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(54) **Antitheft device for an electrically powered apparatus, incorporated in the power cord of the apparatus.**

(57) An antitheft device for electrically powered appliances, which may be subtantially incorporated in the power supply cord of the appliances for determining the state of connection or disconnection by means of a programmable central processing unit capable of processing a bistable signal produced by means of said device and to actuate antitheft measures, permits to maintain an effective protection of said removable appliances also when a conventional alarm system must be entirely or partially disactivated in order to permit the access of authorized personnel to the premises housing said appliances. The system may be implemented by replacing a normal power supply cord of the appliance to be protected with a modified power supply cord into which sensor means are incorporated for establishing a state of connection or disconnection of the cord. The sensors may be of various type and may permit to detect also an eventual cutting of the power cord.

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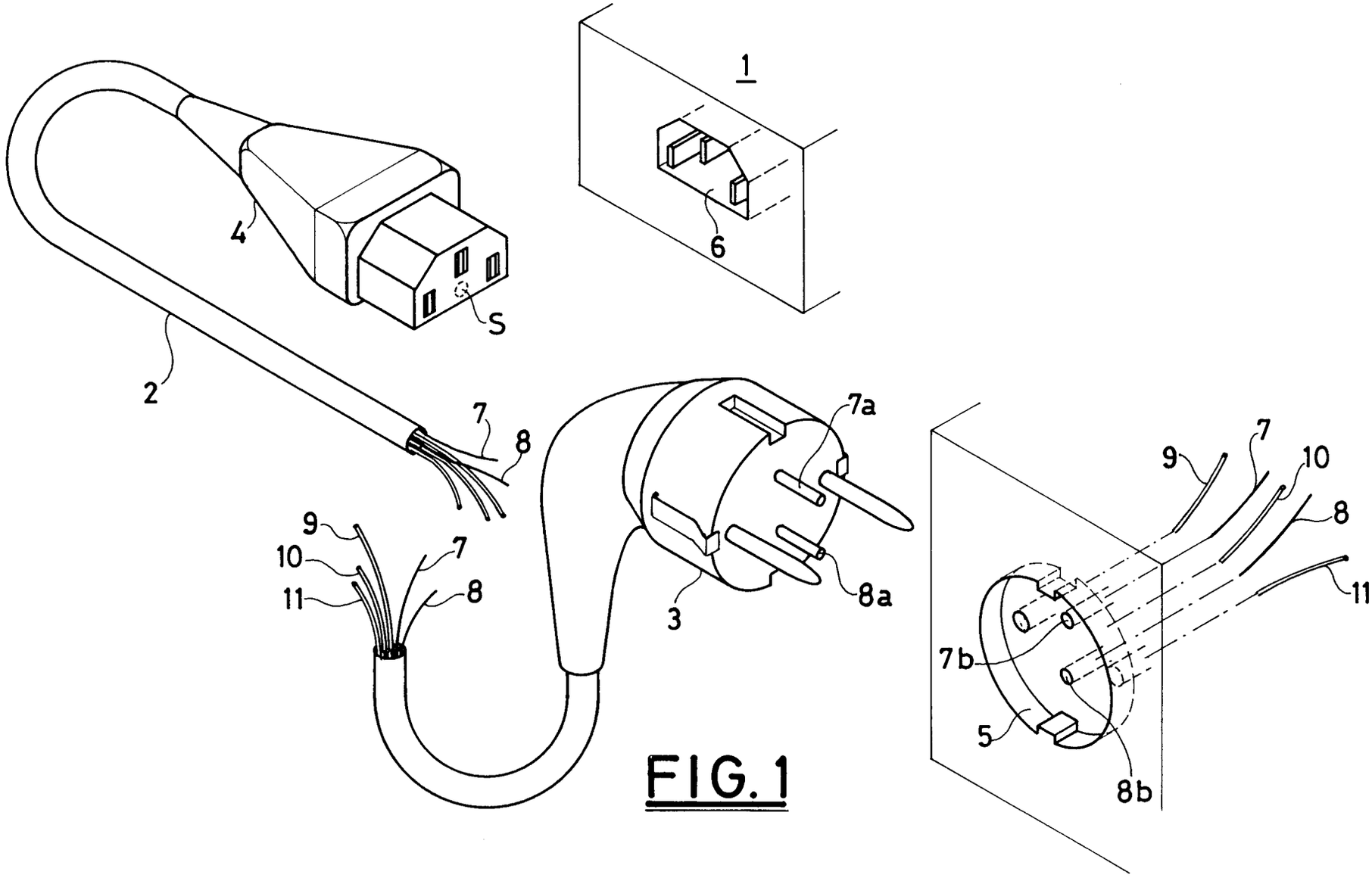


FIG. 1

The present invention relates to alarm systems in general and more in particular to a device for signaling a tentative to displace an electric appliance, powered through a cord plugged into an outlet socket of the power distribution network.

Office machines, computers, air conditioners, television sets, recorders and the like are electrical appliances often having an intrinsic nonnegligeable value which abund in working premises and in houses. Also in premises provided with antitheft alarm installations, situations often occur when, though temporarily, it is impossible to maintain the premises where these appliances are under the protection of the alarm system, which commonly is in practice an antiintrusion alarm installation implying the nonaccessibility of the protected areas when the alarm system is activated. Naturally the alarm system cannot be left active when authorized personnel must freely access to the premises, for example the cleaning personnel during post-working hours in offices and commercial premises, maintenance technicians or building restructuration personnel during vacation periods, and so forth. In all these instances, the alarm system, especially the volumetric and/or perimetral detectors, must be disactivated in order to permit free access and movement of the workers. During these periods, electrical appliances also of a high value, may remain virtually unattended and may become the object of larceny by part of ill-intentioned persons taking advantage of the momentary forced disactivation of the alarm system of the traditional type.

An objective of the present invention is that of implementing in a simple way and compatibly with an eventually pre-existent alarm system, a permanent antitheft protection of electrical appliances which are powered through an electric insulated cable teminating with at least a plug which is plugged into an outlet socket of the power distribution network, also when the normal volumetric and perimetral sensors of said existing antiintrusion alarm system are momentarily disactivated in order to permit the access and the movement of authorized personnel within the area where these carriable electrical appliances are located.

The device of the invention has the prerogative of not requiring any substantial modification of the appliance to be protected nor the assembly, inside these appliances, of particular sensors or devices for disabling the function of the appliance and which may be reset for instance only by means of a secret code. The appliance as such remains perfectly functional and is not modified at all. What is functionally modified, in accordance with the present invention, is merely the cable or cord connection necessary for powering the appliance and which connect the latter to the outlet socket of the power distribution network and eventually the outlet socket of the power distribution network and the wiring thereto. In practicing the invention, the power cord of the electrical applicance may be an insulated cable provided with a plug and a socket temination, or may be a cable fixedly connected to a power connection block inside the appliance and teminating with a plug capable of being plugged into the outlet socket of the distribution network.

In the present context, also the terms "plug" and "socket", when referring to a termination of the power cord, must be intended as substantially interchangeable or equivalent among each other. Of course, it is conventionally intended by the term "socket" a termination provided with female type semi-contacts and with the term "plug" a termination provided with male type semi-contacts. What is strictly essential to the purposes of the invention, is that a cord termination, whether it may be defined as a "plug" or as a "flying socket" be provided with at least three power semi-contacts (or more preferably with at least free semi-contacts, by including a third semi-contact, for connecting to ground potential the electrical appliance's structure through the power cord), capable of mating with respective semi-contacts of another electrical connection organ by a "plugging-in" action.

Having said that, within the present context and as far as possible, reference will be made to a flying socket when said semi-contacts are of a female type and to a plug when said semi-contacts are of a male type, thus using substantially conventionally expressions.

The objective is fully reached by means of the device object of the present invention so as defined in the annexed claims.

Basically, the power cord, as a whole comprising a single or two flying terminations, is functionally modified by providing the cord with organs capable of discriminating between a state of connection or of nonconnection of the power cord. By assuming that the appliance, though turned off, is supposed not to be disconnected from the outlet socket by the personnel which is authorized to access to the premises, when the system of the invention is activated, any disconnection of the power cord of an appliance is detected by the sensor of the device of the invention and will treat the event as a tentative to remove the appliance so disconnected, thus activating suitable prevention measures, such as for example the activation of an acustic or visual alarm in a certain location or in several locations and/or similar antitheft actions.

Of course any inadvertent disconnection of the power cord of an electrical appliance which may be made in good faith by an authorized person will be easily recognized as such and ignored after having reestablished the connection of the appliance and reset the alarm system triggered by the disconnection sensor of the power cable.

The sensor of the device of the invention may be represented by a contact or monopolar switch, which

may be substantially unbiased (clean contact), having two stable states of open contact and of closed contact, which are respectively attained when the power cable of the appliance is physically connected (e.g. into an outlet socket of the power distribution network) and when it is disconnected, or viceversa.

Alternatively, the sensor of the state of connection or disconnection of the cord may be represented by a first pair of additional semi-contacts present in a connection terminal of the power cord (socket or plug), through which the supply voltage of the appliance is replicated by deriving it through a second pair of additional semi-contacts, which are functionally present in the other connection termination (socket or plug), which may be functionally cooperating with the first of said cable terminations.

In either cases, the close or open state of the contact or switch connected to two additional electrical connection terminals which are preferably formed in the same power outlet socket of the distribution network or the presence or lack of presence of the supply voltage of the electrical appliance on a similar pair of additional electrical terminals present in said outlet socket of the power distribution network, will be detected by means of common electrical devices used for this purpose which will conveniently be positioned at distance from the outlet socket of the power distribution network to which the protected appliance is connected and most preferably incorporated in an electronic control unit, through the generation of a substantially bistable electrical signal, i.e. a current or a voltage capable of stably assuming one or the other of two preset logic levels. Such a bistable level electrical signal is processed by the electronic central unit, which, in function of the programming received, will recognize an alarm state and actuate the acustic and/or visual alarms and/or other pre-established antitheft actions.

Of course, the conductors for connecting the two additional poles of the "sensor" which is incorporated in the power cord of the appliance, to the electronic circuitry for the generation of the bistable level signal and for the processing thereof and the generation of actuating signals, may be laid into separate channels or through channels traversed by the power distribution wires, according to what is usually done for wiring volumetric and perimetral sensors of a common alarm system.

More preferably, locally installed transmitting units may be used capable of discriminating the state of the connection-disconnection sensors of one or several power cords plugged into a series of local power outlet sockets, and of generating a bistable level signal and to convert it into a series of digitally coded pulses which may be transmitted in this form to a receiver of a central processing unit through the same conductors of the power distribution network without causing interferences. In this way, the necessity of laying connecting cables between the various locations of connection of electrical appliances to be protected and the electronic central processing unit may be largely eliminated. This system of transmission to a distance of data through the conductors of a local power distribution network is known and specifically used also for realizing complete alarm systems of the known type without the necessity of laying additional cables. The present applicant commercializes alarm systems of this kind, under the commercial denomination of "Line-Link A.P.S. System", which is described in commercial "brochures" well known to a person skilled in the art, the technical descriptive content of which is intended to be herewith incorporated by express reference.

The different aspects and advantages of the invention will be more easily understood through the following detailed description of several preferred embodiments thereof and by reference to the attached drawings, wherein:

Figure 1 is a schematic illustration of a cord connection of an electrical appliance to the power distribution network;

Figure 2 is a schematic showing of a supply cord similar to the one shown in Fig. 1, incorporating a connection sensor according to the present invention;

Figure 3 is a schematic view of a power supply cord of the type permanently fixed inside the electrical appliance to be powered and incorporating a connection sensor equivalent to the one employed in the embodiment described in Fig. 2;

Figures 4 to 10 schematically depict as many alternative embodiments of the device of the invention.

With reference to Fig. 1, an electrical appliance 1 is electrically powered by means of a power supply cable which is indicated with 2 as a whole, which in the particular case shown, is provided with two terminations, respectively a plug termination 3 and a flying socket termination 4. Normally these supply cords have three wires, two of which are essentially dedicated to the electrical supply of the appliance 1, while the third wire is used for connecting to ground potential the appliance's structure, in accordance with widely implemented antishock regulations. Each termination of the supply cord is provided with semi-contacts which mate with respective semi-contacts of the cooperating electrical connection fixtures which in the case shown are respectively an outlet socket 5 of the electric power distribution network (e.g. a wall socket) and a connection receptacle 6, present in a back panel of the appliance 1.

As schematically shown in the figures, the cable 2 is purposely a cable provided with two additional wires, respectively 7 and 8, beside the two power supply wires 9 and 10 and the ground wire 11. Therefore, the plug 3 and the socket 5 may as shown in the Fig-

ure, be provided with a pair of additional semi-contacts, respectively 7a-8a and 7b-8b, beside of course the said trio of supply and ground semi-contacts. According to this embodiment, the wiring to the socket 5 of the distribution network contemplates the connection to the two additional semi-contacts 7b and 8b of the socket of a pair of wires 7 and 8 beside the three conductors of power supply and ground: 9, 10 and 11. In the flying socket termination 4 of the supply cord 2 is schematically indicated, by means of a dash line, a zone S wherein any suitable sensor of the state of connection or of not connection of the supply cord, i.e. of the state of insertion or of not insertion of the flying socket termination 4 into the respective mating receptacle 6 of the appliance 1, may be incorporated. Through the additional pair of conductors 7 and 8, the connection sensor may be connected to a circuitry capable of generating a signal having a substantially bistable logic level and which may be processed by a central control unit capable of recognizing from the level of said bistable signal the state of connection or disconnection of the appliance 1 and of actuating, depending on the programming received, antitheft measures, such as for example the activation of an alarm siren and/or the acustic or visual signaling of the event in a certain surveillance station.

Of course the sensor of the connection or disconnection state of the power cord is indifferent to the fact that the appliance 1 be switched on or off, by simply detecting the state of connection or nonconnection of the power cord, as will be described in more detail later.

A power cable of the type shown in Fig. 1 is reproduced schematically also in the Figures 2, 4, 7 and 10, while Figures 3, 5, 6, 8 and 9 schematically depict a power cable of an appliance 1 provided with a single plug-termination 3 and fixedly connected at the other extremity inside the appliance itself. The invention is applicable to both cases, as shown in the figures. For facilitating cross reference throughout all the figures, the same parts or components which are functionally equivalent to each other are indicated by the same number. Moreover, in order to simplify the illustration, in the diagram shown in Figures 2 to 10, two supply wires 9 and 10 respectively, are shown, while an eventual third conductor, dedicated to the connection to ground of the structure of the appliance 1, is omitted.

In Figure 2, the sensor of the connection state of the cord is constituted by a switch 11 which is incorporated in the flying socket 4 and which is acted upon by a rod 12 which is normally kept in an extended position by the spring 13 and which, upon the insertion of the flying socket 4 in the relative receptacle 6 of the appliance, interferes with the end wall of the receptacle 6 and is forced back into the flying socket body, against the elastic reaction force exerted by the spring 13, by a distance sufficient to close the switch 11, the two terminales of which are connected to the additional conductors 7 and 8, respectively, of the power cord and through the pair of additional semi-contacts 7a-7b and 8a-8b, to the input circuitry of a programmable central processing unit, according to techniques which are well known to a skilled person. Of course, also an eventual cutting of the power cable will be recognized by the input circuitry of the control unit as a disconnection of the power cord and similarly will cause an eventual activation of the alarms.

A device similar to that of Fig. 2 is schematically shown in Fig. 3 as applied to the case of a power cable provided with a single termination, i.e. a terminal plug 3, being the other extremity of the cable permanently anchored inside the appliance 1. Also in this case an eventual cutting of the power cable will be recognized by the alarm system.

Another embodiment of the device of the invention, is shown in Fig. 4, wherein a mercury switch 14, sensitive to acceleration, is shown. Also in this case, the cutting of the power cord, as well as any tentative to disconnect the cable will be immediately detected by the system through the mercury switch sensor.

As shown in Fig. 5, the sensor of the disconnection of the power cord may also be a magnetic proximity sensor. Within the wall socket of the power distribution network a permanent magnet 15 may be incorporated which, upon the plugging-in of the plug 3, causes the closing of the switch 16 acting against the elastic reaction force of the spring 17, thus determining the electrical continuity between the pair of conductor 7 and 8, which will be recognized by the control circuitry.

Alternatively, as schematically shown in Fig. 6, the magnetic switch 16 may also be housed within the wall socket 5 of the power distribution network by providing the terminal plug 3 of the cord with a permanent magnet 15. In this case though an eventual cutting of the power cord will not be recognized by the system as an alarm event.

Yet another embodiment of the device of the invention is schematically depicted in Fig. 7, wherein the sensor of the connection state of the power cord of the appliance is an optoelectronic sensor formed by a photodiode 18 whose state of conductivity is determined by the illumination of its junction by a light source 19, which may be assembled within the receptacle 6 for the cord of the appliance 1. The conductivity state of the photodiode 18 will be recognized by the input circuitry of a control unit through the two-conductor line formed by the pair of wires 7 and 8. The sensor may also be a Hall-effect device.

A capacitive type proximity sensor 20 mounted inside the wall outlet socket 5 and acted upon by an interfering protrusion 21 of the terminal plug 3 of the cord of the appliance 1 is shown in Fig. 8. Also in this embodiment, the cutting of the power cord would not be detected by the alarm circuitry.

According to another embodiment of the device of the invention, the sensor of the connection or disconnection state of the power cord of an appliance, whether of the single-termination type (Fig. 9), or double termination type (Fig. 10), is implemented in a simple way by at least two pairs of additional semi-contacts 7a-7b and 8a-8b, through which on the relative pair of conductors 7 and 8, directed to the input circuitry of the control unit, the supply voltage may be replicated. In this case, the detecting circuitry of the control unit will be capable of recognizing the presence or absence of the supply voltage across the terminals of the two conductors (7 and 8) line and as a consequence, of generating a substantially bistable logic level signal which will be processable by the control circuitry in order to actuate eventually the alarms. As it may be easily observed from the diagrams of Figures 9 and 10, also in these embodiments an eventual cutting of the power cable would be detected by the control circuitry.

Notwithstanding the fact that the invention has been illustrated through a series of particularly preferred embodiments, it may also be implemented in different though functionally equivalent embodiments of the sensors of the insertion or disinsertion of the power cable. Moreover the pair of conductors 7 and 8 directed to the input circuitry of a control unit, could depart from the plug 3 or also from the power supply cable without necessarily modifying an existing wall outlet socket 5. Also separate conduits to a local data transmission unit or to a control processing unit may be used, as will be evident to a skilled person.

## Claims

1. An antitheft device for movable appliances electrically powered through a power cord connectable by means of at least a plug termination to a wall outlet socket, characterized by comprising

   at least a sensor capable of sensing the state of connection or disconnection of said power cord and to cause the generation of a bistable electrical signal;

   at least a programmable central processing unit capable of processing said signal and to implement antitheft measures upon the recognition of a state of disconnection of said power cord.

2. A device as defined in claim 1, wherein said sensor is physically incorporated within said plug and said power cord contains at least two additional isolated conductors for connecting said sensor to said central processing unit.

3. A device as defined in claim 1, wherein said sensor is physically incorporated in said power outlet socket into which said plug of said power cord is plugged-in.

4. A device as defined in claim 1, wherein said sensor is a switch, the state of which is mechanically determined by interference between a mobile stem, slidingly extending out of said plug and which is kept in a stable extended position by a contrasting spring and an interfering surface of said socket.

5. A device as defined in claim 1, wherein said sensor is a switch, the state of which is mechanically determined by interference between a mobile stem, maintained in a stable extended position by a contrasting spring, and physically incorporated in said socket, and an interfering surface of said plug.

6. A device as defined in claim 1, wherein said sensor is an impact sensor.

7. A device as defined in claim 1, wherein said sensor is a proximity sensor.

8. A power supply cable termination plug for an electrical appliance to be protected from an authorized displacement, comprising a body of isolating material, at least two power supply semi-contacts which are electrically connected to isolated conductors of said power supply cord, characterized by the fact that is provided with a sensor capable of causing the generation of a substantially bistable electrical signal representative of a state of insertion or of a state of noninsertion of said plug into a receiving socket.

9. A plug according to claim 8, wherein said sensor is an impact sensor.

10. A plug according to claim 8, wherein said sensor is a proximity sensor.

11. A power supply cord terminating at one extremity with a plug and to the other extremity with a flying socket, both provided with at least two power supply semi-contacts, characterized by the fact that said cord comprises at least a pair of additional isolated conductors and one of said plug and flying socket is provided with a pair of additional semi-contacts which are respectively connected to said two additional isolated conductors of said cord and the other of said plug and flying socket is provided with a sensor capable of assuming a state representative of a state of insertion or noninsertion of said other plug or flying socket into a respective receptacle of an electrically powered appliance.

**12.** A power supply cord according to claim 11, wherein said sensor is an impact sensor.

**13.** A power supply cord according to claim 11, wherein said sensor is a proximity sensor.

**14.** A power supply cord terminating at one extremity with a plug capable of being plugged-in a power outlet wall socket and having at least two power supply semi-contacts functionally connectable to two respective power supply semi-contacts of said outlet socket, characterized by the fact that said plug is provided with at least two additional semi-contacts which are electrically connected in parallel through two additional conductors of said power supply cord to said two power supply semi-contacts of said plug, through which a power supply voltage may be replicated across two additional semi-contacts of said power outlet socket, capable of being connected through a two-conductor line to a bistable circuit capable of recognizing through the presence or absence of the power supply voltage the state of connection or of nonconnection of said power supply cord.

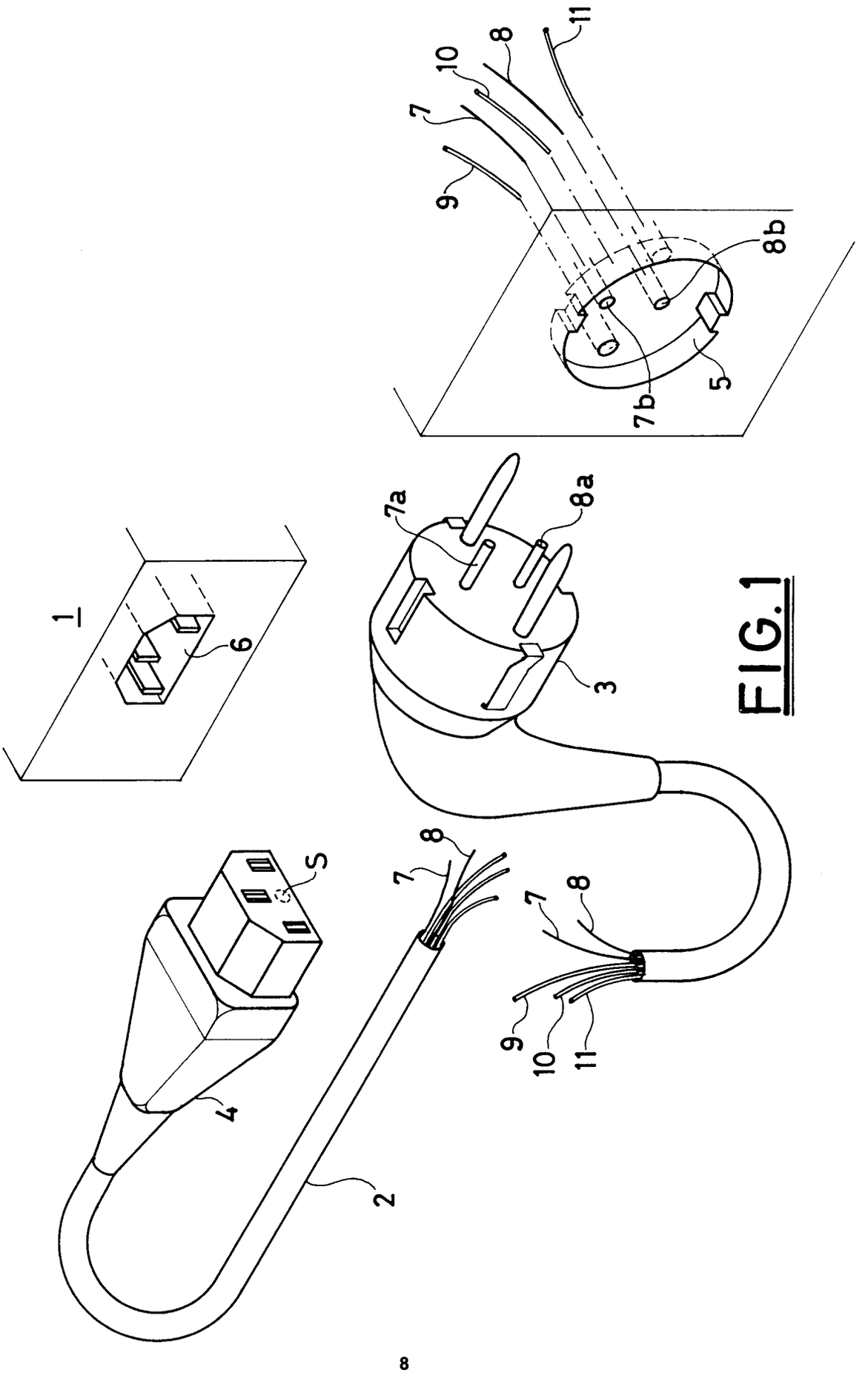


FIG.1

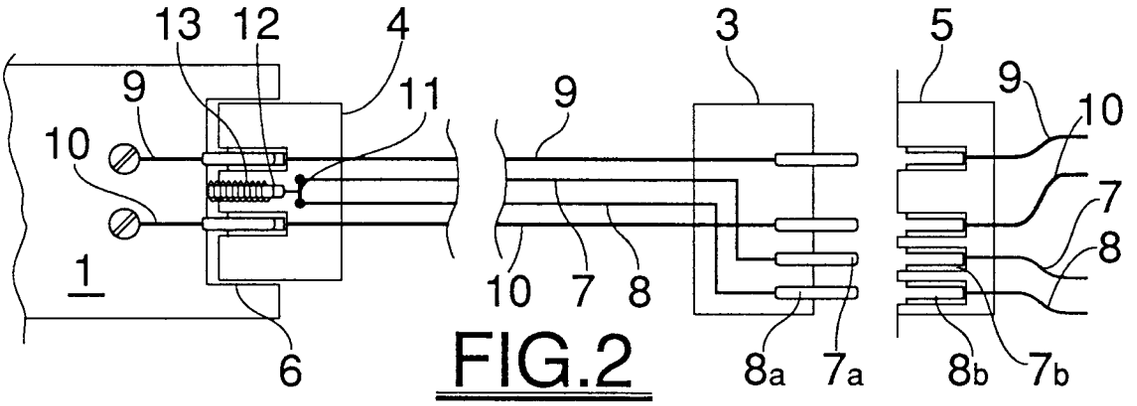


FIG.2

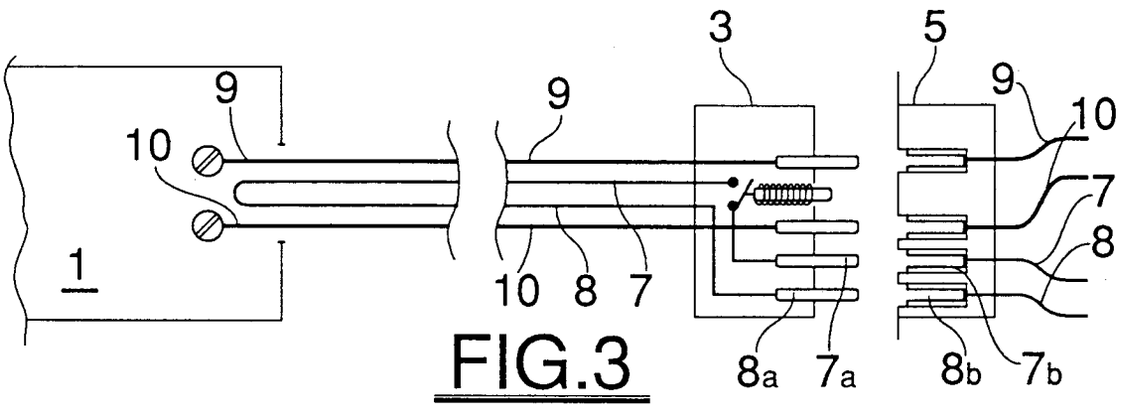


FIG.3

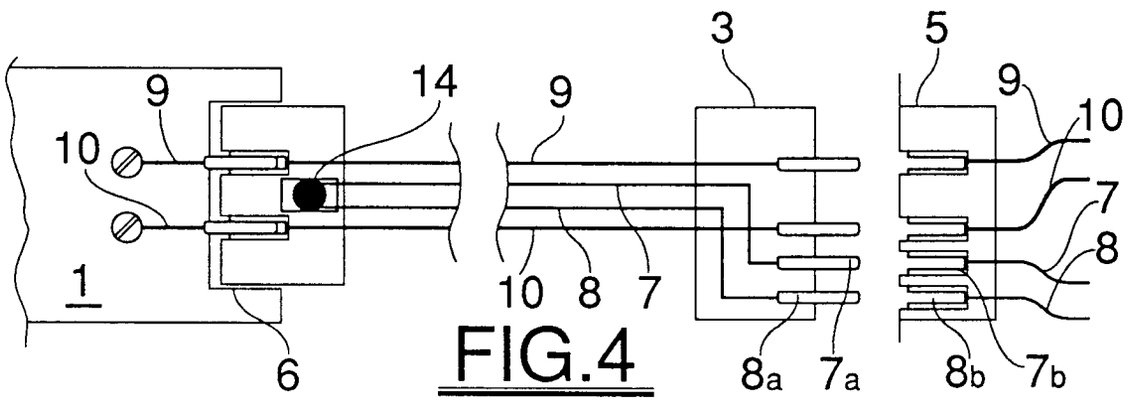


FIG.4

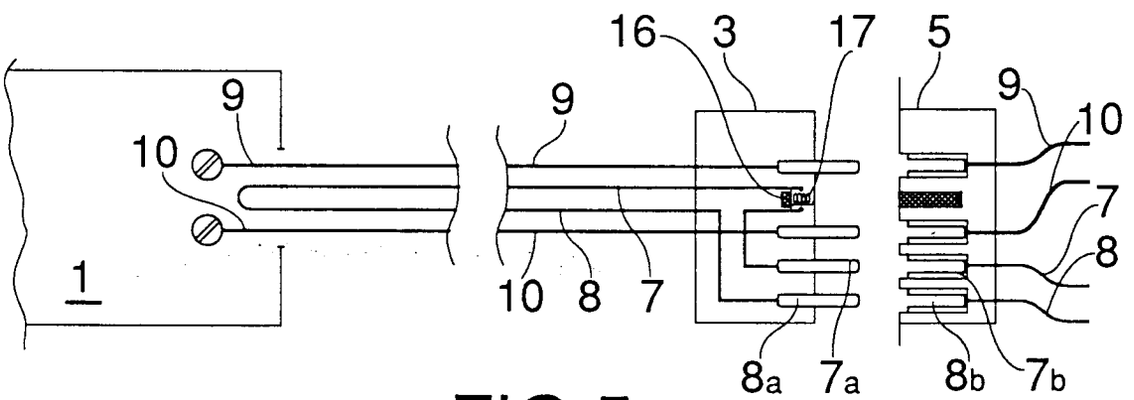


FIG.5

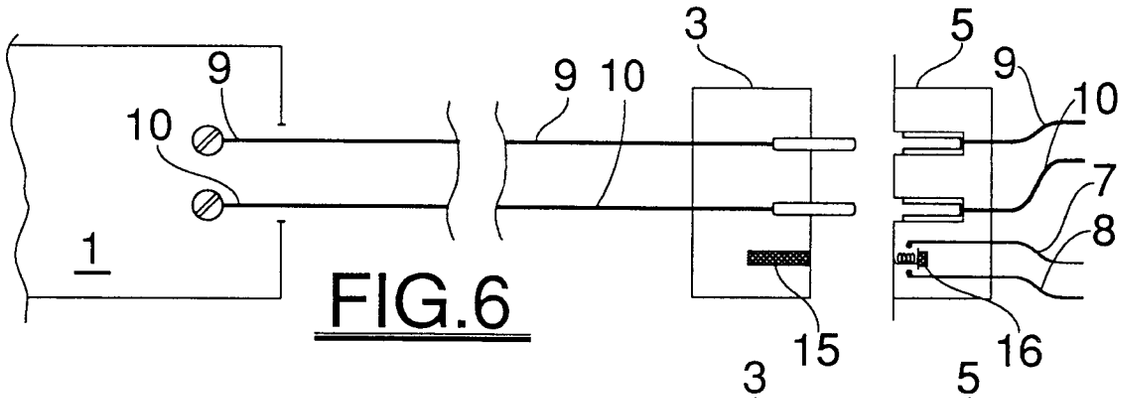


FIG.6

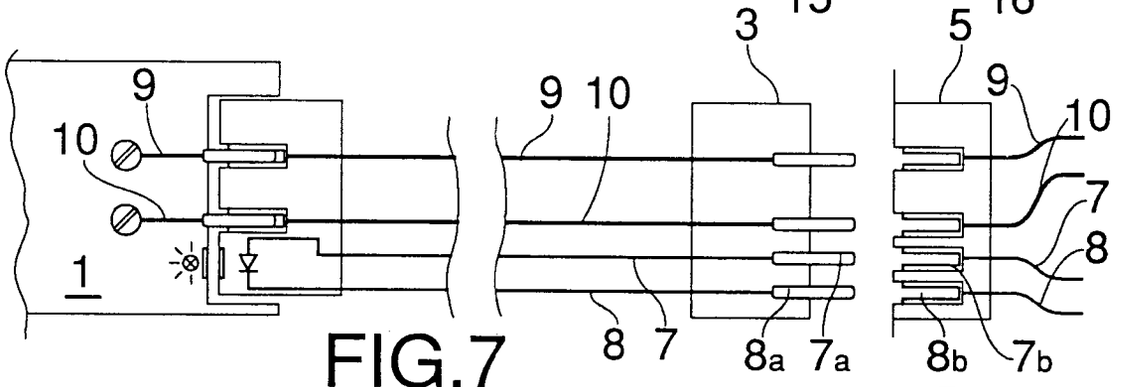


FIG.7

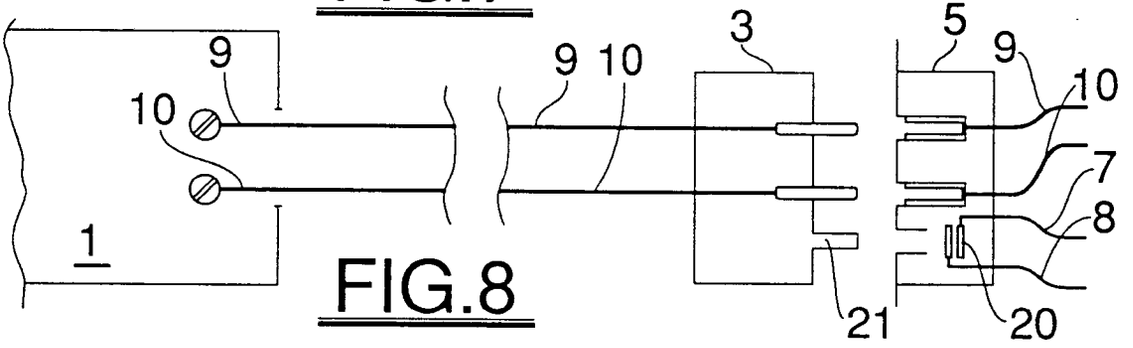


FIG.8

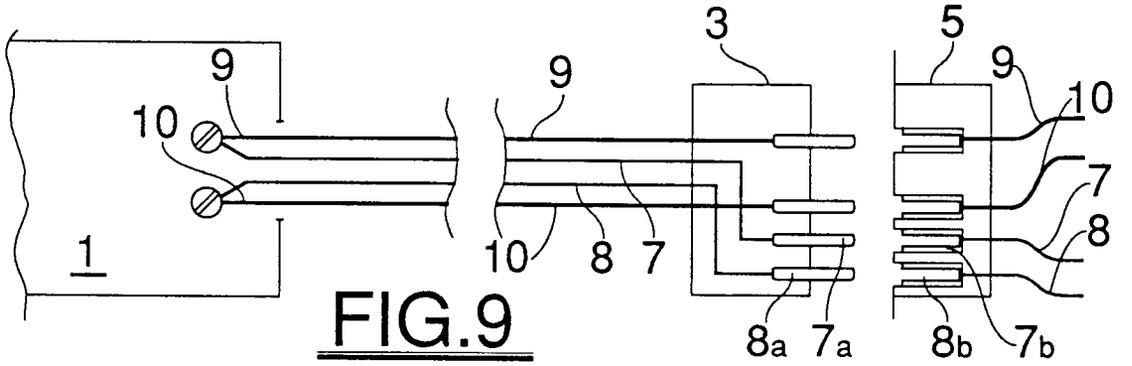


FIG.9

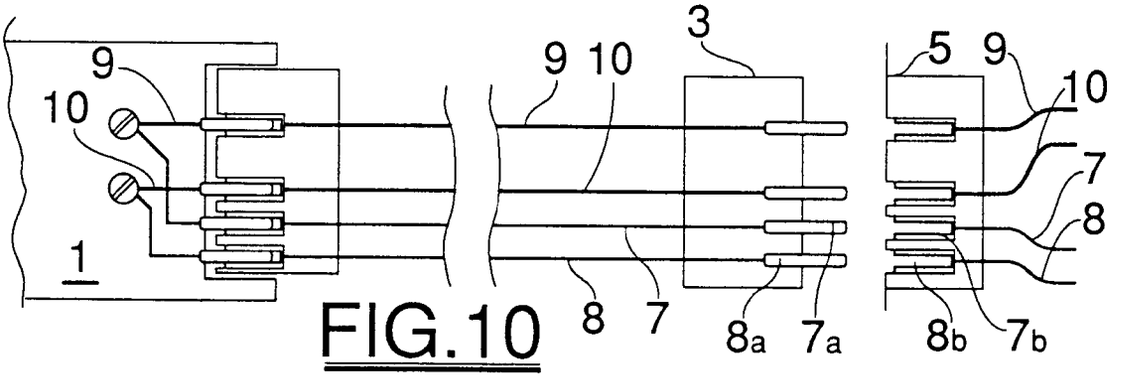


FIG.10