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(71) Applicant: **Idosaka, Shoshin**
Mie 519-21 (JP)

(72) Inventor: **Idosaka, Shoshin**
Mie 519-21 (JP)

(74) Representative:
Müller-Boré & Partner
Patentanwälte
Grafinger Strasse 2
81671 München (DE)

(54) METHOD AND APPARATUS FOR SIGNAL GENERATION TO CHECK FOR ELECTRIC CONNECTION, AND SAFETY CONNECTOR

(57) A confirming signal generator is used for its being attached to a power supply receptacle for an attachment plug of an electric appliance etc. A casing (1) including a pair of plug-in terminals (2A, 2B) removably inserted into plug insertion holes of the power supply receptacle, incorporates a bimetal switch (4) electrically thermally connected to one plug-in terminal (2A) and turned ON when a temperature rises, and first and second light emitting elements (5A, 5B) with their luminous heads protruding from window holes of a cover member (1B). The first light emitting element (5A) is connected directly between the plug-in terminals (2A, 2B), and lights up for confirming a conduction by a voltage between the plug-in terminals. The second light emitting element (5B) is connected between the plug-in terminals (2A, 2B) through the bimetal switch (4), and lights up when the bimetal switch (4) operates to give an alarm of an abnormal heat emission of the receptacle.

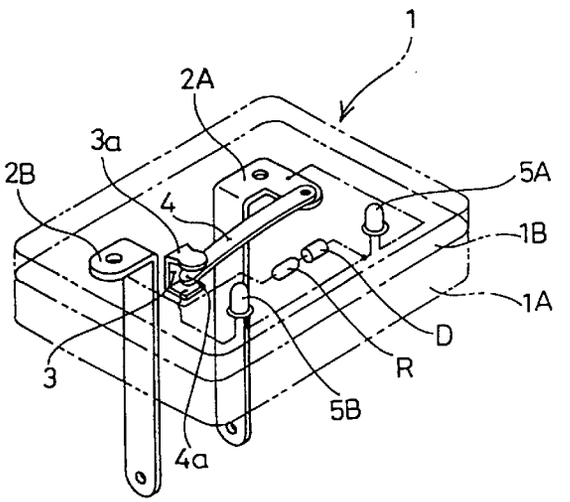

FIG. 1

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Description

Technical Field

The present invention relates to a conductive state confirming signal generator used for its being attached to a double-pole receptacle for inserting an attachment plug of an electric appliance, and an electric connector such as the receptacle or the attachment plug including a conductive state confirming signal generating mechanism and a circuit automatic cut-off mechanism.

Background Arts

A conductive state of each of receptacles installed in general homes and office rooms as outlets for inserting attachment plugs of electric appliances, has hitherto been unrecognizable through a naked eye. Further, even if there exists an overcurrent which might cause an accident such as a fire or a rise in temperature caused by a leak current, it is difficult to detect it at an early stage and to cope with this.

Disclosure of the Invention

It is an object of the present invention, which was contrived in view of the prior arts described above, to provide a small-sized conductive state confirming signal generator at a low cost that can be attached to or incorporated into an existing receptacle.

It is another object of the present invention to provide a small-sized electric connector with a conductive state confirming signal generating function and a safety function at a low cost, which can be attached to or incorporated into an existing receptacle.

To accomplish these objects, according to the present invention, a conductive state confirming signal generator is used for a double-pole receptacle for an attachment plug of an electric appliance. This signal generator comprises a casing formed with window holes through which first and second plug-in terminals detachably inserted into the receptacle are protruded and visible from outside, a first light emitting member provided within the casing so that a luminous head thereof protrudes outside through the window hole, and electrically connected between the first and second plug-in terminals, a temperature displacing member, fixedly disposed within the casing with its rear end being connected to a rear end of the first plug-in terminal within the casing, for closing an electric contact with its deformation when reaching a temperature equal to or greater than a predetermined value, and an alarm generating device connected between the first and second plug-in terminals through the electric contact.

When this conductive state confirming signal generator is attached to the receptacle of a wall surface embedding type or an outside fitting type or a portable type, there lights up the first light emitting member, i.e., a light emitting element such as, e.g., a light emitting diode or an arc light, a neon lamp or a miniature lamp, and it is thus recognizable that the receptacle is in an active state. If a temperature of the receptacle rises over a predetermined value due to an overcurrent and a leak current etc., the electric contact is switched ON through the temperature displacing member such as, e.g., a bimetal fixed to a rear end of the first plug-in terminal, and an alarm signal is generated from the alarm generating device. Accordingly, when turning ON the power supply switch after inserting the attachment plug of the electric appliance etc. into the receptacle, and if the electric appliance etc. does not work in spite of the fact that the first light emitting member lights up, it can be understood that this is caused on the side of the electric appliance. Further, when the alarm signal is given from the alarm generating member, it can be understood that the temperature of the receptacle exceeds the predetermined value, and hence an accident of fire due to the overheat can be prevented.

Further, according to the present invention, a conductive state confirming signal generator used for a double-pole receptacle for an attachment plug of an electric appliance, comprises a casing formed with window holes through which first and second plug-in terminals detachably inserted into the receptacle are protruded and visible from outside, a light emitting member provided within the casing so that a luminous head thereof protrudes outside through the window hole, and electrically connected between the first and second plug-in terminals, a diode having terminal lead wires one of which is electrically and thermally connected to the rear end of the first plug-in terminal within the casing, the diode being sensitive to heat and becoming conductive when the first plug-in terminal reaches the temperature equal to or greater the predetermined value, and an alarm generating device connected between the first and second plug-in terminals via the diode.

This conductive state confirming signal generator gives a notification that the receptacle is in the active state by lighting up the first light emitting member when inserted into the receptacle. When the temperature of the receptacle rises over the predetermined value, a forward current, which has not substantially flowed so far, begins to flow with a change in characteristic of a diode, e.g., a germanium diode fixed directly to the first plug-in terminal due to the increase in temperature, the germanium diode exhibiting a large width of change in the temperature characteristic. Then, the alarm signal can be thereby generated from the alarm generating device.

Moreover, according to the present invention, a conductive state confirming signal generator incorporated into a double-pole receptacle for an attachment plug of an electric appliance, comprises first and second terminal members formed with window holes visible from outside and defined as plug-in terminals or connecting terminals connected to a power supply, a casing

including at least one pair of first and second seizing portions, into which to detachably insert the attachment plug of the electric appliance, and electrically connected to the first and second terminal members per pole, a contact piece provided in the periphery to the seizing portion in a state being insulated therefrom within the casing and, when the attachment plug is completely inserted into the seizing portions, electrically connected to the first seizing portion upon a contact of the tip of the first terminal member, and a light emitting member provided within the casing so that a luminous head thereof protrudes outside from the window hole, and electrically connected between the second terminal member and the contact piece.

When the attachment plug of the electric appliance etc. is completely inserted into the receptacle of the wall surface embedded type, the outside fitting type or the portable type which includes the above confirming signal generator, the tip of the second plug-in terminal of the attachment plug comes into contact with the contact piece, thereby switching ON an electricity supplying circuit to the first light emitting member. The light emitting element thus lights up. The attachment plug and the receptacle are thereby brought into a complete contact with each other, and it is feasible to visually confirm that the electric power can be supplied to the electric appliance. If the insertion of the attachment plug is incomplete, this can be known from the first light emitting member not lighting up.

The conductive state confirming signal generator may further comprise a fixed contact piece fixedly disposed within the casing, a conductive temperature displacing member including its rear end connected to the rear end of the first terminal member within the casing, and coming into contact with the fixed contact piece with its deformation when reaching a temperature equal to or greater than a predetermined value, and an alarm generating device connected between the second terminal member and the fixed contact piece.

The above alarm generating device being thus added, in addition to the confirmation of the complete insertion of the plug, the alarm generating device outputs an alarm signal, for instance, if a current value of the electric appliance in use exceeds a current capacity of the receptacle, and if the temperature of the temperature displacing member exceeds the predetermined value. Accordingly, it is possible to prevent a burning accident of the receptacle due to the overcurrent.

In place of the temperature detection by the temperature displacing member, there can be made a connection between a diode having a pair of terminal lead wires one of which is electrically and thermally connected to the rear end of the first terminal member or a connecting member of the same polarity as that of the first terminal member within the casing, the diode being sensitive to heat and becoming conductive when reaching the temperature equal to or greater than the predetermined value, and an alarm generating device connected between the first and second terminal members via the diode.

With the provisions of the above diode and alarm generating device, if the temperature of the receptacle rises over the predetermined value, the forward current which has not substantially flowed so far begins to flow owing to a characteristic change caused by a rise in temperature of the diode, e.g., the germanium diode, and the alarm signal can be generated from the alarm generating device.

The conductive state confirming signal generator may further comprise a second temperature displacing device embedded substantially in the central portion between the plug-in terminals in parallel thereto within the casing so that an upper edge thereof protrudes into the casing, a first fixed contact provided within the casing, a movable member composed of an insulating material, provided in a side-by-side direction of the plug-in terminal so as to be movable in a direction orthogonal to inserting/removing directions of the plug-in terminals, and including an engagement protruded portion engaging with an upper edge of the second temperature displacing device when at a normal temperature and a first movable contact provided at its front edge and electrically connectable to the first plug-in terminal, a spring for biasing the movable member toward the first fixed contact at all times so that the first movable contact separates from the first fixed contact when the upper edge of the second temperature displacing device engages with the engagement protruded portion of the movable member, and that the first movable contact comes into press-contact with the first fixed contact when the upper edge of the temperature displacing device separates from the engagement protruded portion because of a rise in temperature, and a leak alarm output terminal electrically connected to the first fixed contact.

With the provisions of the second temperature displacing device and the leak alarm output terminal, the casing or the receptacle casing composed of the electric insulating material such as a synthetic resin is exposed at a high temperature for a long period of time and gradually carbonized, and, when the temperature peripheral to the first plug-in terminal rises due to the leak between the terminals upon deterioration or destruction of the electric insulating characteristic, a leak signal is outputted from the leak alarm output terminal with an operation of the second temperature displacing device. This leak signal enables a safety device to operate to cut off the power supply, thereby making it possible to detect the abnormal state of the confirming signal generator itself at an early stage thereof.

Further, the conductive state confirming signal generator may further comprise a second temperature displacing device embedded substantially at the center between the plug-in terminals and in parallel thereto within the casing so that its upper edge protrudes into the casing, a second fixed contact provided within the casing and connected to the first plug-in terminal, a

lever movable within a plane orthogonal to the inserting/removing directions of the plug-in terminals, including its front edge engaging in a possible-of-disengaging manner with one side surface of an upper edge of the second temperature displacing device when at a normal temperature, a second movable contact provided the other side of a middle portion and separably coming into contact with the second fixed contact, and a pin provided at a rear end thereof and movably engaging with a guide groove formed substantially in parallel with the side-by-side direction of the plug-in terminals, a spring for biasing the lever so that the first movable contact comes into press-contact with the first fixed contact when the front edge of the lever engages with the second temperature displacing device in a state of the normal temperature, and turning the lever with the pin serving as a fulcrum in a terminal position so that the first movable contact separates from the first fixed contact, and a leak alarm output terminal, electrically connected to the second movable contact, for outputting a leak signal upon the second movable contact separating from the second fixed contact.

The conductive state confirming signal generator to which this leak signal outputting function is added is capable of directly cutting off the power supply circuit by use of the leak alarm output terminal. Accordingly, it is feasible to prevent a heat evolving accident and a fire accident due to a decline of an insulation resistance of the casing or the receptacle casing.

The conductive state confirming signal generator may further comprise a pair of leak detection pins embedded in parallel to each other in positions closer to the respective terminals between the plug-in terminals of the casing, and a leak alarm generating device, electrically connected between the pair of leak detection pins, and operated by a leak voltage produced between the pair of leak detection pins when an electric insulating characteristic of an insulating material in the periphery to the plug-in terminal is destroyed.

With the provision of this leak alarm generating device, if the insulating characteristic of the electric insulating material such as the synthetic resin of which the casing or the receptacle casing is composed, is deteriorated or destroyed enough to cause the leak of the current, the leak voltage is produced in the leak wire embedded in the vicinity of each plug-in terminal. Then, the leak alarm generating device gives a leak alarm. The user is able to use the confirming signal generator with a sense of safety till the leak alarm is generated. Herein, a mechanical detecting element represented by the bimetal etc. is not employed, and hence the small-sized leak alarm generator can be constructed at a low cost. Furthermore, the power supply circuit can be cut off by making use of the leak alarm. It is feasible to prevent, for example, the fire accident derived from a tracking phenomenon occurred when cotton particles etc. are adhered in the vicinities of the plug insertion holes of the receptacle, and the fire accident caused by the leakage of electricity based on the carbonization of the insulating material in the vicinity of the plug insertion holes due to the heat emission of the contact portion.

The conductive state confirming signal generator may further comprise a pair of leak detection plates embedded in parallel to each other in the vicinities of a pair of plug insertion holes of the casing between at least the pair of plug insertion holes into which the attachment plug of the electric appliance is inserted, and a leak alarm generating device electrically connected between the leak detection plates and operated by a leak voltage produced between the pair of leak detection plates when the electric insulating characteristic of the insulating material in the peripheral of the seizing portion is destroyed.

With the addition of this leak alarm generating device, when fluff is accumulated in the periphery of the second plug-in terminal of the attachment plug of the electric appliance etc. that is inserted into the receptacle, i.e., in the periphery of the plug insertion hole of the receptacle, and besides turn out to be an electric conductor containing a moisture, the leak voltage is produced between the leak detection plates, and the leak alarm is outputted from the leak alarming device. The fire accident caused by the tracking can be prevented by cutting off the power supply circuit using this leak alarm. Further, if the current value of the electric appliance which becomes a load exceeds the current capacity of the receptacle, the contact portion between the seizing portion of the secondary-side connection fitting and the second plug-in terminal of the attachment plug has a maximum exothermic quantity. Hence, the peripheral area of the insertion hole of the attachment plug of the receptacle casing is carbonized by this heat emission enough to deteriorate or destroy the electric insulating characteristic. Thereupon, the leak voltage is produced between the pair of leak detection plates, and the leak alarm device outputs the leak alarm. The power supply circuit is cut off by use of this leak alarm, and the accident derived from the deterioration of the insulation resistance can be prevented.

The alarm generating device may be constructed of a second light emitting member provided within the casing so that a luminous head thereof protrudes outside. the overheat of the receptacle can be detected at the early stage by providing the second light emitting member.

The alarm generating device may be an alarm sound generator provided within the casing. The user can be notified of the overheat of the receptacle through the alarm sound by providing the alarm sound generator such as a buzzer or a bell.

The alarm generating device may be constructed of a member for outputting an electric signal for cutting off a main power supply circuit. The power supply circuit can be cut off directly by this electric signal or through a relay. Accordingly, when this signal generator is installed in an area within the machine casing, in which

the heat might be evolved, this generator is usable as a signal outputting device for cutting off the main power supply circuit upon detecting the heat emission caused by a high-speed operation or an excessive load. A small-sized a heat emission monitoring device can be thereby constructed at a low cost.

The leak alarm generating device may be constructed of a third light emitting member provided within the casing so that a luminous head thereof protrudes outside. The third light emitting member is constructed as a light emitting element luminous in a color different from those of the first and second light emitting elements, whereby the deterioration or the destruction of the electric insulating characteristic of the casing or the receptacle casing can be visually easily known.

The leak alarm generating device may be a second alarm sound generator provided within the casing. This second alarm sound generator is constructed as the one emitting a tone different from that of the first alarm sound generator, thereby making it feasible to easily distinguish through a sound the deterioration or the destruction of the casing or the receptacle casing.

The conductive state confirming signal generator may further comprise an overcurrent preventing element connected in series or in parallel to the second alarm sound generator. With the provision of the overcurrent preventing element, there is eliminated a possibility of damaging the alarm sound generator even if the electric insulating characteristic of the casing or the receptacle casing is completely destroyed.

The leak alarm generating device may be constructed by a relay for outputting a signal depending on opening and closing of the contact. The power supply circuit can be also cut off and so forth by making use of the contact of this relay.

The conductive state confirming signal generator may further comprise an overcurrent preventing member connected in series or in parallel to the relay. With the provision of this overcurrent preventing element, it never happens that the relay falls into break-down even if the electric insulating characteristic of the casing or the receptacle casing is completely destroyed.

Further, according to the present invention, there is provided an electric connector used as a receptacle, for receiving an attachment plug of an electric appliance, having a confirming signal generating function and a circuit automatic cut-off function. This electric connector comprises a casing including first and second primary-side terminal members led out to the outside, and at least one pair of secondary-side terminal members, internally connected to the primary-side terminal members per pole, into which the attachment plug of the electric appliance is removably inserted. The connector also comprises a movable member so provided as to be movable within the casing and composed of an insulating material, a first fixed contact fixed within the casing and connected to one of the pair of secondary-side terminal member, a second fixed contact fixed within the casing, a first movable contact disposed in a face-to-face relationship with the first fixed contact and electrically connected to the first primary-side terminal member, and a second movable contact fixed to the first movable contact and moving together therewith. The connector further comprises a spring for making the first and second movable contacts contact with the first and second fixed contacts at a predetermined contact pressure, and a temperature displacing device for bringing respectively the first and second movable contacts into contact with the first and second fixed contacts by engaging a motion of the movable member at a normal temperature, and respectively separating the first and second movable contacts from the first and second fixed contacts by releasing the engagement of the movable member with a deformation caused by a rise in temperature. The connector still further comprises a first light emitting member for confirming a conduction, lit up by a voltage between the first and second primary-side terminal members through the second movable contact and the second fixed contact when the temperature displacing device in a state of the normal temperature, and extinguished by the second movable contact separating from the second fixed contact when the engagement of the movable member is released with the deformation of the temperature displacing device due to the rise in temperature, a second light emitting member for confirming circuit cut-off, extinguished by its short-circuited through the second movable contact and the second fixed contact when the temperature displacing device in the state of the normal temperature, released from the short-circuit by separating the second movable contact from the second fixed contact when the engagement of the movable member is released with the deformation of the temperature displacing device due to the rise in temperature, and lit up by a voltage between the first and second primary-side terminal members, and a reset member for returning the first and second movable contacts being in a state of separating from the first and second fixed contacts, to a contact state when at the normal temperature.

According to this electric connector, i.e., the receptacle, the engagement hole formed in the front edge of the temperature displacing device engages with the engagement pint at the normal temperature, in which state the first movable contact is brought into press-contact with the first fixed contact by the spring for giving the contact pressure. Then, the voltage of the primary-side terminal member is applied to the secondary-side connection fitting, and the first light emitting member luminous in, e.g., blue lights up to display the confirmation of conduction. The attachment plug of the electric appliance such as, e.g., a heater having a large current value is inserted into the secondary-side connection fitting, and, if there flows a current exceeding the current capacity of the receptacle, the temperature of the receptacle itself rises. With the rise in temperature, when the temperature of the temperature displacing device

increases over a predetermined value, the front edge formed with the engagement hole deforms to warp upward, thus disengaging from the engagement pin. Then, the movable member is moved by a force of the spring, and the first movable contact separates from the first fixed contact. The current circuit between the first primary-side terminal member and the first secondary-side connection fitting is thereby cut off, and simultaneously the second movable contacts separates from the second fixed contact. Then, the first light emitting member luminous in, e.g., blue, for confirming the conduction, which has lighted up so far, is extinguished, and instead the second light emitting member luminous in red for confirming the circuit cut-off lights up. The circuit cut-off can be thus indicated. Accordingly, if this electric connector is used, it never happens that the temperature increases so such an extent that the insulating characteristic of the receptacle casing is deteriorated or destroyed, and hence there is eliminated the possibility of causing the fire. Further, the attachment plug of the electric appliance, which was a cause of the overcurrent, is removed, and the movable member is moved by the reset member till it falls into the engaged state waiting for the temperature of the receptacle to decrease down to the normal temperature. The restoration is thus simply attained, and a repetitive use can be done.

The electric connector may further comprise a temperature fuse provided electrically in series to the second primary-side terminal member. With the provision of this temperature fuse, eve if there arises such an unpredicted abnormal situation that the circuit can not be cut off by the temperature displacing device for some reasons when the receptacle temperature rises, the protective cut-off is made by the temperature fuse. Therefore, the fire accident can be prevented, and a reliability on the safety is much more improved. When the temperature fuse is fused, neither the first light emitting member nor the second light emitting member of the confirming signal generating device lights up. Hence, it is feasible to easily detect the fusion of the temperature fuse and take a measure such as having it repaired in the maker or a nearby electric appliance shop.

Moreover, according to the present invention, there is provided an electric connector used as a receptacle, for receiving an attachment plug of an electric appliance, having a confirming signal generating function and a circuit automatic cut-off function. This electric connector comprises a casing having first and second primary-side terminal members on one surface that are removably inserted into a power supply receptacle, and at least one pair of first and second secondary-side connection fittings on the other surface thereof, into which the attachment plug of the electric appliance is removably inserted, and a temperature fuse provided within the casing and thermally closely provided between the first primary-side terminal member and the first secondary-side connection fitting. The connector also comprises a connecting member, provided within the casing, for making an electric connection between the second primary-side terminal member and the second secondary-side connection fitting, a first light emitting member, connected between the first primary-side fitting and the second primary-side terminal member, for confirming the conduction, a second light emitting member, connected between the first and second primary-side terminal members, for confirming the circuit cut-off, and a member for extinguishing the second light emitting member when the first light emitting member lights up.

According to the electric connector, the current circuit is cut off when temperature of the receptacle rises by use of the temperature fuse extremely simple in terms of structure and making an ensured operation. Hence, the reliability on the safety is enhanced, and the second light emitting member for confirming the circuit cut-off lights up, thus notifying the user of the fusion of the temperature fuse. It is therefore possible to reuse it by replacing the temperature fuse.

The primary-side terminal member in the electric connector described above may be a plug-in terminal removably inserted into the power supply receptacle embedded into a wall surface etc. of a building, or may be a connecting terminal connected to an electric wire from the power supply, which is of a fixed type embedded into the wall surface etc. of the building or a portable type generally known as a so-called table tap.

According to the present invention, there is provided an electric connector used as an attachment plug having a confirming signal generating function and a circuit automatic cut-off function. This electric connector comprises a plug casing having first and second primary-side plug-in terminals, a movable member so provided as to be movable within the plug casing, and composed of an insulating material, a first fixed contact provided within the plug casing, and a first movable contact so provided on the movable member as to be movable and as to come into contact with the first fixed contact by a contact spring, and connected to the first primary-side plug-in terminal. The connector also comprises a temperature displacing device so provided as to engage the movable member in a normal conductive state in which the first fixed contact comes into contact with the first movable contact, a second movable contact fixed to the first movable contact and moving together therewith, a second fixed contact, provided in the plug casing, with which the second movable contact separably comes into contact, and first and second secondary-side connecting terminals provided in the plug casing and connected respectively to the first fixed contact and to the second primary-side plug-in terminal. The connector further comprises a reset member for returning the first and second movable contacts separating from the first and second fixed contacts to a normal closing state, and a confirming signal generating circuit including a first light emitting member for confirming a conduction and a second light emitting member for confirming circuit cut-off, and constructed so that when

an engagement of the movable member is released with a deformation of the temperature displacing device upon an excess of a temperature of the temperature displacing device over a predetermined value after a voltage between the first primary-side plug-in terminal and the second secondary-side connecting terminal has been applied, the first light emitting member for confirming the conduction which has lighted up so far is extinguished, and that instead the second light emitting member for confirming the circuit cut-off lights up.

When this electric connector is attached to the tip of a power supply cord of the electric appliance, the electric connector can be made to function as a safety device of the electric appliance, wherein the load current always changes. Further, if the electric connector is attached to the tip of the power supply cord of a commercially-available receptacle for increasing the number of ports which is, so to speak, referred to as a table tap, it is feasible to prevent the fire accident caused by the overcurrent due to star-burst wiring.

The attachment plug may further comprise a temperature fuse disposed between the second primary-side plug-in terminal and the second secondary-side connecting terminal. With the provision of the temperature fuse, even if there arises such an unpredicted abnormal situation that the circuit is not cut off by the temperature displacing device when the temperature of the plug casing rises, the current circuit is cut off upon a fusion of the temperature fuse. A double safety structure thus functions, and therefore it is possible to construct the attachment plug exhibiting a high safety enough not to develop into an accident as serious as a fire.

Moreover, according to the present invention, there is provided an electric connector, for receiving an attachment plug of an electric appliance, used as a receptacle having a confirming signal generating function and a circuit automatic cut-off function. This electric connector comprises a receptacle casing having first and second primary-side connecting terminals, a movable member so provided as to be movable within the receptacle casing, and composed of an insulating material. The connector also comprises a first fixed contact provided within the receptacle casing, a first movable contact so provided on the movable member as to be movable and as to be biased to come into contact with the first fixed contact by a contact spring, and connected to the first primary-side connecting terminal, and a pawled engagement member, capable of engagement and disengagement, for engaging the movable member in a normal conductive state in which the first fixed contact comes into contact with the first movable contact, a second movable contact fixedly secured to the first movable contact and moving together therewith, a second fixed contact, fixedly secured within the receptacle casing, with which the second movable contact separably comes into contact, and at least a pair of first and second secondary-side connection fittings provided within the receptacle casing and connected respectively to the first fixed contact and the second primary-side connecting terminal, a third fixed contact fixed to the receptacle casing, and a temperature displacing device provided in a possible-of-separation/contact manner so that a rear edge thereof is connected to the second primary-side plug-in terminal, and a front edge thereof separates from the third fixed contact at a normal temperature and comes into contact therewith at a temperature exceeding a predetermined temperature. The connector further comprises a magnet, provided in the vicinity of the pawled engagement member, and including a first electromagnetic coil with its one end electrically connected to the third fixed contact and its other end electrically connected to the first fixed contact, for releasing the engagement of the movable member by attracting the pawled engagement member upon energizing the first electromagnetic coil, and separating the first and second movable contacts respectively from the first and second fixed contacts, and a confirming signal generating circuit including a first light emitting member for confirming a conduction and a second light emitting member for confirming circuit cut-off, and constructed so that when an engagement of the movable member is released with a deformation of the temperature displacing device upon an excess of a temperature of the temperature displacing means over a predetermined value after a voltage between the first primary-side plug-in terminal and the second secondary-side connecting terminal has been applied, the first light emitting member for confirming the conduction which has lighted up so far is extinguished, and that instead the second light emitting member for confirming the circuit cut-off lights up, and a reset member for returning the first and second movable contacts being separate from the first and second fixed contacts upon the disengagement of the movable member, to a normal conductive state.

This electric connector is defined as a fixed type receptacle attached to a wall or a pillar etc., or a portable type receptacle known as a table tap for receiving the attachment plug of the electric appliance. The normal conductive state is kept by engaging the movable member with the pawled engagement member, and, if over the set temperature of the bimetal with an increase in temperature of the receptacle casing, the magnet attracts the pawled engagement member, and the circuit is cut off. Then, neither the first light emitting member for confirming the conduction, e.g., a blue light emitting diode nor the second light emitting member for confirming the circuit cut-off, e.g., a red light emitting diode, lights up. hence, the receptacle comes to have a function of automatically cutting off the circuit upon the rise in temperature of the receptacle casing, and a confirming signal generating function, which is effective in terms of preventing an accident as serious as the fire.

The electric connector, it is desirable, may further comprise a temperature fuse disposed between the second primary-side connecting terminal and the second secondary-side connecting terminal. With the provi-

sion of this temperature fuse, even if there is produced such an unpredicted abnormal situation that the circuit is not automatically cut off when the temperature of the receptacle casing rises over the set temperature of the bimetal, and when the temperature of the receptacle casing increases over the set temperature of the temperature fuse, the temperature fuse is fused, thereby automatically cutting off the circuit. The security can be highly ensured by the double circuit automatic cut-off function. furthermore, when the temperature is fused, neither of the two, e.g., red and blue light emitting elements of the confirming signal generating device lights up, and therefore the fusion of the temperature fuse is easily detected.

The electric connector may further comprise a pair of leak detection plates disposed in parallel to each other in the middle between a pair of plug insertion holes through which to insert the attachment plug of the electric appliance into the receptacle casing and in the vicinities of the respective plug insertion holes, and a second electromagnetic coil additionally wound on the magnet and connected between the pair of leak detection plates. When the leak voltage is generated in the leak detection plates with a destruction of the electric insulating performance of the insulating material in the periphery to the plug insertion hole in the receptacle casing, the magnet attracts the pawled engagement member upon energizing the second electromagnetic coil, and the engagement of the movable member can be thus released.

According to this construction, if the electric insulating characteristic of the receptacle casing is deteriorated or destroyed by, e.g., the tracking phenomenon, the leak voltage is produced in the leak detection plate. The magnet is energized by this leak voltage and attracts the pawled engagement member. The movable member is thereby disengaged, and the circuit is automatically cut off. Accordingly, it is feasible to prevent the fire accident derived from the leak caused by the deterioration or destruction of the electric insulating characteristic of the receptacle casing.

The electric connector may further comprise a vibration detecting device disposed within the receptacle casing so as to become, when vibrations exceeding a set value are caused, electrically a conductive state corresponding to these vibrations, and electrically connected between the second primary-side connecting terminal and the third fixed contact.

According to this construction, when an earthquake or an explosion happens, there is taken such a measure against the vibrations that the vibration detecting device detects it, and, the magnet being energized, the circuit is automatically cut off by the magnet attracting the pawled engagement member. Hence, a secondary electric disaster derived from the earthquake or the explosion etc. can be prevented.

Moreover, the electric connector may further comprise at least one of an alarm sound generator and a leak alarm light emitting member that are electrically connected between the leak detection plates.

According to this construction, even if there arises such an unpredicted abnormal situation that the circuit is not cut off in spite of the leak voltage being produced in the leak detection plate, the user is informed of an occurrence of the leak through at least one of the alarm sound and the alarm light emission, and therefore a safer and more assured receptacle can be provided.

Furthermore, according to the present invention, there is provided an electric connector, for receiving an attachment plug of an electric appliance, used as a portable type receptacle having a confirming signal generating function and a circuit automatic cut-off function. This electric connector comprises a receptacle casing having first and second primary-side connecting terminals, a first fixed contact provided within the receptacle casing, a movable member so provided as to be movable within the receptacle casing, and composed of an insulating material, and a first movable contact so provided on the movable member as to be movable and as to be biased to come into contact with the first fixed contact by a contact spring, and connected to the first primary-side connecting terminal. The connector also comprises a pawled engagement member, capable of engagement and disengagement, for engaging the movable member in a normal conductive state in which the first fixed contact comes into contact with the first movable contact, a second movable contact fixed to the first movable contact and moving together therewith, a second fixed contact, fixedly secured within the receptacle casing, with which the second movable contact separably comes into contact, and at least a pair of first and second secondary-side connection fittings provided within the receptacle casing and connected to the first fixed contact and the second primary-side connecting terminal. The connector further comprises a third fixed contact fixed to the receptacle casing, a temperature displacing device provided in a possible-of-separation/contact manner so that a rear edge thereof is connected to the second primary-side plug-in terminal, and that a front edge thereof separates from the third fixed contact at a normal temperature and comes into contact therewith at a high temperature over a predetermined temperature, and a magnet, provided in the vicinity of the pawled engagement member, and including a first electromagnetic coil with its one end connected to the third fixed contact and its other end electrically connected to the first fixed contact, for releasing the engagement of the movable member by attracting the pawled engagement member upon energizing the first electromagnetic coil subsequently to the contact of the front edge of the temperature displacing device with the third fixed contact, and separating the first and second movable contacts respectively from the first and second fixed contacts. The connector still further comprises a confirming signal generating circuit including a first light emitting member for confirming a conduction and a second light

emitting member for confirming circuit cut-off, and constructed so that when an engagement of the movable member is released with a deformation of the temperature displacing device upon an excess of a temperature of the temperature displacing device over a predetermined value after a voltage between the first primary-side plug-in terminal and the second secondary-side connecting terminal has been applied, the first light emitting member for confirming the conduction which has lighted up so far is extinguished, and that instead the second light emitting member for confirming the circuit cut-off lights up, and a reset member for returning the first and second movable contacts being separate from the first and second fixed contacts upon the disengagement of the movable member, to a normal conductive state.

According to this electric connector, when the temperature of the temperature displacing device increases the set temperature, the magnet is energized and attracts the pawled engagement member, and the circuit is cut off by releasing the engagement of the movable member. In addition, with this circuit cut-off, the light emitting element luminous in, e.g., blue of the confirming signal generating device is extinguished, and instead the light emitting element luminous in red lights up, thus informing the user of the circuit cut-off. Therefore, it is feasible to largely reduce the possibility of causing the accident such as a fire.

The electric connector may further comprise a pair of leak detection plates disposed in parallel to each other in the middle between a pair of plug insertion holes through which to insert the attachment plug of the electric appliance into the receptacle casing and in the vicinities of the plug insertion holes, the leak detection plates generating the leak voltage when the electric insulating performance of the insulating material in the periphery to the plug insertion hole in the receptacle casing is destroyed. The connector may still further comprise a pair of leak detection pins embedded in parallel to each other closer to the respective primary-side plug-in terminals in the middle between the pair of primary-side plug-in terminals of the receptacle casing, and electrically connected to the leak detection plates per pole, the leak detection pins generating the leak voltage when the electric insulating performance of the insulating material in the periphery to the primary-side plug-in terminal of the receptacle casing, and a second electromagnetic coil additionally wound on the magnet and connected between the pair of leak detection plates, the second electromagnetic coil being energized, when the leak voltage is produced between the pair of leak detection plates or between the pair of leak detection pins, to release the engagement of the movable member by the magnet attracting the pawled engagement member.

According to this construction, if the leak voltage is, after the electric insulating performance of the receptacle casing has been deteriorated or destroyed, produced in the leak detection plate or the leak detection pin, the magnet is energized and attracts the pawled engagement member, and the current circuit is cut off by disengaging the movable member. It is therefore possible to prevent the accident as serious as the fire.

Moreover, according to the present invention, there is provided an electric connector, for receiving an attachment plug of an electric appliance, used as a portable type receptacle having a confirming signal generating function and a circuit automatic cut-off function. This electric connector comprises a receptacle casing having first and second primary-side connecting terminals, a first fixed contact provided within the receptacle casing, a movable member so provided as to be movable within the receptacle casing, and composed of an insulating material, a first movable contact so provided on the movable member as to be movable and as to be biased to come into contact with the first fixed contact by a contact spring, and connected to the first primary-side connecting terminal, and a temperature displacing device, disposed at a right angle to a side-by-side direction of the primary plug-in terminals substantially at the center between the primary-side plug-in terminals and at a right angle to inserting/removing directions of the primary-side plug-in terminals, for engaging the movable member in a normal conductive state in which the first fixed contact comes into contact with the first movable contact. The connector also comprises a second movable contact fixed to the first movable contact and moving together therewith, a second fixed contact, provided within the receptacle casing, with which the second movable contact separably comes into contact, at least a pair of first and second secondary-side connection fittings provided within the receptacle casing and constructed of a first secondary-side connection fitting connected to the first fixed contact and of a second secondary-side connection fitting connected to the second primary-side plug-in terminal, and a confirming signal generating circuit including a first light emitting member for confirming a conduction and a second light emitting member for confirming circuit cut-off, and constructed so that when an engagement of the movable member is released with a deformation of the temperature displacing device upon an excess of a temperature of the temperature displacing device over a predetermined value after a voltage between the first primary-side plug-in terminal and the second secondary-side connecting terminal has been applied, the first light emitting member for confirming the conduction which has lighted up so far is extinguished, and that instead the second light emitting member for confirming the circuit cut-off lights up. The connector further comprises first and second leak detection plates disposed in parallel to each other in the middle between a pair of plug insertion holes for the secondary-side connection fittings, through which to insert the attachment plug of the electric appliance into the receptacle casing and in the vicinities of the plug insertion holes, first and second leak detection pins

embedded in parallel to each other in positions closer to the plug-in terminals in the middle between the pair of primary-side plug-in terminal of the receptacle casing, and a magnet member, provided adjacently to an anti-displacing direction due to a rise in temperature as well as being closer to the front edge of the temperature displacing means within the receptacle casing, and including an electromagnetic coil with its one end connected to the first leak detection plate and the first leak detection pin and with its other end connected to the second leak detection plate and the second leak detection pin, the magnet member releasing the engagement of the movable member by pushing up the temperature displacing means upon energizing the electromagnetic coil. The connector still further comprises an automatic cut-off mechanism for operating the magnet member when a leak voltage is produced in the leak detection plate or the leak detection pin after an electric insulating characteristic peripheral to the plug insertion hole of the receptacle casing or to the primary-side plug-in terminal, and thereby cutting off an electric current path to the secondary-side connection fitting from the primary-side plug-in terminal, and a reset member for returning the first and second movable contacts being in a state of separating from the first and second fixed contacts upon the disengagement of the movable member, to a normal conductive state.

According to the electric connector, when the temperature in the receptacle casing rises over the set temperature of the temperature displacing device, the circuit is cut off by releasing the engagement of the movable member. Further, if the electric insulating characteristic peripheral to the plug insertion hole and the protruded terminal of the receptacle casing is deteriorated or destroyed enough to cause the leak voltage in the leak detection pin and the leak detection plate, the magnet is energized to move the movable member, and the current circuit is cut off by disengaging the movable member. Upon this circuit cut-off, for example, the blue light emitting element of the confirming signal generating device is extinguished, and stead the red light emitting element lights up to notify the suer of the circuit cut-off. Hence, there decreases the possibility of causing the accident as serious as the fire due to the leak caused by the overcurrent or the tracking, and a prompt measure can be taken upon seeking the indication of the confirming signal.

The electric connector may further comprise a temperature fuse disposed between the second primary-side plug-in terminal and the second secondary-side connection fitting.

With the provision of this temperature fuse, even if there arises such an unpredicted abnormal situation that the circuit is not cut off by the temperature displacing device in spite of the fact that the temperature of the receptacle casing increases over the set temperature of the temperature displacing device, the current circuit is cut off with the fusion of the temperature fuse when temperature of the receptacle casing rises over the set temperature of the temperature fuse. Therefore, the security with a high certainty can be ensured.

Brief Description of the Drawings

In the accompanying drawings;

FIG. 1 is a perspective view illustrating an interior of a conductive state confirming signal generator in an embodiment 1 of the present invention;
FIG. 2 is a perspective view showing an external configuration of the confirming signal generator in FIG. 1;
FIG. 3 is a diagram showing a connection in an electric circuit using a bimetal to output a safety confirming signal through a light emitting element;
FIG. 4 is a diagram showing a connection in the electric circuit using the bimetal to emit an alarm sound through a buzzer;
FIG. 5 is a diagram showing a connection in the electric circuit constructed as an explosion-proof type using a reed switch and the bimetal;
FIG. 6 is a diagram showing a connection in the electric circuit using the bimetal to fetch a signal for cutting off a power supply;
FIG. 7 is a diagram showing a connection in the electric circuit using the bimetal structured so that a blue light emitting element is extinguished when a red light emitting element light sup;
FIG. 8 is a diagram showing a connection in the electric circuit with a diode used as a sensor to confirming signal through the light emitting element in an embodiment 2;
FIG. 9 is a diagram showing a connection in the electric circuit with the diode used as a sensor so that the light emitting element, the buzzer and a relay simultaneously output confirming signals;
FIG. 10 is a perspective view illustrating an interior of a number-of-ports increasing receptacle with a confirming signal generator in an embodiment 3;
FIG. 11 is a perspective view illustrating an external configuration of the receptacle in FIG. 10;
FIG. 12 is a perspective view illustrating an interior of the receptacle with the confirming signal generator in an embodiment 4;
FIG. 13 is a perspective view illustrating an external configuration of the receptacle in FIG. 12;
FIG. 14 is a perspective view showing an interior of a conductive state confirming signal generator to which a leak alarm generating mechanism using the bimetal is added in an embodiment 5;
FIG. 15 is a diagram showing a connection in the electric circuit of the confirming signal generator in FIG. 14;
FIG. 16 is a diagram showing an electric circuit of a leak alarm generating mechanism including a leak signal output mechanism using the bimetal and a

leak confirming signal circuit based on the light emitting element in an embodiment 5;

FIG. 17 is a perspective view showing the leak alarm generating mechanism for outputting the leak signal by use of the bimetal;

FIG. 18 is a diagram showing a connection in the electric circuit for outputting the leak signal through an alarm light emitting element and an alarm sound generator by a leak voltage in the embodiment 5;

FIG. 19 is a diagram showing a connection in the electric circuit in FIG. 18, to which an overcurrent protection circuit based on a constant current diode is added;

FIG. 20 is a diagram showing a connection in the electric circuit in FIG. 18, to which an overcurrent protection circuit based on an overcurrent preventive resistance is added;

FIG. 21 is a diagram showing a connection in the electric circuit for outputting the leak signal from the relay by the leak voltage generated in a leak detection pin in the embodiment 5;

FIG. 22 is a diagram showing a connection in the electric circuit in FIG. 21, to which the overcurrent protection circuit based on the constant current diode is added;

FIG. 23 is a diagram showing a connection in the electric circuit in which a leak alarm neon lamp is lit up by the leak voltage generated in the leak detection pin in the embodiment 5;

FIG. 24 is a perspective view showing an interior of the receptacle with the confirming signal generator, to which the leak alarm generating mechanism for outputting the leak signal from the relay by the leak voltage generated in the leak detection plate is added, as well as showing a connection in the electric circuit for the leak alarm in the embodiment 5;

FIG. 25 is a perspective view showing an external configuration of the electric circuit in FIG. 24;

FIG. 26 is a perspective view showing an interior of the receptacle with the confirming signal generator, to which the leak alarm generating mechanism for outputting the leak signals from the alarm sound generator and the alarm light emitting element by the leak voltage generated in the leak detection plate is added, as well as showing a connection in the electric circuit for the leak alarm in the embodiment 5;

FIG. 27 is a perspective view showing one example of an interior of the receptacle with a plug-in terminal, which incorporates a confirming signal generating function and a circuit automatic cut-off function in an embodiment 6;

FIG. 28 is a circuit diagram of the confirming signal generator in FIG. 27;

FIG. 29 is a perspective view showing an example of the receptacle with the plug-in terminal having a different plug inserting direction from that in the device in FIG. 27;

FIG. 30 is a perspective view showing an example of the receptacle with the plug-in terminal having a different plug inserting direction from those in FIGs. 27 and 29 in an embodiment 6;

FIG. 31 is a perspective view illustrating a two-port receptacle with the plug-in terminal in the embodiment 6;

FIG. 32 is a perspective view of a fixed type or a portable type two-port receptacle having the confirming signal generating function and the circuit automatic cut-off function in an embodiment 7;

FIG. 33 is a perspective view illustrating the attachment plug having the confirming signal generating function and the circuit automatic cut-off function in an embodiment 8;

FIG. 34 is an explanatory diagram showing a tracking preventive mechanism in an embodiment 9, which is added to the receptacle with the plug-in terminal in the embodiment 6 or the attachment plug in the embodiment 8;

FIG. 35 is a perspective view illustrating an interior of the receptacle with the plug-in terminal that has the confirming signal generating function and a double circuit automatic cut-off function in an embodiment 10;

FIG. 36 is a diagram showing an electric circuit of the device in FIG. 35;

FIG. 37 is a perspective view showing an interior of the receptacle with the plug-in terminal having a different plug inserting direction from the one in FIG. 35, which incorporates the confirming signal generating function ad the double circuit automatic cut-off function;

FIG. 38 is a perspective view showing an interior of the receptacle with the plug-in terminal having a different plug inserting direction from those in FIGs. 35 and 37 in the embodiment 10, which incorporates the confirming signal generating function and the double circuit automatic cut-off function;

FIG. 39 is a perspective view showing an interior of the two-port receptacle with the plug-in terminal which has the confirming signal generating function and the double automatic cut-off function in the embodiment 10;

FIG. 40 is a perspective view showing an interior of a fixed type receptacle attached to a pillar or a desk etc. or a portable type receptacle which has the confirming signal generating function and the double circuit automatic cut-off function;

FIG. 41 is a perspective view showing an interior of the attachment plug attached to the tip of a power supply cord of an electric appliance or a table tap etc. which has the confirming signal generating function and the double circuit cut-off function in an embodiment 12;

FIG. 42 is a perspective view showing an interior of the receptacle with the plug-in terminal which has the confirming signal generating function and the

circuit automatic cut-off function using a temperature fuse in an embodiment 13;

FIG. 43 is a diagram showing a connection in the electric circuit in FIG. 42;

FIG. 44 is a perspective view illustrating an interior of the fixed type receptacle used by its being attached to a wall surface or a pillar etc. which has the confirming signal generating function and the circuit automatic cut-off function, and further incorporates a double circuit cut-off function through the temperature fuse, the circuit automatic cut-off function through the leak detection plate when the leak occurs, the circuit cut-off function through vibrations, and the alarm signal generating mechanism for use when the leak occurs;

FIG. 45 is a perspective view illustrating an external configuration of the receptacle in FIG. 44;

FIG. 46 is a diagram showing a connection in the electric circuit of the receptacle in FIG. 44;

FIG. 47 is a diagram of a connection in the electric circuit in the receptacle having the confirming signal generating function and the circuit automatic cut-off function in an embodiment 14, showing an example of using the magnet taking a different configuration;

FIG. 48 is a perspective view of the receptacle with the plug-in terminal which incorporates the confirming signal generating function and the circuit automatic cut-off function in an embodiment 15, illustrating an interior of the receptacle having the circuit automatic cut-off function through the leak detection plate and the leak detection pin when the leak occurs;

FIG. 49 is a diagram showing a connection in the electric circuit of the receptacle shown in FIG. 48;

FIG. 50 is a perspective view of the receptacle with the plug-in terminal which incorporates the confirming signal generating function and the circuit automatic cut-off function in an embodiment 16, illustrating an interior of the receptacle having the circuit automatic cut-off function with which the bimetal is moved by the magnet when the leak occurs; and

FIG. 51A is a diagram showing a connection in the electric circuit of the receptacle in FIG. 50; and FIG. 51B is an explanatory sectional view taken substantially along the line A-A in FIG. 51A, showing a relationship between the bimetal and the magnet.

Best Mode for Carrying out the Invention

Embodiments of the present invention will hereinafter be described with reference to the drawings.

(Embodiment 1)

FIG. 1 is a perspective view showing an interior of a conductive state confirming signal generator of such a type as to be inserted into an existing receptacle. FIG. 2 is a perspective view illustrating an external configuration thereof. Referring to FIGs. 1 and 2, a casing 1 comprises a body member 1A and a cover member 1B, each of which is composed of an insulating material such as synthetic resin. The cover member 1B is formed with a window hole 1a through which heads of light emitting elements 5A, 5B protrude enough to be visible from outside.

A pair of plug-in terminals 2A, 2B detachably attachable to a double-pole power supply receptacle are fixed to the body member 1A. A rear end of a bimetal 4 is fixed to a rear end of one plug-in terminal 2A so that these rear ends come into electrically and thermally well contact with each other by riveting or welding etc. A contact 4a fitted to the tip of the bimetal 4 extends to a position under a contact 3a of a fixed conductor 3 fixed to the body member 1A. The contact 4a of the bimetal 4 is separate from the contact 3a of the contactor 3 at a normal temperature and, when over a predetermined set temperature high than the normal temperature deforms so as to warp upward, thus electrically contacting the contact 3a. The bimetal 4 is manufactured by sticking two sheets of metals to each other, which have different coefficients of expansion. The bimetal is used as a temperature displacement member in which a mechanical displacement is produced depending on the temperature, and similar shape memory elements composed of a shape memory alloy capable of reverting to a previously memorized shape at a predetermined temperature and other materials can be also used without being limited to the bimetal. A concrete example of the temperature displacement member using the bimetal will hereinafter be explained.

Two pieces of light emitting elements which are, e.g., light emitting diodes (LEDs) 5A, 5B or miniature bulbs etc. are attached with their heads directed upward to the body member 1A, and the heads thereof protrude from the window hole 1a of the cover member 1B enough to be visible from outside. The LEDs 5A, 5B are capable of emitting the light beams in colors different from each other. For example, the LED 5A is able to be luminous in blue, while the LED 5B is able to be luminous in red. The casing 1 incorporates a rectifying diode D and a current-limiting resistor R.

FIG. 3 is a diagram showing one example of an electric circuit of the signal generator. In this circuit, the bimetal 4 is separated from the fixed conductor 3, in which state there is formed a closing circuit extending from the plug-in terminal 2B to the plug-in terminal 2A via the resistor R, the diode D and the LED 5A, and the LED 5A lights up with a blue luminance. The bimetal 4 comes in contact with the fixed conductor 3, whereby the electric current flows across also the LED 5B therethrough and the LED 5B lights up with a red luminance.

According to the signal generator illustrated in FIGS. 1 - 3, when the plug-in terminals 2A, 2B are inserted into the unillustrated power supply receptacle, the electric current flow across the LED 5A via the resis-

tor R and the diode D, with the result that this LED 5A lights up with a blue luminance for confirming a conductive state. Next, if a temperature of the unillustrated power supply receptacle rises abnormally due to, e.g., an overcurrent, a temperature of the bimetal 4 rises via the plug-in terminal 2A, and, if over a set temperature, the bimetal 4 deforms enough to contact the fixed conductor 3 with the result that the LED 5B lights up to be luminous in red for an alarm.

As shown in FIG. 4, a comparatively small-sized alarm sound generator, e.g., a piezoelectric buzzer 6 and a bell etc. are usable as substitutes for the LED 5B. Further, the alarm sound generator such as the piezoelectric buzzer 6. can be used in combination with the LED 5B.

As shown in FIG. 5, a reed switch 7 can be used in place of the fixed conductor 3 and the bimetal 4 in FIG. 3. In this case, a magnet MG is attached to the tip of the bimetal 4 and normally in an unoperated (switch-OFF) state of its being separate from the reed switch 7. When the magnet MG approaches the reed switch 7 due to a thermal deformation of the bimetal 4, the reed switch 7 turns ON, thereby lighting up the LED 5B. In accordance with this embodiment, the contact of the circuit breaker which might cause a spark is not exposed, and hence an explosion-proof type signal generator can be attained.

As illustrated in FIG. 6, the body member 1A is provided with another terminal 2C fitted to an independent connector provided to a receptacle etc. of, e.g., an electronic office machine, and a voltage of the plug-in terminal 2A is led to the terminal 2C owing to the thermal deformation of the bimetal 4. With this contrivance, an unillustrated circuit breaker for wiring or an unillustrated electromagnetic contactor provided in a power supply unit for supplying the receptacle with the voltage, can be cut off through a relay or a timer relay etc..

FIG. 7 shows a modified example of the embodiment shown in FIG. 3. In an apparatus illustrated in FIG. 7, a direction of each diode in FIG. 3 is reversed, and the resistor R in FIG. 3 is provided in such a form as to be divided into resistors RA, RB in each of the LEDs 5A, 5B. Further, a diode DA is connected between an anode of the LED 5B and a cathode of the LED 5A, wherein a cathode thereof is set on the cathode side of the LED 5A, and an anode thereof is set on the anode side of the LED 5B. In this circuit configuration, the current flows via the resistor R and the diode D to the LED 5A in order to confirm the conduction in a normal time of the bimetal 4 being in an OFF-state, whereby the LED 5A lights up in blue. The bimetal 4 is switched ON, and the current flows to the LED 5B via the resistor R and the diode D, with the result that the LED 5B lights up in red while the LED 5A is extinguished by action of a diode DA. This embodiment is characterized by extinguishing the LED 5A when the LED 5b lights up by the action of the diode DA.

(Embodiment 2)

The conductive state confirming signal generator in an embodiment 2 makes the use of a variation in characteristic of a germanium diode which is caused by the temperature instead of the opening and closing of the contact based on the deformation of the bimetal 4 in the embodiment 1. The germanium diode may be originally a semiconductor device in which a characteristic thereof is easy to change due to the temperature, and exhibits such a nature that a voltage at which a forward current starts flowing is, e.g., approximately 0.2 V at the normal temperature and, when the temperature rises, starts flowing at a voltage smaller than the above voltage. Then, as illustrated in FIG. 8, a germanium diode 9 is connected in series to the LED 5B via a variable resistor VR1. One lead wire 9a of the diode 9 is connected directly to, e.g., one plug-in terminal 2A so that the heat of the plug-in terminal is easy to transmit, This embodiment is substantially the same as the embodiment 1 except for the electric circuit. The LED 5A for confirming the conduction, the rectifying diode D1 and the current-limiting resistor R1 are connected between the plug-in terminals 2A and 2B. The LED 5B for alarm is connected in parallel to the LED 5a via the germanium diode 9 and the variable resistor VR1.

In a circuit shown in FIG. 8, when the plug-in terminals 2A, 2B are inserted into the unillustrated power supply receptacle, and if this power supply receptacle is in a normal temperature state, the diode 9 is in a high-resistance state, and the LED 5b does not become luminous. Then, the current flows to only the conduction confirming LED 5A via the diode D1 and the resistor R1, and the LED 5A emit the light in blue. If a temperature of the power supply receptacle abnormally increases because of, e.g., the overcurrent etc., the heat thereof is transmitted to also the germanium diode 9 via the lead wire 9a from the plug-in terminal 2A, with the result that the temperature thereof rises. When the temperature of germanium diode 9 increases over a set temperature, the forward current flows across the LED 5B, whereby the LED 5B for the alarm emits the light in red. Note that the variable resistor VR1 is provided for making such an adjustment that the LED 5B does not light up with the diode 9 being in the high-resistance state at the normal temperature, and that the diode 9 is energized, i.e., the LED 5B lights up when over the set temperature.

In FIG. 9, the operation that the conduction confirming LED 5A to which the voltage is applied upon inserting the plug-in terminals 2A, 2B into the power supply receptacle light up, is the same as the above-mentioned, however, a single or a plurality of electric appliances requiring a larger electric power can be driven when the germanium diode is switched ON by an emission of heat from the power supply receptacle. Therefore, in the embodiment 9 shown in FIG. 9, when the forward current flows across the germanium diode, an electric power amplifying transistor TR amplifies this

current.

The embodiments shown in FIGs. 1 through 8 involve the use of a half-wave rectifier based on the single diode D. In the embodiment in FIG. 9, however, there is used a full-wave rectifier, i.e., a single-phase bridge rectifier D3 for rectifying an AC power obtained from the plug-in terminals 2A, 2B. A DC output terminal of the rectifier D3 is connected via a current-limiting resistor R2 to a smoothing capacitor C, and a DC voltage is fetched out of two terminals P, N of the capacitor C. The conduction confirming LED 5A is connected between the terminals P, N via the resistor R3. A light emitting diode of a photo coupler HC is connected between the terminals P, N via two germanium diodes 9A, 9B connected in series. Further, output terminals of the diodes 9A, 9B are connected to a base of the transistor TR through a photo transistor of the photo coupler HC as well as through a resistor R4. The LED 5B, the alarm sound generator such as a buzzer (Bz) 6 and a solenoid of a relay 8 are connected in parallel, and further connected between the terminals P, N through the transistor TR. Note that a current-limiting resistor R5 is connected in series to the LED 5B. Herein, the two germanium diodes 9A, 9B connected in series are used in order to make conspicuous a limit point at which the forward current starts flowing. Besides, these diodes are disposed in the vicinity of the plug-in terminal 2A or 2B so as to be well influenced by the heat of this plug-in terminal.

In the circuit shown in FIG. 9, when the plug-in terminal 2A or 2B is inserted into the power supply receptacle, the conduction confirming LED 5A lights up with the blue luminance. At this time, the temperature of the diodes 9A, 9B disposed in the vicinity of the plug-in terminal 2A or 2B does not rise, and hence, when these diodes are in the OFF-state, the transistor TR is not switched ON because of a base current not flowing Accordingly, none of the LED 5B, the buzzer 6 and the relay 8 operate. When the temperature of the power supply receptacle increases, however, the temperature of the diodes 9A, 9B also rises through the plug-in terminals 2A, 2B, and the forward current starts flowing. When the forward current flows across the diodes 9A, 9B, the transistor TR is so switched ON as to be driven through the photo coupler HC. The LED 5B thereby lights up, and simultaneously the buzzer 6 emits an alarm sound. Then, the relay 8 is energized. With the energizing of the relay 8, for example, the main power supply circuit can be cut off by the contact thereof. If there is no necessity for simultaneously executing the lighting of the LED 5B, the emission of the alarm sound from the buzzer 6 and the opening/closing of the contact of the relay 8, these elements may be each solely operated. Further, the operations thereof may be conducted in arbitrary combinations such as a combination of the LED 5B and the relay 8 or a combination of the buzzer 6 and the relay 8.

Note that the germanium diode is the semiconductor device exhibiting the most conspicuous temperature characteristic, however, it remains the same that characteristics of other diodes such as silicon also change due to the heat, and such diodes are usable for the same purpose as the germanium diode. In this case also, the amplifier circuit for amplifying the diode output may be incorporated therein.

(Embodiment 3)

FIG. 10 is a perspective view showing an internal configuration of the conductive state confirming signal generator incorporated into a receptacle with plug-in terminals that is provided for an increment in the number of ports through which to attach the power supply receptacle. FIG. 11 is a view showing an external configuration thereof. Referring to FIGs. 10 and 11, a receptacle body 10 is constructed by use of a molded part consisting of a body member 10A and a cover member 10B each composed of an insulating material such as synthetic resin. The surface of the cover member 10A is constructed of a roof-shaped portion formed with a plug insertion holes 10A, and of a flat portion formed with window holes 10b through which to emit the light.

The body member 10A includes a pair of secondary connection fittings 11A, 11B constructed integrally with primary-side plug-in terminals 12A, 12B, and conductors 11a into which plug-in terminals 18a of an attachment plug 18 fitted to the tip of the electric appliance, are integrally formed in a V-shape for two ports at both ends of the secondary-side connection fittings 11A, 11B. Further, the central part of a bottom plate of one secondary-side connection fitting 11A is cut off, and a contact piece 15 is fitted into this cut-off central part in a state of being insulated from the other secondary-side connection fitting 11B. When the plug-in terminal 18a of the plug 18 is completely attached to the secondary-side connection fitting, the tip thereof comes into contact with the contact piece 15.

A proximal portion of the bimetal 14 is fixed to the upper edge of a crooked portion of the contact piece 15 by riveting or welding, and the tip of the bimetal 14 is separated from a contact 13a of the conductor 13 fixed to the body member 10A at the normal temperature but comes into contact therewith when the temperature rises. Moreover, the body member 10A is fitted with the two LEDs 5A, 5B with their luminous heads directed upward. A neon lamp, a glow lamp and a miniature bulb etc. are adequately usable as light emitting elements in addition to the LED. The luminous heads of the LEDs 5A, 5B protrude from the window holes 10b of the cover member 10B enough to be visible from outside, and the receptacle body 10 incorporates the diode D and the resistor R that are connected in series. Note that the bimetal 14 can be fixed directly to the secondary-side connection fitting 11B, in which case the heat can be transmitted much faster to the bimetal 14.

The contact piece 15 is electrically insulated from the secondary-side connection fitting 11A integral with the plug-in terminal 12A, and the tip of the plug-in terminals 18a, when the attachment plug 18 is completely inserted into the secondary-side connection fitting 11A, comes into contact with the contact piece 15, thereby connecting the secondary-side connection fitting 11A with the conductor 13. Thus, in this embodiment, the constructions other than the bimetal 14 being fixed to the contact piece 15 are substantially the same as those in the circuit shown in FIG. 3.

When the attachment plug 18 of the electric appliance is completely inserted into the number-of-ports increasing receptacle fitted into the unillustrated power supply receptacle, the tip of the plug-in terminal 18a of the plug 18 is brought into contact with the contact piece 15, and the contact piece 15 has the same electric potential as the secondary-side connection fitting 11A, whereby the conduction confirming LED 5A lights up with the blue luminance. If the temperature of the number-of-ports increasing receptacle rises due to the overcurrent or others, and if the bimetal 14 exceeds the set temperature, the tip of the bimetal 14 contacts the contact 13a of the conductor 13 because of its thermal deformation, with the result that the LED 5B for the alarm lights up with the red luminance.

Note that the alarm sound generator such as the piezoelectric buzzer may emit the sound instead of the lighting of the LED 5B as in the embodiment 1. The direct opening an closing between the bimetal 14 and the conductor 13 can be set as an anti-explosion type by which the opening and closing are conducted through the reed switch as in the embodiment shown in FIG. 5.

Furthermore, the body member 10A is provided with another additional terminal for a connection to an independent connection fitting of the receptacle used in the office electric appliance (OA device and equipment). Upon a contact of the bimetal 14 with the conductor 13, the voltage is applied to this additional terminal, whereby it is feasible to output a signal for cutting off the power supply circuit directly by the circuit breaker or the electromagnetic contactor etc., or through the relay and the timer relay etc..

Moreover, in the number-of-ports increasing receptacle with the conductive state confirming signal generator in the embodiment 3, as illustrated in the electric circuit diagram of FIG. 8 or 9, instead of the bimetal 14 and the conductor 13, the rise in temperature is directly transmitted by connecting one lead wire of one of the germanium diodes 9, 9A and 9B to the connection fitting 11B, and the LED 5B electrically connected between the contact piece 15 and the other lead wire of the germanium diode is light up by making use of the temperature characteristic of the germanium diode, or alternatively two or three of the LED 5B, the buzzer 6 and the relay 8 can be simultaneously operated.

Note that there may be constructed such that one lead wire of the germanium diode is fixed to the contact piece 15, and the LED 5B is electrically connected between the connection fitting 1B and the other lead wire.

(Embodiment 4)

FIG. 12 is a perspective view illustrating an interior of the receptacle with the conductive state confirming signal generator in this embodiment, which can be attached to a pillar or wall surface or is usable as a portable type. FIG. 13 is a view showing an external configuration thereof. Referring to FIGs. 12 and 13, a receptacle 20 is constructed by using a box-shaped molded part consisting of a cover member 20A and a cover member 20B each composed of the insulating material such as the synthetic resin, and the surface of the cover member 20B is formed with a plug insertion hole 20a and window holes 20b for the LEDs 5A, 5B.

In the receptacle 20, secondary-side connection fittings 21A, 21B each including a pair of seizing portions 21a at both ends are so fixed as to be disposed in side-by-side relationship, and two electric wires of primary-side power supply cords 22 are respectively connected to the secondary-side connection fittings 21A, 21B. Contact pieces 25A, 25B are disposed just under the seizing portions 21a at both ends of one secondary-side connection fitting 21A, in a state of being electrically insulated from the secondary-side connection fitting 21A. Then, when the plug-in terminal 18a of the attachment plug 18 of the electric appliance is completely inserted into the sizing portion 21a, the tip of the plug-in terminal 18a comes into contact with a lower contact surface of the contact piece 25A or 25B, whereby the secondary-side connection fitting 21A is conductively connected to the contact piece.

The proximal portion of the bimetal 24 is fixed to the upper edge of the crooked portion of one contact piece 25A by riveting or welding, and a contact piece 23 including a contact 23a with which a contact portion of the tip of the bimetal 24 comes into contact in the openable/closable manner. Further, as in the embodiments 1 and 3, the body member 20A is fitted with the LEDs 5A, 5B and incorporates the diode D and the resistor R.

Note that if the proximal portion of the bimetal 24 is connected directly to the secondary-side connection fitting 21B, it can be expected the heat transmissivity to the bimetal 24 be enhanced.

The body member 20A may incorporate an electric circuit as shown in FIG. 7 or 8, wherein in place of the bimetal 24 and the contact piece 23, one lead wire of the germanium diode is connected to the secondary-side connection fitting 21B so that the rise in temperature is transmitted directly, and an alarm generating device electrically connected between the contact piece 25a and the other lead wire of the germanium diode, is operated by making use of the temperature characteristic of the germanium diode. Further, one lead wire of the germanium can be fixed to the contact piece 25A.

The embodiment 4 has substantially the same function as that of the embodiment 3, and hence an explanation of the operation thereof is omitted.

Note that the conductive state confirming signal generator is applicable to a receptacle of a wall surface embedded type.

(Embodiment 5)

An embodiment 5 shows a function of outputting a leak signal by detecting such a state that a leak current occurs due to a cause in which the insulating material such as the synthetic resin of the body member 1A of the casing 1 of the conductive state confirming signal generator for the receptacle in the embodiments 1 and 2, or the insulating material of the body 10 (FIG. 10) of the receptacle wit the number-of-ports increasing plug-in terminal in the embodiment 3, is exposed to a high temperature for a long period of time and gradually carbonized, resulting in a decline or destruction of the electric insulating characteristic. Accordingly, it is feasible to prevent a serious accident such a fire caused by the decline or destruction of the electric insulating characteristic of the casing 1 or the receptacle body 10 exposed to the high temperature increased due to the overcurrent etc., by adding that leak signal output function to the conductive state confirming signal generator for the receptacle that has been described so far in detail.

FIG. 14 is a perspective view showing the receptacle in which the above-described leak signal output function is added to the confirming signal generator of such as type as to be attached to double-pole receptacle shown in FIG. 1. FIG. 15 is a diagram illustrating an electric circuit thereof. Herein, the same components as those in FIG. 1 are marked with the same numerals, and their explanations are omitted or simplified.

A second bimetal 34 is vertically embedded substantially in the central portion between the pair of plug-in terminals 2A, 2B the proximal portions of which are fixed to the body member 1A of the casing 1 composed of the insulating material such as the synthetic resin so that a lower edge of the bimetal 34 is embedded while an upper edge thereof protrudes. This bimetal 34 is so constructed as to take substantially a verticality at the normal temperature and lean forward at a high temperature.

An unillustrated guide is formed extending in the terminal side-by-side direction of the plug-in terminals 2A, 2B, i.e., in right-and-left directions on the rear side of the bimetal 34 within the casing 1, and a movable member 35 is movably placed on this guide. The movable member 35 is composed of an electrically insulating material such as bakelite, wherein a front side surface thereof is formed integrally with an engagement protruded portion 35a, and a front edge surface thereof is fitted with a movable contact 36. This movable contact 36 is connected via a lead wire 37 to one plug-in terminals 2A and is biased by a spring 39 toward a fixed contact 38 at all times. At a normal time, however, the bimetal 34 engages with the engagement protruded portion 35a, and a spring force of the spring 39 is made ineffective by the bimetal 34. The fixed contact 38 is connected to a leak alarm output terminal 41 via a current-limiting resistor R6.

In the conductive state confirming signal generator shown in FIGs. 14 and 15, when the plug-in terminals 2A, 2b of the conductive state confirming signal generator are inserted into the unillustrated power supply receptacle, the LED 5A for confirming the conduction lights up with the blue luminance. If the temperature of the power supply receptacle abnormally rises due to, e.g., the overcurrent etc., the heat thereof is transmitted via the plug-in terminal 2A to the bimetal 4. If the temperature of the bimetal 4 exceeds the set temperature, the bimetal 4 deforms, and a front edge 4a thereof contacts the contact 3a of the contact piece 3, whereby the LED 5B for the alarm lights up with the red luminance.

What has been described so far is the same as the operation in the embodiment 1, however, this embodiment has such a difference from the embodiment 1 that a function of outputting the leak signal which will be explained next is added.

For example, if the body member 1A of the casing 1 is exposed to the high heat for a long time, the insulating material such as the synthetic resin is carbonized enough to deteriorate or destroy the insulation resistance. A leak current or a short-circuit current thereby flows between the plug-in terminals 2A and 2B, and a temperature of the insulating material of the body member 1A increases. With this increase in temperature, a temperature of the second bimetal 34 rises. If over the set temperature, the upper edge of the bimetal 34 deforms substantially right-downward in FIG. 14 as indicated by an imaginary line (a two-dotted line) and thus separates from the engagement protruded portion 35a of the movable member 35. Then, the movable member 35 advances by dint of the spring force of the spring 39, and the movable contact 36 is pressed by the fixed contact 38. An electric potential of the plug-in terminal 2A is led via the resistor R6 to the leak alarm output terminal 41 an can be used as a leak signal.

The power supply can be cut off, or an optical or sound alarm can be generated by a different alarm generating member by operating the unillustrated relay or breaker or electromagnetic contactor etc. with this leak signal.

Note that the movable member 35 is composed of the insulating material, and therefore the leak signal can be fetched without being conducted to the bimetal 34.

It is preferable that the cover member 1B of the casing 1 be provided with an unillustrated reset mechanism for making the tip of the bimetal 34 engage with the engagement protruded portion 35a by moving, the movable member moving with the deformation of the bimetal 34, this movable member 35 just when the

bimetal 34 reverts to the normal temperature after the leak signal has been outputted.

FIG. 16 shows an embodiment in which a leak alarm display circuit is added to the leak signal output mechanism in the apparatus shown in FIG. 15, wherein the conduction confirming signal generating unit and the alarm signal generating unit are omitted. Referring to FIG. 16, an LED 5C as a light emitting element is connected between the plug-in terminals 2A and 2B via a resistor R9 and a diode D8, and an LED 5D and a resistor R8 are connected in series between a fixed contact 38 and an anode of the diode D8. Moreover, a diode D7 is connected between the fixed contact 38 and a cathode of the LED 5C. The arrangement that the fixed contact 38 is connected to the leak alarm output terminal 41 via the resistor R6 is the same as that in the case of FIG. 15.

In accordance with the embodiment shown in FIG. 16, only the LED 5C lights up with the blue luminance at the normal time. When the temperature of the body member 1A of the casing 1 rises, the bimetal 34 deforms enough to disengage from the engagement protruded portion 35a, with the result that the movable contact 36 comes into contact with the fixed contact 38 by the spring force of the spring 39. With this operation, the LED 5C is extinguished while the LED 5D lights up with the red luminance, and the leak signal is generated at the output terminal 41.

The LEDs 5C, 5D are colored different from the LEDs 5A, 5B in order to avoid a misconception of whether or not the temperatures of the plug-in terminals 2A, 2B rise, or may be spaced as away from the LEDs 5A, 5B as possible.

FIG. 17 shows the principal portion in a modification of the embodiment shown in FIG. 16. What is omitted herein is the signal generating units of the confirming the conduction and for the alarm, i.e., the lighting circuits of the LEDs 5A, 5B. The bimetal 34 is vertically embedded substantially in the central portion between the pair of plug-in terminals 2A, 2B the proximal portions of which are fixed to the body member 1A of the casing 1 so that the lower edge of the bimetal 34 is embedded while the upper edge thereof protrudes. This bimetal 34 is so constructed as to take substantially the verticality at the normal temperature and lean forward as indicated by a two-dotted line at the high temperature. An upper edge outer periphery thereof is covered with the insulating material, and the fixed contact 43 is so fixed via an L-shaped fitting 44 to one plug-in terminal 2A as to be directed to the axial center of the apparatus. A slot 1a is holed in the terminal side-by-side direction in a position spaced away from the plug-in terminals 2A, 2B of the body member 1A. A rear end of a lever 46 is provided with a guide pin 45 or a roller engaging with this slot 1a so as to be movable therein. A movable contact 47 attached to one side surface of a front edge of the lever 46 comes into contact with the fixed contact 43 as to be separable therefrom. The other side surface of the front edge 46a engages with the side surface of the front edge of the bimetal 34 at the normal temperature. The proximal portion of the lever 46 is pulled left downward in the Figure by a tensile spring 48.

At the normal time when the bimetal 34 does not deform, the front edge of the bimetal 34 engages with the front edge of the lever 46, and the proximal portion of the lever 46 is pulled by the spring 48, whereby the movable contact 47 is kept contact with the fixed contact 43 at a predetermined contact pressure. The electric insulating characteristic of the body member 1A of the casing 1 is deteriorated or destroyed as explained above, and the temperature of the body member 1A increases due to the leak current between the plug-in terminals 1A and 1B, at which time the upper edge of the bimetal 34 deforms forward as indicated by the imaginary line (the two-dotted line) in FIG. 17 and separates from the side surface of the front edge 46a of the lever 46. Thereupon, the lever loses the support of the front edge 46a, and the guide pin 45 provided at the proximal portion is guided within the slot 1a by the tensile force of the spring 48 and reaches its terminal, at which time the lever 46 rotates counterclockwise with its terminal serving as a fulcrum. Then, the lever front edge displaces in an farrowed direction Q, and the movable contact 47 separates from the fixed contact 43.

Hence, there is cut off a signal having the same potential as that of one plug-in terminal 2A which has been applied to the leak alarm output terminal 41 connected via the lead wire 49 to the lever 46. Accordingly, the power supply circuit can he cut off directly or through the relay etc. by making use of the signal when the voltage signal applied to the output terminal 41 is cut off.

Note that the front edge of the bimetal 34 is covered with the unillustrated insulating material, and the voltage of the same potential as that of the plug-in terminal 2A is not applied at all. Moreover, the cover member 1B may be provided with the reset mechanism after outputting the leak signal.

FIG. 18 illustrates an embodiment different from the embodiments shown in FIGs. 15 to 17. Herein, as in the case of FIGs. 16 and 17, the signal generating units for confirming the conduction and for the alarm, i.e., the lighting circuits of the LEDs 5A, 5B are also omitted. Two pieces of leak detection pins 51, 52 are embedded between the plug-in terminals 2A and 2B of the body member 1A of the casing 1 so that upper edges thereof protrude substantially vertically in the vicinities of the plug-in terminals 2A, 2B. For instance, a piezoelectric buzzer 53 serving as an alarm sound generator for a leak alarm is connected to upper edges of the two leak detection pins 51, 52 through a rectifying diode D1 and the current-limiting resistor R5, and further, e.g., an LED 54 as a light emitting element is connected via the resistor R5 to the piezoelectric buzzer 53. The LED 54 is provided so that the luminous head thereof protrudes from the window hole of the cover member 1B of the casing

1 enough to be visible from outside. A Zanier diode having a Zanier voltage corresponding to a rated voltage of the piezoelectric buzzer 53 is connected to an output side of the diode D1. The LED 54 might as well assume, e.g., a yellow etc., which is selected as a different color from those of the LEDs 5A, 5B for confirming the conduction and for the alarm. The buzzer 54 also might as well emit a sound the tone of which is selected as a different one from others.

In the circuit shown in FIG. 18, as far as the electric insulating characteristic is not deteriorated or destroyed in the body member 1A of the body 1, it never happens that the LED 54 lights up, or that the piezoelectric buzzer 53 sounds. If the electric insulating characteristic is deteriorated or destroyed in the body member 1A, however, the leak voltage from one plug-in terminal 2A is produced in one leak detection pin 51, while the leak voltage from the other plug-in terminal 2B is produced in the other leak detection pin 52. The LED 54 thereby lights up with the yellow luminance, and simultaneously the buzzer 53 sounds.

As illustrated in FIG. 19, the constant current diode D7 is connected in series to the rectifying diode D1 instead of the Zanier diode 5D, thereby making it feasible to protect the piezoelectric buzzer 53 from the overcurrent even if a leak voltage approximate to 100 V for the commercial use is applied between the leak detection pins 51 and 52.

As shown in FIG. 20, the buzzer 53 can be protected from the overcurrent by connecting the current-limiting resistor R8 in series to the diode D1.

Note that both of the light emitting element such as the LED 54 and the alarm sound generator such as the buzzer 53 are not necessarily provided in combination, and only any one of them may be provided.

Further, as shown in FIG. 21, the rectifying diode D1 and the smoothing capacitor R1 are connected to the output sides of the two leak detection pins 51, 52, and the a relay (Ry) 55 is connected to the capacitor R1, whereby the relay 55 can be energized by generating the leak voltage. A contact output of the relay 55 is used as a leak signal output, which may be available for the alarm and the protection. In this embodiment, in order to protect the relay 55 from the over voltage, the Zanier diode may be connected in parallel to the relay 55.

As shown in FIG. 22, the constant-current diode D8 is connected in series to the diode D1, in which case the relay 55 can be protected from the overcurrent even when the leak voltage in the vicinity of 100 V is applied between the leak detection pins 51, 52.

As illustrated in FIG. 23, a neon lamp 56 is connected between the two leak detection pins 51, 52 via the current-limiting resistor R9, and can be also so constructed as to light up when the leak voltage occurs between the two leak detection pins 51 and 52.

The leak signal output device shown in FIGS. 15 to 23 is used as an addition to the conductive state confirming signal generator for the receptacle according to the present invention, and each of the leak signal output devices having different constructions may be used in arbitrary combination with each of the signal generators shown in FIGs. 3 to 9.

The above-described leak signal output device can be added together with the confirming signal generator to the receptacle with the number-of-ports increasing plug-in terminal to be attached to the power supply receptacle illustrated in FIGs. 10 and 11.

The leak signal output device described above can be similarly added together with the confirmation signal generator to the receptacle attachable to the pilar or the wall surface or usable as a portable type, which is shown in FIGs. 12 and 13. In this case, the bimetal 34 or the leak detection pins 51, 52 may be provided between the secondary-side contact fittings 21A, 21B.

FIGs. 24 and 25 are perspective views partly containing an electric circuit diagram and respectively illustrating an interior and an external configuration, but show examples in which leak signal output devices different from the above-mentioned are added to the receptacle with the confirming signal generator shown in FIGs. 12 and 13. Herein, the same members as those in FIGs. 12 and 13 are marked with the same numerals, and explanations thereof are omitted or simplified. Note that the conductive state confirming signal generator is omitted in FIG. 24.

Referring to FIGs. 24 and 25, a pair of leak detection plates 26A, 26B are provided in parallel to each other in position in close vicinities to the secondary-side connection fittings 21A, 21B between the pair of secondary-side connection fittings 21A, 21B each having the seizing portions 21a at both ends thereof within the body 20 of the two-port receptacle. Upper edges of substantially C-shaped crooked portion 26a of each of the leak detection plates 26A, 26B are so fitted as to be embedded into slots 20c adjacent to the plug insertion holes 20a in the cover member 20B, and an upper surface of the crooked portion 26a is substantially flush with the upper surface of the cover member 20B.

In the electric circuit, as shown in FIG. 24, the relay 55 is connected to the output side of a rectifying-smoothing circuit consisting of the diode D1 and the capacitor R1 between the leak detection plates 26A and 26B. If the receptacle body 20 increases in temperature for some reasons, the electric insulating characteristic peripheral to the plug insertion hole 20a in the cover member 20B is deteriorated or destroyed, with the result that the leak voltages from the secondary-side connection fittings 21A, 21B are produced in the pair of leak detection plates 26A, 26B. At this time, the relay 55 is energized, and the contact output thereof is utilized as a leak detection signal.

In accordance with the embodiment shown in FIGs. 24 and 25, cotton particles and dusts are adhered to the peripheral portions of the pair of plug-in terminals 18a, 18a of the attachment plug 18 of the electric appliance which are inserted into the plug insertion holes 20a of

the receptacle body 20, resulting in a moisture state containing oil and water etc.. This deteriorates the electric insulation, and, before a tracking phenomenon appears between the plug-in terminals 18a, 18a of the attachment plug 18, the relay 55 is energized upon generation of the leak voltages in the leak detection plates 26A, 28B existing close thereto, whereby the contact output thereof is produced. When the power supply circuit is cut off directly or indirectly by this contact output, it is possible to prevent an occurrence of fire attributed to the tracking phenomenon.

The receptacle and the attachment plug 18 tend to emit the heat due to the overload current a the highest temperature a the contact portion between the seizing portion 21a of each of the secondary-side connection fittings 21A, 21B and the plug-in terminal 18a of the plug 18. Therefore, the peripheral portion of the plug insertion hole 20a in the cover member 20B is carbonized by the heat, and the electric insulation resistance is deteriorated or destroyed, in which case the leak voltages are produced in the leak detection plates 26A, 26B because of the leak current becoming easy to flow. Then, as explained above, the power supply circuit is cut off through the relay 55.

Referring to FIG. 26, if the leak voltages are generated in the leak detection plates 26A, 26B, a small-sized alarm sound generator such as the piezoelectric buzzer 53 and a bell emits the sound, and the leak alarm LED 54 lights up. Any one of the alarm sound generator and the light emitting element may be provided.

The relay circuit in FIG. 24 is the same as the relay circuit in FIG. 21 while the leak alarm circuit in FIG. 26 is the same as the leak alarm circuit in FIG. 18, and explanations thereof are omitted. Further, the relay circuit in FIG. 24 can be constructed the same as the relay circuit in FIG. 22. Moreover, the electric circuit in FIG. 26 can be also constructed the same as the leak alarm circuits in FIGS. 10 and 20.

In both of the devices in FIGS. 24 and 26, the electric circuit can be changed to the leak alarm circuit using the neon lamp 56 shown in the electric circuit diagram in FIG. 23.

Further, the leak signal output device in the embodiment 5 is not necessarily used in combination with the confirming signal generator, and the respective devices can be constructed as signal output devices.

(Embodiment 6)

An embodiment 6 shows the receptacle with the plug-in terminal, which is used a connection power supply for the attachment plug of the electric appliance and incorporates a conductive state confirming signal generating function and a circuit automatic cut-off function.

FIG. 27 is a perspective view showing one example of an interior of the receptacle. FIG. 28 is a diagram illustrating electric circuits of a confirming signal generating mechanism and of a circuit automatic cut-off mechanism. Referring to FIGS. 27 and 28, a receptacle body 60 is constructed of a body member 60A and a cover member 60B each composed of the insulating material such as the synthetic resin. The cover member 60B is formed with unillustrated two window holes through which luminous heads of LEDs 61A, 61B which will be mentioned later on protrude enough to be visible from outside.

A pair of primary-side plug-in terminals 62A, 62B detachably attached to a double-pole type power supply receptacle, are fixed to the body member 60A. A proximal portion of a bimetal 64 is fixed substantially at the central portion between one primary-side plug-in terminal 62A and the other primary-side plug-in terminal 62B at a right-angle to the side-by-side direction (hereinafter referred to as a "crosswise direction") of the plug-in terminals as well as at a right-angle to an inserting/removing direction of the primary-side plug-in terminal. The front edge of the bimetal 64 has an engagement hole 64a elongate in the longitudinal direction, and deforms so as to warp upwards when the temperature rises.

The central portion of the body member 60A is provided with an unillustrated guide extending in the crosswise direction, and a movable member 63 composed of the insulating material such as the synthetic resin is so provided as to be movable along this crosswise guide. The movable member 63 is biased in a left downward (rightward in FIG. 28) direction in FIG. 27 at all times by a compression spring 65 adjacent just under the front edge of the bimetal 643 when at the normal temperature and disposed between a protruded portion 63a and a protruded portion 60a of the body member 60A.

The movable member 63 includes a vertical groove 63b cut in a side surface closer to the front edge thereof, and the front edge of the movable member 63 is provided with a first movable contact 66 so as to be movable crosswise within a width dimension of the vertical groove 63b. The first movable contact 66 is always kept contact with a fixed contact 71 by the compression spring 67 at a predetermined contact pressure. A second movable contact 68 having a small current capacity is therefore provided integrally just beside the first movable contact 66. The first movable contact 66 is connected to one plug-in terminal 62A through a comparatively thick stranded wire 69.

The body member 60A is provided with a first fixed contact 71 with which the movable contact 66 separably comes into contact, and a second fixed contact 72 with which the movable contact 68 separably comes into contact. The body member 60A is provided with a pair of secondary-side connection fittings 73A, 73B for an attachment plug 78. One secondary-side connection fitting 73A is connected to the first fixed contact 71 through a connection plate or an electric wire having a large current capacity, and the other secondary-side connection fitting 73B is connected likewise to the other plug-in terminal 62B.

The body member 60A is provided with a movable

reset pin 74 the front edge of which penetrates a side plate 60b and protrudes therefrom. This reset pin 74 is biased so that its rear edge is always brought into contact with a side surface of the protruded portion 63a of the movable member 63 by a spring 75 weaker than the spring 65 for biasing the movable member 63.

An engagement pin 76 engaging with an engagement hole 64a of the bimetal 64 in a manner of being possible of disengagement therefrom, is vertically embedded in an upper surface of the movable member 63. The movable member 63 is moved resisting a force of the spring 65 by manually pressing the tip of the reset pin 74 that protrudes from the body member 60A, and the first movable contact 66 apart therefrom is brought into contact with the first fixed contact 71, at which time the engagement pin 76 engages with the engagement hole 64a of the bimetal 64, thus engaging the movable member 63. There becomes a normal state in which the secondary-side connection fitting 73A and the primary-side plug-in terminal 62a get conductive in this state, whereby the function as a receptacle is implemented.

Disposed within the receptacle body 60 are an LED 61A emitting the light in, e.g., blue for confirming the conduction, a circuit cut-off confirming LED 61B lighting up with, e.g., a red luminance when in a non-conductive state, i.e., when the secondary circuit is cut off, current-limiting resistors r1, r2, and rectifying diodes d1, d2. These electric parts are connected as shown in FIG. 28. That is, the LED 61A, the resistor r1 and the diode d1 are connected between the second fixed contact 72 and the primary-side plug-in terminal 62B, while the LED 61B, the resistor r2 and the diode d1 are connected between the primary-side plug-in terminals 62A and 62B. Further, the diode d2 is connected, a cathode being common, between the second fixed contact 72 and the cathode of the LED 61B.

In the devices shown in FIGs. 27 and 28, if the temperature of the receptacle body 60 increases because of the overcurrent etc., and if the bimetal 64 exceeds the set temperature, as indicated by an imaginary line (a two-dotted line) in FIG. 27, the front edge deforms so as to warp upward, the engagement hole 64a disengages from the engagement pin 76. Then, the movable member 63 is moved by the spring force of the spring 65, resisting the spring force of the spring 75, and the first movable contact 66 separates from the first fixed contact 71, thereby cutting off between the primary-side plug-in terminal 62A and the secondary-side connection fitting 73A. Then, if the temperature of the bimetal 64 decreased down to the normal temperature, the primary-side plug-in terminal 62A and the secondary-side connection fitting 73A assume the conductive state as described above simply by manually pushing the reset pin 74 once again, thereby making it feasible to revitalize the function as the receptacle.

The operation of this electric circuit will be described in greater detail. When in the normal conductive state in which the normal function as the receptacle is satisfied, the contact pairs 66/71 and 68/72 are closed, and, the LED 61B not lighting up by dint of the operation of the diode d2, only the LED 61A lights up in blue. The bimetal 64 deforms with the increase in temperature of the receptacle body 60, and two sets of contact pairs are opened, at which time the LED 61A is extinguished and only the LED 61B lights up in red. The second contact pairs 68,72 are provided for the purpose of preventing a weak voltage from appearing through the signal generating circuit between the secondary-side connection fittings 73A and 73B in the state of the secondary circuit being cut off.

FIG. 29 is a perspective view showing an interior of the receptacle with the plug-in terminal of such a type that the attachment plug 78 of the electric appliance inserted in the crosswise direction (in the side-by-side direction of the plug-in terminals 62A, 62B). FIG. 30 is a perspective view illustrating an interior of the receptacle with the plug-in terminal of such a type that the attachment plug 78 of the electric appliance is inserted from above. Differences between the receptacles with the plug-in terminals of two types different in terms of their plug inserting directions and the receptacle with the plug-in terminal in FIG. 27, are only a structure of connection between the first fixed contact 71 and the other primary-side plug-in terminal 62B due to a difference between fitting positions of the secondary-side connection fittings 79A and 79B (FIG. 29) or 80A and 80B (FIG. 30), and a change of the reset pin 84 in order to avoid interference due to the difference between these fitting positions. Others are the same, and therefore the components are marked with the same numerals with an explanatory omission. The reset pin 84 is vertically embedded in the upper surface of the protruded portion 63a of the movable member 63. The cover member 60B of the receptacle body 60 is formed with an unillustrated slot extending in the crosswise direction (the moving direction of the movable member 63) through which the upper edge of this reset pin 84 penetrates and protrudes.

What has been all explained so far is about the one-port receptacle provided with only one pair of seizing portions of the secondary-side connection fitting. It is, however, feasible to provide two-port secondary-side connection fittings 81A, 81B including two pairs of seizing portions 81a, 81a, which are disposed in a V-shape as illustrated in FIG. 31. Further, it is also possible to provide a three-port receptacle having three pairs of seizing portions or a four-port receptacle having four pairs of seizing portions.

(Embodiment 7)

An embodiment 7 deals with a receptacle of a fixed type, which is attached to the wall and the pillar or a desk etc., or of a portable type, this receptacle incorporating the conductive state confirming signal generating function and the circuit automatic cut-off function.

FIG. 32 is a perspective view showing one example of an internal structure of this receptacle, wherein the same portions as those in the embodiment 6 are marked with the same numerals, and their explanations are omitted or simplified.

A receptacle body 83 is constructed of a body member 83A and an unillustrated cover member each composed of the insulating material such as the synthetic resin, and the unillustrated cover member is formed with two pairs of plug insertion holes and window holes for LEDs 61A, 61B serving as the light emitting elements. The body member 83A of the receptacle 83 are provided with a pair of primary-side connecting terminals 85A, 85B for connecting an electric wire 84 extending from a domestic power supply. Unillustrated guides extending in the side-by-side direction (the crosswise direction) are provided in the vicinities of the primary-side connecting terminals 85A, 85B. The same movable member 632 as that in the embodiment 6 is so provided as to be movable along this guide. The movable member 63 is always biased rightward downward in the Figure by the compression spring 65.

The movable member 63 includes the vertical groove 63b formed in the side surface of the front edge portion thereof, and the front edge of the movable member 63 is provided with the first movable contact 66 movable in the crosswise direction within the width dimension of the vertical groove 63b. A contact spring 67 acting thereon is also provided. The first movable contact 66 is connected to one primary-side connecting terminal 85A through the comparatively thick stranded wire 69, and a second movable contact 68 is provided beside the first movable contact 66.

Connected respectively to the body member 83A are the first fixed contact 71 with which the first movable contact 66 separably comes into contact, and the second fixed contact 72 with which the second movable contact 68 separably comes into contact. Fixed adjacent to the movable member 63 are two pairs of secondary-side connection fittings 86A, 86B in parallel to each other which integrally include the seizing portions 86a, 86b at both edges thereof. One secondary-side connection fitting 86A is connected to the first fixed contact 71 through a link or an electric wire 87 having a large current capacity, and the other secondary-side connection fitting 86B is connected through the same link or an electric wire 88 to the other primary-side connecting terminal 85B.

The proximal portion of a bimetal 89 is fixed centrally between the seizing portions 86a, 86b of the secondary-side connection fittings 86A, 86B on the side of the movable member 63 so that the bimetal 89 is orthogonal to the moving direction of the movable member 63 and that the front edge thereof becomes contiguous to the upper surface of the movable member 63. The front edge of the bimetal 89 is formed with an engagement hole 89a elongate in the longitudinal direction, and an engagement pin 76 engaging in a possible-of-disengagement manner with the engagement hole 89a is vertically embedded in the upper surface of the movable member 63.

The bimetal 89 includes the engagement hole 89a formed in its front edge, and the movable member 63 is engaged by engaging this engagement hole 89a with the engagement pin 76 in a conductive state in which the first movable contact 66 is pressed against the first fixed contact 71 by a spring force of the contact spring 67, and the second movable contact 68 comes into contact with the second fixed contact 72. If a temperature in the receptacle body 83 rises due to the overcurrent or other causes, and if the temperature of the bimetal 89 exceeds the set value, the front edge of the bimetal 89 deforms so as to warp upward, whereby the engagement hole 89a disengages from the engagement pin 76, and the movable member 63 displaces by the force of the spring 65 in such a direction as to move away from the first fixed contact 71. With this displacement of the movable member 63, the first movable contact 66 separates from the first fixed contact 71, and simultaneously the second movable contact 68 separates from the second fixed contact 72. Then, the primary-side connecting terminal 85A and the secondary-side connection fitting 86A are disconnected; the LED 61A having lighted up in blue so far is extinguished; and instead the LED 61B lights up in red, thus giving an indication of the circuit cut-off confirmation.

In order to restore the cut-off circuit, after the temperature of the receptacle body 83 has decreased down to the normal temperature, the movable body 63 may be moved by manually operating a reset pin 94 till the engagement pin 76 engages with the engagement hole 89a.

(Embodiment 8)

In an embodiment, the electric connector according to the present invention is applied to the attachment plug including the circuit automatic cut-off mechanism and the conductive state confirming signal generating mechanism attached to the tip of the power supply cord of the electric appliance and a table tap etc..

FIG. 33 is a perspective view showing an interior of this attachment plug. A plug body 90 is constructed of a body member 90A and a cover member 90B each composed of the insulating material such as the synthetic resin. The pair of primary-side plug-in terminals 62A, 62B are fixed to the body member 90A.

The plug body 90 incorporates the bimetal 64, the movable member 63, the first movable contact 66, the second movable contact 68, the first fixed contact 71 and the second fixed contact 72, which are the same as those in the embodiment 6. If the temperature of the bimetal 64 rises over the set value, the engagement hole 64a formed in the front edge thereof disengages from the engagement pin 76 provided on the upper surface of the movable member 63, and the movable body

63 is moved by the spring force of the spring 65 with the result that the first movable contact 66 separates from the first fixed contact 71, thus disconnecting one primary-side plug-in terminal 62A from the first fixed contact. Simultaneously, the second movable contact 68 separates from the second fixed contact 72, at which time the LED 61A luminous in blue is extinguished, and the LED 61B light up in red.

What is different in the embodiment 8 from the embodiment 6 is that the body member 90A is fitted with a pair of secondary-side connecting terminals 91A, 91B for connecting a power supply electric wire 92 of the electric appliance etc., instead of the secondary-side connection fittings 73A, 73B, one secondary-side connection terminal 91A is connected to the first fixed contact 71, and the other secondary-side connecting terminal 91B is connected to the plug-in terminal 62B through the link or the electric wire having the large current capacity. Other corresponding components are marked with the same numerals, and their explanations are omitted.

When the attachment plug in the embodiment 8 is used for the electric appliance having the comparatively large current capacity such as a heater, it is feasible to prevent such a situation that a fire accident happens from a cause of overheat of the power supply receptacle due to the over current. Further, if used as an attachment plug of a multi-port receptacle for increasing the number of ports such as the table tap, it is feasible to prevent the fire accident caused by the overcurrent in star-burst wiring etc.

(Embodiment 9)

In an embodiment 9, a safety mechanism for preventing an electrical short-circuit due to the tracking phenomenon, i.e., a destruction of insulation between the plug-in terminals, is added to the receptacle with the plug-in terminal in the embodiment 6 or to the attachment plug in the embodiment 8.

FIG. 34 is a perspective view of the receptacle in the embodiment 6 (FIGs. 27 - 31) as viewed from the rear side (from the side of the primary-side plug-in terminal). Referring to FIG. 34, a slit 60c is formed at a right angle to the terminal side-by-side direction at the center between the primary-side plug-in terminals 62A, 62B of the plug body member 60A or the receptacle body 60, and a slide 93 is so provided as to be movable among this slit 60c. The tip of the slide 93 comes into contact with an engagement portion 63c newly formed on the side surface of the movable member 63 by a pressing force of a compression spring 94 secured to the wall surface of the body member 60A.

The slide 93 is movable in the direction orthogonal to the moving direction of the movable member 63 with a crosswise movement of the movable body 63. A position of the slide 93 within the slit 60c changes when the engagement hole 64a of the unillustrated bimetal 64 engages with the engagement pin 76 of the upper surface of the movable member 63 with the first movable contact 66 and the first fixed contact 71 being closed, and when the engagement hole 64a disengages from the engagement pin 76 due to the rise in temperature of the bimetal 64 while the movable member 63 is moved by the spring force of the spring 65 with the first movable contact 66 and the first fixed contact 71 being opened.

Now supposing that fluff is accumulated between the primary-side plug-in terminals 62A, 62B inserted into the power supply receptacle and turn out to be an electric conductor containing a moisture content of water or oil etc., the leak current flows between the primary-side plug-in terminals 62A, 62B, and a bypass is formed by the destruction of insulation in the body member 60A because of the heat evolved thereby. If left as it is, this might cause a fire. When the bimetal 64 deforms with the heat caused by the above tracking and the secondary circuit is cut off, as explained above, the position of the slide 83 shifts, and the portion the insulation of which is not destroyed intercepts the bypass derived from the destruction of insulation that is formed in the body member 60A, thereby hindering the leakage between the plug-in terminals 62A, 62B after the secondary circuit has been cut off.

Note that the slide 93 may be moved by disengaging the engagement member of the slide 93 from the movable member 63 upon the crosswise movement of the movable member 63 and causing a large shift by the spring force of the spring 94.

Further, a tracking preventive mechanism in the embodiment 9 is not limited to those added to the attachment plug or the receptacle with the plug-in terminal for cutting off the secondary-side circuit as in the embodiment 6 or 8. Unlike the case of a gas leakage alarming device that light be often left as it is after giving the alarm in the belief that the alarm function works after, e.g., the secondary circuit has been cut off, in accordance with the embodiment 9, in a case where there is no possibility of the heat being evolved by the overcurrent and no necessity for the cut-off mechanism of the secondary-side circuit, the slide 93 may be moved directly or indirectly by its being disengaged upon the deformation of the bimetal due to the thermal emission caused from the tracking.

For hindering the electric bypass formed by the destruction of insulation between the plug-in terminals, there is no necessity for being limited to t contrivance based on the movement of the above-described slide 93 in the longitudinal direction of the slit 60c, and the slide 93 may be so structured as to move in a depthwise direction of the slit 60c. The slit 60c may remain open a all times but may be closed with an openable/closable door and opened as the necessity may arise.

(Embodiment 10)

In an embodiment 10, the circuit automatic cut-off

mechanism has a double safety structure based on cut-off of the contact through the bimetal 64 and a fusion of a temperature fuse 70 by adding the temperature fuse to the receptacle with the plug-in terminal that includes the conductive state confirming signal generating mechanism and the circuit auto cut-off mechanism in the embodiment 6.

FIG. 35 is a perspective view illustrating an interior of the receptacle with the plug-in terminal having the above-described double safety structure, which receptacle is substantially the same as the one shown in FIG. 27 in the embodiment. The same members are marked with the same numerals with an omission of their explanations, and only a difference will be described.

Temperature fuse fittings 62a, 73a are fixed respectively to the primary-side plug-in terminals 62B and the secondary-side connection fitting 73B, and a temperature fuse 70 is detachably attached to between the two temperature fuse fittings 62a, 73a with machine screws. It is preferable that a fusion temperature of the temperature fuse 70 be set higher by 5° C - 10° C than the circuit cut-off temperature through the bimetal 64. Thus, the circuit cut-off operation by the bimetal 64 is given a preference, thereby making it feasible to reduce a troublesome exchanging operation of the temperature fuse 70. If the temperature of the receptacle body 60 increases over the set temperature, and even if there occurs such an unpredicted abnormal condition that the first movable contact 66 and the first fixed contact 71 are not disconnected because of the bimetal not working for some reasons, the temperature fuse 70 is fused when over an allowable temperature of the temperature fuse 70, whereby the primary-side plug-in terminal 62B and the secondary-side connection fitting 73B are disconnected. hence, it is feasible to prevent an occurrence of a serious accident such as the fire caused by the deterioration or the destruction of the electric insulating characteristic when the receptacle body 60 is carbonized.

FIG. 36 is a diagram showing an electric circuit of the receptacle with the plug-in terminal which includes the above-described double circuit cut-off mechanism, wherein the receptacle is substantially the same as the one shown in FIG. 28 in the embodiment 6, and only a difference therebetween is described.

Connected via an electric wire a to the diode d1 of the signal generating circuit is a secondary-side end of the temperature fuse 70 between the primary-side plug-in terminal 62B and the secondary-side connection fitting 73B, i.e., the connection end to the secondary-side connection fitting 73B. Accordingly, when the temperature fuse 70 is fused, a voltage applied to the conductive state confirming signal circuit is cut off, and, for example, neither the LED 61A luminous in blue for confirming the conduction nor the LED 61b luminous in red for confirming the cut-off of the circuit lights up. Therefore, as far as it is not misunderstood for a service interruption or for a case of the power supply breaker operating, it can be judged that it is the fusion of the temperature fuse 70.

The temperature fuse 70 may be provided between the first fixed contact 71 and one secondary-side connection fitting 73A, or between one plug-in terminal 62A and the first movable contact 66. In this case, however, the fusion of the temperature fuse can not be recognized from the confirmation signal display.

FIG. 37 shows an example of the receptacle with the plug-in terminal which includes the double circuit cut-off mechanism of such a type that the attachment plug 78 is inserted in the crosswise direction, i.e., the primary-side plug-in terminal side-by-side direction, wherein the receptacle is substantially the same as the one shown in FIG. 29 in the embodiment 6, and only a difference therebetween is explained.

The temperature fuse fitting 62b is fixed to the primary-side plug-in terminal 62B, and the other secondary-side connection fitting 79B directed sideway is also provided integrally with a temperature fuse fitting 79a. The temperature fuse 70 is detachably attached to between the two temperature fuse fittings 62b, 79a with the machine screw. A lead wire b of the confirming signal circuit is connected to the secondary-side end of the temperature fuse 70, i.e., a connection end to the secondary-side connection fitting 79B. Then, as stated above, when the temperature fuse 70 is fused, the voltage applied to the confirming signal circuit is cut off, and both the LED 61A luminous in blue and the LED 61B luminous in red are extinguished.

FIG. 38 shows an example of the receptacle with the plug-in terminal that includes the double circuit cut-off mechanism of such a type that the attachment plug 78 is inserted from above. A difference from the one shown in FIG. 30 in the embodiment 6 is that a temperature fuse fitting 62c is fixed to the other primary-side plug-in terminal 62B; a temperature fuse fitting 80a is fixed also to other secondary-side connection fitting 80B; and the temperature fuse 70 is detachably attached to between the two temperature fuse fittings 62c, 80c with the machine screw.

When the temperature fuse 70 is fused, the voltage applied to the confirming signal circuit is cut off, and neither the LED 61a luminous in blue nor the LED 61B luminous in red lights up.

FIG. 39 illustrates an example of the two-port receptacle with the plug-in terminal which includes the double circuit cut-off mechanism of such a type that the attachment plug 78 is inserted from above obliquely. A difference from the embodiment 6 (FIG. 31) is that the temperature fuse 70 is provided between the other plug-in terminal 62B and the other secondary-side connection fitting 81B via temperature fuse fittings 62d, 81b, and the voltage to the confirming signal circuit is cut off when the temperature fuse 70 is fused.

Note that FIG. 39 shows an example of the two-port receptacle with the plug-in terminal, however, a three- or four-port receptacle with the plug-in terminal which includes the double circuit cut-off mechanism can be

also constructed.

In each of the embodiments shown in FIGS. 37, 38 and 39, the temperature fuse 70 can be provided between the first fixed contact 71 and one secondary-side connecting fittings 79A, 80A, 81A, or between the first movable contact 66 and one primary-side plug-in terminal 62A. In this case, however, the fusion of the temperature fuse can not be recognized from the confirming signal display.

(Embodiment 11)

In an embodiment 11, the electric connector according to the present invention is applied to the receptacle of the fixed type of is being fitted to the wall and the pillar or the desk etc. or of the portable type, which receptacle includes the conductive state confirming signal generating mechanism and the double circuit automatic cut-off mechanism.

FIG. 40 is a perspective view showing an interior of the receptacle having the double circuit automatic cut-off mechanism described above, wherein the receptacle is substantially the same as the one shown in FIG. 32 in the embodiment 7, and the same members are marked with the same numerals while their explanations are omitted.

The primary-side connecting terminal 85B for connecting the electric wire 84 extending from the domestic power supply, is provided integrally with a temperature fuse fitting 85a. The temperature fuse 70 is detachably attached to between this temperature fuse fitting 85a and a pair of secondary-side connection fittings 86B for the two ports with the machine screws.

It is preferable that a fusion temperature of the temperature fuse 70 be set higher by 5° C - 10° C than the circuit cut-off temperature through the bimetal 89 as in the embodiment 10. Thus, the circuit cut-off by the bimetal 89 is given a preference, thereby making it feasible to obtain a double safety effect by reducing the exchanging operation of the temperature fuse 70. The confirming signal circuit is connected the secondary-side end of the temperature fuse 70, i.e., the connection end to the secondary-side connection fitting 86B via the electric wire c, and the voltage applied to the confirming signal circuit is cut off when the temperature fuse 70 is fused. Then, both the LED 61A luminous in, e.g., blue for confirming the conduction ad the LED 61B luminous in, e.g., red for confirming the circuit cut-off are extinguished, and hence it can be judged that the temperature fuse 70 is fused.

Note that the temperature fuse 70 can be provided between the first fixed contact 71 and one secondary-side connection fitting 86A, or between the first movable contact 66 and one primary-side connecting terminal 85A. In this case, the fusion of the temperature fuse can not be recognized from the confirming signal display.

(Embodiment 12)

In an embodiment 12, the electric connector according to the present invention is applied to the attachment plug including the conductive state confirming signal generating mechanism and a double circuit cut-off mechanism.

FIG. 41 is a perspective view showing an interior of the attachment plug having the above-mentioned circuit cut-off mechanism, wherein the plug is substantially the same as the one shown in FIG. 33 in the embodiment 8, and the same members are marked with the same numerals with an explanatory omission thereof.

Temperature fuse fittings 62a, 91a are fixed respectively to one terminal 62B of a pair of the primary-side plug-in terminals and to one terminal 91B of a pair of secondary-side connecting terminals, which are provided on the body member 90A of the plug body 90. The temperature fuse 70 is detachably attached to between the temperature fuse fittings 62e, 91a with the machine screws.

The confirming signal circuit is connected to the secondary-side end of the temperature fuse 70, i.e., the secondary-side connecting terminal 91B through an electric wire d. When the temperature fuse 70 is fused, the voltage applied to the confirming signal electric circuit is cut off, and both the LED 61A luminous in blue and the LED 61B luminous in red are extinguished.

Accordingly, if all the confirming signal displays are extinguished in a state where the secondary side is not energized by cutting off the circuit, it can be judged the temperature fuse 70 is fused. Based on this, the temperature fuse 70 may be replaced.

The fusion temperature of the temperature fuse 70 is set higher by 5° C - 10° C than the circuit cut-off temperature of the bimetal 64 as in the embodiments 10 and 11, and it is preferable that the troublesome operations of exchanging the temperature fuse be reduced.

Note that the temperature fuse 70 may be provided between the primary-side plug-in terminal 62a and the first movable contact 66, or between the first fixed contact 71 and the secondary-side connecting terminal 91A. In this case, however, the fusion of the temperature fuse can not be judged from the confirming signal display.

(Embodiment 13)

In an embodiment 13, the electric connector according to the present invention is applied to the receptacle with the plug-in terminal having the conductive state confirming signal generating mechanism and the circuit automatic cut-off mechanism, which is used as a connection power supply for the attachment plug of the electric appliance.

FIG. 42 is a diagram showing one example of an interior of such a receptacle with the plug-in terminal. FIG. 43 is a diagram of an electric circuit thereof.

The receptacle body 60 is a body constructed of the body member 60A and the unillustrated cover member each composed of the insulating material such as the synthetic resin. The cover member is formed with the window holes through which the heads of the LEDs 61A, 61B are visible from outside, and the body member 10A and the cover member are formed with slots for inserting the unillustrated attachment plug into secondary-side connection fittings 99A, 99B.

The pair of primary-side plug-in terminals 62A, 62B are fixed to the body member 60A, while a temperature fuse fitting 62f is fixed to the primary-side plug-in terminal 62A. Further, the body member 60A is provided with the pair of secondary-side connection fittings 99A, 99B disposed side by side in the side-by-side direction of the primary-side plug-in terminals. A temperature fuse fitting 99a is fixed to one secondary-side connection fitting 99A, and the other secondary-side connection fitting 99B is connected to the other plug-in terminal 62B. The temperature fuse 70 is detachable attached to between the two temperature fuse fittings 62f, 99a wit the machine screws. If a temperature of the thus constructed receptacle with the plug-in terminal exceeds the fusion temperature of the temperature fuse 70, the temperature fuse 70 is fused, whereby one circuit is cut off.

The confirming signal generating circuit illustrated in an upper part in FIG. 43 is the same as the one shown in FIG. 28 in the embodiment 6, wherein an electric potential of the secondary-side connection fitting 99A is led to an anode of the LED 61B on one hand, and led to anodes of the diodes d2 and of the LED 61 via the temperature fuse 70 and the primary-side plug-in terminal 62A on the other hand. An electric potential of the secondary-side connection fitting 99B is led to a cathode of the diode d1 via the primary-side plug-in terminal 62B.

In this circuit, the LED 61B luminous in red does not light up by the operator of the diode d2 when in the normal conductive state, and only the LED 61A luminous in blue for confirming the conduction lights up. When the temperature fuse 70 is fused upon an increase in temperature of the receptacle with the plug-in terminal, the voltage applied to the LED 61A is cut off, and the diode 61A luminous in blue is extinguished. Instead, the LED 61B luminous in red for confirming the circuit cit-off lights up. Accordingly, when the LED 61B luminous in red lights up, it is judged that the temperature fuse 70 is fused, and the temperature fuse 70 may be replaced.

Note that the temperature fuse 70 may be provided between the plug-in terminal 62B and the secondary-side connection fitting 73B with the confirming signal electric circuits reversed in the right-and-left directions.

The receptacle with the plug-in terminal having the circuit automatic cut-off mechanism through the temperature fuse and the confirming signal, is applicable as a fixed type of its being secured to the wall and the pillar etc. or a portable type such as the table tap.

This embodiment is not limited to the one-port receptacle with the plug-in terminal as shown in FIG. 42 but may be applied to the multi-port, i.e., two-, three- and four-port receptacles with the plug-in terminals, and to the receptacles of the fixed type of their being secured to the wall and the pillar etc. or of the portable type.

(Embodiment 14)

In an embodiment 13, the electric connector according to the present invention is applied to at least the one-port receptacle (the two-port receptacle in the example shown therein) incorporating the confirming signal generating function and the circuit automatic cut-off function for a connection to the fixed type power supply so used as to be embedded mainly in the wall surface. FIG. 44 is a perspective view illustrating an internal structure thereof. FIG. 45 is a perspective view showing an external configuration thereof. FIG. 46 is a diagram showing an electric circuit.

A receptacle body 101 is a casing constructed of a body member 101A embedded into the wall surface and a cover member 101B exposed to the outside from the wall surface, which are each composed of the insulating material such as the synthetic resin. The pair of primary-side connecting terminals 85A, 85B for connecting a lead-in wire 102 from the domestic power supply, are fixed to the body member 101A of the receptacle body 101. A movable member 103 movable along an unillustrated guide in the side-by-side direction (the crosswise direction) of the primary-side connecting terminals, is provided in the vicinities of the primary-side connecting terminals 85A, 85B.

The movable member 103 is always biased in the left direction in FIG. 46, and a groove 103b extending in the front-and-rear direction is formed in the upper surface of the front edge thereof. The front edge of the movable member 103 is provided with the first movable contact 66 movable in the cross-wise direction within a width dimension of the groove 103b extending in the front-and-rear direction. A contact pressure is always imparted to the first movable contact 66 by a contact spring 67. The first movable contact 66 is connected to one primary-side connecting terminal 85A through a comparatively thick stranded wire 69. A second movable contact 68 is fixed to the first movable contact 66. Connected to the body member 101A are the first fixed contact 71 with which the first movable contact 66 separably comes into contact, and the second fixed contact 72 with which the second movable contact 68 separably comes into contact.

The movable member 103 is formed with an engagement groove 103c extending in the front-and-rear direction in the lower surface of the central portion. A pawled engagement lever 104 including a front edge pawl 104c engaging in the possible-of-disengagement manner with the engagement groove 103c, is so pro-

vided as to be swayable about a pivotal pin 105 under the movable member 103. The pawled engagement lever 104 is biased by a spring 106 so that the front edge pawl 104a engages with the engagement groove 103c of the movable member 103 at all times.

A magnet 107 is fixed, with its adsorbing surface directed upward, adjacently just under the front edge pawl 104a of the pawled engagement lever 104. The magnet 107 is constructed such that first and second electromagnetic coils 107a, 107b are, as shown in FIG. 46, wound on a common iron core 107c. When any one or both of the electromagnetic coils are energized, the front edge pawl 104a of the pawled engagement lever 104 is pulled in, thereby releasing the engagement of the movable member 103. Then, the first and second movable contacts 66, 68 separate from the first and second fixed contacts 71, 72, thereby cutting off the circuit. A reset pin 84 is embedded in the front surface of the movable member 103, and the tip of the reset pin 84 protrudes out of a slot 101f of the cover member 101B. When the movable member 103 is moved by using this reset pin 84 in the right direction in FIG. 46, the normal conductive state can be returned simply by engaging the pawl 104a of the pawled engagement lever 104 with the engagement groove 103c.

The pair of two-port secondary-side connection fittings 86A, 86B each including the seizing portions 86a, 86b at both ends thereof are fixed in parallel to each other to the body member 103A under the magnet 107. One secondary-side connection fitting 86A is connected to the first fixed contact 71 through a link or an electric wire 87 having a large current capacity, and the other secondary-side connection fitting 86B is connected to the other primary-side connection fitting 85B through the temperature fuse 70.

Further, a pair of leak detection plates 26A, 26B are provided in parallel to each other in a state of being insulated in positions closer to the respective connection fittings but between the secondary-side connection fittings 86A, 86B. The leak detection plates 26A, 26B each takes substantially a C-shape including crooked portions at both ends thereof. The tip of the crooked portion 26a is so fitted as to be embedded into a slot 101c adjacent to a plug insertion hole 101a of the cover member 101B, and a front edge surface of the crooked portion 26a is substantially flush with the upper surface of the cover member 101B.

As shown in the electric circuit diagram of FIG. 46, one leak detection plate 26A is connected to one end of a smoothing capacitor c1 via a rectifying diode d3, while the other leak detection plate 26B is connected to the other end of the smoothing capacitor c1 via a protection circuit consisting of a fuse f2 and a temperature fuse 70b. A rectifier smoothing circuit is constructed of the diode d3 and the capacitor c1. A second electromagnetic coil 107b is connected in parallel to the capacitor c1.

An L-shaped fitting 108 is fixed at a central portion between the secondary-side connection fittings 86A, 86B in the lower portion of the body member 101A. This L-shaped fitting 108 is connected to the other primary-side connecting terminal 85B. A bimetal 109 is vertically downward fixed to the L-shaped fitting 108, and a third fixed contact 110 is fixed to a position corresponding to the tip of the bimetal 109. The tip of the bimetal 109 separates from the third fixed contact 110 at the normal temperature and, when over the set temperature, comes into contact with the third fixed contact 110.

A vibration detector 111 having, e.g., a coil spring 111a closely wound thereon or a pendulum 111b composed of a flexible material such as a piano wire at the lower end thereof, suspends downward from the front edge of the L-shaped fitting 108. The pendulum 111b penetrates with a gap into a vibration detection hole 112 having a diameter larger than that of the pendulum 111b formed integrally with the third fixed contact 110. A smoothing capacitor c2 is connected in parallel to the first electromagnetic coil 107a, and one end thereof is connected to the third fixed contact 110 via a rectifying diode d4, a temperature fuse 70a and a fuse f1 while the other end thereof is connected to the first fixed contact 71, i.e., the secondary-side connection fitting 86A. Herein, the temperature fuse 70a and the fuse f1 also shape the protection circuit. Note that the fuses f1, f2 are current fuses fused when the electric current equal to or greater than a predetermined value flows therethrough.

Note that there might be no problem if the rectifier smoothing circuit is removed from the diode d3 and the capacitor c1 or from the diode d4 and the capacitor c2 because of no necessity for maintaining the absorptive force if the secondary circuit is cut off by the magnet 107 adsorbing the pawled engagement lever 104. Furthermore, the protection circuit consisting of the fuses f1, 70a or consisting of the fuses f2, 70b must not necessarily be provided but provided for obtaining an operational stability and much higher safety as well. In each these protection circuits, both the current fuse and the temperature fuse are not necessarily provided, and the protection circuit may be constructed of any one of these fuses.

In the circuit shown in FIG. 46, the tip of the bimetal 109 comes into contact with the third fixed contact 110 when the temperature of the bimetal 109 rises over the set temperature, at which time the pendulum 111b contacts an internal surface of the vibration detection hole 112, i.e., the third fixed contact 110 due to vibrations caused by an earthquake or an explosion etc.. At this moment, a power supply voltage is applied to the first electromagnetic coil 107a, and the magnet 107 attracts the front edge pawl 104a of the pawled engagement lever 104 enough to disengage the movable member 103 therefrom, thereby cutting off the circuit. Owing to the circuit cut-off, a supply of the voltage to the first electromagnetic coil 107a is cut off, and hence there must be safe even if a house slants in the event of, e.g., a big

earthquake and the pendulum 111b remains contact with the internal surface of the vibration detection hole 112.

Even in such a case that the electric insulating characteristic in the periphery of the plug insertion hole 101a of the cover member 101B of the receptacle body 101 is deteriorated or destroyed due to, e.g., the tracking, and that the leak voltage leaking from the secondary-side connection fittings 21A, 21B are produced in the leak detection plates 26A, 26B, the magnet 107 is energized by the second electromagnetic coil 107b, thereby cutting of the circuit by disengaging the movable body 103.

As shown in the circuit diagram of FIG. 46, a small-sized alarm sound generator such as a piezoelectric buzzer 53 and a light emitting element such as a LED 54 luminous in, e.g., yellow for a leak alarm, are connected between the pair of leak detection plates 26A, 26B through the rectifier smoothing circuit (the diodes d3, and the capacitor c1) and the diode d6 as the necessity arises. The current-limiting resistor R7 is connected in series to the LED 54. A zener diode ZD for protection from the overvoltage may be connected in parallel to the LED 54 and the piezoelectric buzzer 53. The cover member 101B is, as illustrated in FIG. 45, formed with a window hole 101d through which the luminous head of the LED 54 is visible from outside, and a plurality of small holes 101e through which a sound of the piezoelectric buzzer 53 is outputted to the outside.

In the confirming signal generating circuit shown in an upper part in FIG. 46, in the normal conductive state, i.e., in the conductive state where the movable member 103 is engaged and the first and second movable contacts 66, 68 are kept contact with the first and second fixed contacts 71, 72, the LED 61A for confirming the conduction lights up with, e.g., a blue luminance. When the circuit is cut off upon releasing the contacts of the contacts after disengaging the movable member 103, the LED 61A luminous in blue is extinguished, and instead the LED 61B for confirming the circuit cut-off lights up with, e.g., a red luminance. Further, when the temperature fuse 70 is fused, both the LEDs 61A, 61B are completely cut off from the power supply and therefore extinguished. The LEDs 61A, 61B are constructed so that the luminous heads thereof are visible from outside through the window holes 101b of the cover member 101B. This confirming signal generating circuit is the same as the confirming signal generating circuit shown in FIG. 43 in the embodiment 13, and therefore detailed explanation thereof is omitted.

According to the embodiment 14 constructed as described above, if the temperature of the bimetal 109 rises over the set temperature due to the increase in temperature of the receptacle body 101 that is caused by, e.g., the over current, the magnet 107 works, and the circuit is automatically cut off. Moreover, if fluff is accumulated in the periphery of the plug-in terminal 78a of the attachment plug of the electric appliance that is inserted into the plug insertion holes 101a of the cover member 101B of the receptacle body 101 and turn out to be an electric conductor containing the moisture content of water or oil etc. enough to form an electrical bypass through which to flow the electric current, resulting in an occurrence such a tracking phenomenon. Then, the electric insulating characteristic peripheral to the plug insertion hole 101a of the cover member 101B is deteriorated or destroyed, in which case the voltages of the secondary-side connecting terminals 86A, 86B leak, and the voltages are generated in the leak detection plates 26A, 26B. Then, the magnet 107 works, and the circuit is automatically cut off.

Supposing that there occurs such an unpredicted abnormal situation that the circuit is not cut off even if the temperature of the receptacle body 101 increases over the set temperature of the bimetal 109, the temperature increases over the set temperature of the temperature fuse 70, the temperature fuse 70 is fused to cut off the circuit, and hence there is no possibility of causing an accident as serious as a fire.

Further, provided that there occurs such an unpredicted abnormal situation that the circuit is not cut off even when the leak voltages are produced in the leak detection plates 26A, 26B, upon sounding of the buzzer 53, the LED 54 lights up with, e.g., the yellow luminance for the leak alarm. Therefore, an emergent measure can be taken immediately, and the serious accident like the fire can be prevented.

In case there are caused the vibrations of, e.g., a seismic intensity of 4 equal to or larger than a middle earthquake due to the earthquake and the explosion etc., the pendulum 111b of the vibration detector 111 is brought into contact with the internal surface of the vibration detection hole 112, and the magnet 107 is energized, thereby cutting off the secondary circuit. Therefore, if used in a place in which a dangerous substance exhibiting a high inflammability is treated, a secondary disaster derived from the earthquake and the explosion can be prevented.

The embodiment 14 deals with the safety mechanism corresponding to the overcurrent, the tracking and the earthquake etc. as described above and can be, depending on location in use and other circumstances, simplified by respectively removing the circuit cut-off mechanism based on the temperature fuse 70, the leak alarm mechanism based on the buzzer and the light emitting diode, and the circuit cut-off mechanism relative to the earthquake.

The receptacle in the embodiment 14 is not confined to the fixed type power supply connecting receptacle used by its being embedded into the wall surface, but is applicable to a portable type receptacle generally known as a table tap.

FIG. 47 shows an embodiment in which to show a magnet 117 assuming a configuration different from the magnet 107 for cutting off the circuit described above.

Referring to FIG. 47, an iron core of the magnet 117

is divided into two iron cores 117c, 117c disposed in side-by-side relationship. First and second electromagnetic coils 117a, 117b are separately wound on the iron cores 117c, 117c. The two iron cores 117c, 117c are connected by a yoke 117d on side of the rear surface. The thus constructed iron core taking substantially a U-shape in section on the whole exhibits a higher magnetic flux density than a bar-like iron core and has a high adsorbing strength as a magnet. Therefore, a sensitivity can be enhanced as a safety mechanism. The pawled engagement lever 104 corresponds to the two iron cores 117c, 117c disposed in the side-by-side relationship, and hence the lever member shapes elongate. As a result, the pawl 104a is formed substantially at the center of the lever member. Others are the same as those in FIG. 46.

(Embodiment 15)

In an embodiment 15, the electric connector according to the present invention is applied to the receptacle for relay or for increasing the number of ports, which has the plug-in terminals inserted into the power supply receptacle and incorporates at least the one-port conductive state confirming signal generating function and the circuit automatic cut-off function. FIG. 48 is a perspective view illustrating an internal structure thereof. FIG. 49 is a diagram of an electric circuit thereof. Referring to FIGs. 48 and 49, many components are common to those in the embodiments 10 (FIG. 35) and the embodiment 14 (FIG. 44). Therefore, the same members are marked with the same numerals, and their explanations are omitted or simplified while different portions are emphatically described.

The receptacle body 60 is a casing constructed of the body member 60A and the cover member 60B each composed of the insulating material such as the synthetic resin. The pair of primary-side plug-in terminals 62A, 62B inserted into the power supply receptacle are fixed to the body member 60A. One end of a heat collecting plate 120 extending close to the proximal portion of the primary-side plug-in terminal 62A, is fixed to the proximal portion of the primary-side plug-in terminal 62B. A rear end of a bimetal 121 is fixed onto the proximal portion of this heat collecting plate 120. The bimetal 121 is provided at a right angle to the side-by-side direction of the primary-side plug-in terminals 62A, 62B, and a third fixed contact 122 is fixed in a position corresponding to the front edge of the bimetal 121 within the body member 60A. The front edge of the bimetal 121 is spaced away from the third fixed contact 122 at the normal temperature but comes into contact with the third fixed contact 122 when over the set temperature.

A guide (unillustrated) is provided in the side-by-side direction (the crosswise direction) of the plug-in terminals at substantially the central portion of the body member 60A, and the movable member 103 is so provided as to be movable along this guide. The movable member 103 is always biased rightward in FIG. 49 by a spring 65, and a vertical groove 103b is formed in the side surface of the front edge. The first movable contact 66 is so provided at the front edge of the movable member 103 as to be movable crosswise within a width dimension of the vertical groove 103b.

The first movable contact 66 is connected to the primary-side plug-in terminal 62A via a comparatively thick stranded wire 69 and is always biased by the contact spring 67 toward the first fixed contact 71 which will be mentioned later on. The first movable contact 66 is provided integrally with the second movable contact 68. The body member 60a is provided with the first fixed contact 71 with which the first movable contact 66 separably comes into contact and the second fixed contact 72 with which the second movable contact 68 separably comes into contact.

The movable member 103 is formed with the engagement groove 103c in the side surface of the central portion thereof. The pawled engagement lever 104 including the front edge pawl 104c engaging in the possible-of-disengagement manner with the engagement groove 103c, is so provided as to be swayable about the pivotal pin 105 adjacently to the movable member 103. The pawled engagement lever 104 is biased by the spring 106 so that the front edge pawl 104a engages with the engagement groove 103c of the movable member 103 at all times.

A magnet 107 is fixed, with its adsorbing surface directed toward the front edge pawl 104a, adjacently to the front edge pawl 104a of the pawled engagement lever 104. The magnet 107 is constructed such that the first and second electromagnetic coils 107a, 107b are, as shown in FIG. 48, wound on the common iron core 107c. When the voltage is applied to any one or both of the electromagnetic coils, the front edge pawl 104a is pulled in, thereby releasing the engagement of the movable member 103 and cutting of the circuit.

The body member 60a of the receptacle body 60 incorporates the secondary-side connection fittings 73A, 73B. One secondary-side connection fitting 73A is connected to the first fixed contact 71 through a link plate or an electric wire having a large current capacity, and the other secondary-side connection fitting 73B is connected to the other primary-side plug-in terminal 62B through the temperature fuse 70.

The pair of leak detection pins 51, 52 are embedded in position closer to the plug-in terminals in the middle between the primary-side plug-in terminals 62a, 62B so that the pins 51, 52 are set in inserting/removing directions of the primary-side plug-in terminals 62A, 62B into and from the receptacle and are parallel to each other. Leak detection plates 123A, 123B are provided in parallel to each other closer to the respective unillustrated plug-in insertion holes in the middle between the plug insertion holes for the secondary-side connection fittings 73A, 73B of the receptacle body 60. The leak detection pin 51 is connected via a lead wire

(unillustrated) to the leak detection plate 123A, and the leak detection pin 52 is connected via the lead wire (unillustrated) to the leak detection plate 123B.

The first electromagnetic coil 107a of the magnet 107 is connected between the third fixed contact 122 and the first fixed contact 71 through the rectifier smoothing circuit consisting of the diode d4 and the capacitor c2 as well as through the protection circuit consisting of the fuse f1 and the temperature fuse 70a. The second electromagnetic coil 107b is connected between the leak detection pins 51, 52, i.e., between the leak detection plates 123A, 123B through the rectifier smoothing circuit consisting of the capacitor c1 and the diode d3 as well as through the protection circuit consisting of the temperature fuse 70b and the fuse f2. The confirming signal generating circuit shown in an upper part in FIG. 49 is the same as the one illustrated in FIG. 46 in the embodiment 14, and therefore its explanation is omitted.

According to the receptacle with the plug-in terminal which incorporates the confirming signal generating function and the circuit automatic cut-off function in the embodiment 15, with an increase in temperature of the receptacle body 60 due to, e.g., the overcurrent, if the temperature of the bimetal 121 rises over the set temperature, the front edge thereof comes into contact with the third fixed contact 122, and the voltage is applied to the first electromagnetic coil 107a. Then, the magnet 107 pulls in the front edge pawl 104a of the pawled engagement lever 104 to disengage the movable member 103, thus automatically cutting off the circuit.

Further, if the electric insulating characteristic between the primary-side plug-in terminals 62A, 62B of the receptacle body 60 or between the plug insertion holes is deteriorated or destroyed for some reasons, the leak voltages are produced in the leak detection pins 51, 52 or in the leak detection plates 123A, 123B, in which case the circuit is automatically cut off by applying the voltage to the second electromagnetic coil 107b.

Moreover, if there occurs such an unpredicted abnormal situation that the circuit is not automatically cut off based on the bimetal 121 in spite of the fact that the temperature of the receptacle body 60 increases over the set temperature of the bimetal 121, and if the temperature of the receptacle body 60 increases over the set temperature of the temperature fuse 70, the temperature fuse 70 is fused, thereby preventing an accident as serious as a fire. This is how the double safety structure works.

The receptacle with the plug-in terminal in the embodiment 15 is not confined to the one-port receptacle as shown in FIG. 48 but is, as a matter of course, applicable to a two- or three-port receptacle with the plug-in terminal for increasing the number of ports.

The magnet 107 can be constructed into the iron core divided type as shown in FIG. 47. Further, the rectifier smoothing circuit can be removed from the diode d3 and the capacitor c1, or from the diode d4 and the capacitor c2. Moreover, the protection circuit consisting of the fuses f1, 70a or consisting of the fuse f2, 70b must not be necessarily provided. a protection consisting of only the current fuse or temperature fuse may be provided as the case may be.

(Embodiment 16)

In an embodiment 16, the electric connector according to the present invention is applied to the receptacle for the relay or for increasing the number of ports, which has the plug-in terminals inserted into the power supply receptacle and incorporates at least the one-port confirming signal generating function and the circuit automatic cut-off function. FIG. 50 is a perspective view illustrating an internal structure thereof. FIG 51A is a diagram showing an electric circuit thereof. FIG. 51B is a view taken along the line A-A in FIG. 51A.

Referring to FIGs. 50, 51A and 51B, there are many components common to those in FIGs. 35 and 36, and hence the explanations thereof are omitted or simplified, with the same members being marked with the same numerals. Different portions are emphatically described.

The receptacle body 60 is constructed of the body member 60A and the cover member 60B each composed of the insulating material such as, e.g., the synthetic resin. The upper surface thereof is formed with window holes through which the luminous heads of the LEDs 61A, 61B are visible from outside, and the side surface thereof is formed with plug holes through which to insert the attachment plug 78 of the electric appliance into the secondary-side connection fittings 73A, 73B.

The proximal portion of the bimetal 64 is fixed substantially at the center between the pair of primary-side plug-in terminals 62A, 62B at a right-angle to the side-by-side direction (hereinafter referred to as a "crosswise direction") of the plug-in terminals as well as at a right-angle to the inserting/removing directions of the primary-side plug-in terminals 62A, 62B. The bimetal 64 has an engagement hole 64a formed in its front edge and deforms so that the front edge thereof warps upward when the temperature increases. The movable body 103 composed of the insulating material is so provided as to be movable along a guide 60c provided at the central portion of the body member 60A and extending in the crosswise direction. The movable member 63 is always biased rightward in FIG. 51 by the spring 65 disposed between a protruded portion 63a and a protruded portion 60a of the body member 60A adjacently just under the front edge of the bimetal 64 when at the normal temperature.

The movable member 63 is constructed such that the first movable contact 66 is so provided as to be movable in the crosswise direction within a width dimension of a vertical groove 63b, and that the second movable contact 68 is biased by the contact spring 67 at all times and likewise movably fixed to the first movable contact

66. Then, the first movable contact 66 is connected to one plug-in terminal 62A through the comparatively thick stranded wire 69.

Connected respectively to the body member 60A are the first fixed contact 71 with which the first movable contact 66 separably comes into contact, and the second fixed contact 72 with which the second movable contact 68 separably comes into contact. Further, the body member 60a is provided with the pair of secondary-side connection fittings 73A, 73B. One secondary-side connection fitting 73A is connected to the first fixed contact 71, while the other secondary-side connection fitting 73B is connected via the temperature fuse 70 to the other plug-in terminal 62B.

The body member 60A includes the movable reset pin 74 the tip of which penetrates the side plate 60b and protrudes outside. The reset pin 74 is always biased by the spring 75 so that the rear end thereof is kept contact with the side surface of the protruded portion 63a of the movable member 63.

The engagement pin 76 is vertically embedded in the upper surface of the movable member 63, and, when at the normal temperature, the engagement pin 76 engages with the engagement hole 64a of the front edge of the bimetal 64, thus engaging the movable member 63. Then, the first movable contact 66 is pressed against the first fixed contact 71 by the contact spring 67, and simultaneously the second movable contact 68 is in contact with the second fixed contact 72. When the temperature of the receptacle body 60 increases over the set temperature of the bimetal 64, the front edge of the bimetal deforms so as to warp, with the result that the engagement hole 64a disengages from the engagement pin 76. The movable body is moved rightward in FIG. 50 by a force of the spring 65, and the first and second movable contacts 66, 68 separate respectively from the first and second fixed contacts 71, 72, thereby cutting off the circuit. In order to make the cut-off circuit revert to the conductive state, the reset pin 74 is manually depressed after the temperature of the bimetal 64 has decreased, and the movable member is moved leftward in FIG. 50 resisting the force of the spring 65. The engagement pin 76 is thereby engaged with the engagement hole 64a, and the circuit thus returns to the normal conductive state.

In the body member 60A, the pair of leak detection pins 51, 52 are embedded in positions closer to the respective plug-in terminals in the middle between the primary-side plug-in terminals 62A, 62B in such a manner that the pins 51, 52 ar set in the inserting/removing directions of the primary-side plug-in terminals 62A, 62B into and from the receptacle as well as being parallel to each other. The leak detection plates 123A, 123B are provided in parallel to each other closer to the respective plug insertion holes in the middle between the unillustrated plug insertion holes for the secondary-side connection fittings 73A, 73B of the receptacle body 60. The leak detection pin 51 is connected via the lead wire to the leak detection plate 123A, and the leak detection pin 52 is connected via the lead wire to the leak detection plate 123B.

The body member 60A includes a magnet 127 provided in a position closer to the front edge of the bimetal 64 but under the bimetal 64 so that a line of magnetic force is substantially the same as a displacement direction when the temperature of the bimetal 64 rises. The magnet 127 is, as shown in FIG. 51B, constructed of an electromagnetic coil 127a, a fixed iron core 127b and a movable iron core 127c movably inserted into a central hole of the fixed iron core 127b. The movable iron core 127c, its tip being normally kept contact with the rear surface of the bimetal 64, is separate from an adsorbing surface of the fixed iron core 127b.

One end of the electromagnetic coil 127a is connected to one leak detection pin 51 and to one leak detection plate 123A, and the other end of the coil 127a is connected to the other leak detection pin 52 and to the other leak detection plate 123B via the diode d3, the temperature fuse 70a and the fuse f1. The protection circuit comprises the temperature fuse 70a and the fuse f1. Note that the capacitor c1 is connected in parallel to the electromagnetic coil 127a, and the rectifier smoothing circuit is constructed of the diode d3 and the capacitor c1. Upon a generation of the leak voltage between the leak detection pins 51, 52 or between the leak detection plates 123A, 123B, the magnet 127 is energized by the electromagnetic coil 127a, and the movable iron core 127c is pulled in and moved toward the bimetal 64. Then, the tip of the movable iron core 127c pushes up the bimetal 64 to release the engagement of the movable member 63, thereby cutting off the circuit. Note that the leak detection pins 51, 52 may be replaced with leak detection plates similar to the leak detection plates 123A, 123B.

The confirming signal generating circuit illustrated in an upper part in FIG. 51 is the same as the one shown in FIG. 46 in the embodiment 14, and therefore its explanation is omitted.

According to the receptacle with the plug-in terminal which incorporates the confirming signal generating function and the circuit automatic cut-off function in the embodiment 16, if the temperature of receptacle body 60 rises over the set temperature of the bimetal 64 due to, e.g., the overcurrent, the front edge of the bimetal 64 deforms so as to warp upward, and the engagement hole 64a is thereby disengaged from the engagement pin 76. Then, the movable member 63 is moved rightward in FIG. 51A by the spring force of the spring 65, and the first movable contact 66 separates from the first fixed contact 71, thus cutting off the primary-side plug-in terminal 62A and the secondary-side connection fitting 73A. Simultaneously, the second movable contact 68 separates from the second fixed contact 72, and the voltage applied to a mid-part of the confirming signal circuit is thereby cut off. The LED 61A remaining lit up so far in blue for confirming the conduction is extinguished,

and, instead, the LED 61B luminous in red for confirming the circuit cut-off lights up.

If the electric insulating characteristic between the primary-side plug-in terminals 62A, 62B of the receptacle body or between the plug insertions holes for the secondary-side connection fittings 73A, 73B, is deteriorated or destroyed because of a rise in temperature due to the overcurrent or of a local increase in temperature due to the tracking, and if the leak voltage is produced in the leak detection pins 51, 52 or in the leak detection plates 123A, 123B, the voltage is applied to the electromagnetic coil 127a, and the movable iron core 127c is attracted and moved upward. Then, the tip of the iron core 127c pushes up the bimetal 64 to release the engagement of the movable member 64, thereby cutting off the circuit.

Supposing that there occurs such an unpredicted abnormal situation that the circuit is not cut off based on the bimetal 121 in spite of the fact that the temperature of the receptacle body 60 increases over the set temperature of the bimetal 64, and if the temperature of the receptacle body 60 increases over the set temperature of the temperature fuse 70, the temperature fuse 70 is fused, thereby preventing the accident as serious as the fire. This is how the double safety structure works.

The receptacle with the plug-in terminal in the embodiment 16 is not limited to the one-port receptacle as shown in FIG. 50 but may be, as a matter of course, applicable to the two- or three-port receptacle with the plug-in terminal.

The rectifier smoothing circuit (the diode d3, and the capacitor c1) for the electromagnetic coil 127a may be omitted. Further, the protection circuit (the fuses f1, 70a) may be similarly omitted, or alternatively only the fuse f1 or the temperature fuse 70a may be provided.

Claims

1. A conductive state confirming signal generator used for a double-pole receptacle for an attachment plug of an electric appliance, comprising:

   a casing formed with window holes through which first and second plug-in terminals detachably inserted into said receptacle are protruded and visible from outside;
   a first light emitting member provided within said casing so that a luminous head thereof protrudes outside through said window hole, and electrically connected between said first and second plug-in terminals;
   temperature displacing means, fixedly disposed within said casing with its rear end being connected to a rear end of said first plug-in terminal within said casing, for closing an electric contact with its deformation when reaching a temperature equal to or greater than a predetermined value; and
   alarm generating means connected between said first and second plug-in terminals through said electric contact.

2. A conductive state confirming signal generator used for a double-pole receptacle for an attachment plug of an electric appliance, comprising:

   a casing formed with window holes through which first and second plug-in terminals detachably inserted into said receptacle are protruded and visible from outside;
   a light emitting member provided within said casing so that a luminous head thereof protrudes outside through said window hole, and electrically connected between said first and second plug-in terminals;
   a diode having terminal lead wires one of which is electrically and thermally connected to the rear end of said first plug-in terminal within said casing, said diode being sensitive to heat and becoming conductive when said first plug-in terminal reaches the temperature equal to or greater the predetermined value; and
   alarm generating means connected between said first and second plug-in terminals via said diode.

3. A conductive state confirming signal generator incorporated into a double-pole receptacle for an attachment plug of an electric appliance, comprising:

   first and second terminal members formed with window holes visible from outside and defined as plug-in terminals or connecting terminals connected to a power supply;
   a casing including at least one pair of first and second seizing portions, into which to detachably insert said attachment plug of the electric appliance, electrically connected to said first and second terminal members per pole;
   a contact piece provided in the periphery to said seizing portion in a state being insulated therefrom within said casing and, when said attachment plug is completely inserted into said seizing portions, electrically connected to said first seizing portion upon a contact of the tip of said first attachment plug; and
   a light emitting member provided within said casing so that a luminous head thereof protrudes outside from said window hole, and electrically connected between said second terminal member and said contact piece.

4. The conductive state confirming signal generator according to claim 3, further comprising:

a fixed contact piece fixedly disposed within said casing;

conductive temperature displacing means including its rear end connected to the rear end of said first terminal member within said casing, and coming into contact with said fixed contact piece with its deformation when reaching a temperature equal to or greater than a predetermined value; and

alarm generating means connected between said second terminal member and said fixed contact piece.

5. The conductive state confirming signal generator according to claim 3, further comprising:

a diode having a pair of terminal lead wires one of which is electrically and thermally connected to the rear end of said first terminal member or a connecting member of the same polarity as that of said first terminal member within said casing, said diode being sensitive to heat and becoming conductive when reaching the temperature equal to or greater than the predetermined value; and

alarm generating means connected between said first and second terminal members via said diode.

6. The conductive state confirming signal generator according to any one of claims 1 to 5, further comprising:

second temperature displacing means embedded substantially in the central portion between said plug-in terminals in parallel thereto within said casing so that an upper edge thereof protrudes into said casing;

a first fixed contact provided within said casing;

a movable member composed of an insulating material, provided in side-by-side direction of said plug-in terminal so as to be movable in a direction orthogonal to inserting/removing directions of said plug-in terminals, and including an engagement protruded portion engaging with an upper edge of said second temperature displacing means when at a normal temperature and a first movable contact provided at its front edge and electrically connectable to said first plug-in terminal;

a spring for biasing said movable member toward said first fixed contact at all times so that said first movable contact separates from said first fixed contact when the upper edge of said second temperature displacing means engages with said engagement protruded portion of said movable member, and that said first movable contact comes into press-contact with said first fixed contact when the upper edge of said temperature displacing means separates from said engagement protruded portion because of a rise in temperature; and

a leak alarm output terminal electrically connected to said first fixed contact.

7. The conductive state confirming signal generator according to any one of claims 1 to 5, further comprising:

second temperature displacing means embedded substantially at the center between said plug-in terminals and in parallel thereto within said casing so that its upper edge protrudes into said casing;

a second fixed contact provided within said casing and connected to said first plug-in terminal;

a lever movable within a plane orthogonal to the inserting/removing directions of said plug-in terminals, including its front edge engaging in a possible-of-disengaging manner with one side surface of an upper edge of said second temperature displacing means when at a normal temperature, a second movable contact provided the other side of a middle portion and separably coming into contact with said second fixed contact, and a pin provided at a rear end thereof and movably engaging with a guide groove formed substantially in parallel with the side-by-side direction of said plug-in terminals;

a spring for biasing said lever so that said first movable contact comes into press-contact with said first fixed contact when the front edge of said lever engages with said second temperature displacing means in a state of the normal temperature, and turning said lever with said pin serving as a fulcrum in a terminal position so that said first movable contact separates from said first fixed contact; and

a leak alarm output terminal, electrically connected to said second movable contact, for outputting a leak signal upon said second movable contact separating from said second fixed contact.

8. The conductive state confirming signal generator according to any one of claims 1 to 5, further comprising:

a pair of leak detection pins embedded in parallel to each other in positions closer to said respective terminals between said plug-in terminals of said casing: and

leak alarm generating means, electrically connected between said pair of leak detection pins, and operated by a leak voltage produced

between said pair of leak detection pins when an electric insulating characteristic of an insulating material in the periphery to said plug-in terminal is destroyed.

9. The conductive state confirming signal generator according to any one of claims 3 to 5, further comprising:

a pair of leak detection plates embedded in parallel to each other in the vicinities of a pair of plug insertion holes of said casing between at least the pair of plug insertion holes into which said attachment plug of the electric appliance is inserted; and
leak alarm generating means electrically connected between said leak detection plates and operated by a leak voltage produced between said pair of leak detection plates when the electric insulating characteristic of the insulating material in the peripheral of said seizing portion is destroyed.

10. The conductive state confirming signal generator according to any one of claims 1, 2, 4 and 5, wherein said alarm generating means is a second light emitting member provided within said casing so that a luminous head thereof protrudes outside.

11. The conductive state confirming signal generator according to any one of claims 1, 2, 4 and 5, wherein said alarm generating means is a first alarm sound generator provided within said casing.

12. The conductive state confirming signal generator according to any one of claims 1, 2, 4 and 5, wherein said alarm generating means is a member for outputting an electric signal for cutting off a main power supply circuit.

13. The conductive state confirming signal generator according to claim 8 or 9, wherein said leak alarm generating means is a third light emitting member provided within said casing so that a luminous head thereof protrudes outside.

14. The conductive state confirming signal generator according to claim 8 or 9, wherein said leak alarm generating device is a second alarm sound generator provided within said casing.

15. The conductive state confirming signal generator according to claim 14, further comprising an overcurrent preventing element connected in series or in parallel to said second alarm sound generator.

16. The conductive state confirming signal generator according to claim 8 or 9, wherein said leak alarm generating means is a relay for outputting a signal depending on opening or closing of the contact.

17. The conductive state confirming signal generator according to claim 16, further comprising an overcurrent preventing member connected in series or in parallel to said relay.

18. An electric connector used as a receptacle, for receiving an attachment plug of an electric appliance, having a confirming signal generating function and a circuit automatic cut-off function, said connector comprising:

a casing including first and second primary-side terminal members led out to the outside, and at least one pair of secondary-side terminal members, internally connected to said primary-side terminal members per pole, into which said attachment plug of the electric appliance is removably inserted;
a movable member so provided as to be movable within said casing and composed of an insulating material;
a first fixed contact fixed within said casing and connected to one of said pair of secondary-side terminal member;
a second fixed contact fixed within said casing;
a first movable contact disposed in a face-to-face relationship with said first fixed contact and electrically connected to said first primary-side terminal member;
a second movable contact fixed to said first movable contact and moving together therewith;
a spring for making said first and second movable contacts contact with said first and second fixed contacts at a predetermined contact pressure;
temperature displacing means for bringing respectively said first and second movable contacts into contact with said first and second fixed contacts by engaging a motion of said movable member at a normal temperature, and respectively separating said first and second movable contacts from said first and second fixed contacts by releasing the engagement of said movable member with a deformation caused by a rise in temperature;
a first light emitting member for confirming a conduction, lit up by a voltage between said first and second primary-side terminal members through said second movable contact and said second fixed contact when said temperature displacing means in a state of the normal temperature, and extinguished by said second movable contact separating from said second fixed contact when the engagement of said

movable member is released with the deformation of said temperature displacing means due to the rise in temperature;

a second light emitting member for confirming circuit cut-off, extinguished by its short-circuited through said second movable contact and said second fixed contact when said temperature displacing means in the state of the normal temperature, released from the short-circuit by separating said second movable contact from said second fixed contact when the engagement of said movable member is released with the deformation of said temperature displacing means due to the rise in temperature, and lit up by a voltage between said first and second primary-side terminal members; and

reset means for returning said first and second movable contacts being in a state of separating from said first and second fixed contacts, to a contact state when at the normal temperature.

19. The electric connector according to claim 18, further comprising a temperature fuse provided electrically in series to said second primary-side terminal member.

20. An electric connector used as a receptacle, for receiving an attachment plug of an electric appliance, having a confirming signal generating function and a circuit automatic cut-off function, said connector comprising:

a casing having first and second primary-side terminal members on one surface that are removably inserted into a power supply receptacle, and at least one pair of first and second secondary-side connection fittings on the other surface thereof, into which said attachment plug of the electric appliance is removably inserted;

a temperature fuse provided within said casing and thermally closely provided between said first primary-side terminal member and said first secondary-side connection fitting;

connecting means, provided within said casing, for making an electric connection between said second primary-side terminal member and said second secondary-side connection fitting;

a first light emitting member, connected between said first primary-side fitting and said second primary-side terminal member, for confirming the conduction;

a second light emitting member, connected between said first and second primary-side terminal members, for confirming the circuit cut-off; and

means for extinguishing said second light emitting member when said first light emitting member lights up.

21. The electric connector according to any one of claims 18 to 20, wherein said primary-side terminal member is a plug-in terminal removably inserted into said power supply receptacle.

22. The electric connector according to any one of claims 18 to 20, wherein said primary-side terminal member is a connecting terminal connected to an electric wire from the power supply.

23. An electric connector used as an attachment plug having a confirming signal generating function and a circuit automatic cut-off function, comprising:

a plug body having first and second primary-side plug-in terminals;

a movable member so provided as to be movable within said plug body, and composed of an insulating material;

a first fixed contact provided within said plug body;

a first movable contact so provided on said movable member as to be movable and as to come into contact with said first fixed contact by a contact spring, and connected to said first primary-side plug-in terminal;

temperature displacing means so provided as to engage said movable member in a normal conductive state in which said first fixed contact comes into contact with said first movable contact;

a second movable contact fixed to said first movable contact and moving together therewith;

a second fixed contact, provided in said plug body, with which said second movable contact separably comes into contact:

first and second secondary-side connecting terminals provided in said plug body and connected respectively to said first fixed contact and to sad second primary-side plug-in terminal;

reset means for returning said first and second movable contacts separating from said first and second fixed contacts to a normal closing state; and

a confirming signal generating circuit including a first light emitting member for confirming a conduction and a second light emitting member for confirming circuit cut-off, and constructed so that when an engagement of said movable member is released with a deformation of said temperature displacing means upon an excess of a temperature of said temperature displacing means over a predetermined value after a volt-

age between said first primary-side plug-in terminal and said second secondary-side connecting terminal has been applied, said first light emitting member for confirming the conduction which has lighted up so far is extinguished, and that instead said second light emitting member for confirming the circuit cut-off lights up.

24. The attachment plug according to claim 23, further comprising a temperature fuse disposed between said second primary-side plug-in terminal and said second secondary-side connecting terminal.

25. An electric connector, for receiving an attachment plug of an electric appliance, used as a receptacle having a confirming signal generating function and a circuit automatic cut-off function, said connector comprising:

a receptacle body having first and second primary-side connecting terminals;
a movable member so provided as to be movable within said receptacle body, and composed of an insulating material;
a first fixed contact provided within said receptacle body;
a first movable contact so provided on said movable member as to be movable and as to be biased to come into contact with said first fixed contact by a contact spring, and connected to said first primary-side connecting terminal;
a pawled engagement member, capable of engagement and disengagement, for engaging said movable member in a normal conductive state in which said first fixed contact comes into contact with said first movable contact;
a second movable contact fixedly secured to said first movable contact and moving together therewith;
a second fixed contact, fixedly secured within said receptacle body, with which said second movable contact separably comes into contact;
at least a pair of first and second secondary-side connection fittings provided within said receptacle body and connected respectively to said first fixed contact and said second primary-side connecting terminal;
a third fixed contact fixed to said receptacle body;
temperature displacing means provided in a possible-of-separation/contact manner so that a rear edge thereof is connected to said second primary-side plug-in terminal, and a front edge thereof separates from said third fixed contact at a normal temperature and comes into contact therewith at a temperature exceeding a predetermined temperature;
a magnet, provided in the vicinity of said pawled engagement member, and including a first electromagnetic coil with its one end electrically connected to said third fixed contact and its other end electrically connected to said first fixed contact, for releasing the engagement of said movable member by attracting said pawled engagement member upon energizing said first electromagnetic coil, and separating said first and second movable contacts respectively from said first and second fixed points;
a confirming signal generating circuit including a first light emitting member for confirming a conduction and a second light emitting member for confirming circuit cut-off, and constructed so that when an engagement of said movable member is released with a deformation of said temperature displacing means upon an excess of a temperature of said temperature displacing means over a predetermined value after a voltage between said first primary-side plug-in terminal and said second secondary-side connecting terminal has been applied, said first light emitting member for confirming the conduction which has lighted up so far is extinguished, and that instead said second light emitting member for confirming the circuit cut-off lights up; and
reset means for returning said first and second movable contacts being separate from said first and second fixed contacts upon the disengagement of said movable member, to a normal conductive state.

26. The electric connector according to claim 25, further comprising a temperature fuse disposed between said second primary-side connecting terminal and said second secondary-side connecting terminal.

27. The electric connector according to claim 25 or 26, further comprising:

a pair of leak detection plates disposed in parallel to each other in the middle between a pair of plug insertion holes through which to insert the attachment plug of the electric appliance into said receptacle body and in the vicinities of the respective plug insertion holes; and
a second electromagnetic coil additionally wound on said magnet and connected between said pair of leak detection plates,

wherein when the leak voltage is generated in the leak detection plates with a destruction of the electric insulating performance of the insulating material in the periphery to the plug insertion hole in said receptacle body, said

magnet attracts said pawled engagement member upon energizing said second electromagnetic coil, and the engagement of said movable member is thus released.

28. The electric connector according to any one of claims 25 to 27, further comprising vibration detecting means disposed within said receptacle body so as to become, when vibrations exceeding a set value are caused, electrically a conductive state corresponding to these vibrations, and electrically connected between said second primary-side connecting terminal and said third fixed contact.

29. The electric connector according to claim 27, further comprising at least one of an alarm sound generator and a leak alarm light emitting member that are electrically connected between said leak detection plates.

30. An electric connector, for receiving an attachment plug of an electric appliance, used as a portable type receptacle having a confirming signal generating function and a circuit automatic cut-off function, said connector comprising:

a receptacle body having first and second primary-side connecting terminals;
a first fixed contact provided within said receptacle body;
a movable member so provided as to be movable within said receptacle body, and composed of an insulating material;
a first movable contact so provided on said movable member as to be movable and as to be biased to come into contact with said first fixed contact by a contact spring, and connected to said first primary-side connecting terminal;
a pawled engagement member, capable of engagement and disengagement, for engaging said movable member in a normal conductive state in which said first fixed contact comes into contact with said first movable contact;
a second movable contact fixed to said first movable contact and moving together therewith;
a second fixed contact, fixedly secured within said receptacle body, with which said second movable contact separably comes into contact;
at least a pair of first and second secondary-side connection fittings provided within said receptacle body and connected to said first fixed contact and said second primary-side connecting terminal;
a third fixed contact fixed to said receptacle body;
temperature displacing means provided in a possible-of-separation/contact manner so that a rear edge thereof is connected to said second primary-side plug-in terminal, and a front edge thereof separates from said third fixed contact at a normal temperature and comes into contact therewith at a high temperature over a predetermined temperature;
a magnet, provided in the vicinity of said pawled engagement member, and including a first electromagnetic coil with its one end connected to said third fixed contact and its other end electrically connected to said first fixed contact, for releasing the engagement of said movable member by attracting said pawled engagement member upon energizing said first electromagnetic coil subsequently to the contact of the front edge of said temperature displacing means with said third fixed contact, and separating said first and second movable contacts respectively from said first and second fixed contacts;
a confirming signal generating circuit including a first light emitting member for confirming a conduction and a second light emitting member for confirming circuit cut-off, and constructed so that when an engagement of said movable member is released with a deformation of said temperature displacing means upon an excess of a temperature of said temperature displacing means over a predetermined value after a voltage between said first primary-side plug-in terminal and said second secondary-side connecting terminal has been applied, said first light emitting member for confirming the conduction which has lighted up so far is extinguished, and that instead said second light emitting member for confirming the circuit cut-off lights up; and
reset means for returning said first and second movable contacts being separate from said first and second fixed contacts upon the disengagement of said movable member, to a normal conductive state.

31. The electric connector according to claim 30, further comprising:

a pair of leak detection plates disposed in parallel to each other in the middle between a pair of plug insertion holes through which to insert the attachment plug of the electric appliance into said receptacle body and in the vicinities of the plug insertion holes, said leak detection plates generating the leak voltage when the electric insulating performance of the insulating material in the periphery to the plug insertion hole in said receptacle body is destroyed;
a pair of leak detection pins embedded in par-

allel to each other closer to said respective primary-side plug-in terminals in the middle between said pair of primary-side plug-in terminals of said receptacle body, and electrically connected to said leak detection plates per pole, said leak detection pins generating the leak voltage when the electric insulating performance of the insulating material in the periphery to said primary-side plug-in terminal of said receptacle body; and

a second electromagnetic coil additionally wound on said magnet and connected between said pair of leak detection plates, said second electromagnetic coil being energized, when the leak voltage is produced between said pair of leak detection plates or between said pair of leak detection pins, to release the engagement of said movable member by energizing said first electromagnetic coil and thereby said magnet attracts said pawled engagement member.

32. An electric connector, for receiving an attachment plug of an electric appliance, used as a portable type receptacle having a confirming signal generating function and a circuit automatic cut-off function, said connector comprising:

a receptacle body having first and second primary-side connecting terminals;

a first fixed contact provided within said receptacle body;

a movable member so provided as to be movable within said receptacle body, and composed of an insulating material;

a first movable contact so provided on said movable member as to be movable and as to be biased to come into contact with said first fixed contact by a contact spring, and connected to said first primary-side connecting terminal;

temperature displacing means, disposed at a right angle to a side-by-side direction of said primary plug-in terminals substantially at the center between said primary-side plug-in terminals and at a right angle to inserting/removing directions of said primary-side plug-in terminals, for engaging said movable member in a normal conductive state in which said first fixed contact comes into contact with said first movable contact;

a second movable contact fixed to said first movable contact and moving together therewith;

a second fixed contact, provided within said receptacle body, with which said second movable contact separably comes into contact;

at least a pair of first and second secondary-side connection fittings provided within said receptacle body and constructed of a first secondary-side connection fitting connected to said first fixed contact and of a second secondary-side connection fitting connected to said second primary-side plug-in terminal;

a confirming signal generating circuit including a first light emitting member for confirming a conduction and a second light emitting member for confirming circuit cut-off, and constructed so that when an engagement of said movable member is released with a deformation of said temperature displacing means upon an excess of a temperature of said temperature displacing means over a predetermined value after a voltage between said first primary-side plug-in terminal and said second secondary-side connecting terminal has been applied, said first light emitting member for confirming the conduction which has lighted up so far is extinguished, and that instead said second light emitting member for confirming the circuit cut-off lights up;

first and second leak detection plates disposed in parallel to each other in the middle between a pair of plug insertion holes for said secondary-side connection fittings, through which to insert the attachment plug of the electric appliance into said receptacle body and in the vicinities of the plug insertion holes;

first and second leak detection pins embedded in parallel to each other in positions closer to said plug-in terminals in the middle between said pair of primary-side plug-in terminal of said receptacle body;

a magnet member, provided adjacently to an anti-displacing direction due to a rise in temperature as well as being closer to the front edge of said temperature displacing means within said receptacle body, and including an electromagnetic coil with its one end connected to said first leak detection plate and said first leak detection pin and with its other end connected to said second leak detection plate and said second leak detection pin, said magnet member releasing the engagement of said movable member by pushing up said temperature displacing means upon energizing said electromagnetic coil;

an automatic cut-off mechanism for operating said magnet member when a leak voltage is produced in said leak detection plate or said leak detection pin after an electric insulating characteristic peripheral to the plug insertion hole of said receptacle body or to said primary-side plug-in terminal, and thereby cutting off an electric current path to said secondary-side connection fitting from said primary-side plug-in terminal; and

reset means for returning said first and second movable contacts being in a state of separating from said first and second fixed contacts upon the disengagement of said movable member, to a normal conductive state.

33. The electric connector according to any one of claims 30 to 33, further comprising a temperature fuse disposed between said second primary-side plug-in terminal and said second secondary-side connection fitting.

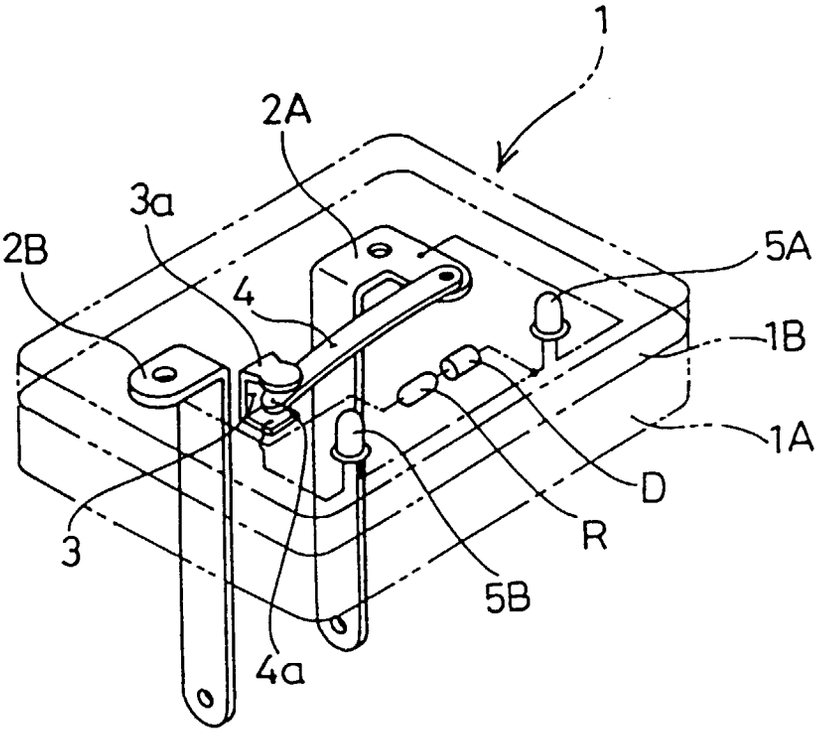

FIG. 1

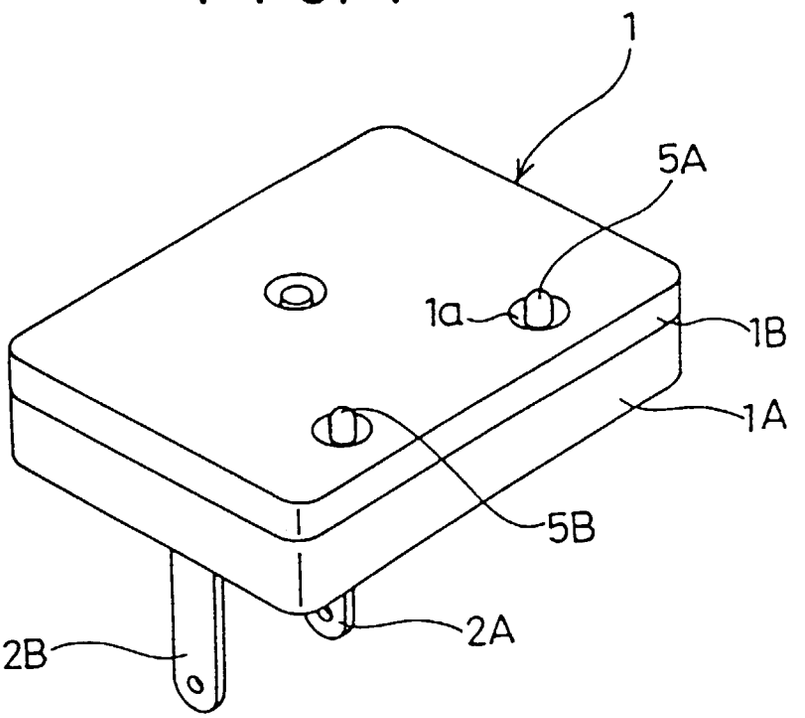

FIG. 2

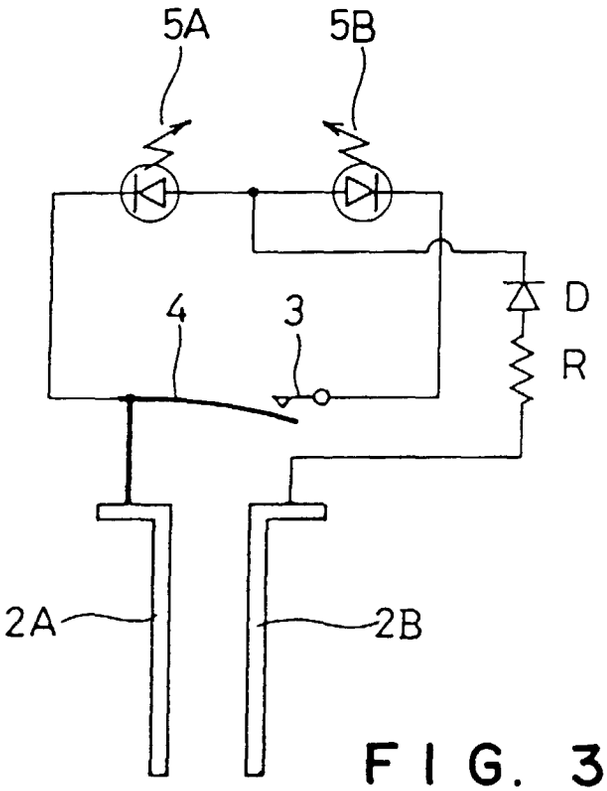

FIG. 3

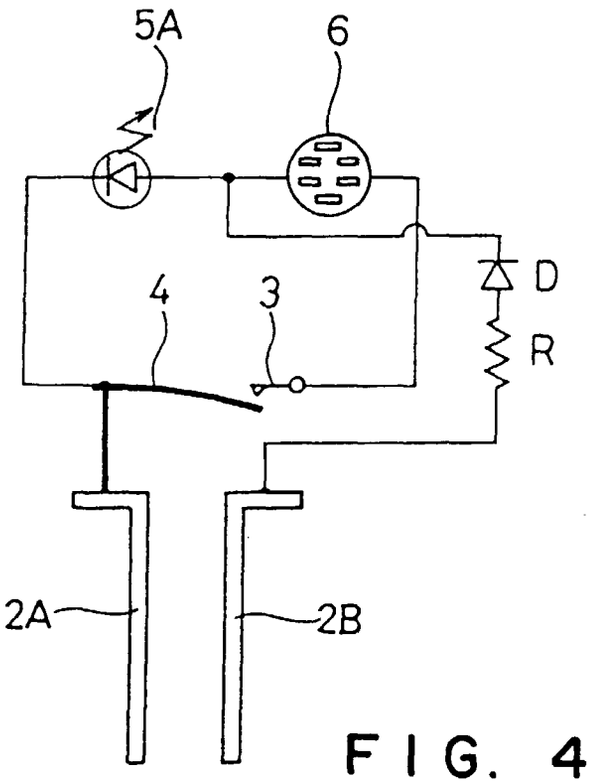

FIG. 4

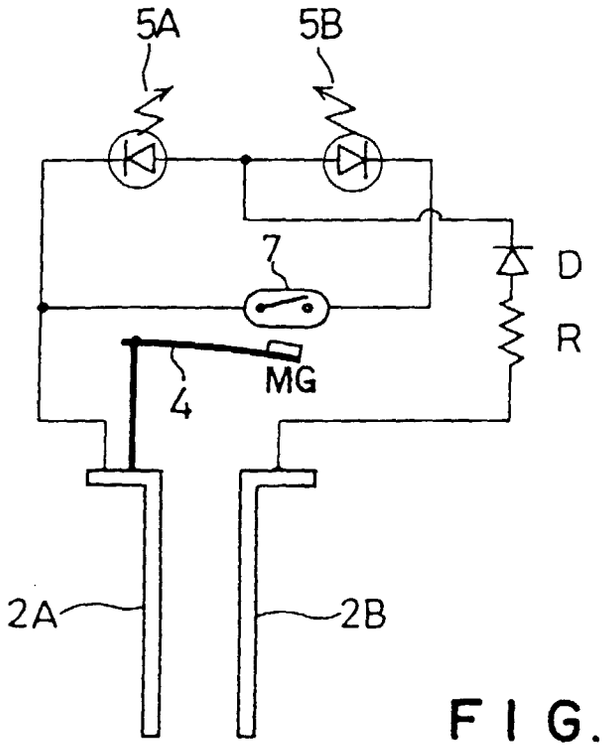

FIG. 5

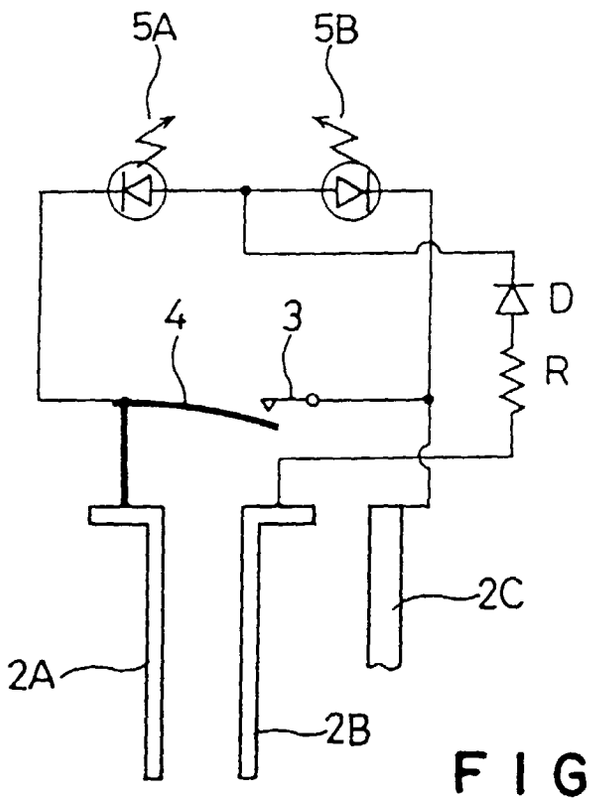

FIG. 6

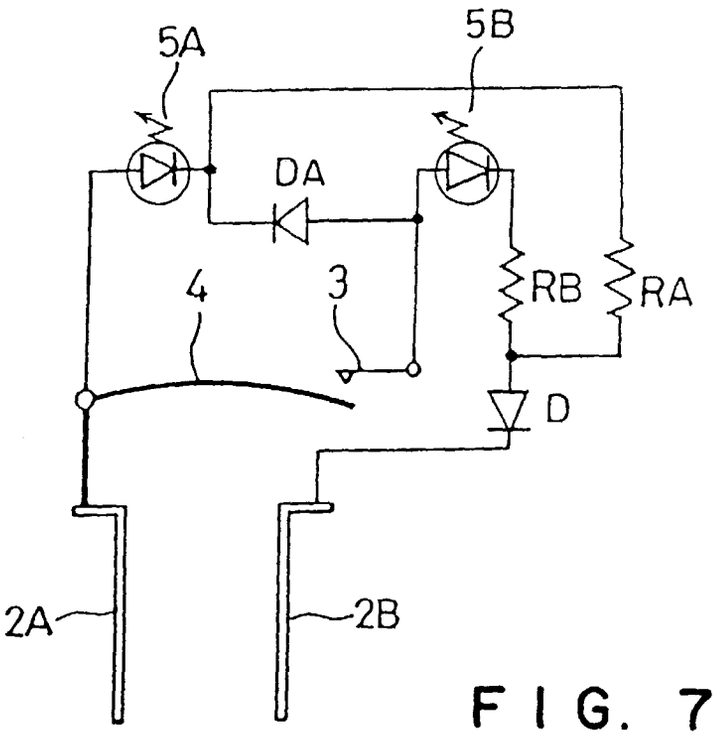

FIG. 7

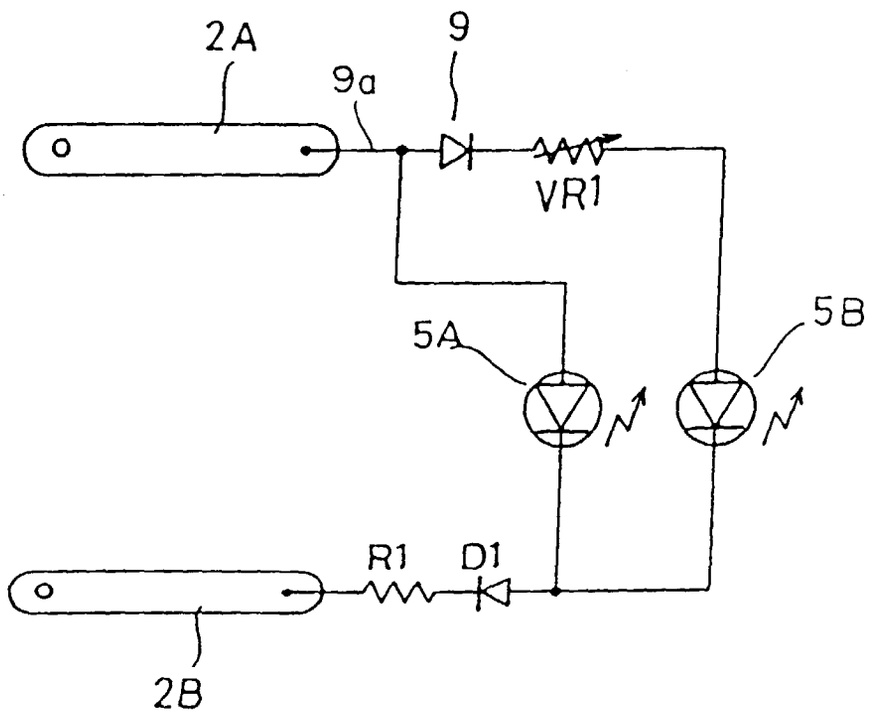

FIG. 8

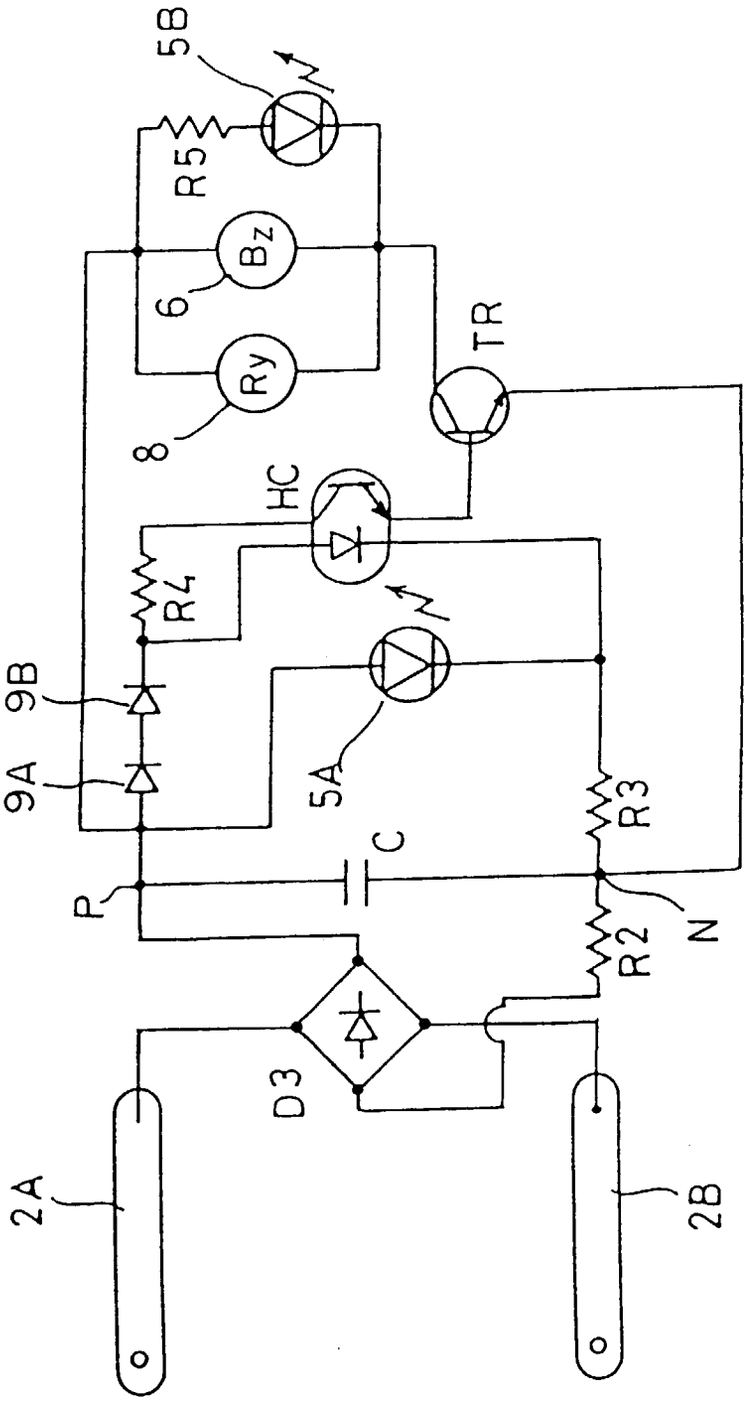

FIG. 9

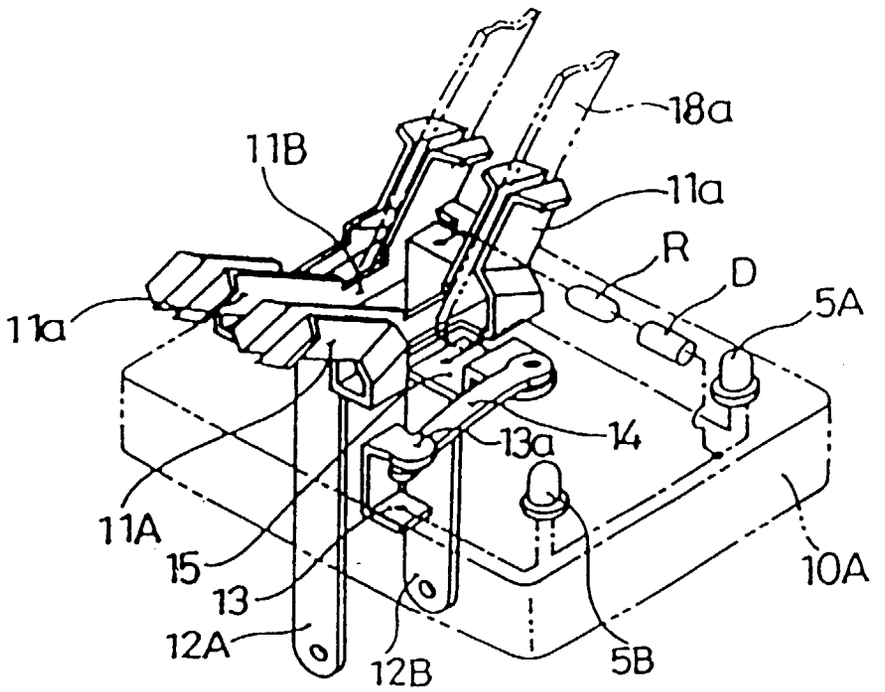
18a
11B
11a
R
D
5A
11a
13a
14
11A
15
13
12A
12B
5B
10A

FIG. 10

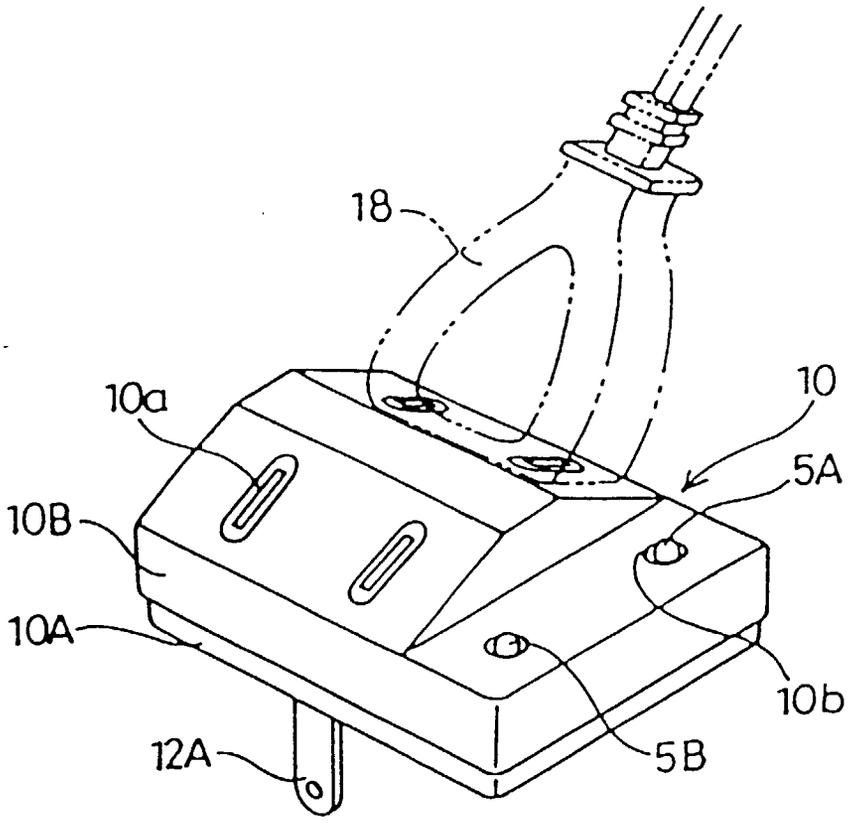
18
10a
10
5A
10B
10A
10b
12A
5B

FIG. 11

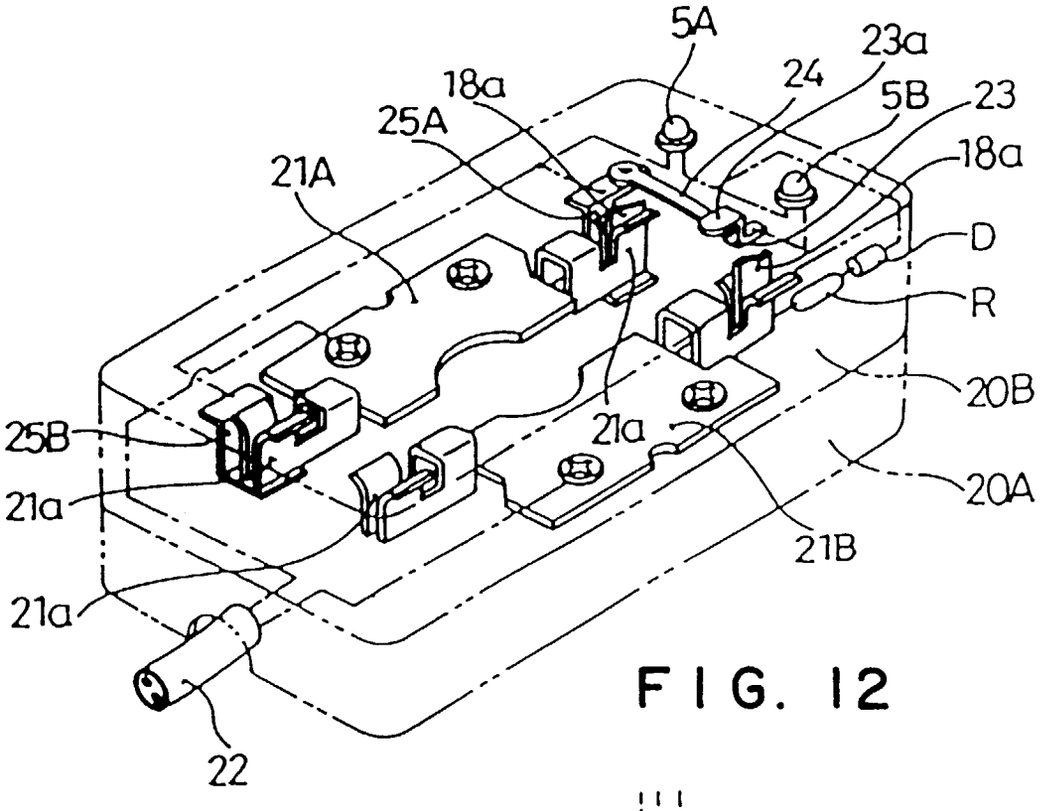
5A
23a
24
18a
5B
23
25A
18a
21A
D
R
20B
25B
21a
20A
21a
21B
21a
22

FIG. 12

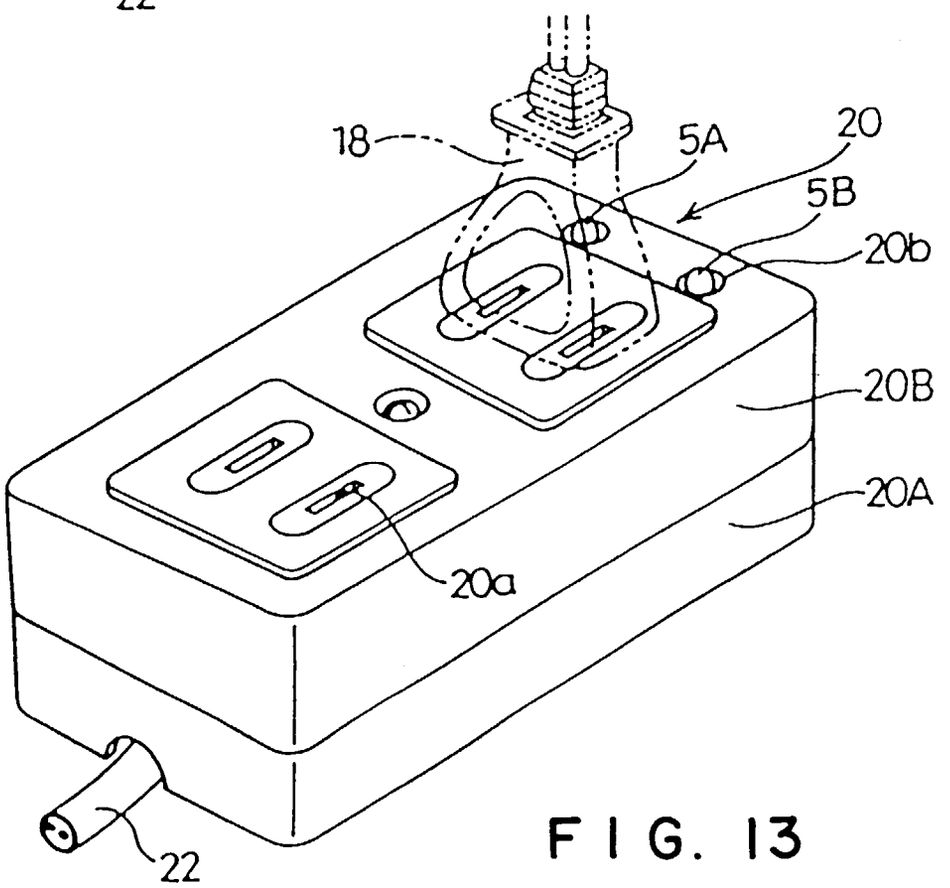
18
5A
20
5B
20b
20B
20A
20a
22

FIG. 13

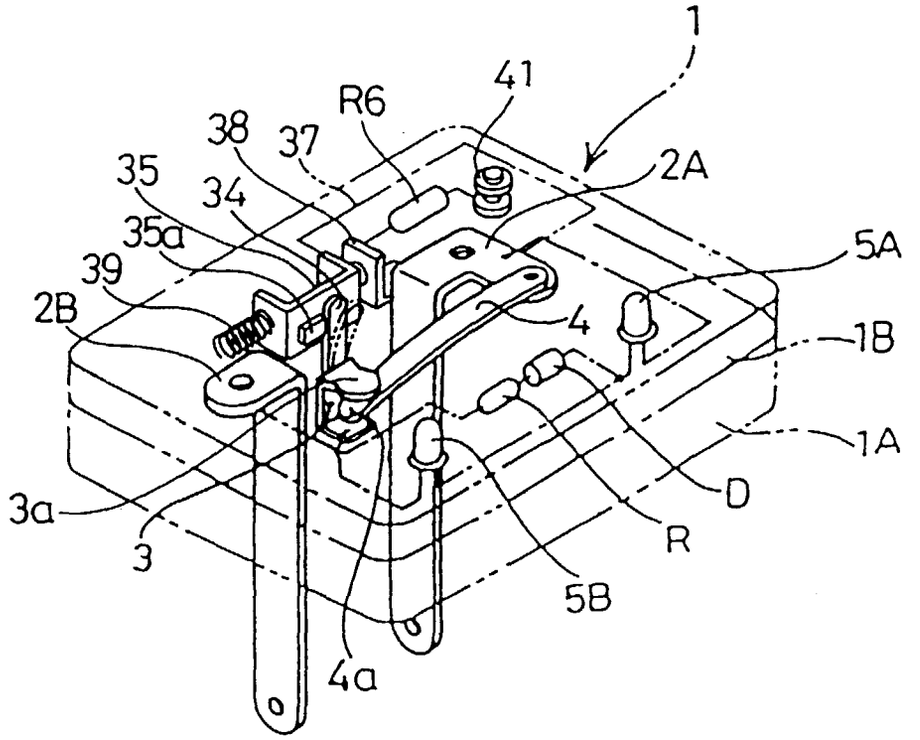
1
41
R6
38
37
2A
35
34
35a
5A
39
2B
4
1B
1A
3a
3
D
R
5B
4a

FIG. 14

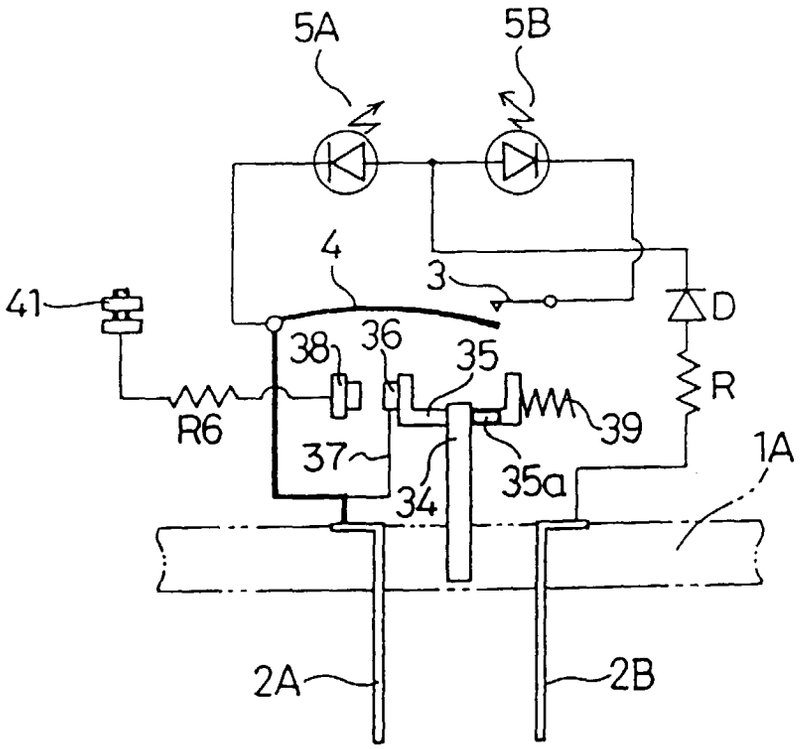
5A
5B
4
3
41
D
38
36
35
R
R6
39
37
1A
35a
34
2A
2B

FIG. 15

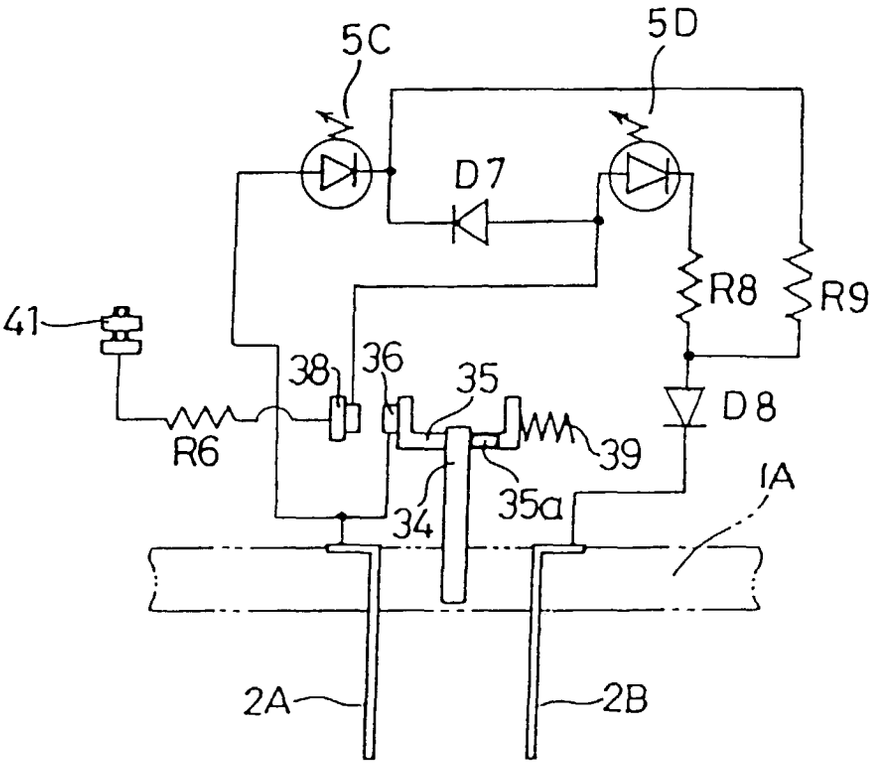
5C
5D
D7
R8
R9
41
38
36
35
D8
R6
39
34
35a
1A
2A
2B

FIG. 16

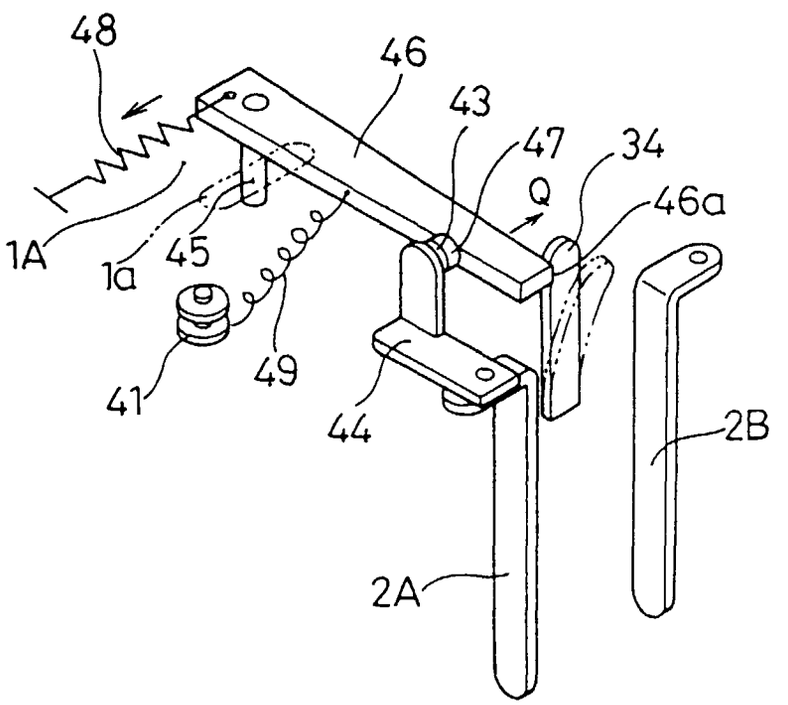
48
46
43
47
34
Q
46a
1A
1a
45
41
49
44
2B
2A

FIG. 17

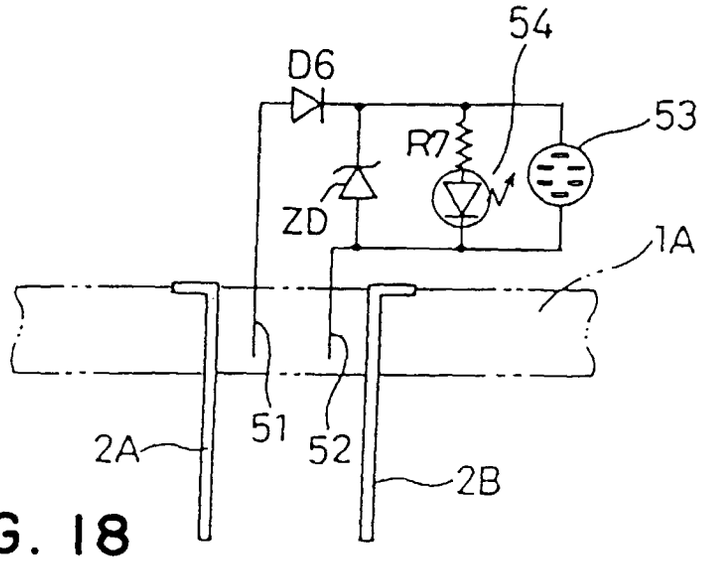

FIG. 18

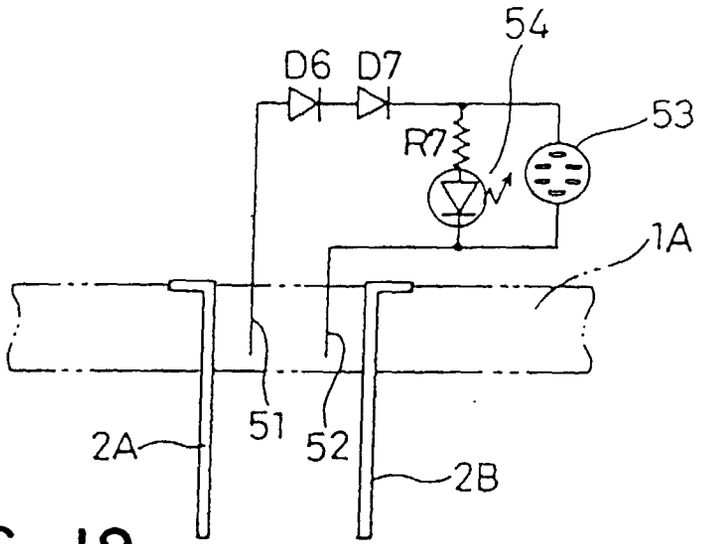

FIG. 19

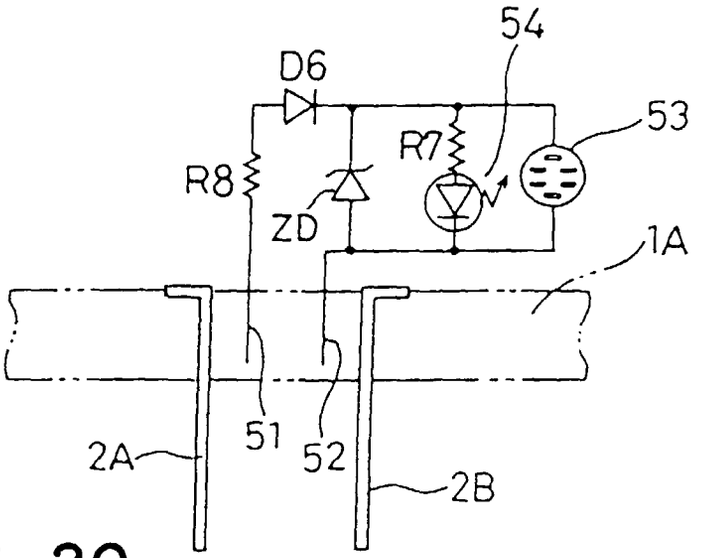

FIG. 20

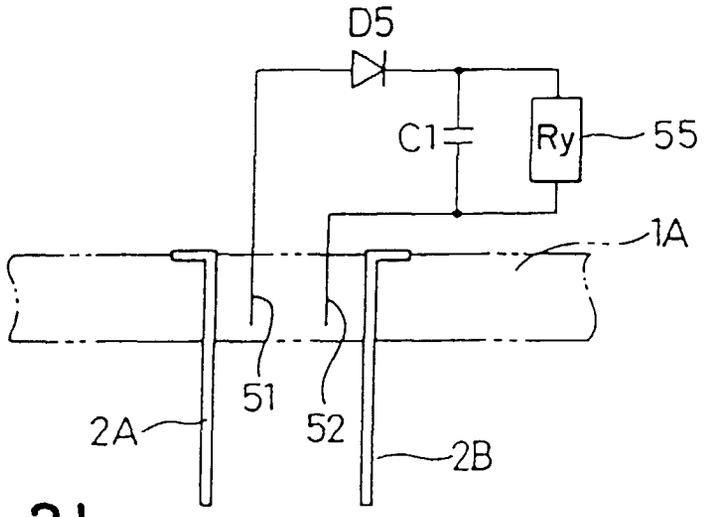

FIG. 21

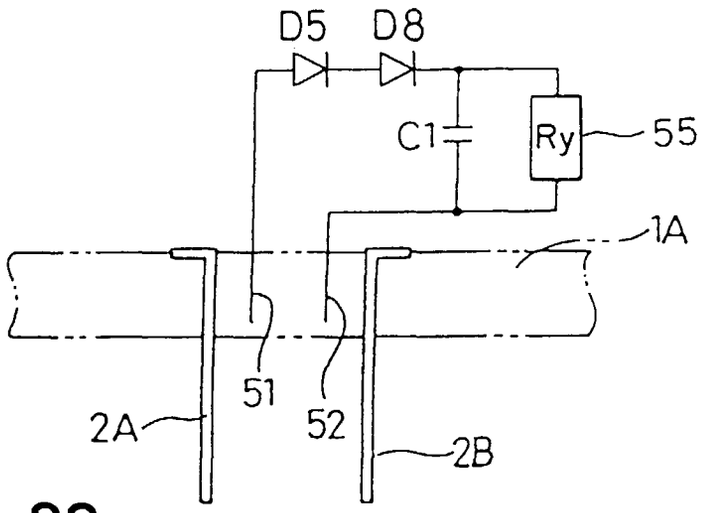

FIG. 22

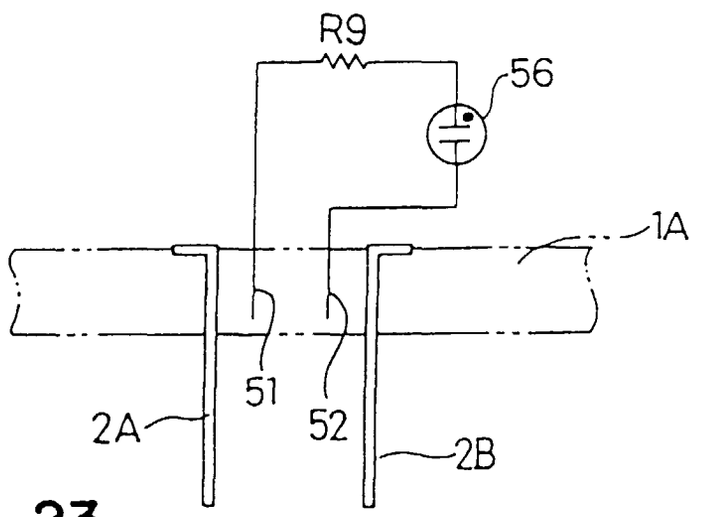

FIG. 23

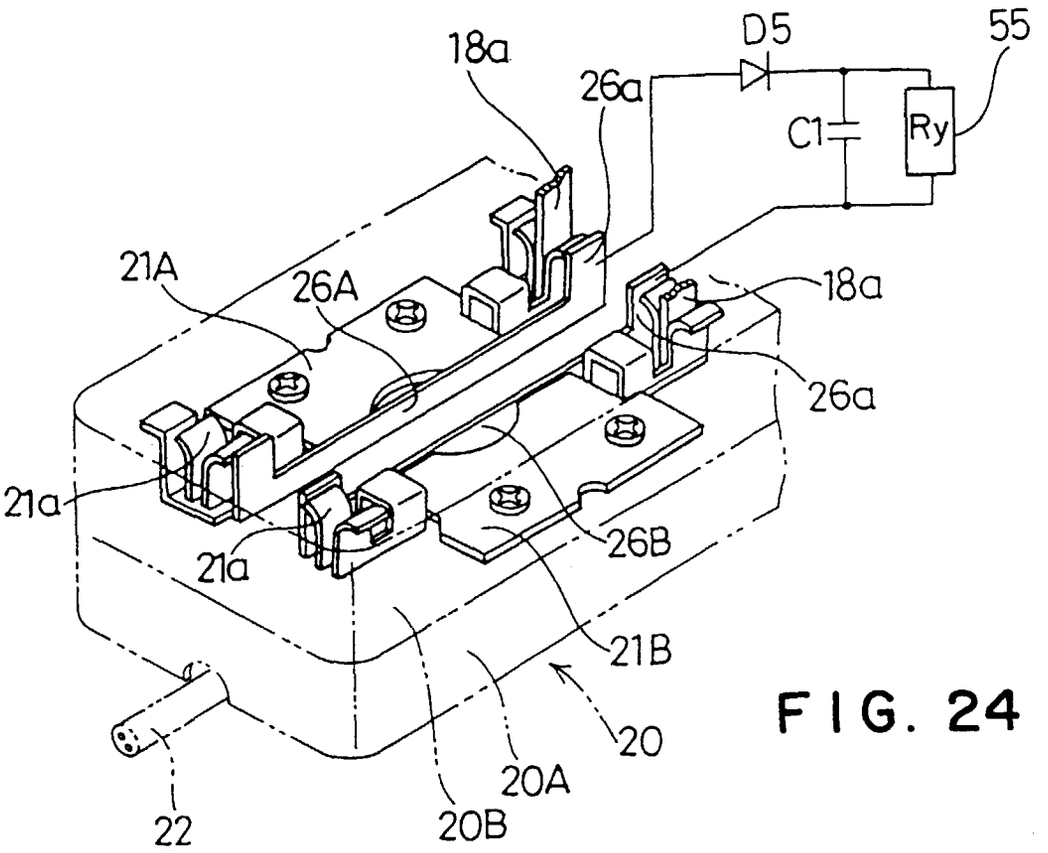
18a
D5
55
26a
C1
Ry
21A
26A
18a
26a
21a
21a
26B
21B
20
20A
20B
22

FIG. 24

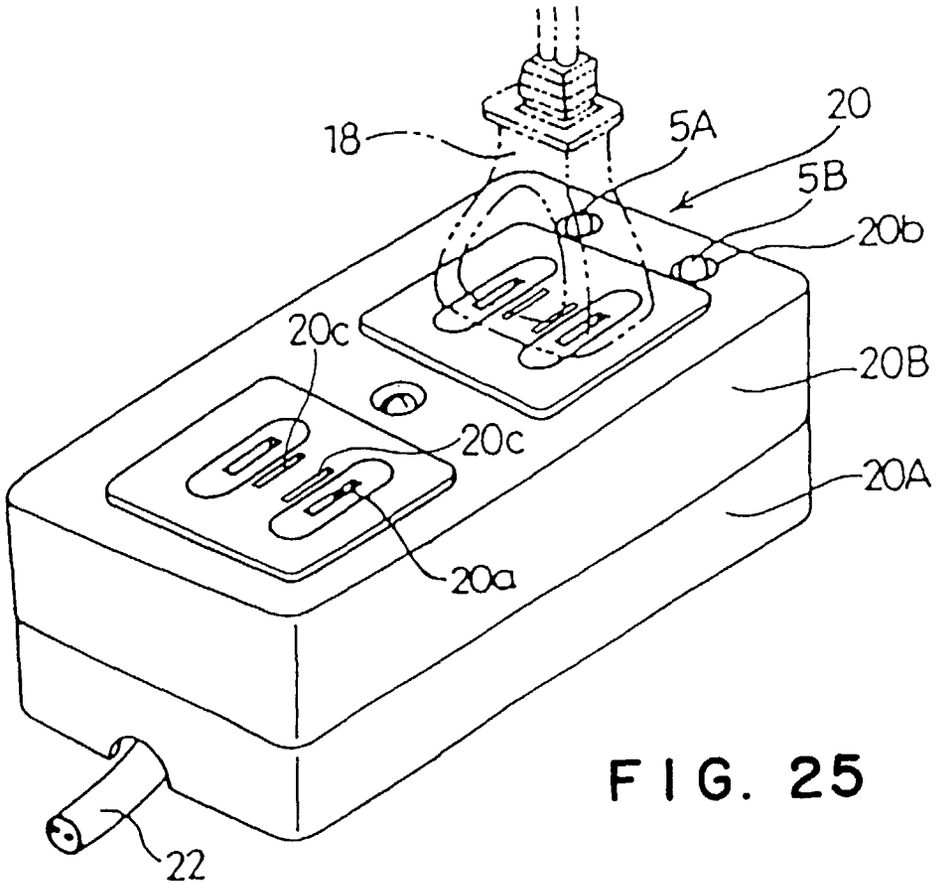
18
5A
20
5B
20b
20c
20B
20c
20A
20a
22

FIG. 25

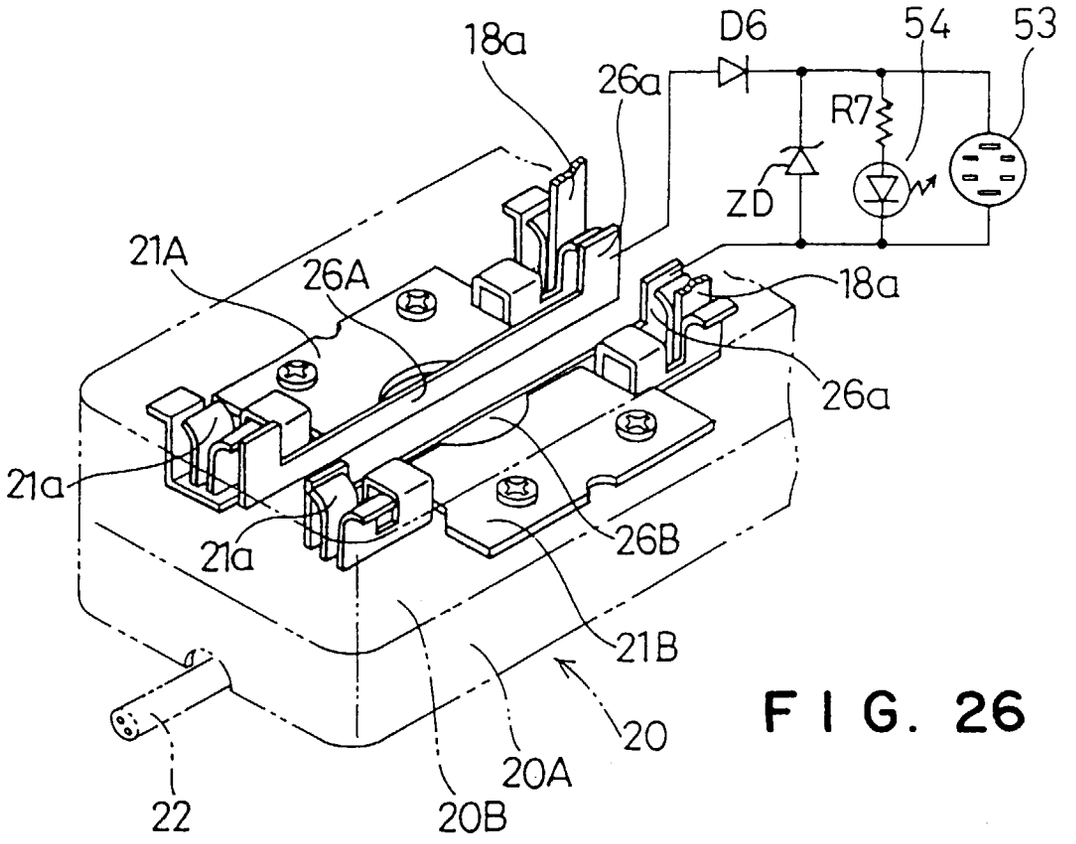
18a
D6
54
53
26a
R7
ZD
21A
26A
18a
26a
21a
21a
26B
21B
20
20A
22
20B

FIG. 26

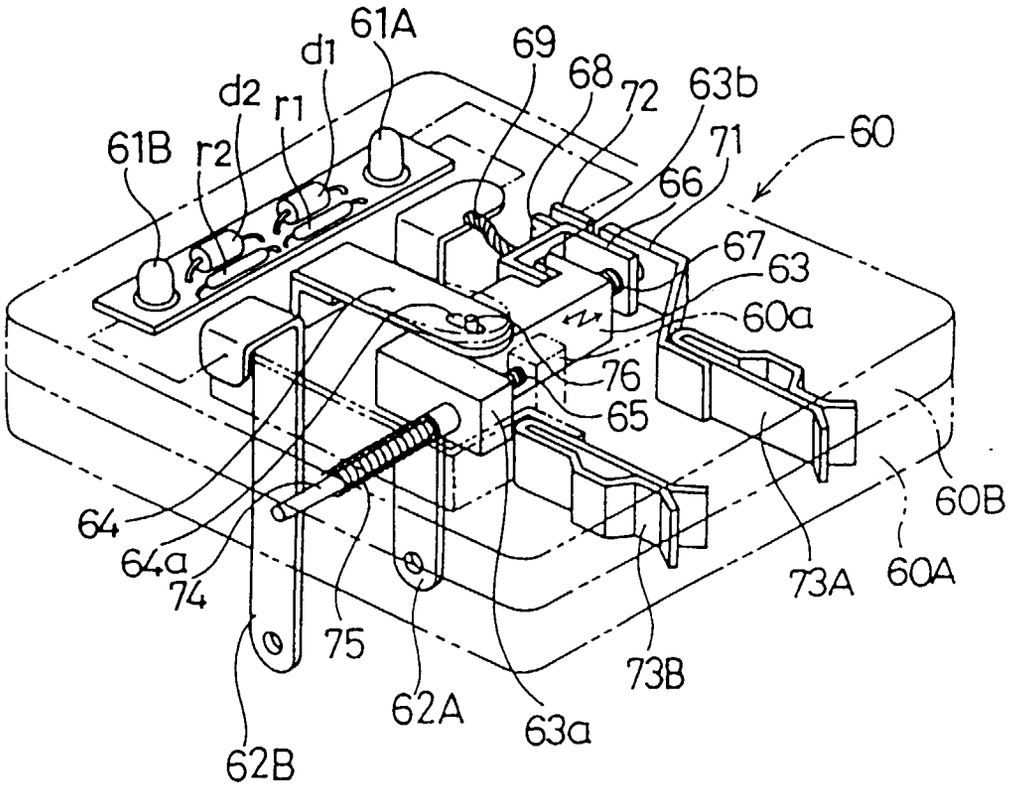
61A
d1
69
68
72
63b
d2
r1
61B
r2
71
60
66
67
63
60a
76
65
64
64a
74
75
62A
63a
73B
73A
60A
60B
62B

FIG. 27

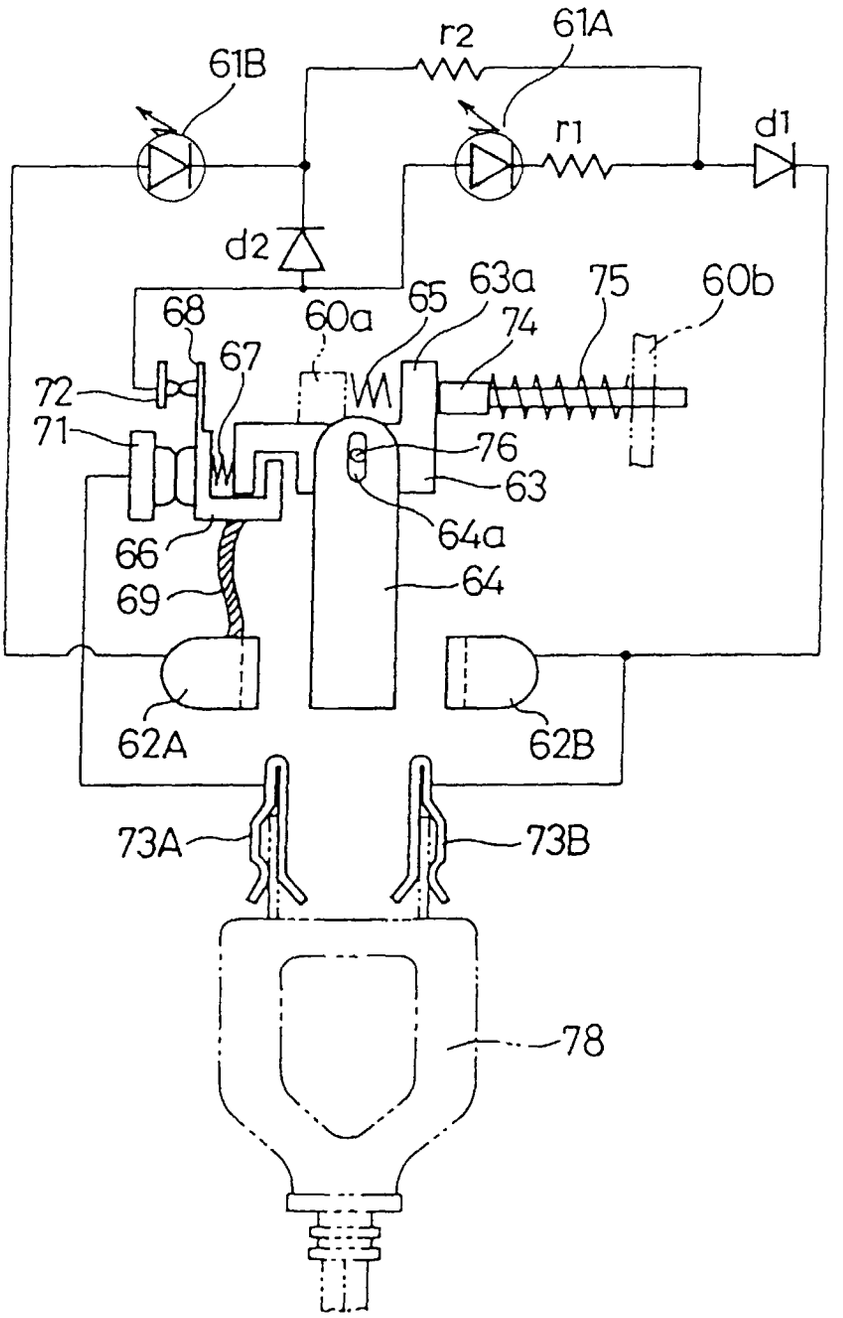
r2
61A
61B
r1
d1
d2
63a
75
60b
68
60a
65
74
67
72
71
76
63
64a
66
64
69
62A
62B
73A
73B
78

FIG. 28

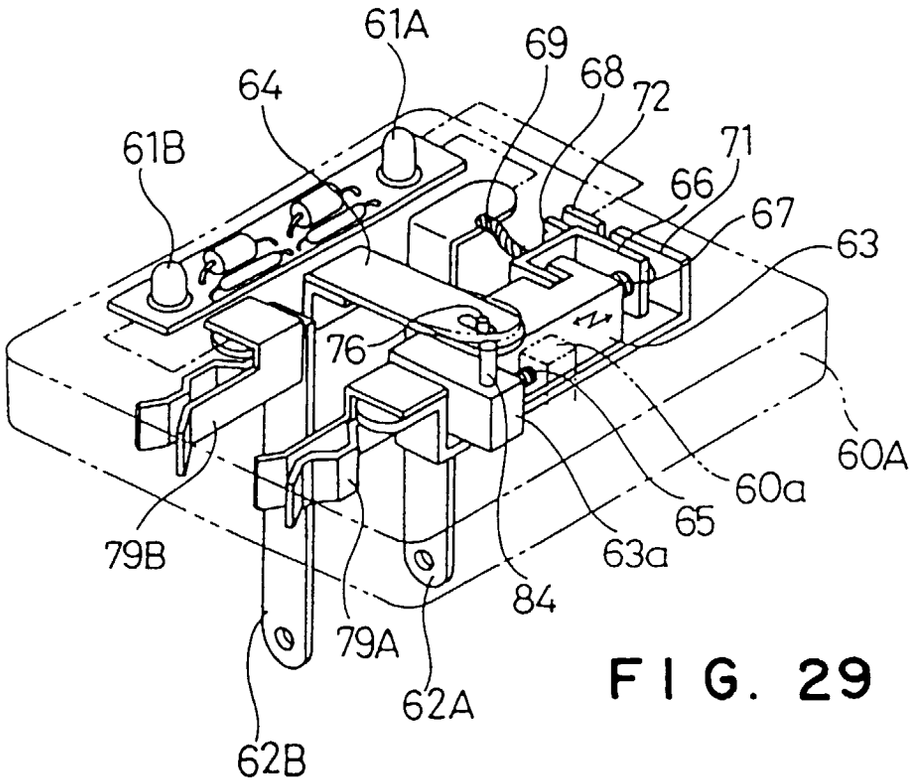
61A
69
68
72
64
71
61B
66
67
63
76
60A
60a
65
63a
79B
84
79A
62A
62B

FIG. 29

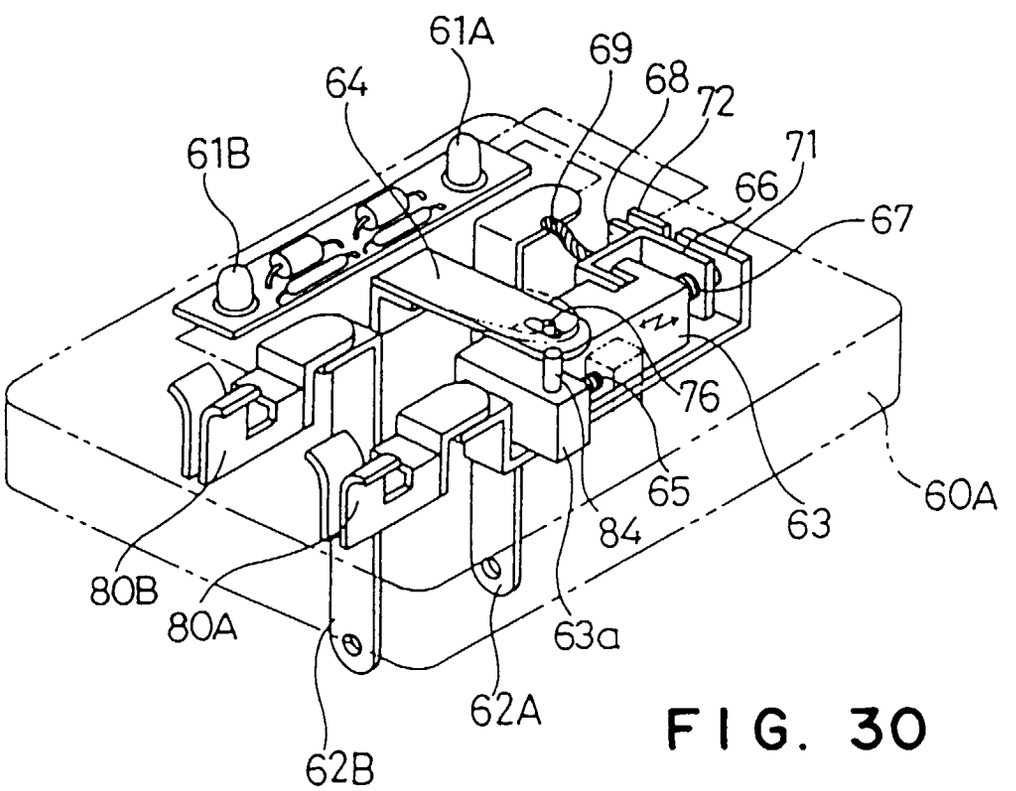
61A
69
68
72
64
71
61B
66
67
76
65
60A
84
63
80B
80A
63a
62A
62B

FIG. 30

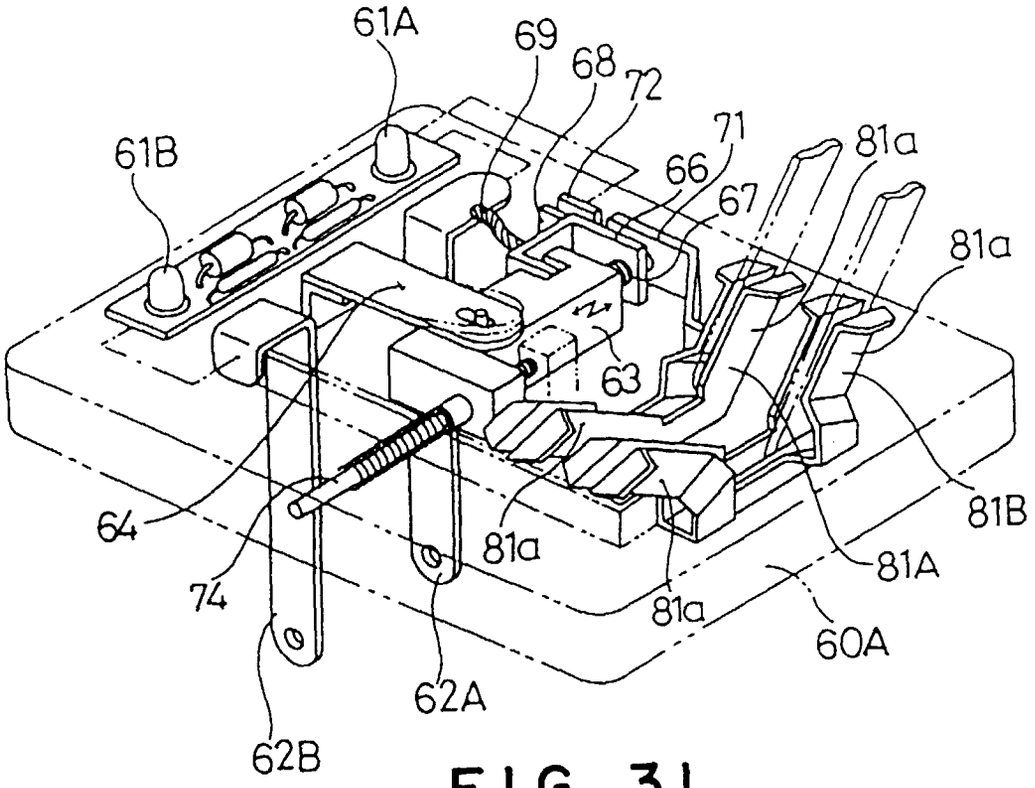
61A
69
68
72
71
66
67
81a
61B
81a
63
64
74
81a
81B
81A
81a
60A
62A
62B

FIG. 31

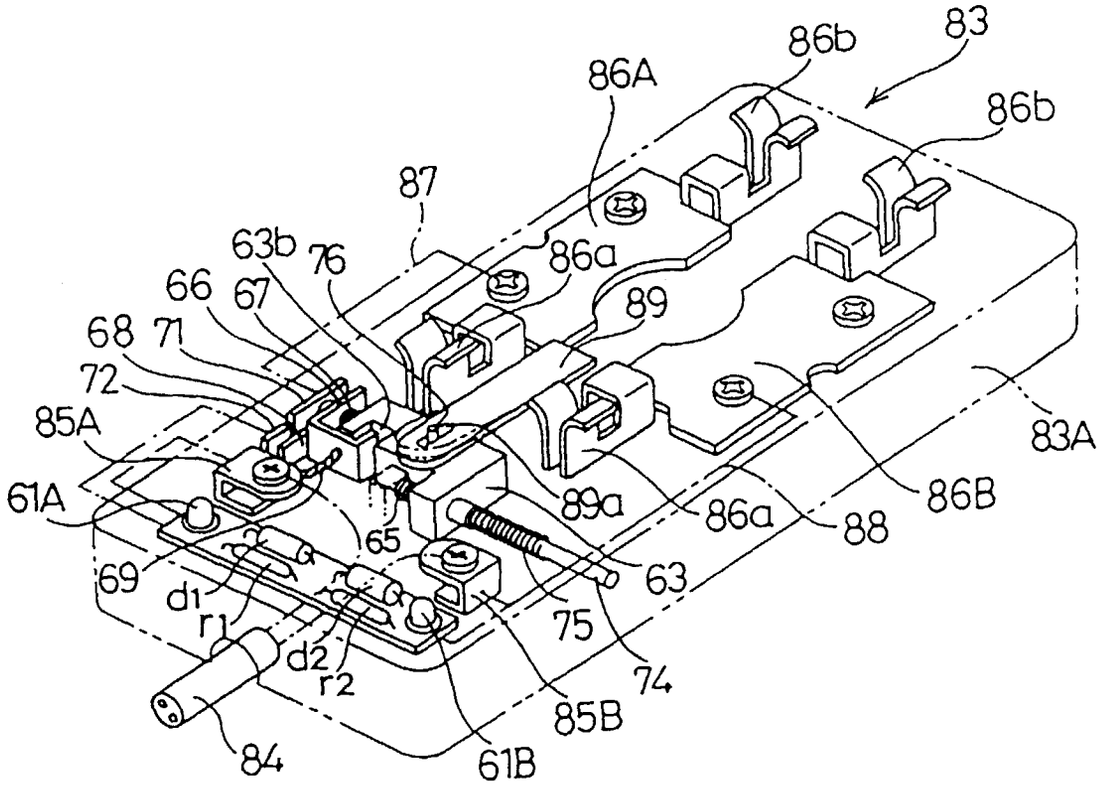
86b
83
86A
86b
87
63b
76
86a
66
67
89
68
71
72
85A
83A
61A
89a
86a
88
86B
65
69
63
d1
r1
75
d2
r2
74
85B
84
61B

FIG. 32

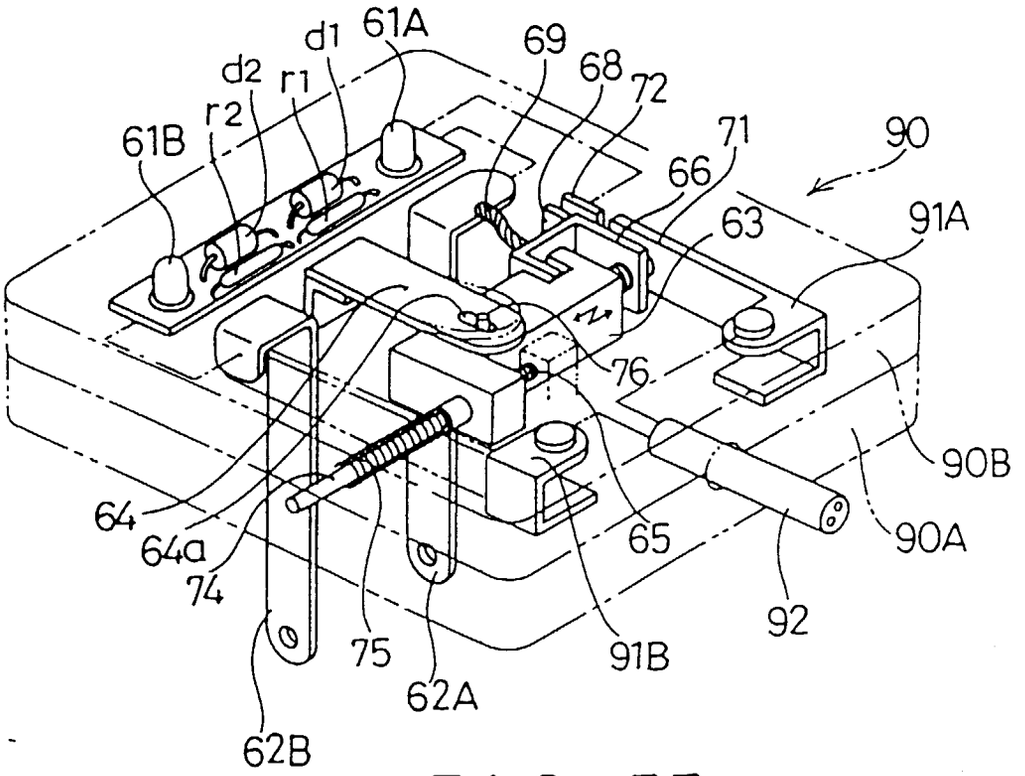
d1
61A
69
68
72
d2
r1
r2
61B
71
90
66
63
91A
76
90B
64
64a
74
65
90A
92
75
91B
62A
62B

FIG. 33

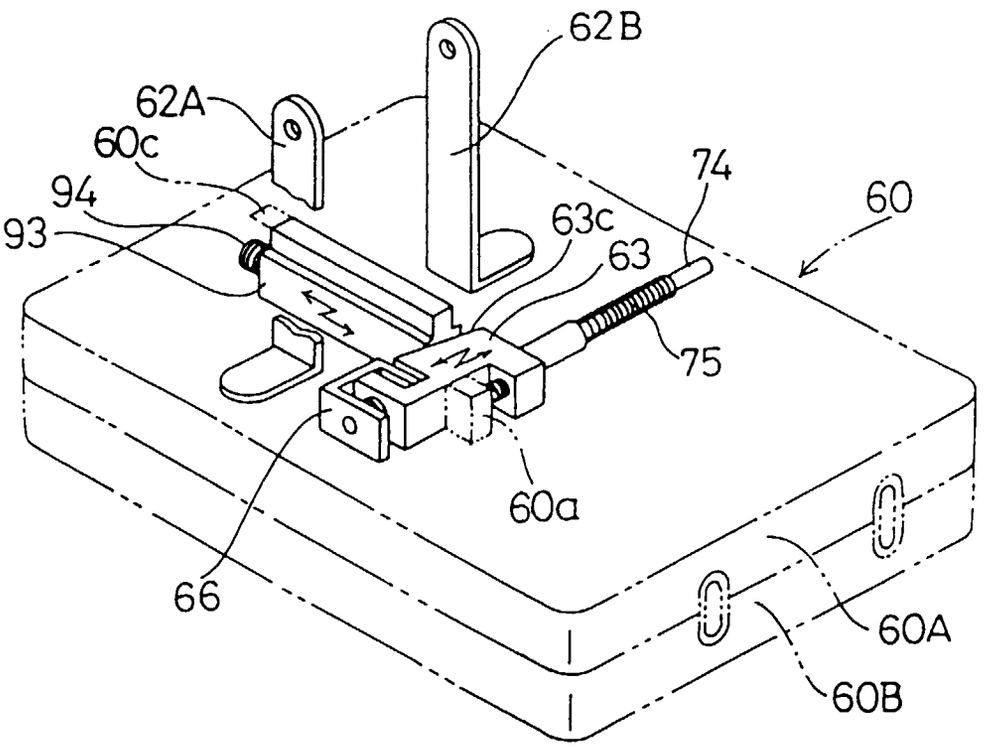
62B
62A
60c
74
94
60
93
63c
63
75
60a
66
60A
60B

FIG. 34

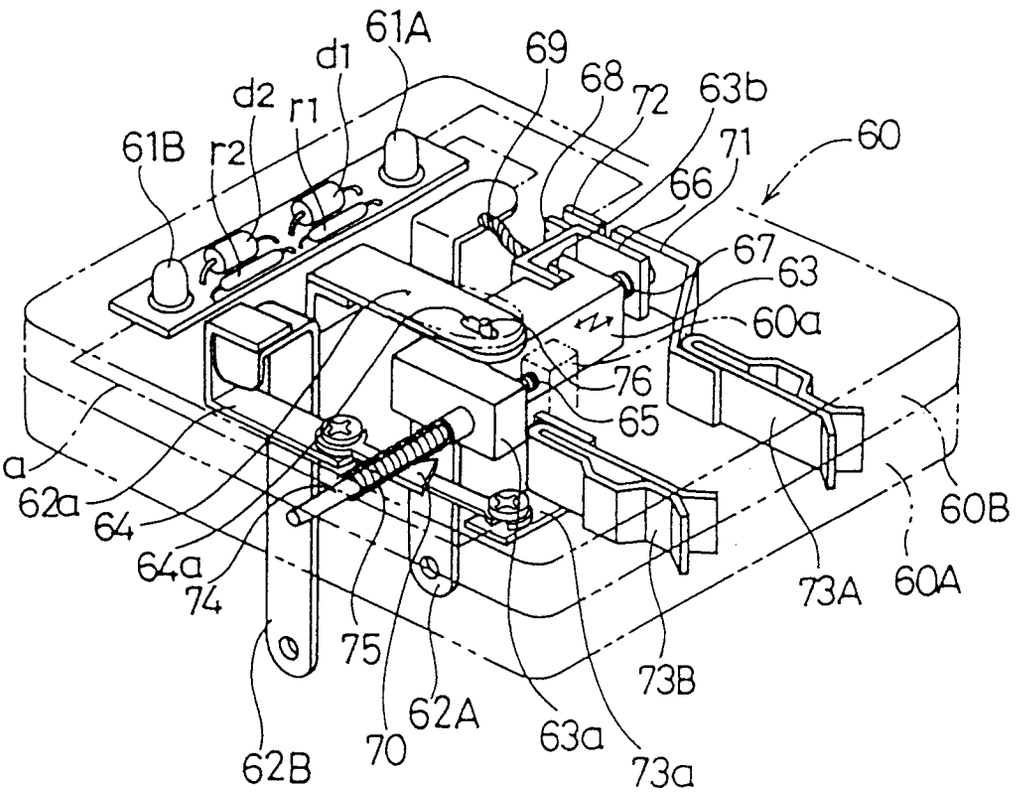
61A
d1
69
68
72
63b
d2
r1
61B
r2
71
60
66
67
63
60a
76
65
a
62a
64
64a
74
75
62A
70
62B
63a
73a
73B
73A
60A
60B

FIG. 35

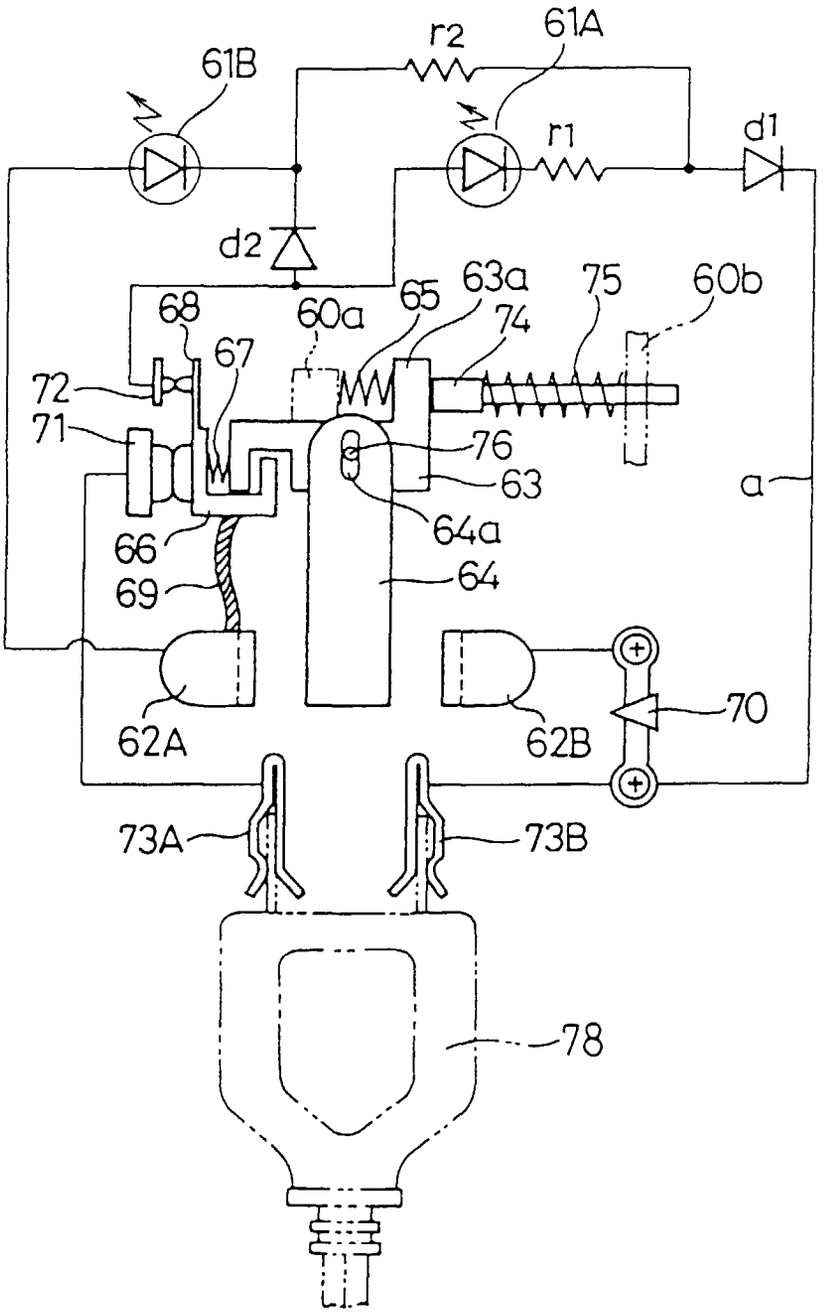
r2
61A
61B
r1
d1
d2
63a
75
60b
68
60a
65
74
67
72
71
76
63
a
64a
66
64
69
70
62A
62B
73A
73B
78

FIG. 36

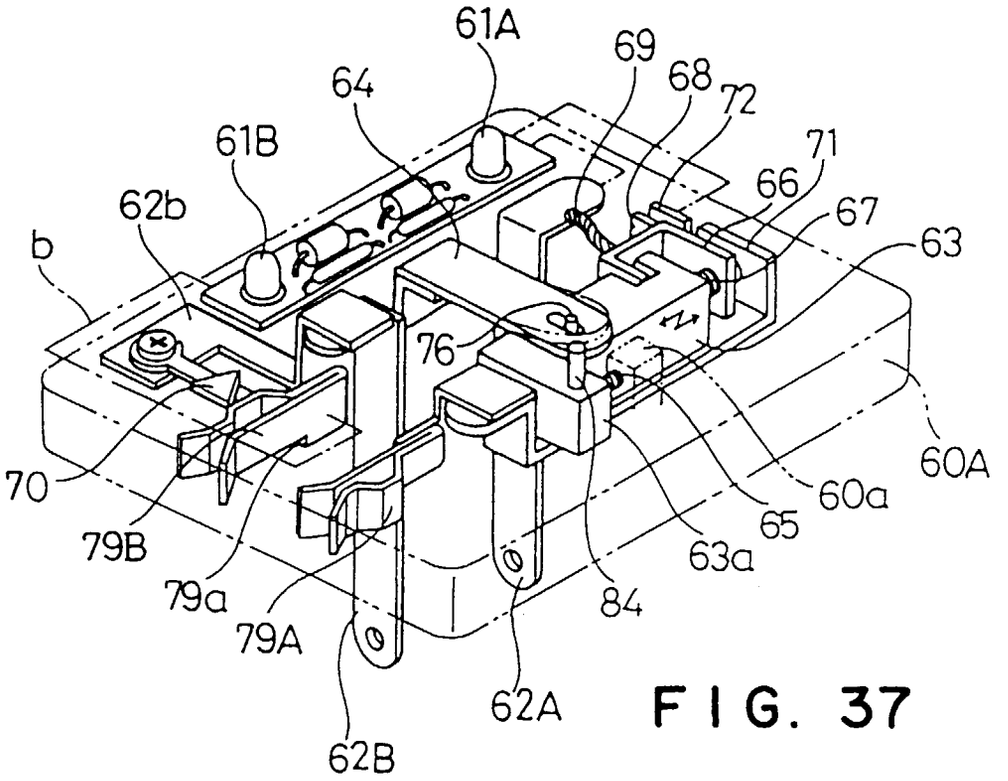
61A
69
68
72
64
61B
71
66
62b
67
b
63
76
60A
70
60a
65
79B
63a
79a
84
79A
62A
62B

FIG. 37

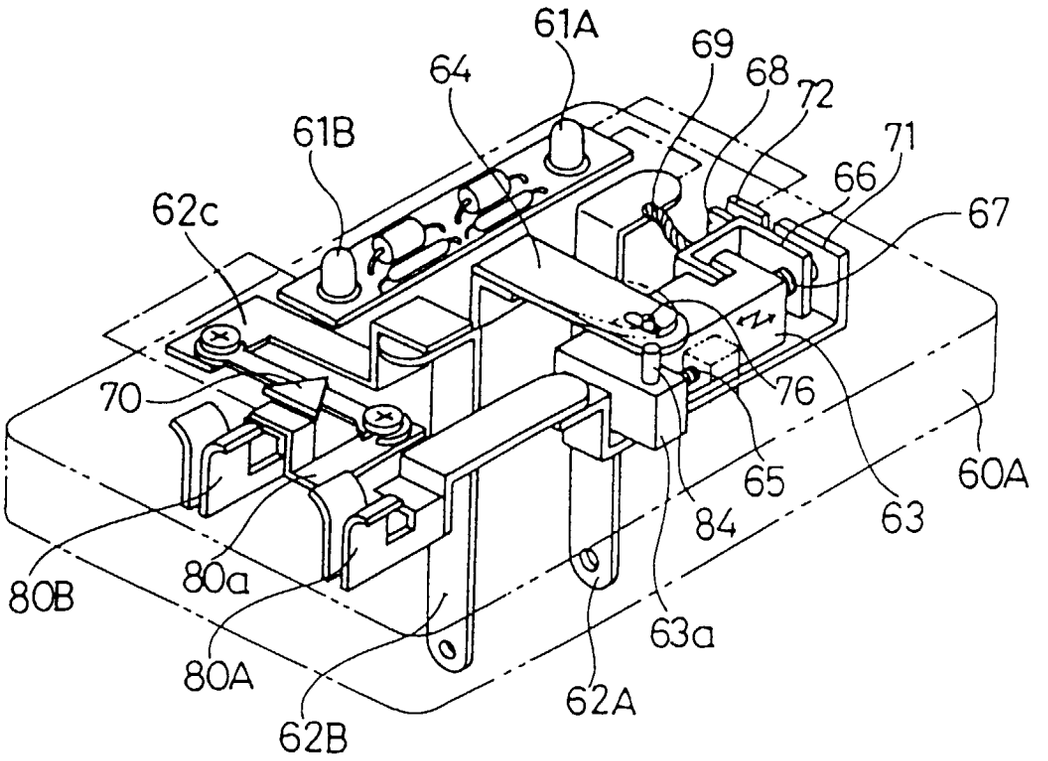
61A
69
64
68
72
61B
71
66
62c
67
76
70
65
60A
84
63
80B
80a
63a
80A
62A
62B

FIG. 38

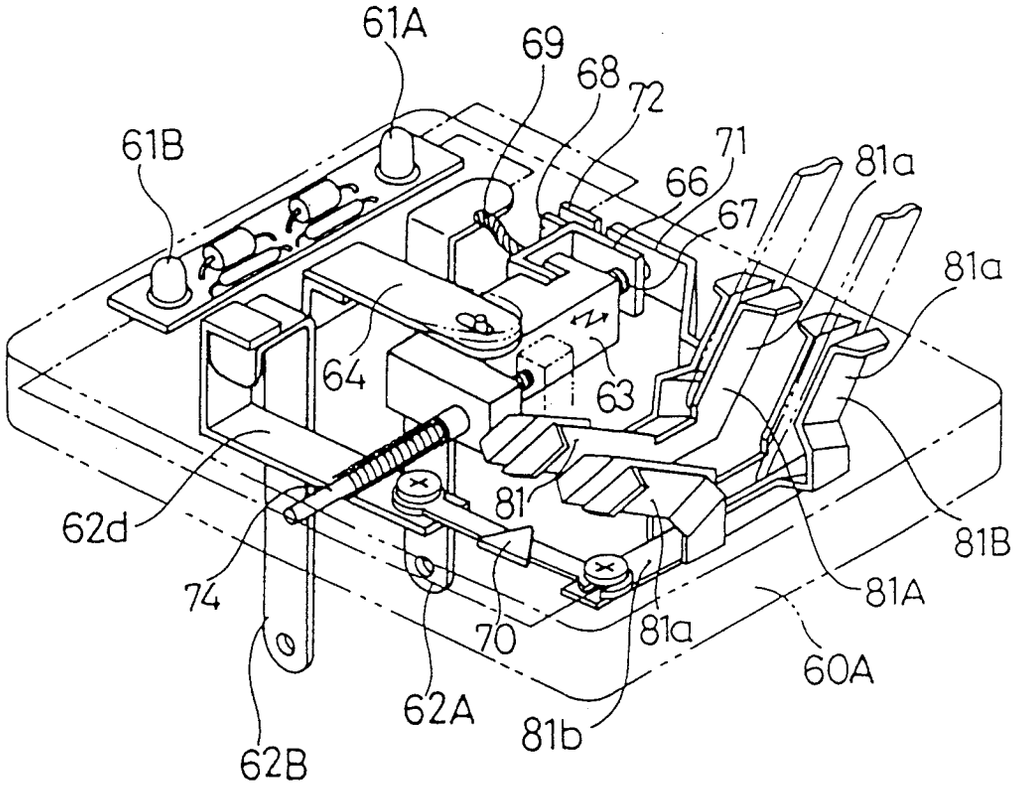
61A
69
68
72
71
66
67
81a
61B
64
63
81a
62d
81
81B
74
70
81A
81a
60A
62A
81b
62B

FIG. 39

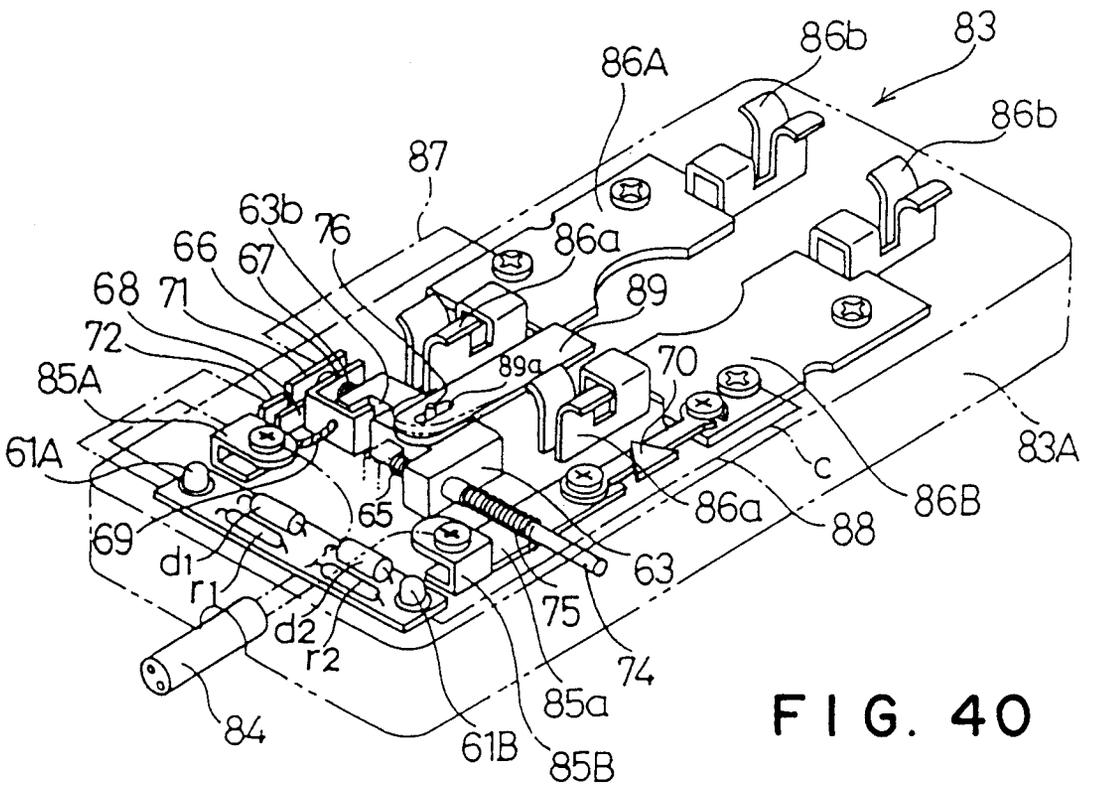
86b
83
86A
86b
87
63b
76
86a
66
67
68
71
89
72
89a
70
85A
61A
c
83A
65
86a
86B
69
88
d1
r1
63
75
d2
r2
74
85a
84
61B
85B

FIG. 40

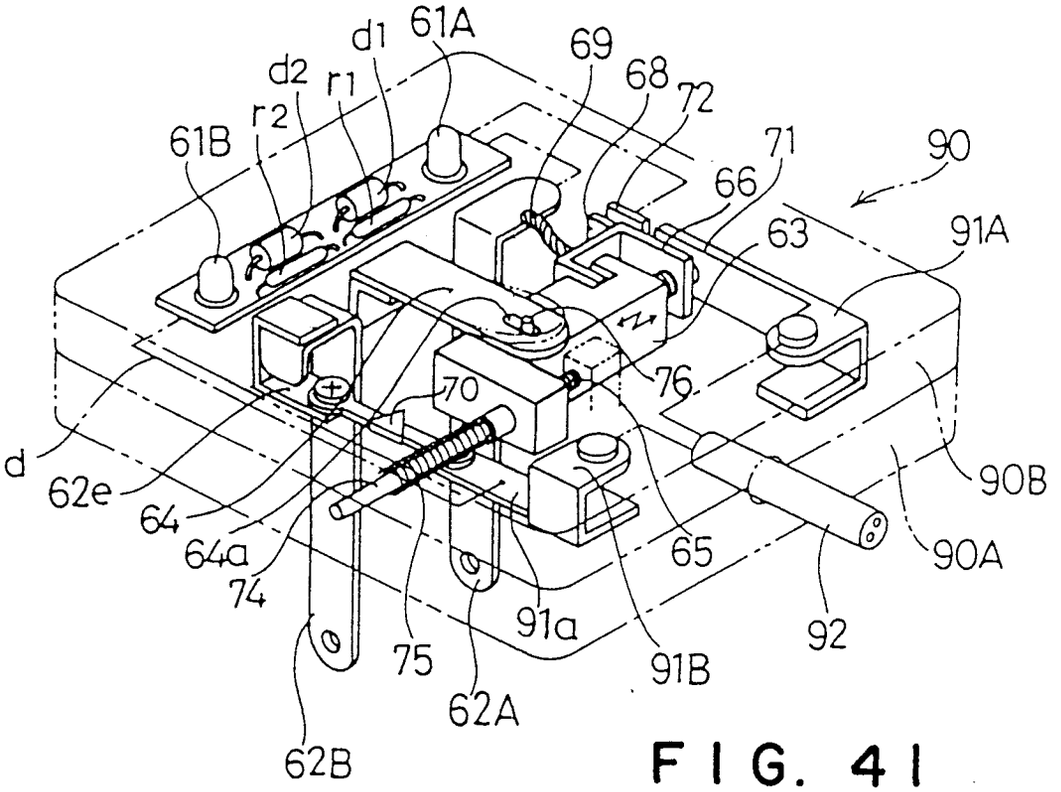
d1
61A
69
d2
r1
68
72
r2
61B
71
90
66
63
91A
76
70
d
62e
64
64a
74
65
90B
90A
91a
92
75
91B
62A
62B

FIG. 41

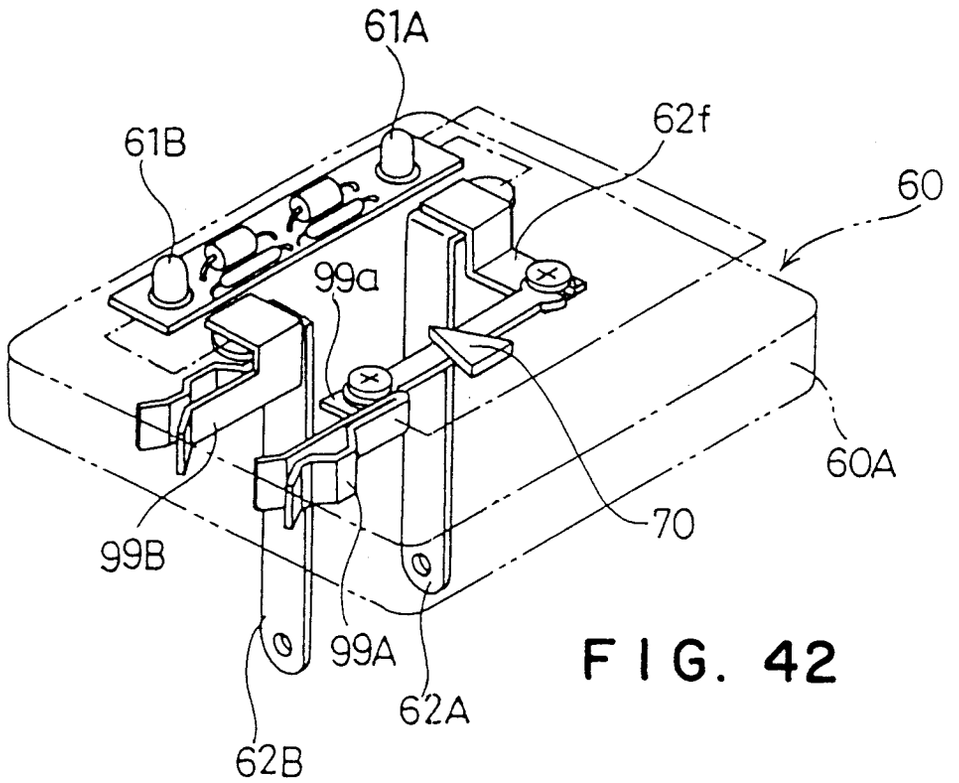
61A
62f
61B
60
99a
60A
70
99B
99A
62A
62B

FIG. 42

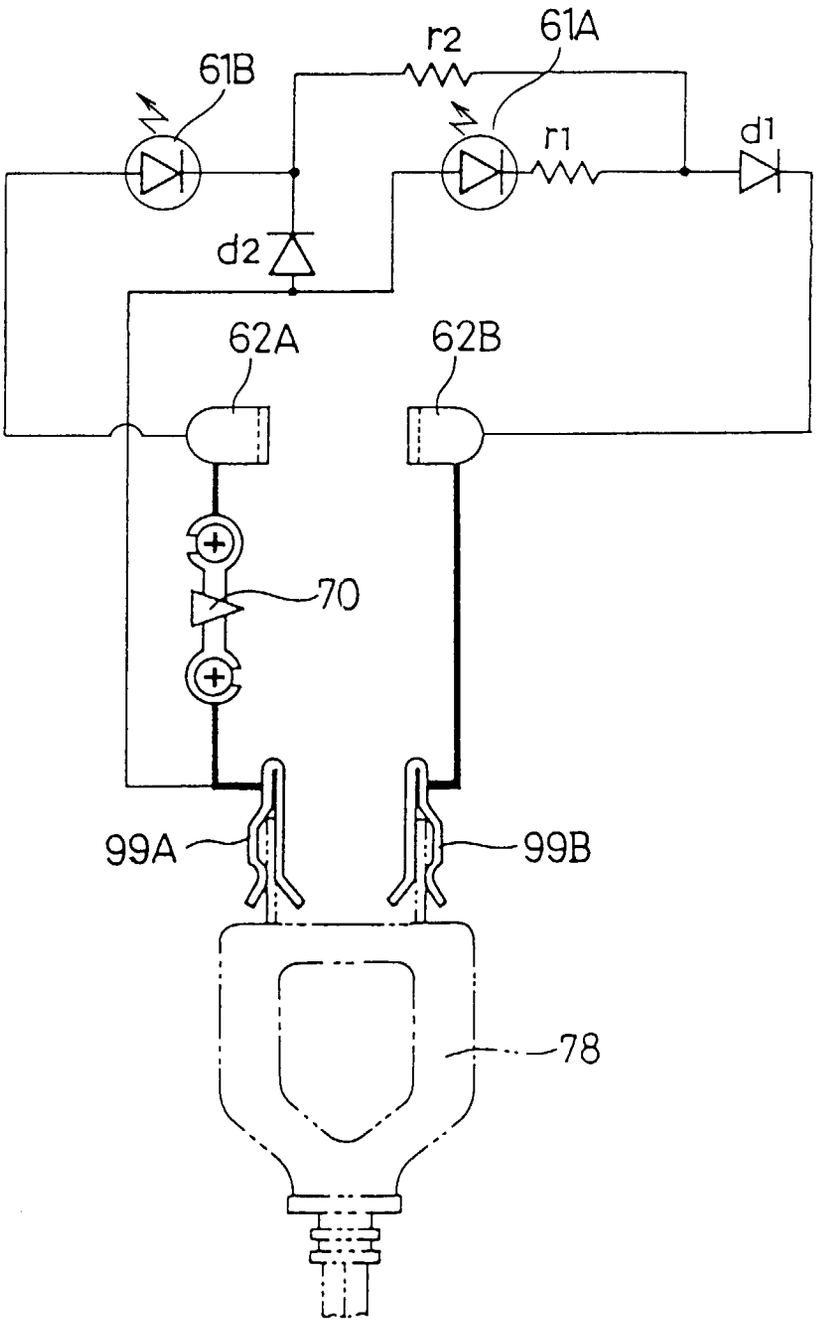

FIG. 43

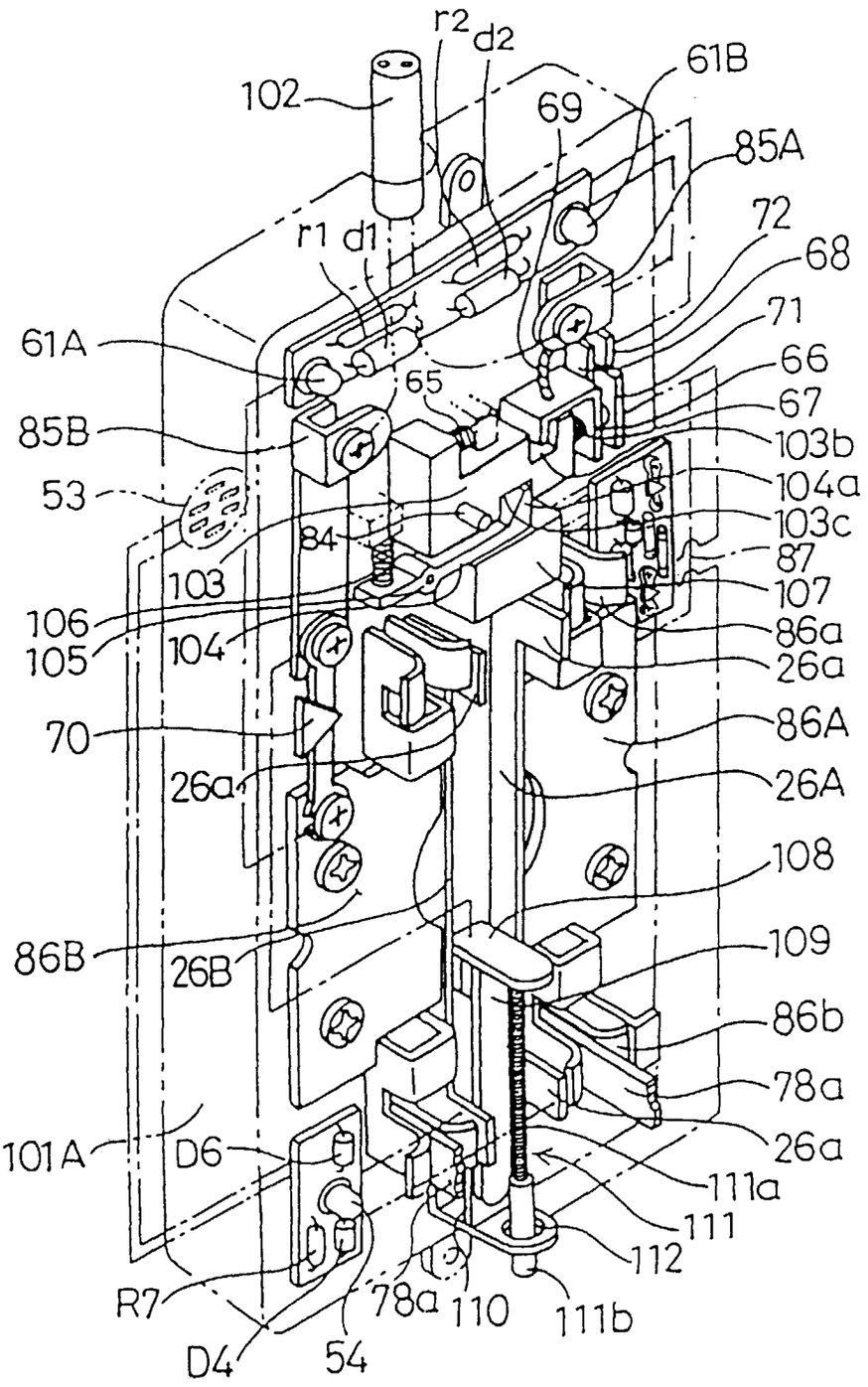
r2
d2
61B
102
69
85A
72
r1
d1
68
71
61A
66
65
67
85B
103b
53
104a
103c
84
87
103
107
106
86a
105
104
26a
70
86A
26a
26A
108
86B
26B
109
86b
78a
101A
D6
26a
111a
111
112
R7
78a
110
111b
D4
54

FIG. 44

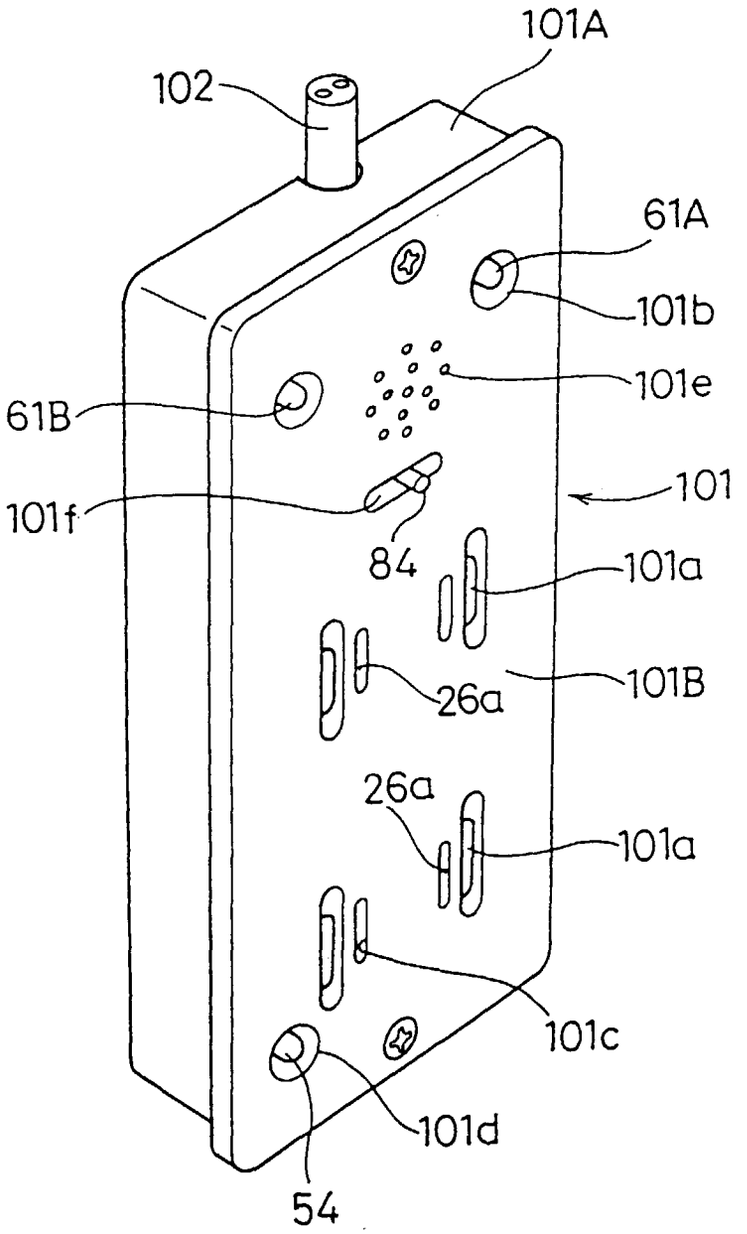
101A
102
61A
101b
101e
61B
101
101f
84
101a
101B
26a
26a
101a
101c
101d
54

FIG. 45

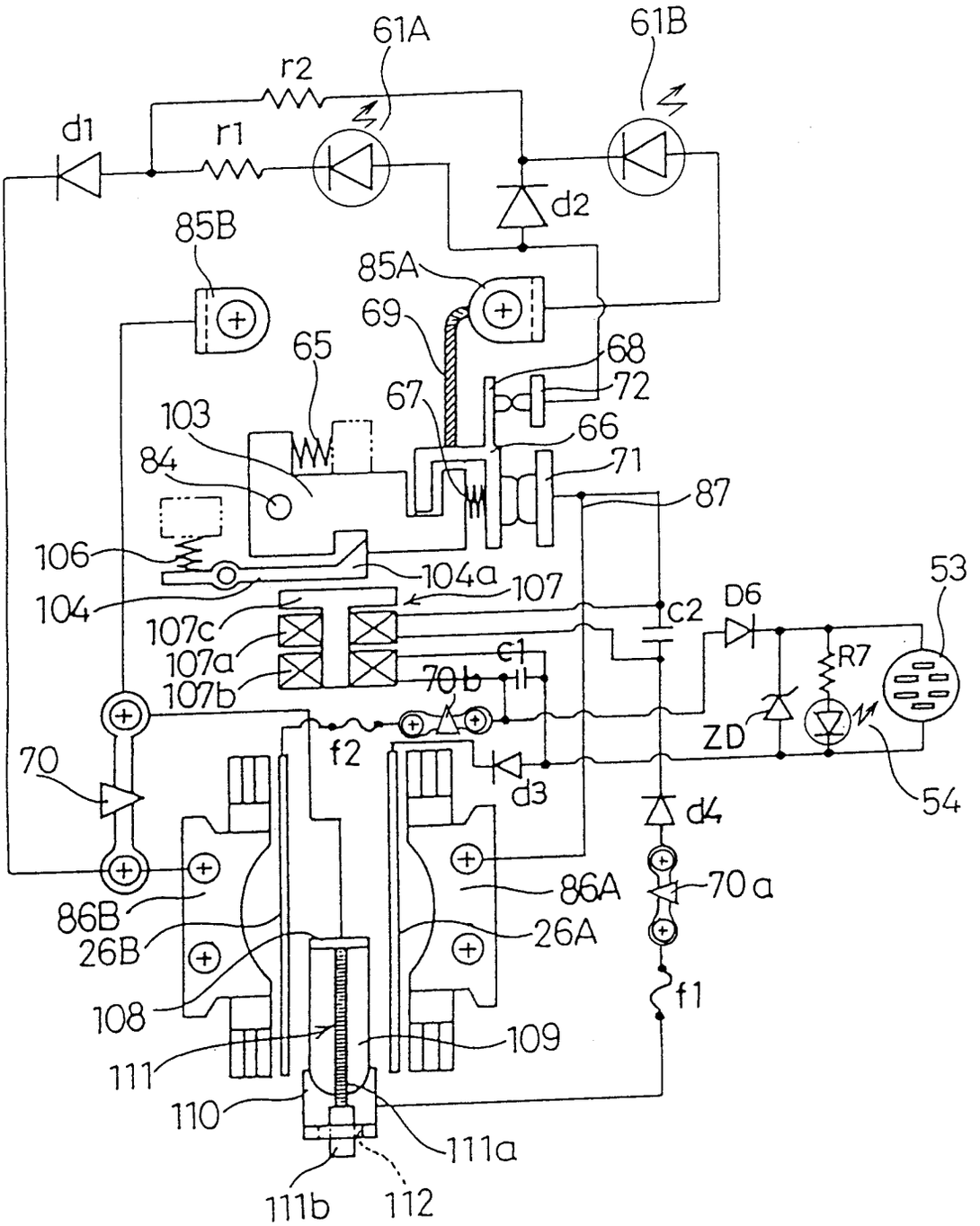
61A
61B
r2
d1
r1
d2
85B
85A
69
65
68
72
67
103
66
84
71
87
106
104a
107
104
53
107c
c2
D6
107a
c1
R7
107b
70b
ZD
70
f2
d3
54
d4
86A
70a
86B
26B
26A
f1
108
109
111
110
111a
111b
112

FIG. 46

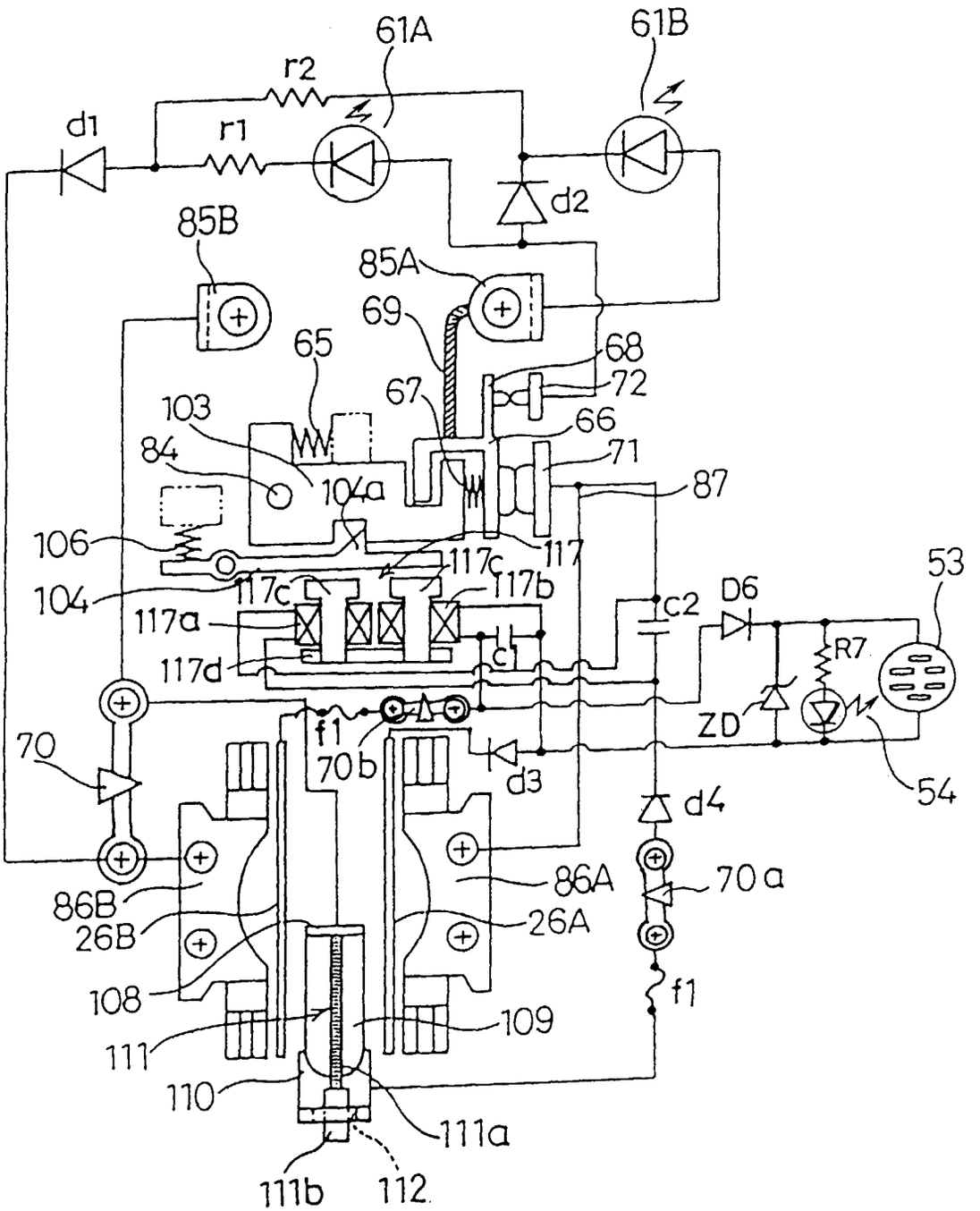
61A
61B
r2
d1
r1
d2
85B
85A
69
65
68
72
67
103
66
84
71
104a
87
106
117c
117
104
117c
117b
53
117a
c2
D6
117d
c1
R7
ZD
f1
70
70b
d3
54
d4
86A
70a
86B
26B
26A
108
f1
109
111
110
111a
111b
112

FIG. 47

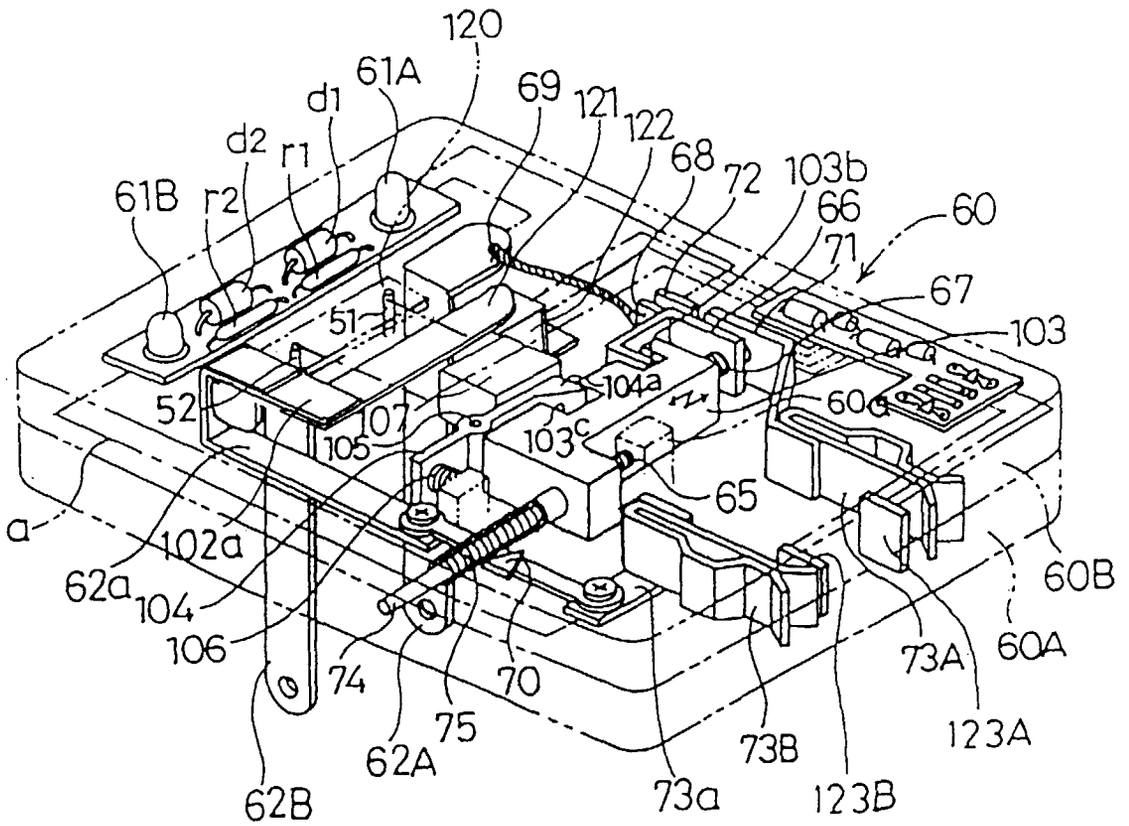
120
61A
d1
69
121
122
68
72
103b
66
60
d2
r1
61B
r2
71
67
51
103
52
104a
60c
107
105
103c
65
a
102a
62a
104
106
74
70
75
62A
62B
73a
73B
123B
123A
73A
60A
60B

FIG. 48

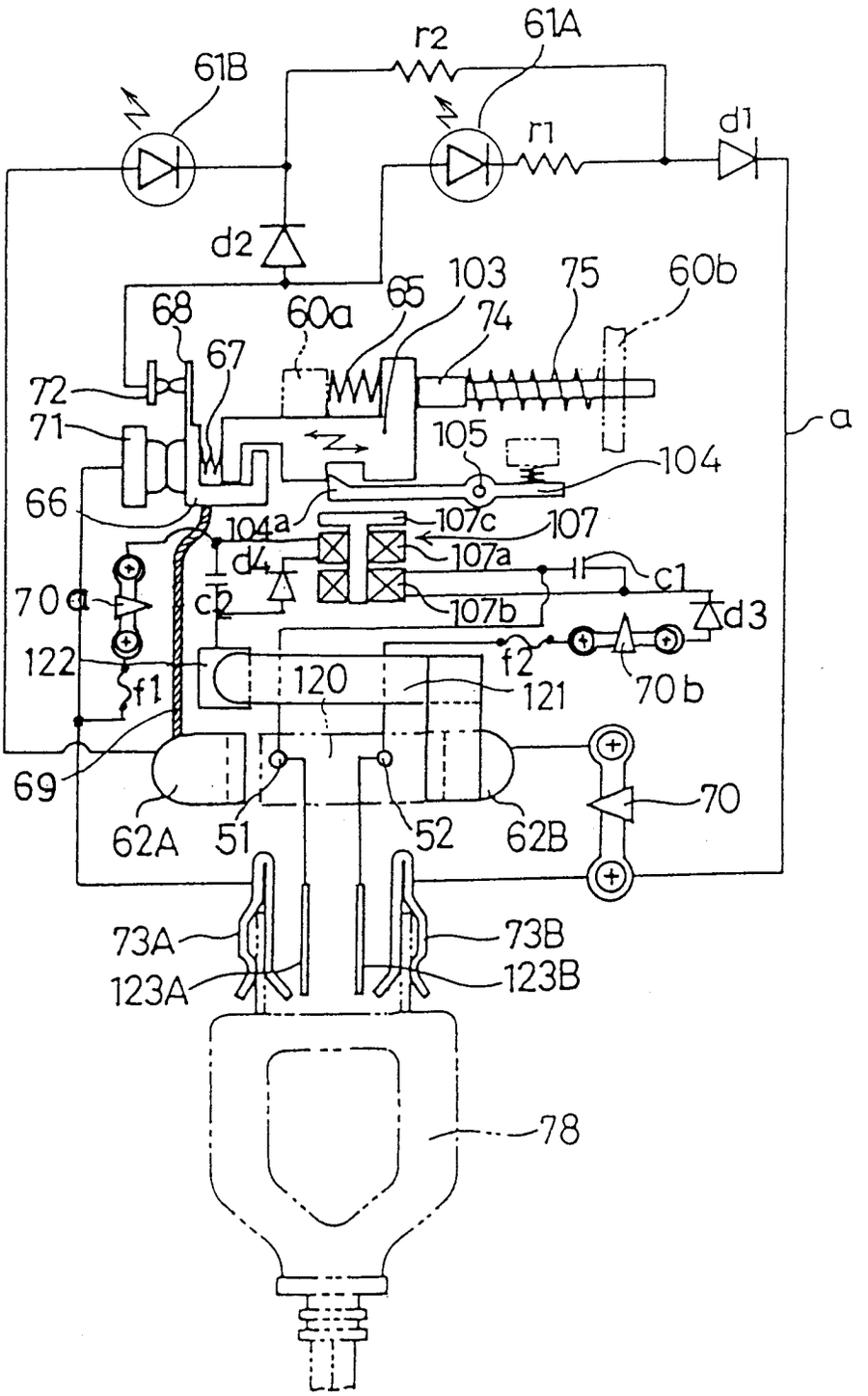
61B
r2
61A
r1
d1
d2
68
60a
65
103
74
75
60b
67
72
71
105
104
a
66
104a
107c
107
107a
d4
c1
70a
c2
107b
d3
122
f1
120
f2
121
70b
69
62A
51
52
62B
70
73A
73B
123A
123B
78

FIG. 49

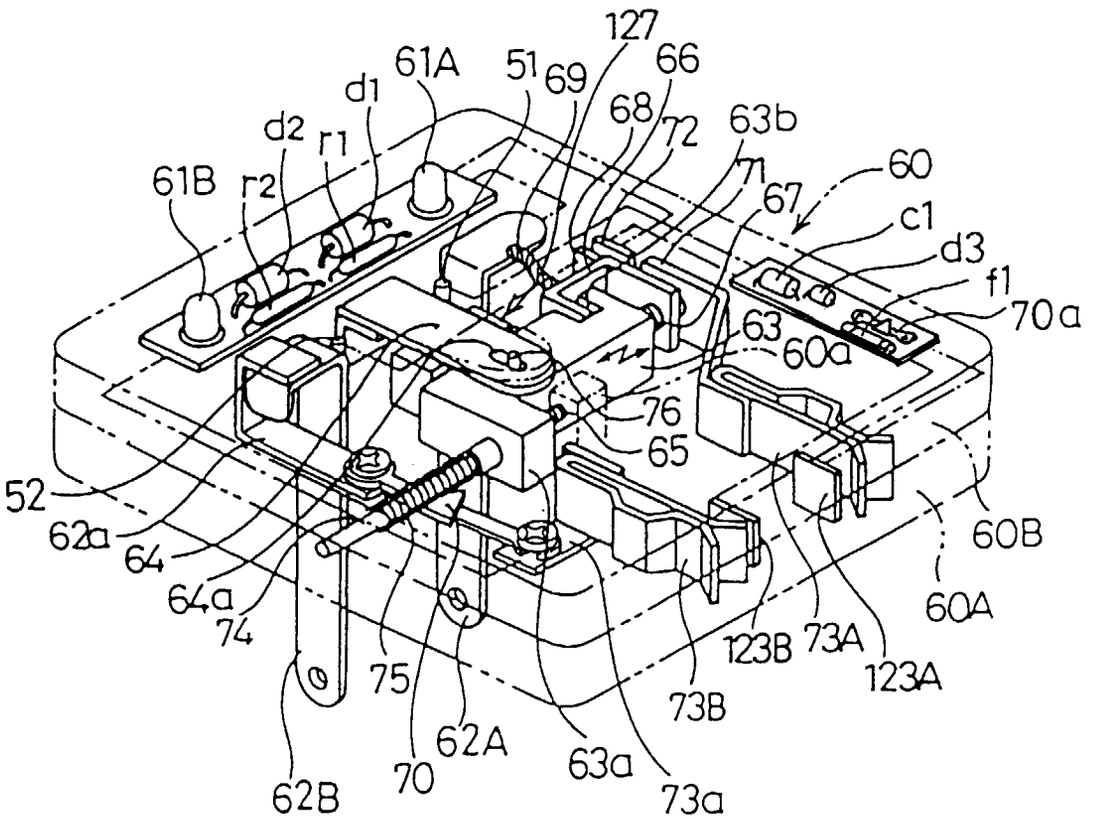
127
66
61A
51
69
d1
68
72
63b
d2
r1
71
60
61B
r2
67
c1
d3
f1
70a
63
60a
76
65
52
62a
64
60B
64a
74
60A
123B
73A
123A
75
73B
62A
63a
62B
70
73a

FIG. 50

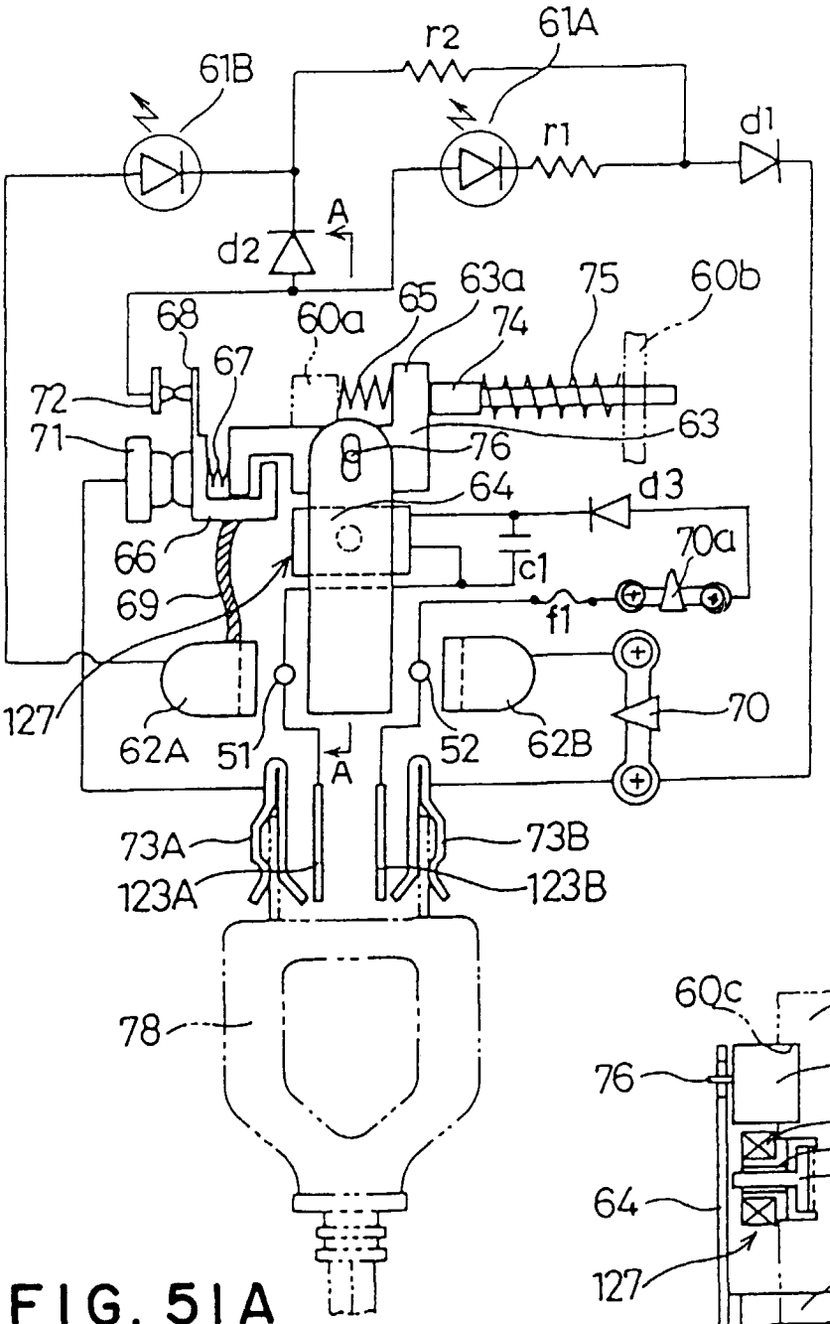

FIG. 51A

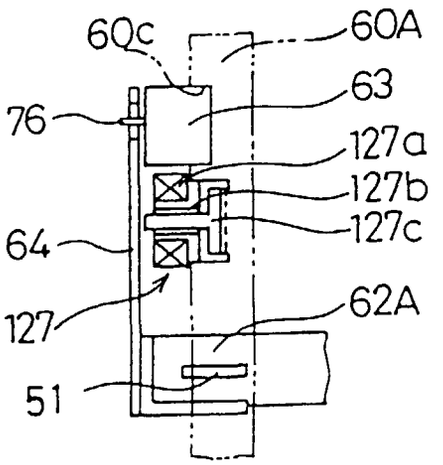

FIG. 51B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP96/02247

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl^6 H01R13/66, 13/68, 13/713, 13/717, 25/00

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)
Int. Cl^6 H01R13/66-13/717, 25/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926 - 1996
Kokai Jitsuyo Shinan Koho 1971 - 1994
Toroku Jitsuyo Shinan Koho 1994 - 1996

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP, 36-21316, Y1 (Toshio Matsumoto), August 17, 1961 (17. 08. 61)(Family: none)	1, 2, 10-12 6-8, 13-17
Y A	JP, 51- 152680, U (Matsushita Electric Works, Ltd.), December 6, 1976 (06. 12. 76)(Family: none)	1, 4, 10-12 6-9, 13-22
Y A	JP, 51-684, A (Ryuzo Uchida), January 6, 1976 (06. 01. 76)(Family: none)	1, 4, 10-12 6-9, 13-17, 25-29
Y A	JP, 54-88694, U (Nippon Seimitsu Keisoku K.K.), June 22, 1979 (22. 06. 79)(Family: none)	2, 5, 10-12 6-9, 13-17, 23, 24
X Y A	JP, 54-36082, U (Yoshihisa Sato), March 9, 1979 (09. 03. 79)(Family: none)	3 4, 5, 10-12 6-9, 13-17
A	JP, 59-26533, Y2 (Kurashige Denko K.K.), August 1, 1984 (01. 08. 84)(Family: none)	6-9, 13-17, 27-29, 31-33

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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"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
October 28, 1996 (28. 10. 96)	November 5, 1996 (05. 11. 96)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP96/02247

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP, 52-11190, U (Yukitomo Sato), January 26, 1977 (26. 01. 77)(Family: none)	18-22, 30-33
A	JP, 48-58988, U (Fuji Photo Film co., Ltd.), July 26, 1973 (26. 07. 73)(Family: none)	19 - 22

Form PCT/ISA/210 (continuation of second sheet) (July 1992)