, einem elektromagnetischen Mechanismus und einer Kombination davon ist.

Revendications

1. Adaptateur de fiche intelligente (1) comprenant :

- un boîtier (30) ayant, enfermés dans celui-ci, un dispositif de commande (50) et des circuits électriques (52),
- un organe mâle (10) s'étendant depuis une surface (32) du boîtier (30) et configuré pour recevoir du courant électrique lorsqu'il est mis en prise avec une prise d'alimentation externe (80),
- un mécanisme de verrouillage (40) disposé au niveau de la surface (32) du boîtier (30) et configuré, lorsqu'il est actionné, pour verrouiller l'organe mâle (10) avec la prise d'alimentation (80),
- un organe femelle (20) formé sur la surface (32) du boîtier (30) et configuré pour fournir du courant électrique à un dispositif électrique (90) lorsqu'une fiche de dispositif (91) du dispositif électrique (90) est mise en prise avec l'organe femelle (20), dans lequel les circuits électriques (52) sont configurés pour conduire le courant électrique depuis l'organe mâle (10) vers l'organe femelle (20), **caractérisé par**
- un actionneur de vibrations mécaniques (60) disposé au niveau de l'organe femelle (20) et configuré pour émettre des vibrations mécaniques vers l'extérieur depuis le boîtier (30),
- au moins un capteur de vibrations (62) disposé au niveau de l'organe femelle (20) et configuré pour déterminer des vibrations mécaniques, lorsqu'elles sont présentes, provenant de la fiche de dispositif (91), dans lequel le capteur de vibrations (62) est configuré en outre pour envoyer au dispositif de commande (50) un signal correspondant à une détermination de vibrations mécaniques, et

dans lequel le dispositif de commande (50) est configuré pour envoyer un signal d'actionnement au mécanisme de verrouillage (40) lorsque le dispositif de commande (50) reçoit le signal en provenance du capteur de vibrations (62) correspondant à la détermination de vibrations mécaniques telles que présentes, et dans lequel le signal d'actionnement actionne le mécanisme de verrouillage (40).

2. Adaptateur de fiche intelligente (1) selon la revendication 1, dans lequel l'organe mâle (10) comprend des broches de connecteur conducteur (12) confi-

gurées pour se mettre en prise avec la prise d'alimentation (80) et pour établir une connexion électrique entre les circuits électriques (52) et la prise d'alimentation (80).

3. Adaptateur de fiche intelligente (1) selon la revendication 1 ou 2, dans lequel l'organe femelle (20) est formé en tant que réceptacle (24) sur la surface (32) du boîtier (30). 5
4. Adaptateur de fiche intelligente (1) selon l'une quelconque des revendications 1 à 3, dans lequel l'organe femelle (20) comprend des trous de connecteur conducteur (22) configurés pour se mettre en prise avec des connecteurs (92) de la fiche de dispositif (91) et pour établir une connexion électrique entre les circuits électriques (52) et la fiche de dispositif (91). 10
5. Adaptateur de fiche intelligente (1) selon l'une quelconque des revendications 1 à 4, dans lequel l'actionneur de vibrations mécaniques (60) est l'un d'un entraînement électromécanique, d'un transducteur piézoélectrique et d'un entraînement électromagnétique. 15
6. Adaptateur de fiche intelligente (1) selon l'une quelconque des revendications 1 à 5, dans lequel l'actionneur de vibrations mécaniques (60) est configuré pour générer des vibrations mécaniques ayant une valeur de fréquence de moins de 10 Hz. 20
7. Adaptateur de fiche intelligente (1) selon la revendication 6, dans lequel l'actionneur de vibrations mécaniques (60) est configuré pour générer des vibrations mécaniques ayant une valeur de fréquence de moins de 1 Hz. 25
8. Adaptateur de fiche intelligente (1) selon l'une quelconque des revendications 1 à 7, dans lequel le capteur de vibrations (62) est un capteur de vibrations piézoélectrique. 30
9. Adaptateur de fiche intelligente (1) selon l'une quelconque des revendications 1 à 8, comprenant une pluralité des capteurs de vibrations (62) agencés de manière dispersée dans l'organe femelle (20). 35
10. Adaptateur de fiche intelligente (1) selon la revendication 9, dans lequel le dispositif de commande (50) est configuré pour envoyer le signal d'actionnement au mécanisme de verrouillage (40) lorsque le dispositif de commande (50) reçoit le signal en provenance d'au moins deux des capteurs de vibrations (62) correspondant à la détermination de vibrations mécaniques telles que présentes. 40
11. Adaptateur de fiche intelligente (1) selon les reven- 45

dications 1 à 10, dans lequel le mécanisme de verrouillage (40) est l'un d'un mécanisme à actionnement hydraulique, d'un mécanisme à actionnement pneumatique, d'un mécanisme électromécanique, d'un mécanisme électromagnétique, et une combinaison de ceux-ci.

Fig. 1

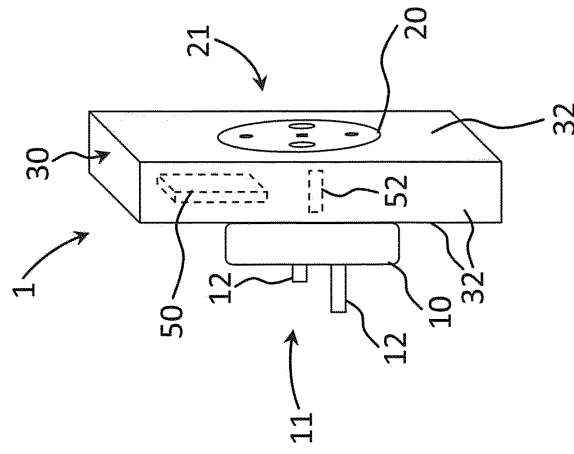


Fig. 2

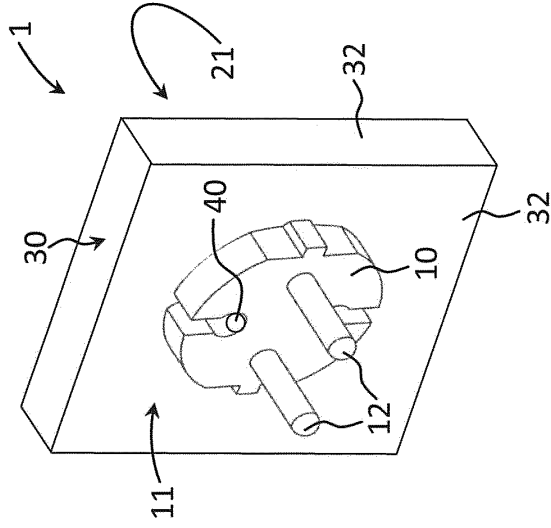


Fig. 3

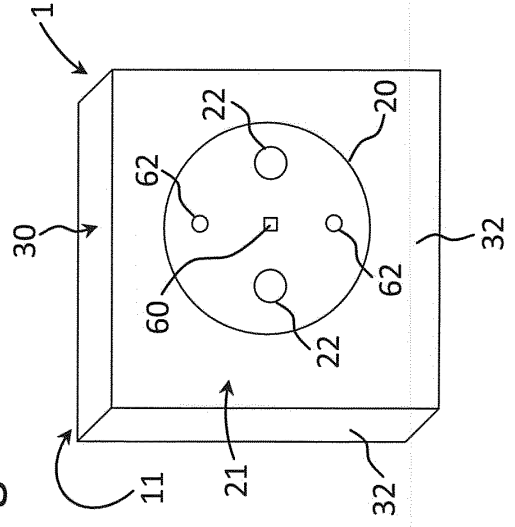


Fig. 4

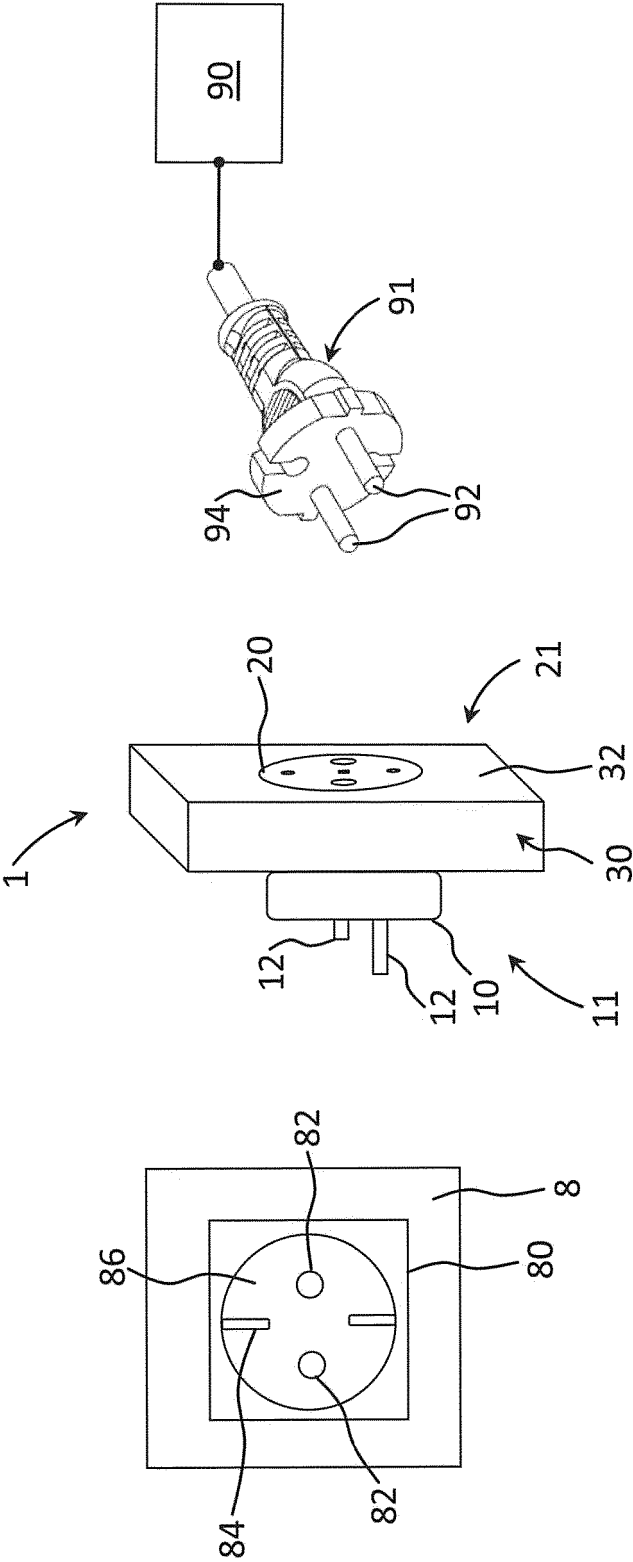


Fig. 6

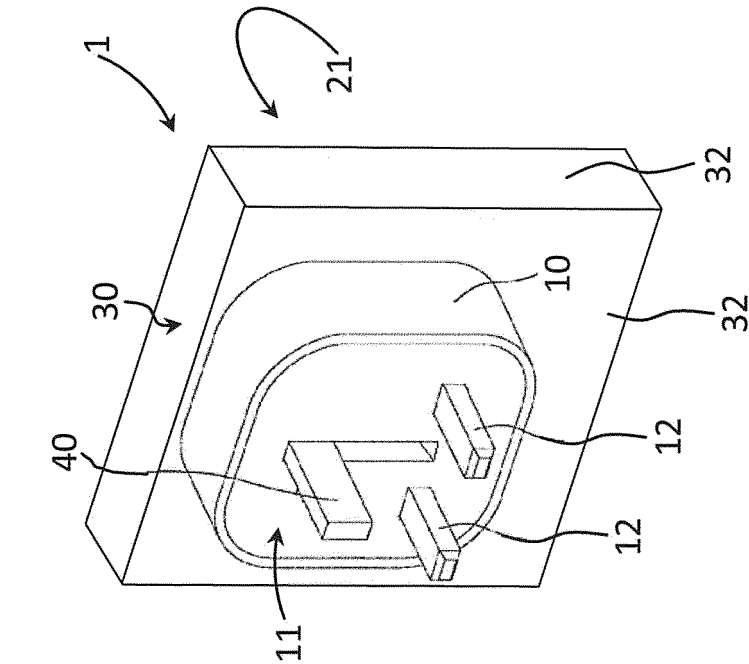


Fig. 5

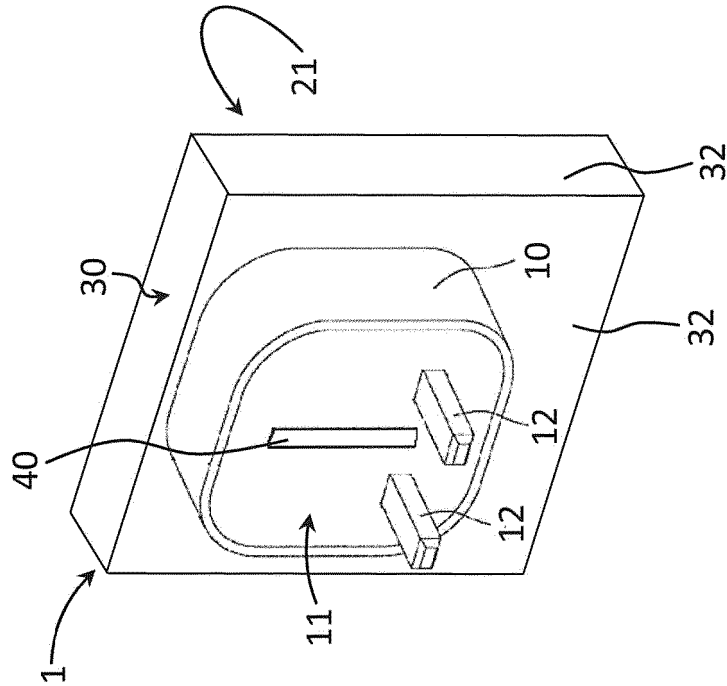


Fig. 7

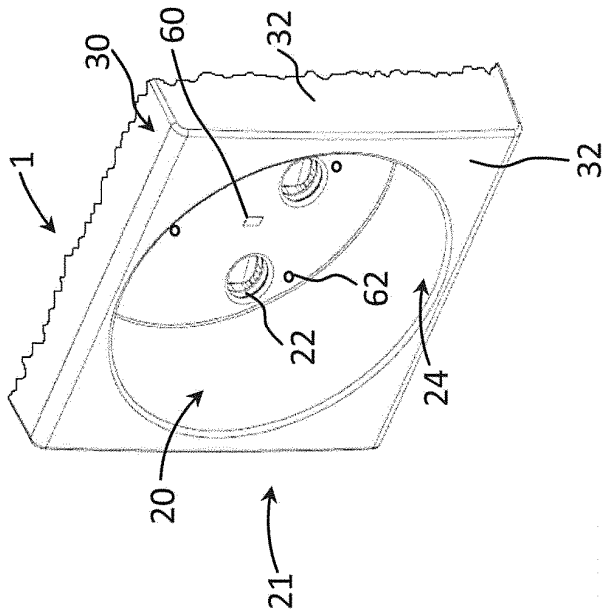


Fig. 8

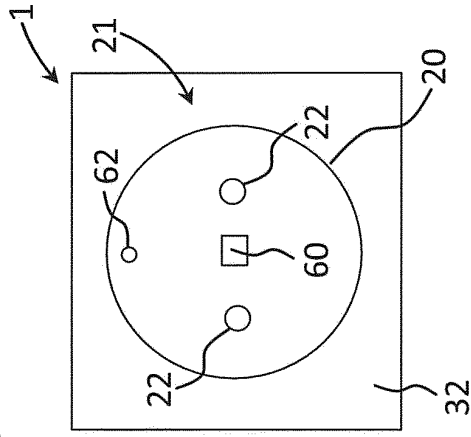


Fig. 9

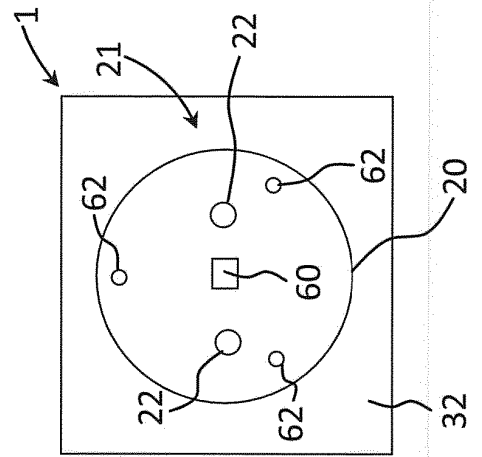
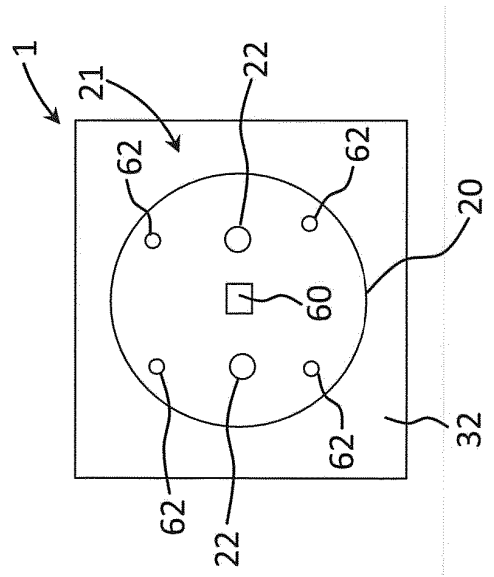


Fig. 10



REFERENCES CITED IN THE DESCRIPTION

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