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Fiorentino et al.

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(54) **PERSONAL COMPUTER POWER SUPPLY INSTALLED WITHIN A CASE OF A PERSONAL COMPUTER**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(22) Filed: **Sep. 8, 2004**

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Related U.S. Application Data

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(51) **Int. Cl.**
H05K 5/00 (2006.01)
H05K 5/04 (2006.01)
H05K 5/06 (2006.01)

(52) **U.S. Cl.** **361/752**; 361/724; 361/753; 361/823; 439/76.1

(58) **Field of Classification Search** 361/683, 361/687, 823 829, 727–730, 720–724; 307/128–139; 439/883, 76.1
See application file for complete search history.

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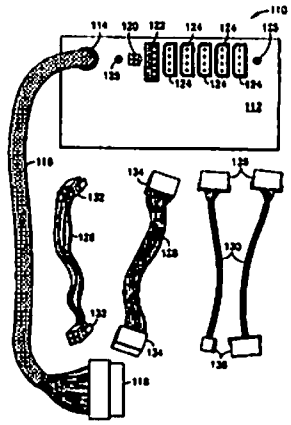
(57) **ABSTRACT**

The present invention relates to power supplies and methods of installing power supplies. More particularly, one embodiment of the present invention relates to a power supply adapted for installation within a computer case for receiving AC current from an AC current source and providing DC current from the power supply to a component disposed inside of the computer case via a removable cable attached to the power supply, comprising: a housing having an interior volume defined by a top panel, a bottom panel and a plurality of side panels; AC to DC circuitry disposed within the interior volume of the housing; and a DC output socket, wherein the DC output socket is fixed to one of the top panel, bottom panel and side panels defining the interior volume in which the AC to DC circuitry is disposed; wherein the AC to DC circuitry receives AC current from the AC current source; wherein the AC to DC circuitry converts the received AC current into DC current and supplies the DC current to the DC output socket; and wherein the DC output socket is fixed to one of the panels of the housing in a position such that when the power supply is installed within the computer case the DC output socket is disposed inside of the computer case for mating with the removable cable.

9 Claims, 20 Drawing Sheets



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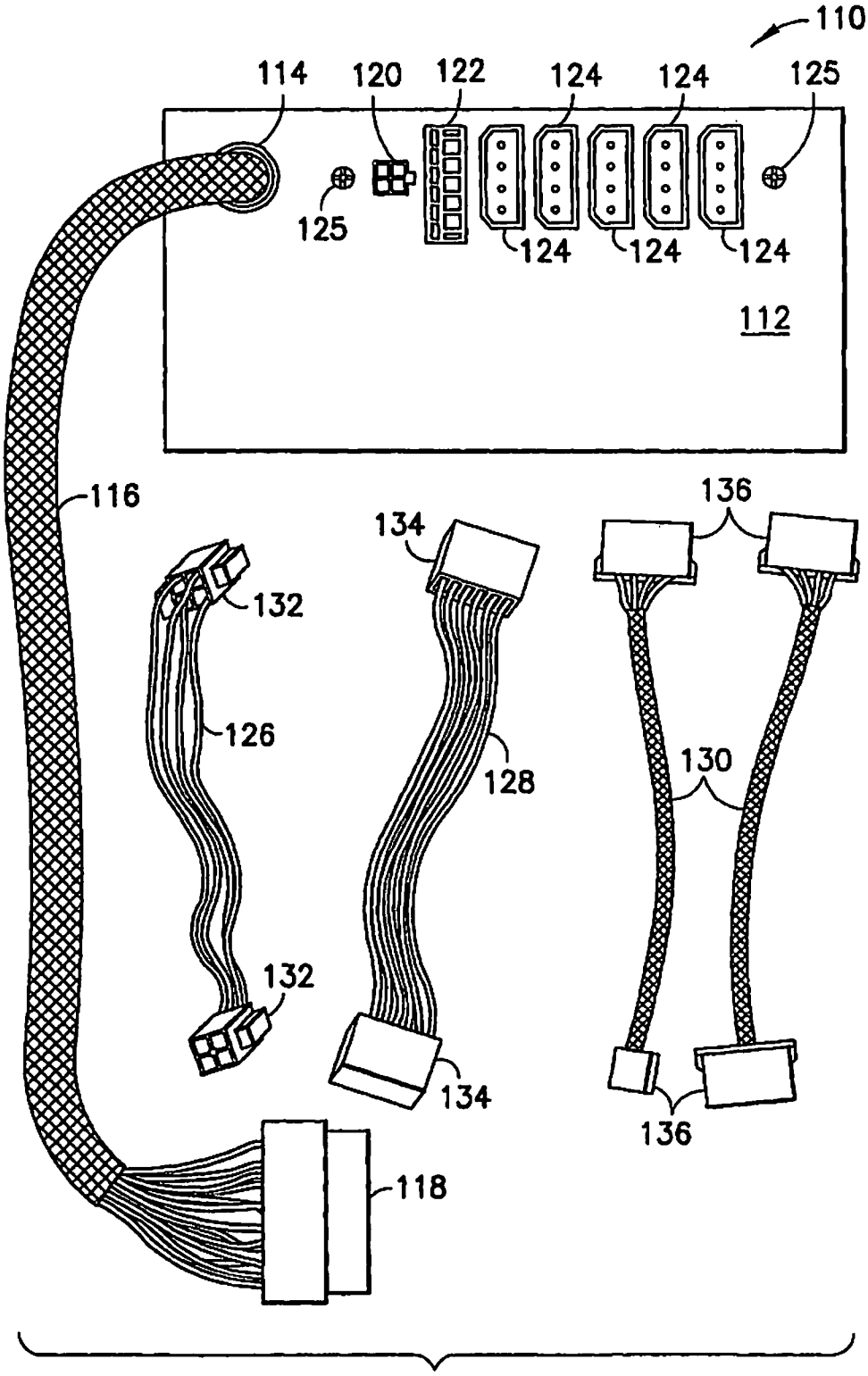
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FIG. 1

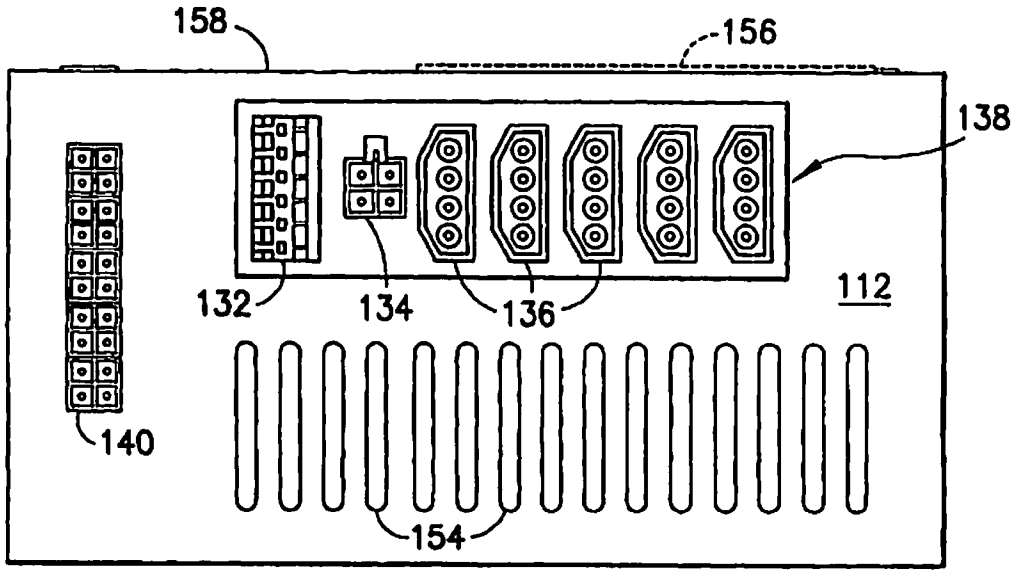


FIG.2

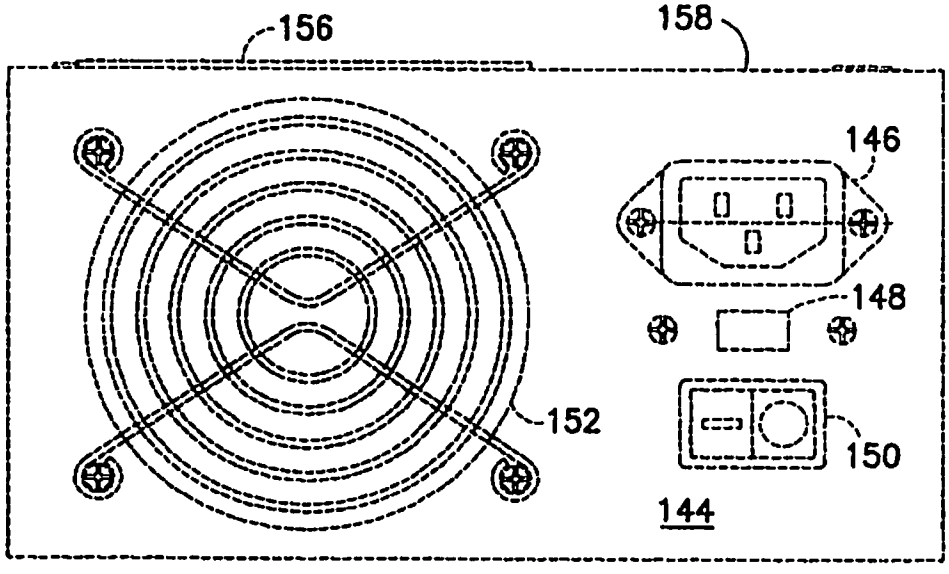
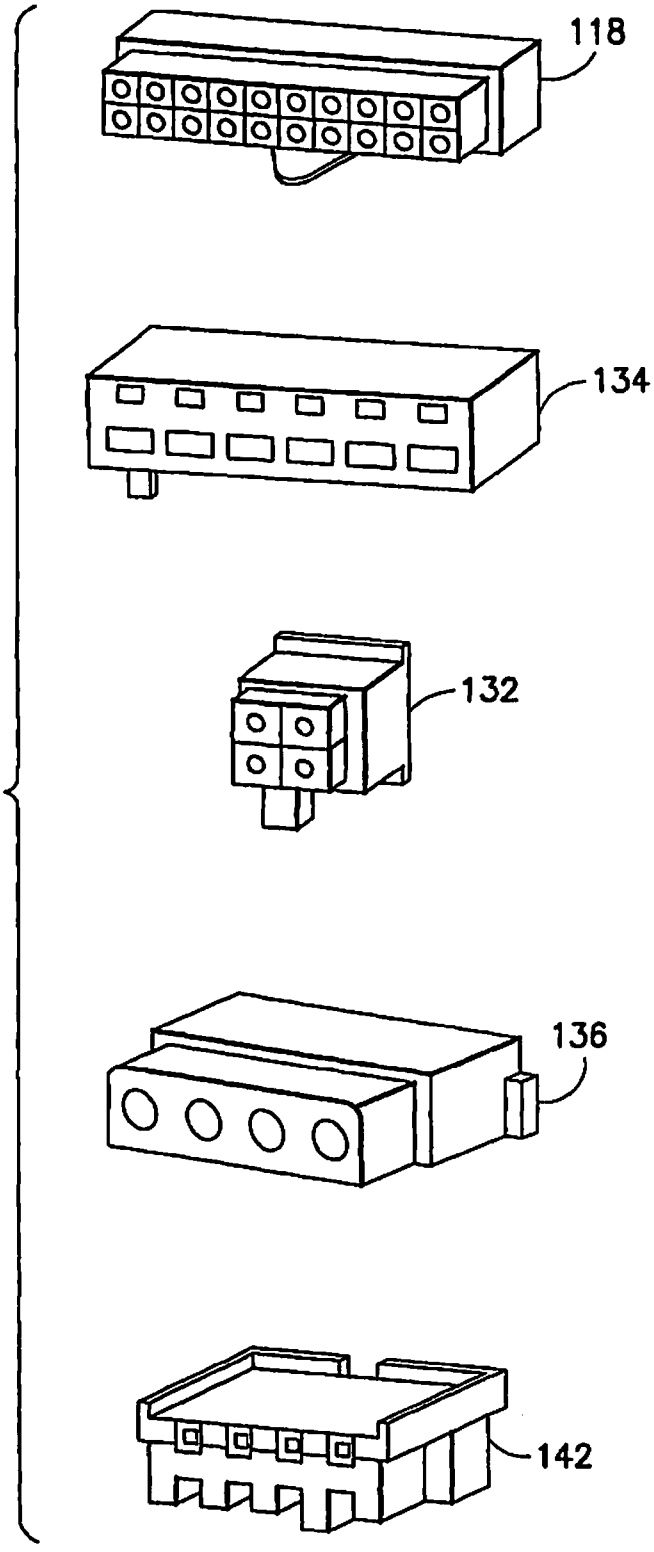


FIG.4

FIG.3



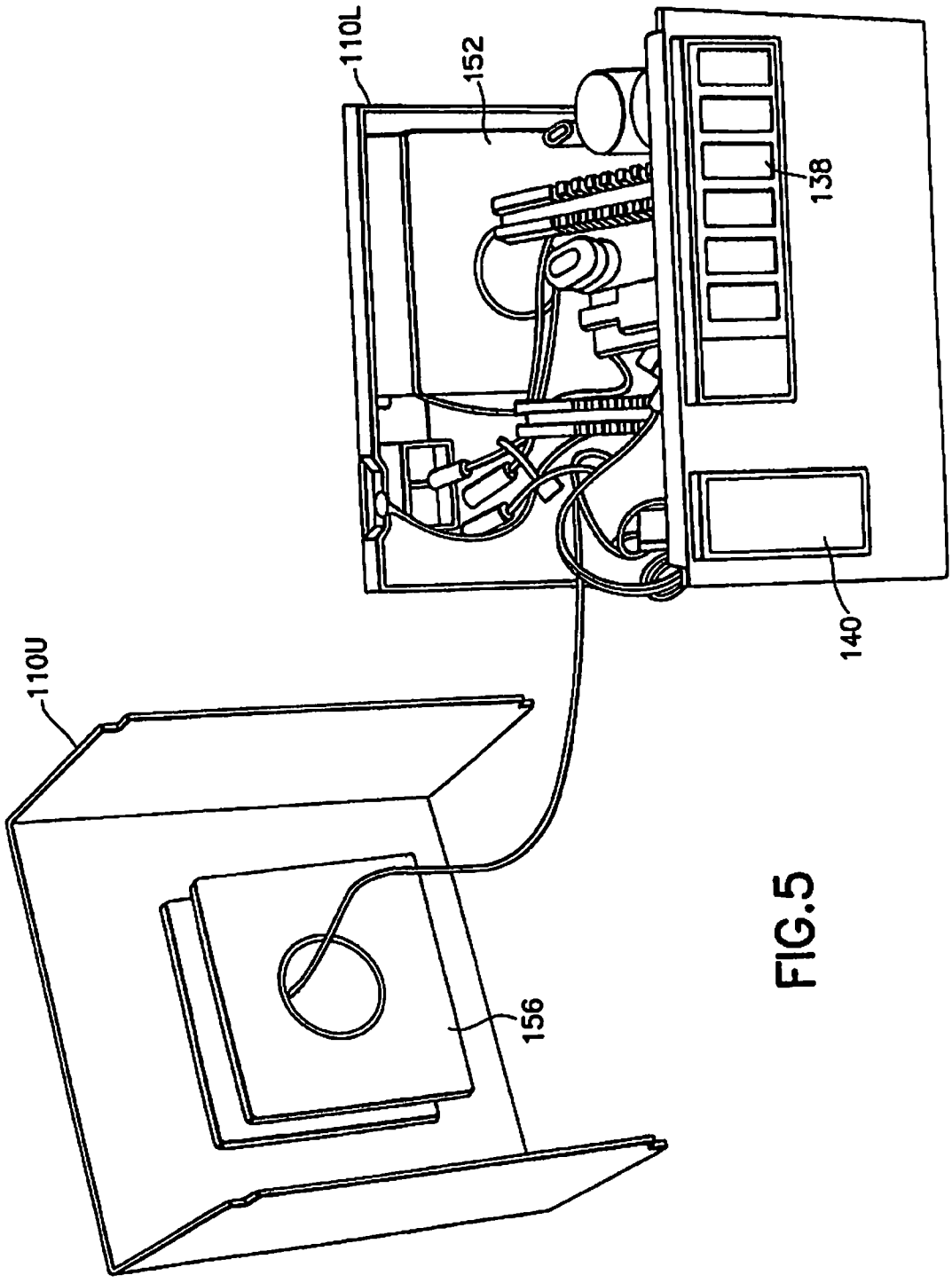


FIG.5

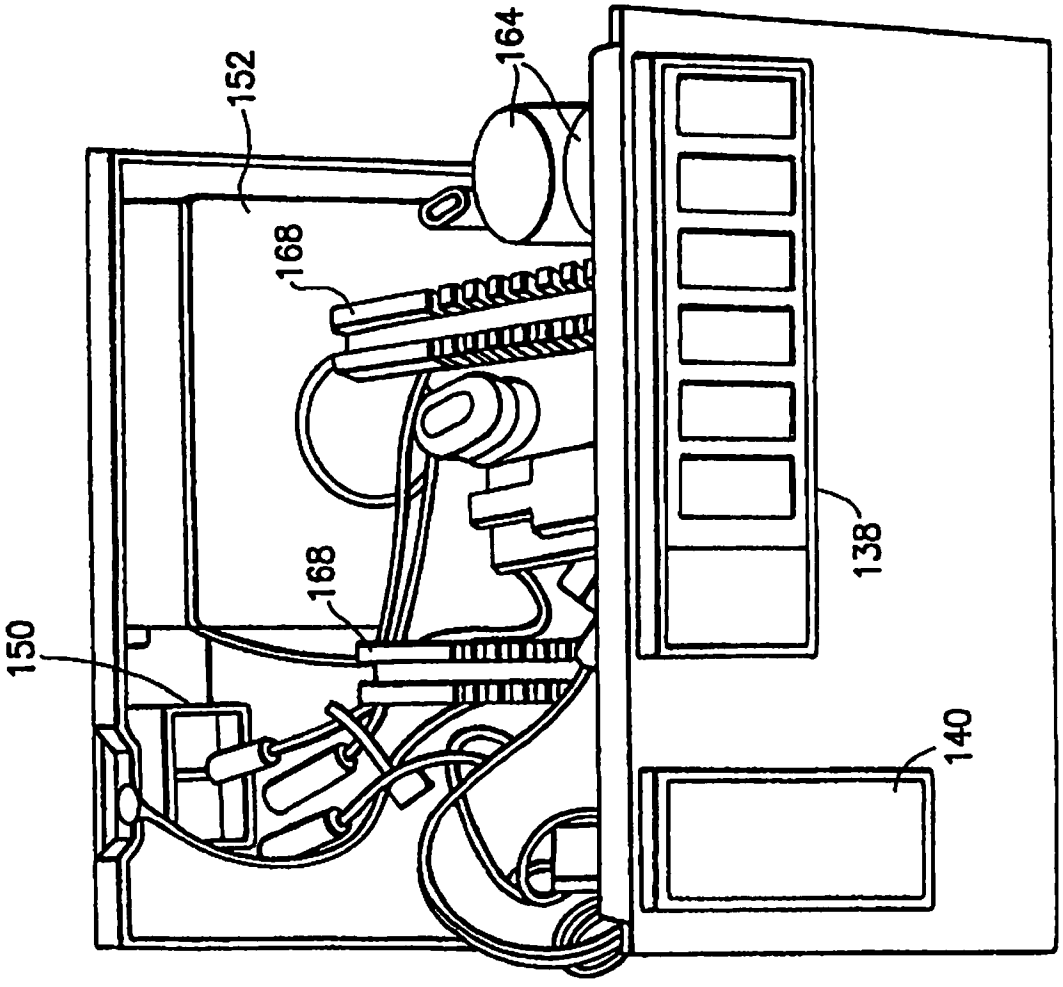


FIG.6A

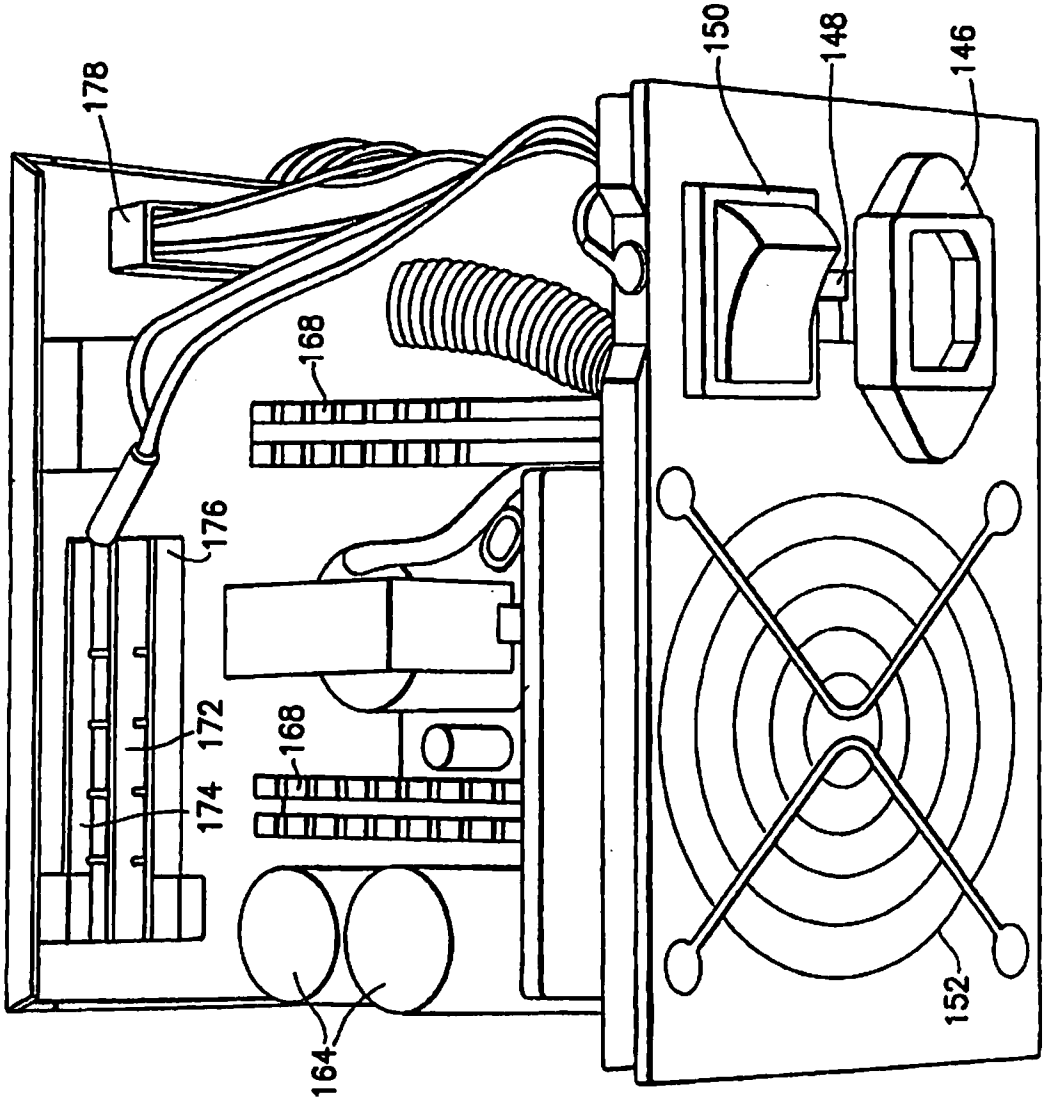


FIG.6B

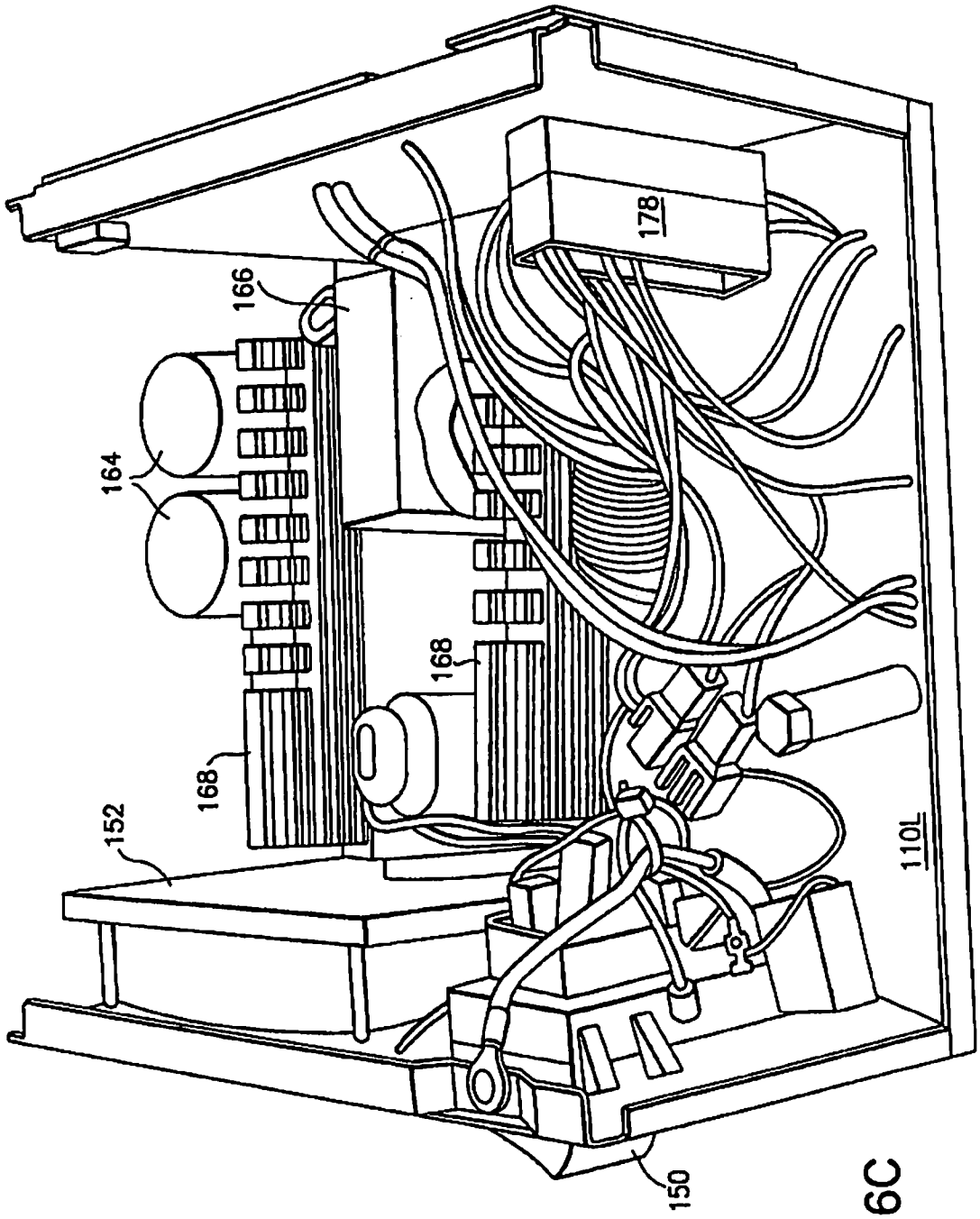


FIG.6C

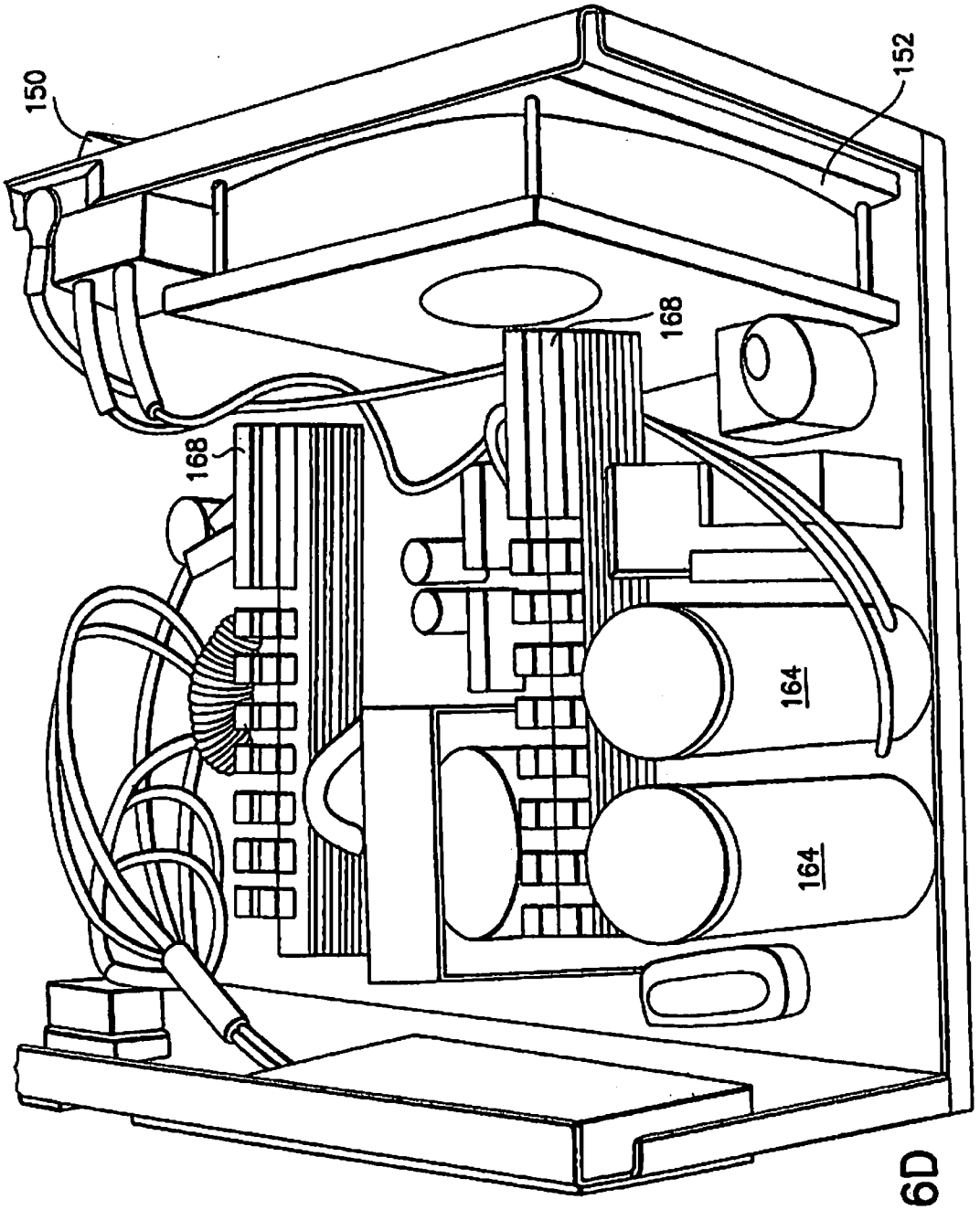


FIG.6D

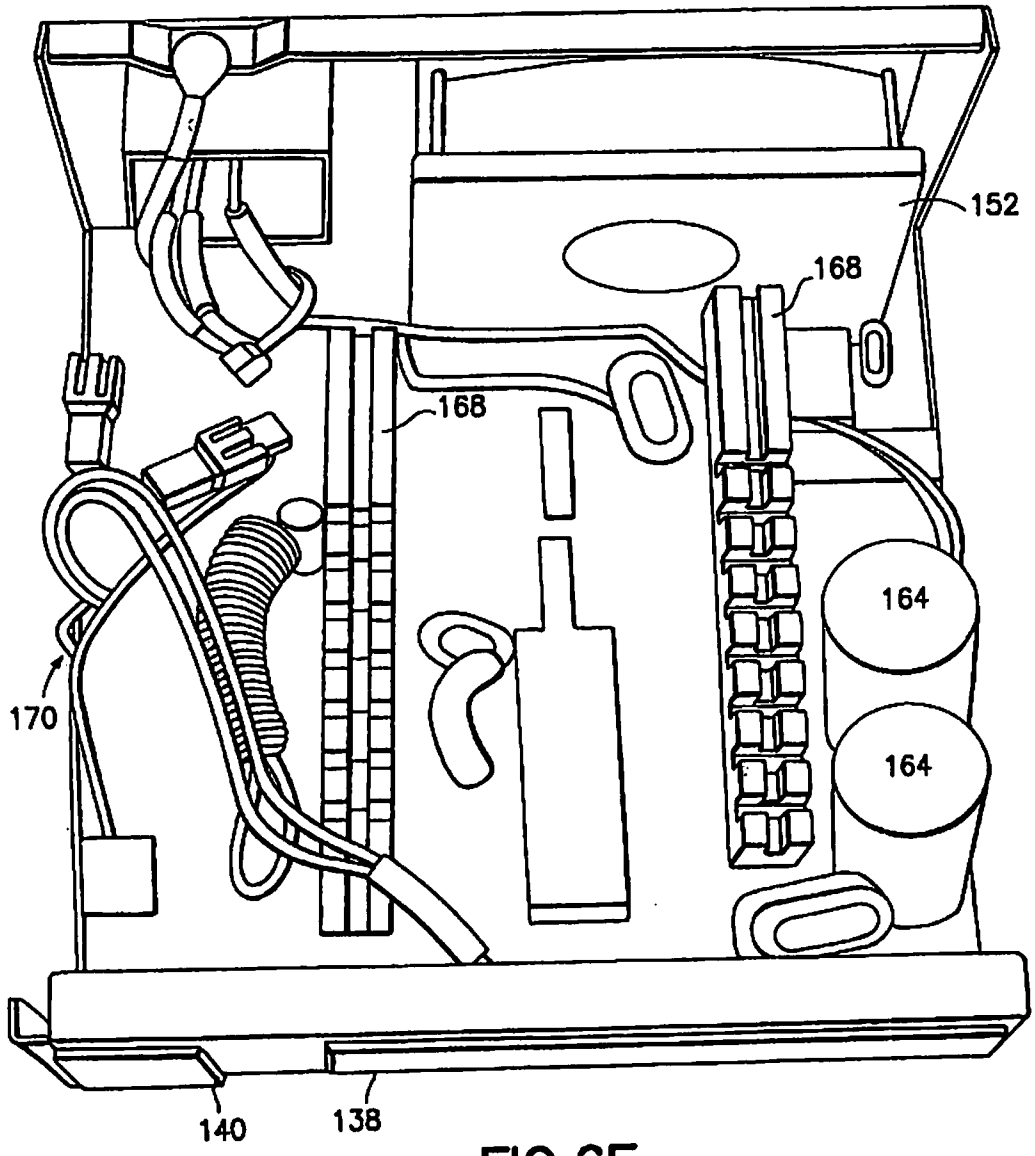


FIG.6E

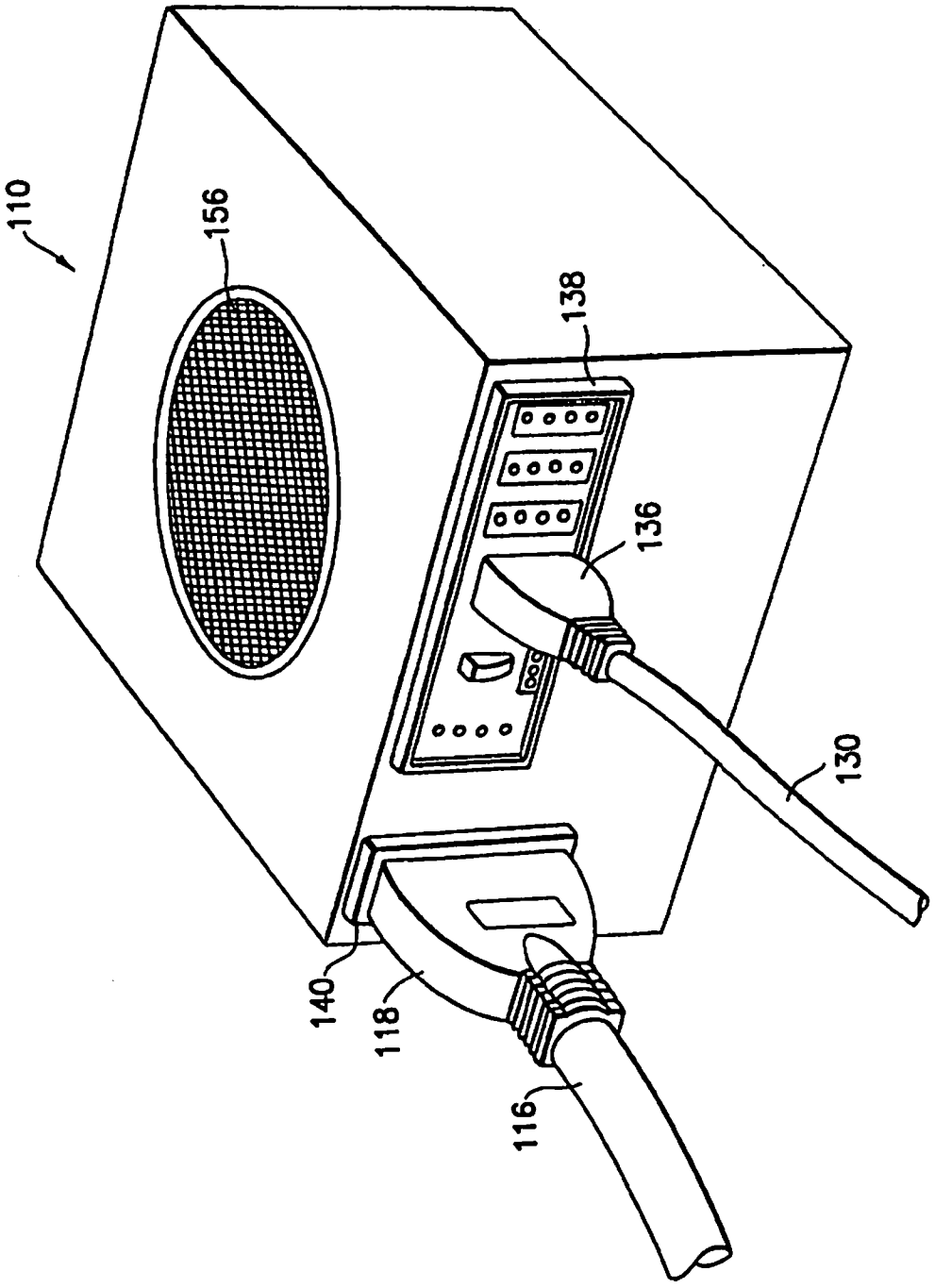


FIG.7

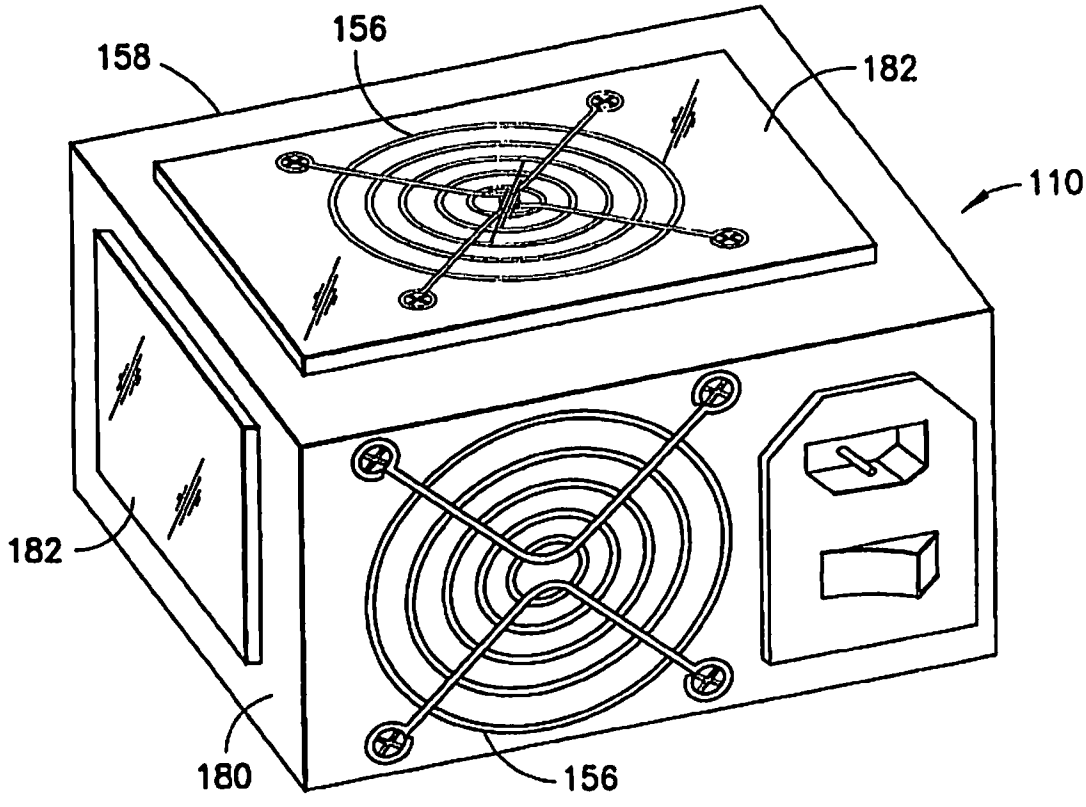


FIG.8

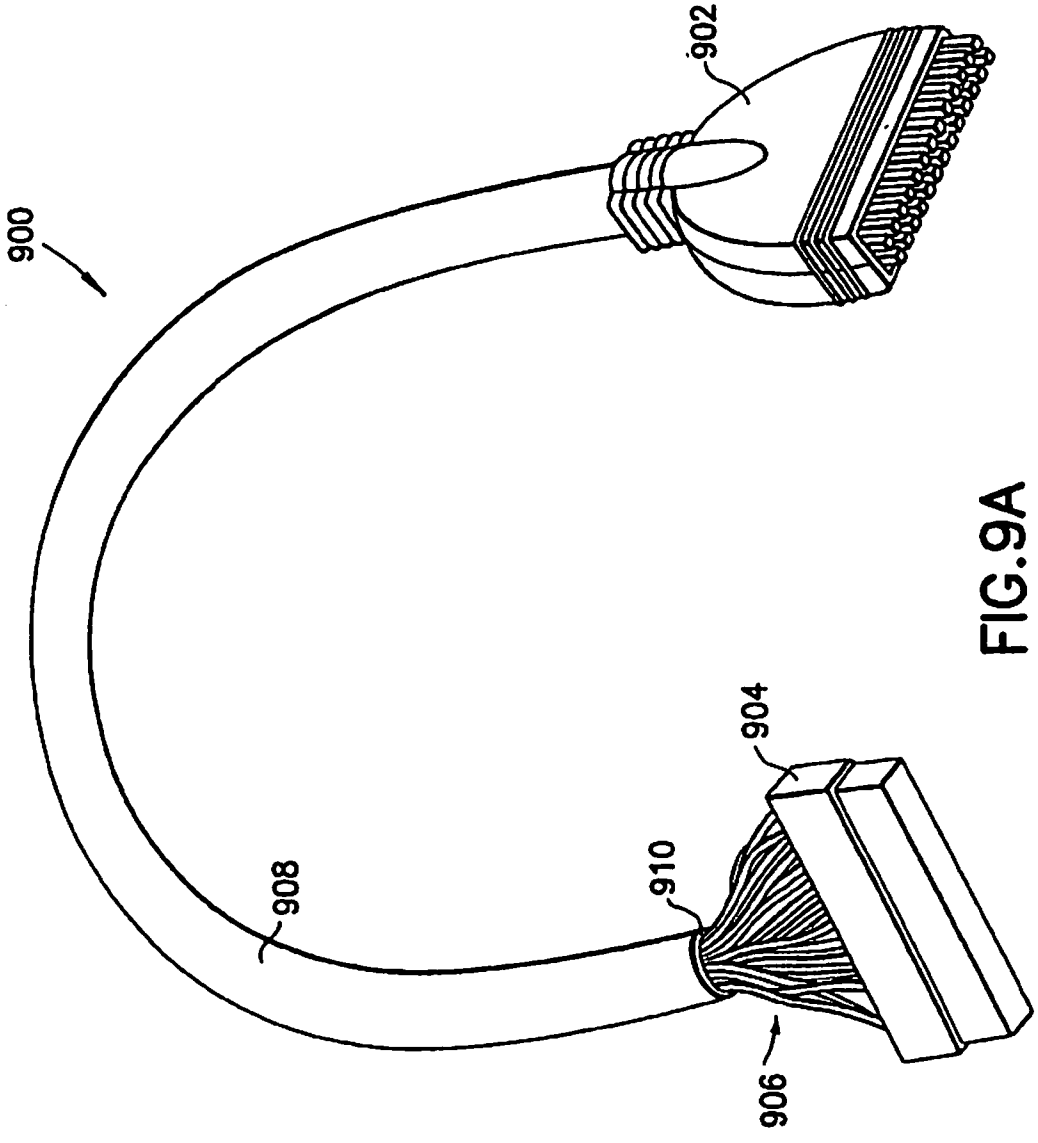


FIG.9A

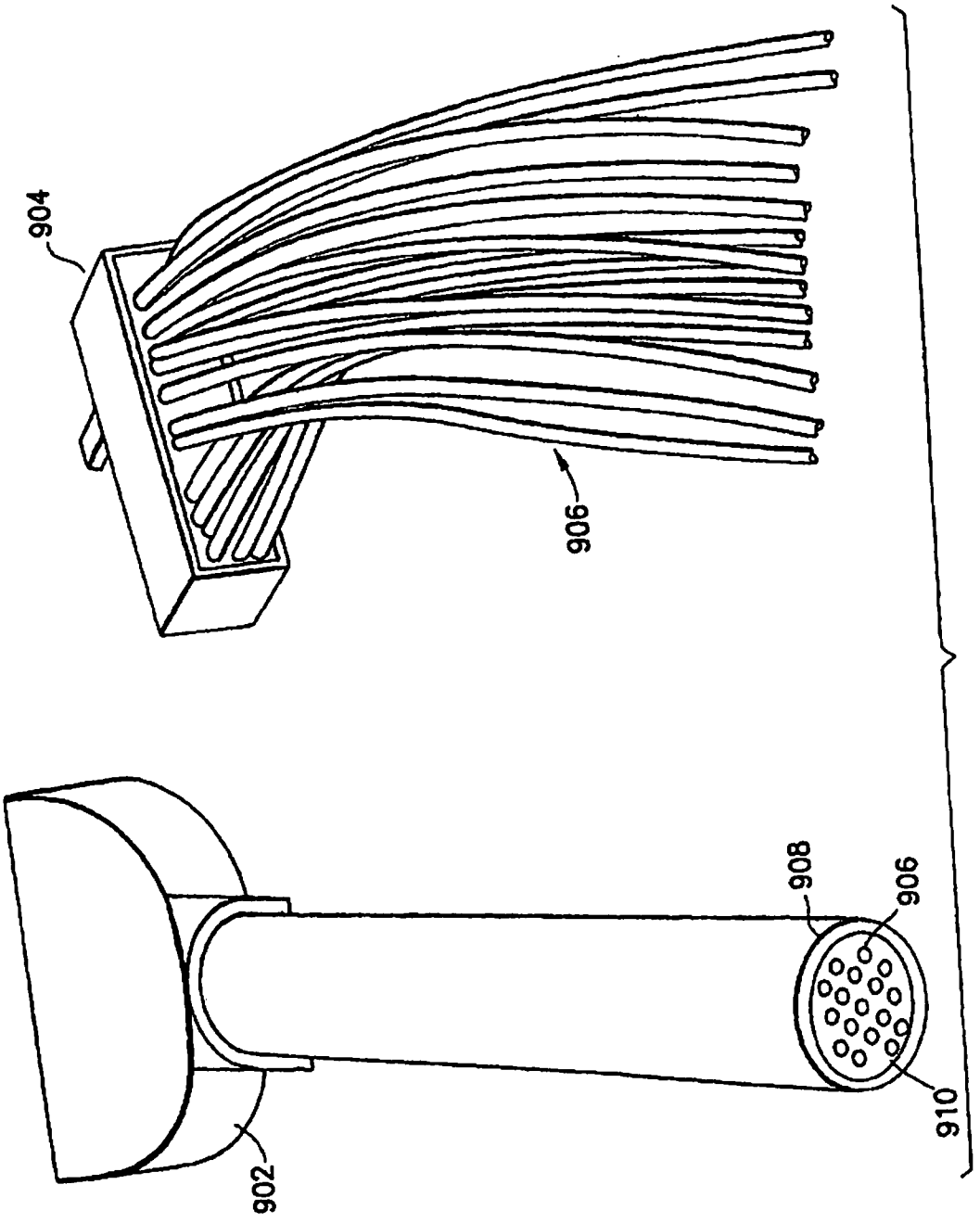


FIG.9B

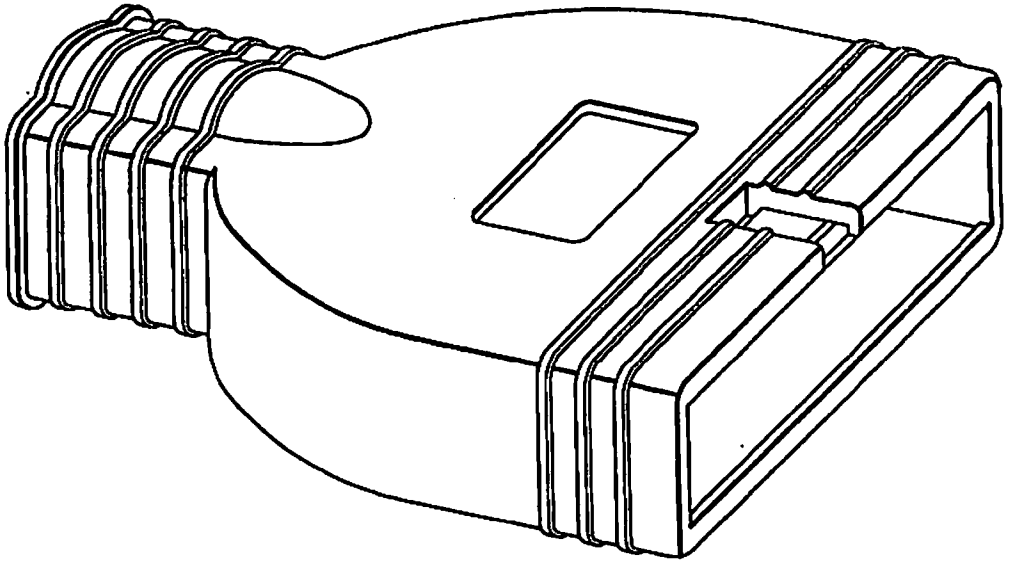


FIG. 10A

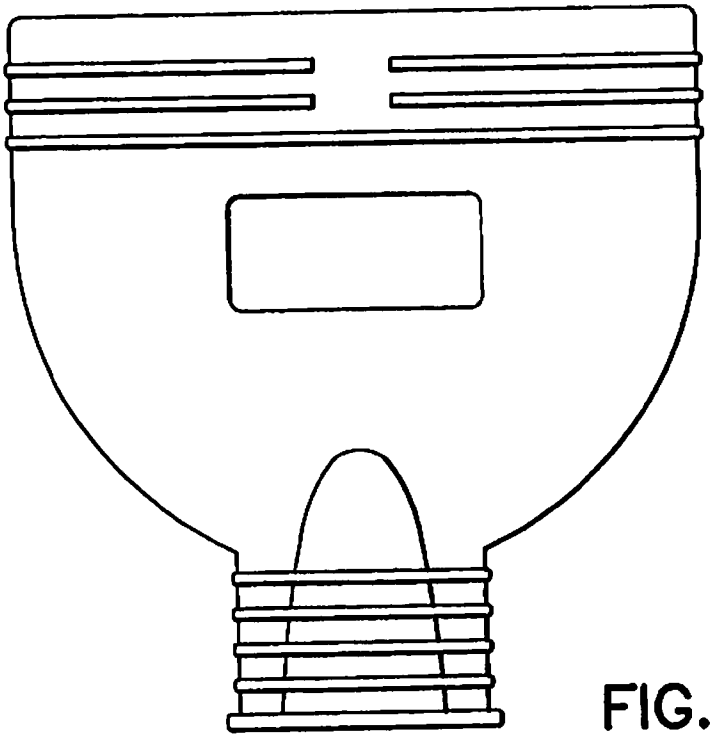
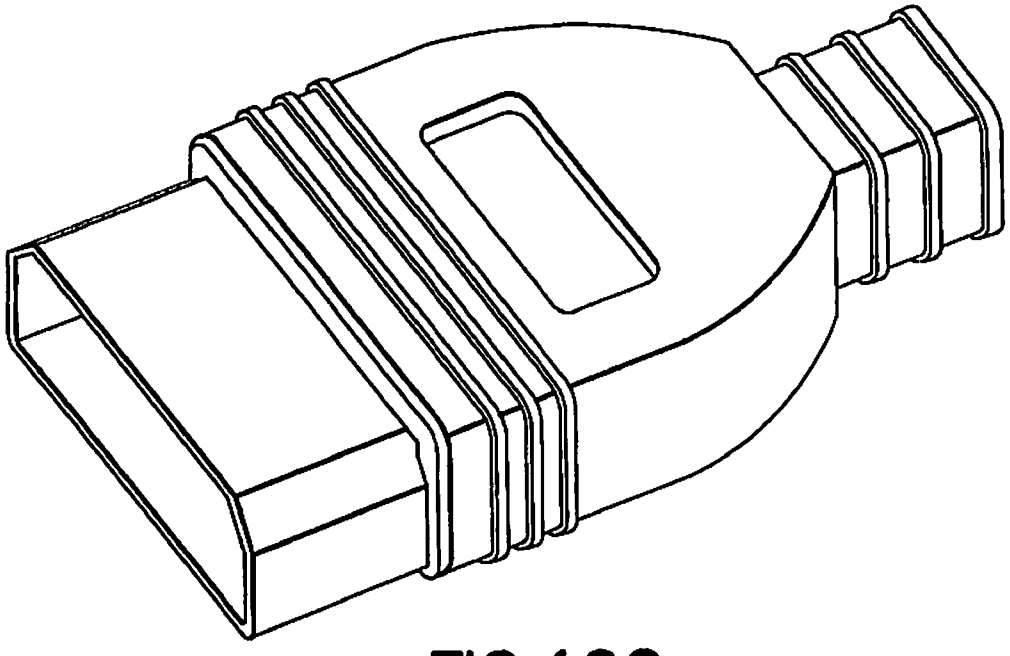


FIG. 10B



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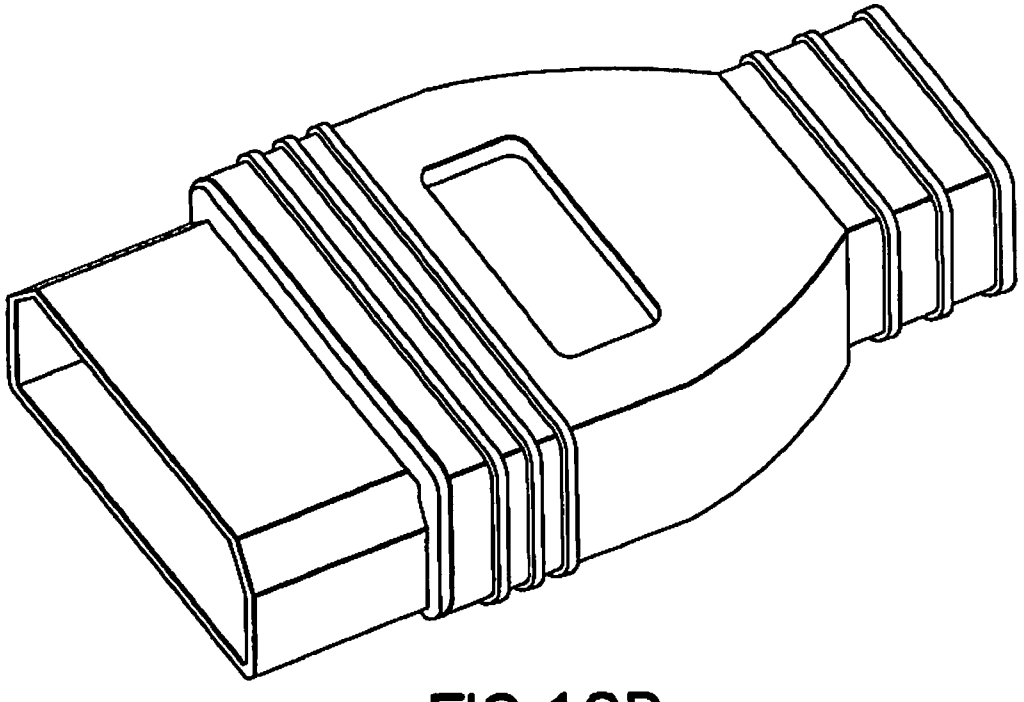

FIG.10D

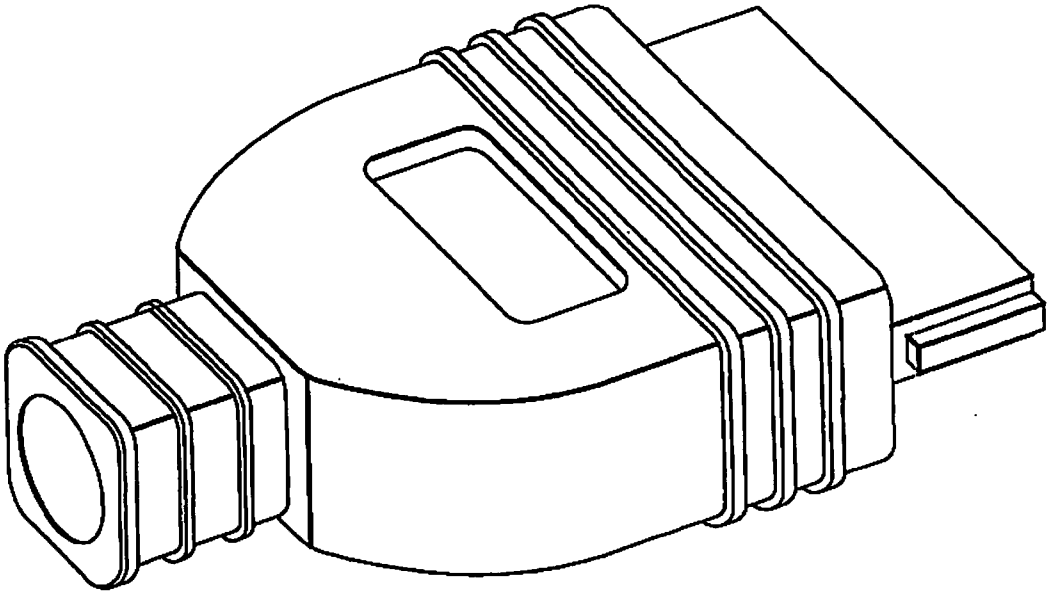

FIG. 10E

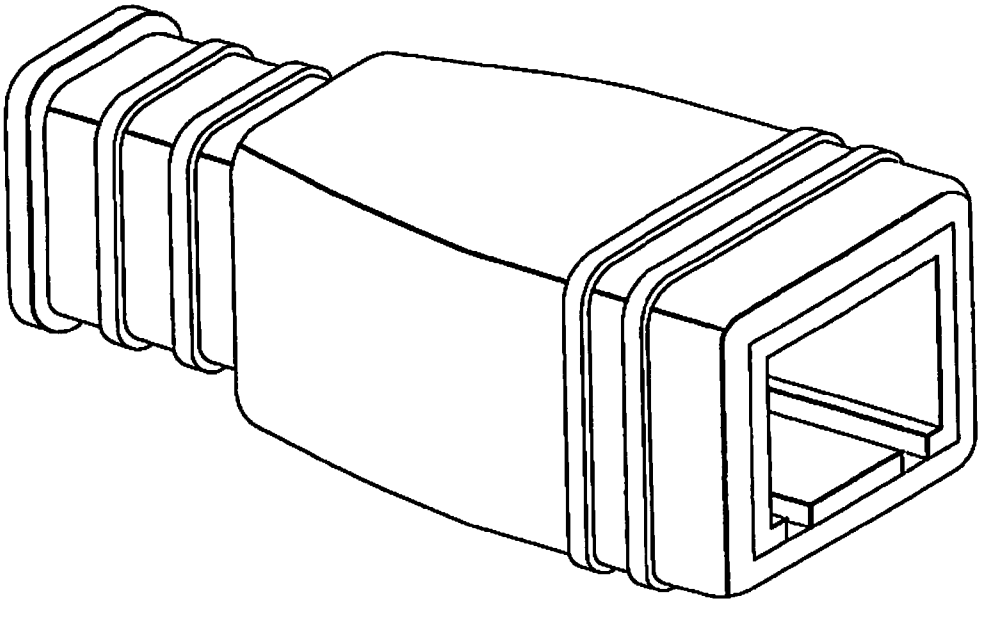

FIG. 10F

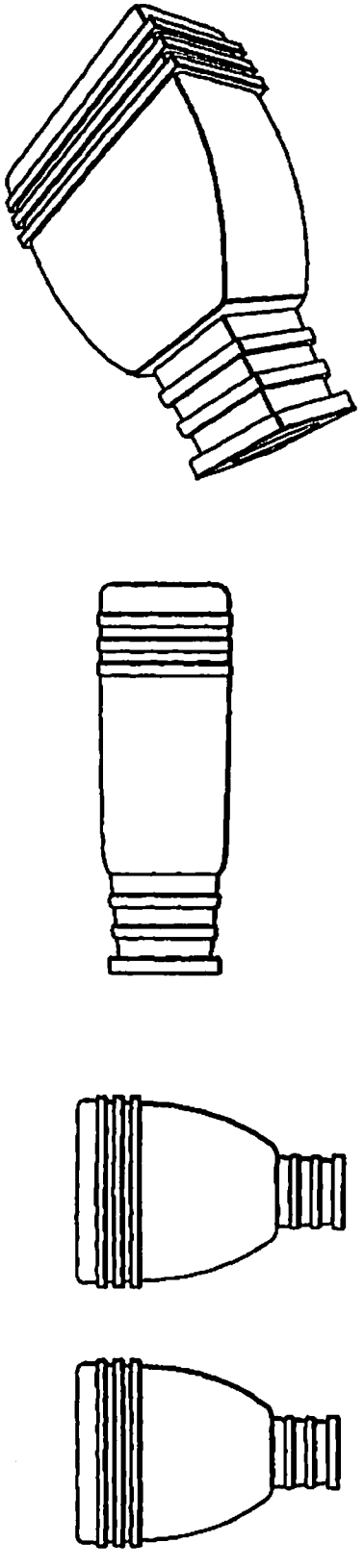

FIG.10G

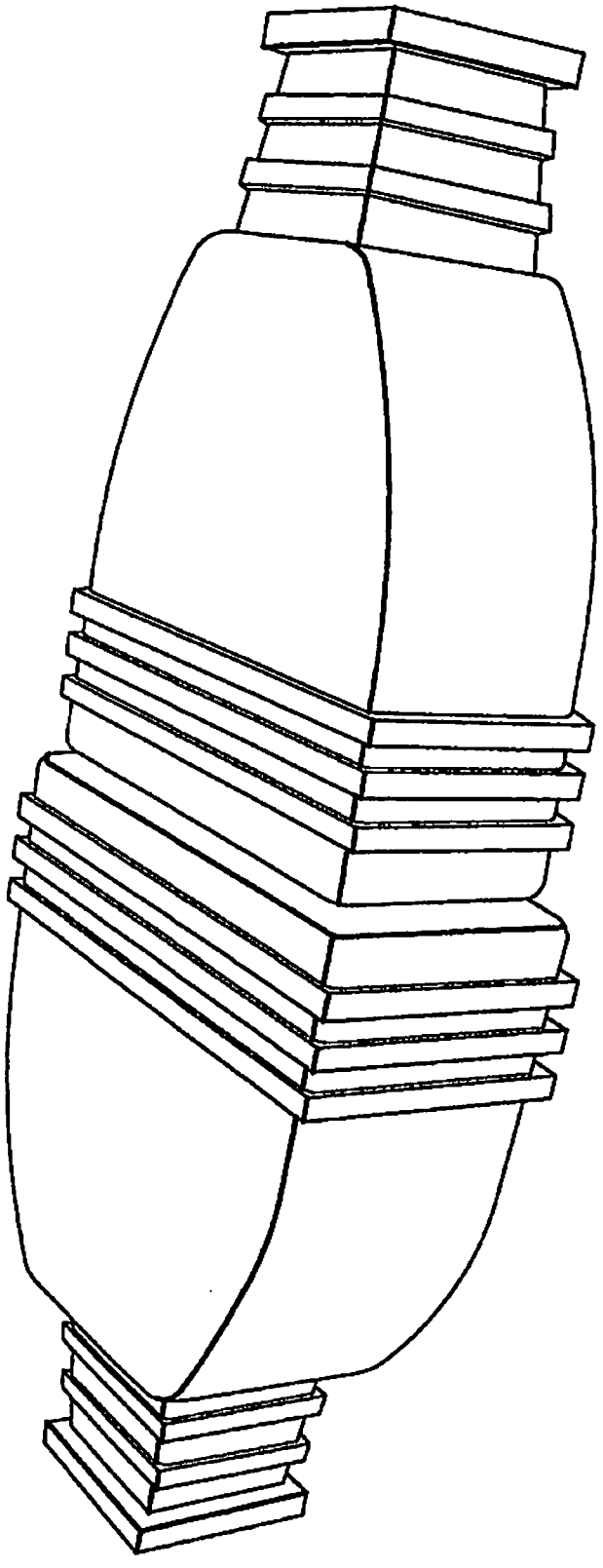

FIG. 10H

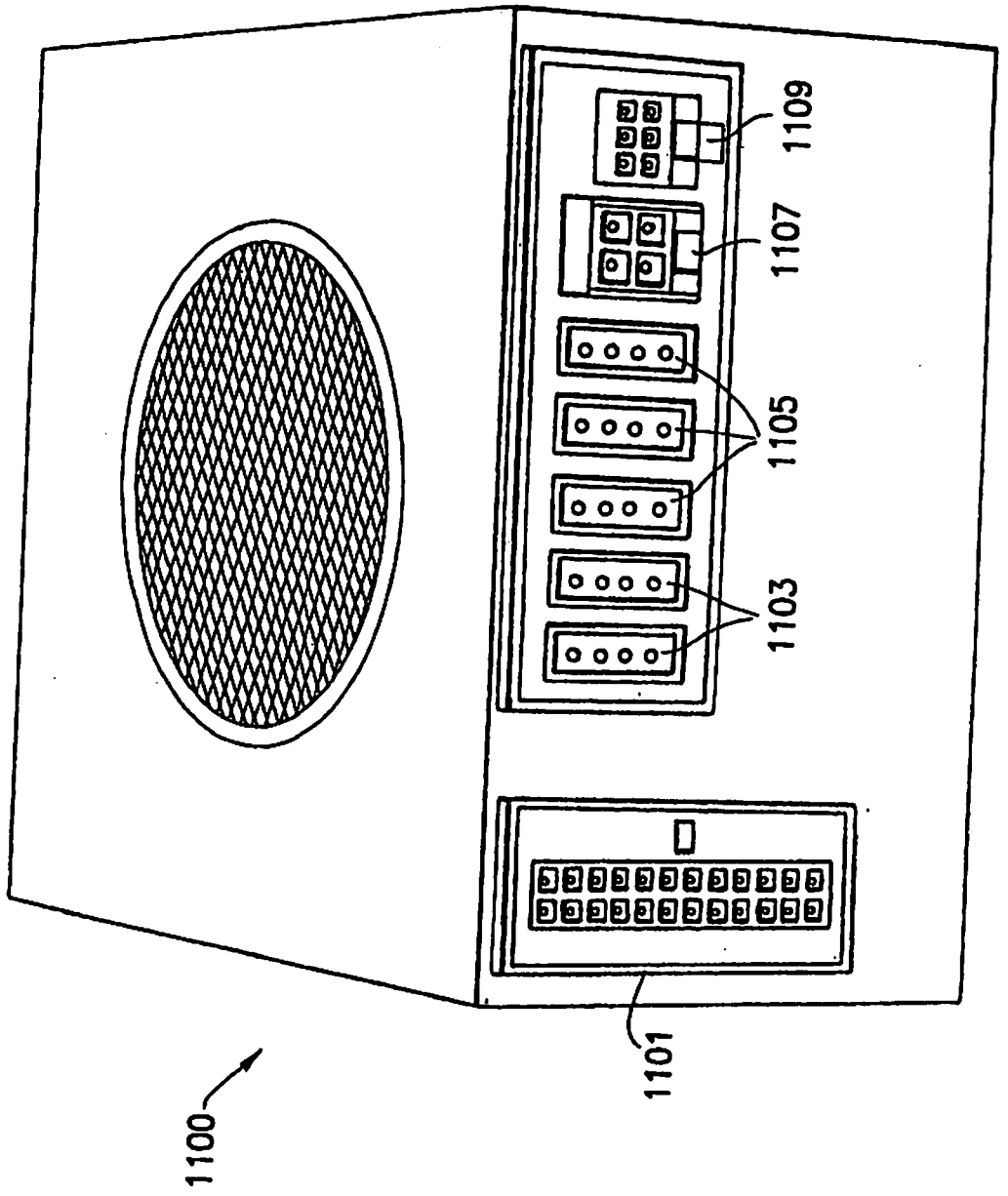

FIG. 11

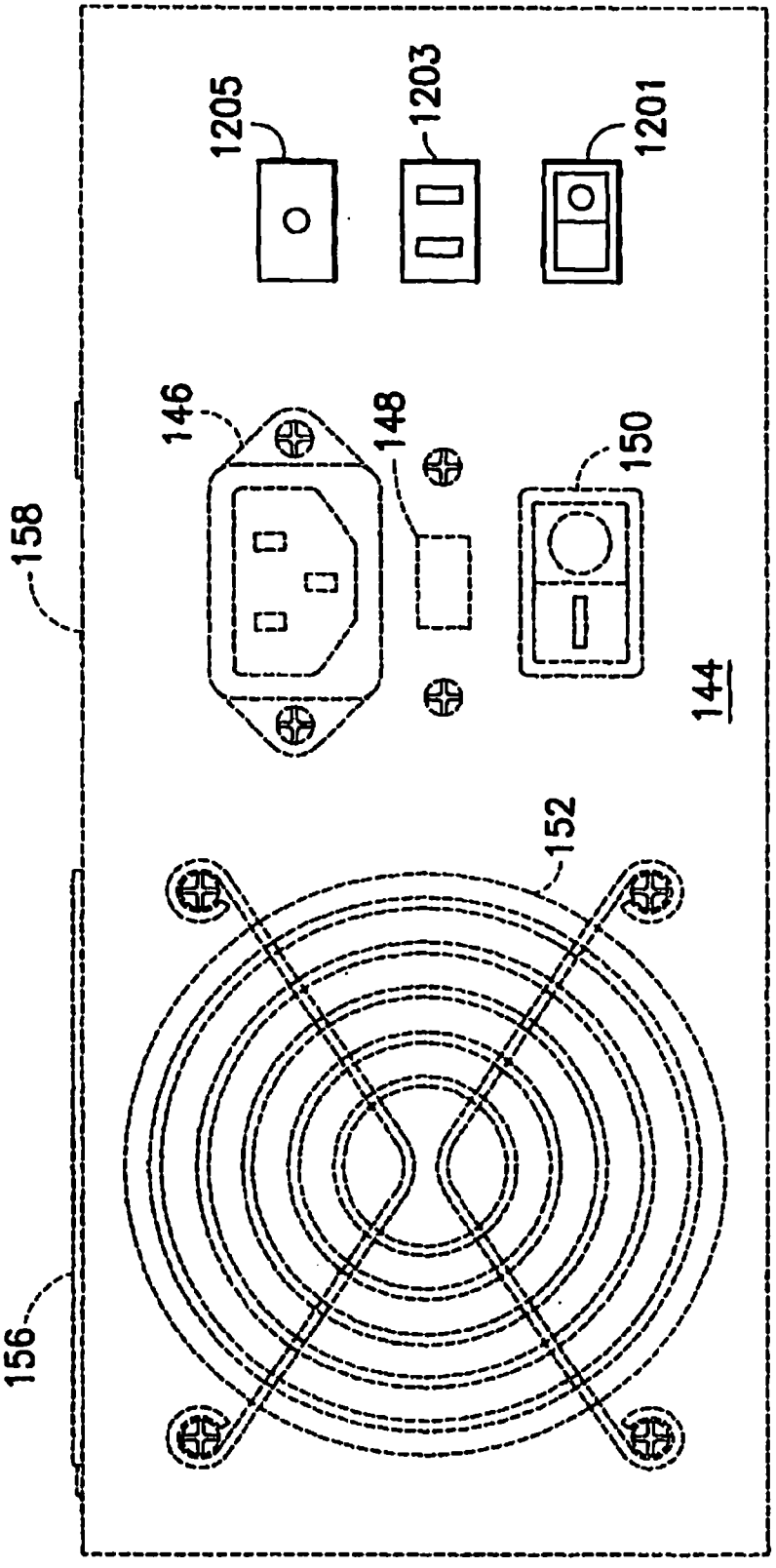

FIG. 12

PERSONAL COMPUTER POWER SUPPLY INSTALLED WITHIN A CASE OF A PERSONAL COMPUTER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part application of U.S. Ser. No. 29/195,186, filed Dec. 5, 2003, now U.S. Pat. No. D,501,648.

FIELD OF THE INVENTION

The present invention relates to power supplies and methods of installing power supplies.

More particularly, one embodiment of the present invention relates to a power supply adapted for installation within a computer case for receiving AC current from an AC current source and providing DC current from the power supply to a component disposed inside of the computer case via a removable cable attached to the power supply, comprising: a housing having an interior volume defined by a top panel, a bottom panel and a plurality of side panels; AC to DC circuitry disposed within the interior volume of the housing; and a DC output socket, wherein the DC output socket is fixed to one of the top panel, bottom panel and side panels defining the interior volume in which the AC to DC circuitry is disposed; wherein the AC to DC circuitry receives AC current from the AC current source; wherein the AC to DC circuitry converts the received AC current into DC current and supplies the DC current to the DC output socket; and wherein the DC output socket is fixed to one of the panels of the housing in a position such that when the power supply is installed within the computer case the DC output socket is disposed inside of the computer case for mating with the removable cable.

For the purposes of describing and claiming the present invention, the term "socket" is intended to refer to a device which cooperates with a "plug" (defined below) to provide a connectable/breakable electrical connection. Such a socket may have, for example, a male or female electrical terminal configuration and a male or female physical body configuration. Further, such a socket is intended to refer to a device attached to a relatively fixed structure, such as a housing.

Further, for the purposes of describing and claiming the present invention, the term "plug" is intended to refer to a device which cooperates with a "socket" (defined above) to provide a connectable/breakable electrical connection. Such a plug may have, for example, a male or female electrical terminal configuration and a male or female physical body configuration. Further, such a plug is intended to refer to a device attached to a relatively movable structure, such as an electrical cable.

Further still, for the purposes of describing and claiming the present invention, the term "component" is intended to refer to any interior element or part of a computer (e.g., personal computer) requiring a supply of power. Thus, as used herein, the term "component" is intended to include, but not be limited to: one or more motherboards, floppy disc drives, hard disc drives, CD-ROMs, CD-RWs, DVDs, sound cards, video cards, gaming cards, network cards, cooling devices, and/or network hubs.

Further still, for each term which is identified herein as "intended to include" certain definitions, when such term is used in the claims the term is to be construed more specifically as "intended to include at least one of the definitions".

BACKGROUND OF THE INVENTION

Various mechanisms for supplying power (e.g., to a computer system or other electrical device) have been proposed. Examples include the mechanisms described in the following patent documents.

U.S. Pat. No. 4,886,979 relates to a power source device for monitors and host computers. The device includes a first power source arrangement having a plug at one end and a capacitor parallel-connected at the other end which is electrically coupled with an internal circuit of a monitor for supplying a DC power to the monitor; and a second power source arrangement with a connecting component having input terminals electrically coupled with an internal switching power supply circuit of a host computer for obtaining a DC power therefrom, and output terminals connected to a socket fixed in a housing unit wall of the host computer; thereby, with the first and second power source arrangements connected together, DC power source will be directly supplied to the monitor from the host computer so as to eliminate any low-frequency and high-frequency interferences on the screen of the monitor.

U.S. Pat. No. 5,321,580 relates to an expansion device which includes a device body which has first and second side surfaces and a bottom surface continuous with the first and second side surfaces. A power cord of the device leads out from the first side surface, and a plug is provided at an extended end of the power cord. The plug is adapted to be connected to a power socket of the electronic apparatus. The device body includes a guide groove formed in the bottom surface, in which part of the power cord is removably fitted. The guide groove includes a first portion having one end open to the first side surface and the other end in the bottom surface, a second portion extending from the other end of the first portion to the first side surface, and a third portion extending from the other end of the first portion to the second side surface.

U.S. Pat. No. 5,761,029 relates to an audio power amplifier module which fits in a disk bay of a computer and bolts to the frame of the computer. The module is powered from the power supply in the computer and uses the frame of the computer as a heat sink. The module includes connectors for attachment to an internal sound board and to external speakers. A volume control is provided on the power module, in addition to the volume control typically included in a sound board.

U.S. Pat. No. 5,822,181 relates to a computer system having a unitary housing structure for containing a display unit, a power supply, and a docking bay receptacle to accommodate an insertion of a main computer body; and an electrical power/signal connection assembly installed to provide electrical power/signal connections between the power supply, the display unit and the main computer body. The electrical power/signal connection assembly includes a connector plug mounted on one side of the unitary housing structure and a corresponding connector socket mounted on the main computer body so that, when the main computer body is inserted into the docking bay receptacle of the unitary housing structure, the corresponding connector socket as mounted on said main computer body is visibly coupled to the connector plug mounted on one side of the unitary housing structure in order to prevent any misalignment that would cause damage to the connector plug.

U.S. Pat. No. 5,880,932 relates to a modular power supply to be used in a personal computer or other similar device. The preferred embodiment of the present invention includes a base assembly, a power supply housing, a power supply,

and a fan assembly. The base assembly provides a foundation for the modular power supply and includes a terminal board attached thereto and a system common quick-disconnect embedded therein which serves as a central junction for the distribution of power to the various electrical components. The power supply housing provides a protective structure for the power supply contained therein. The fan assembly provides cooling for the power supply and is mounted on the outside of the power supply housing. The power supply is electrically connected to the system common quick disconnect which in turn feeds the terminal board attached to the base assembly, the fan assembly, and any other components located within the base assembly. The terminal board provides access to power for peripheral components such as logic cards, I/O boards, and the like. The use of multiple quick-disconnect electrical connectors allows components such as the power supply and fans to be replaced without detaching the components which are normally "hard wired" to the power supply.

U.S. Pat. No. 6,535,377 relates to a power distribution unit (PDU) for supplying power to at least one electrical device (APP1–APP12). The PDU comprises at least one distribution point (P) for the power supply, and at least one female outlet (J1–J12) on its accessible side. The outlet is adapted to receive a male connector of a cable of an electrical device (APP1–APP12). The point (P) is electrically connected by a respective electrical cable to at least one manually resettable circuit breaker (BRK1–BKR6). The at least one circuit breaker comprises a respective push button (POU1–POU6) for resetting the circuit breaker. The circuit breaker (BRK1–BRK6) is connected by a respective electrical cable to the at least one female outlet (J1–J12). The circuit breaker (BRK1–BRK6) is located inside the unit and at least one reset mechanism capable of resetting the at least one circuit breaker is provided. Several circuit breakers may be supported in line and the reset mechanism is capable of resetting all of the circuit breakers simultaneously. The push button may be responsive to the condition of the circuit breaker with an end extending beyond the wall for the distribution power unit so as to provide a visual indication that an electrical failure has occurred in one of the electrical devices.

U.S. Pat. No. 6,677,687 relates to a system for distributing power in a compact peripheral component interconnect (CPCI) computer architecture. A CPCI computer architecture comprises a plurality of CPCI systems each having respective backplanes. The backplanes further have respective local power rails providing power for a corresponding one of the plurality of CPCI systems. The power distribution system provides power to the backplanes, and comprises a common power rail connected to each one of the local power rails of the backplanes. A plurality of power supplies is connected to the common power rail of the power distribution system. Power taken from any one of the plurality of power supplies is available to any one of the backplanes.

U.S. Pat. No. 6,744,628 relates to a multi-directional power distribution unit (PDU) which provides flexibility in the configuration of a computer system, disk drive array or other enclosure. The power distribution unit may be installed in one orientation for a power feed having a first configuration (e.g., from the front of the enclosure), and may be installed in a second orientation for a power feed in a second configuration (e.g., from the rear of the enclosure). In either orientation, a set of external power connectors couples to one or more external power feeds.

Depending on the orientation, either a first or second internal connector will interface with the system or enclosure (e.g., a midplane, a power supply). The PDU may include circuitry for filtering electrical power and may also include a heat sink.

U.S. Patent Publication No. US2003222503 relates to automatic voltage selection in a DC power distribution apparatus. Provision is made in the housing of a host to provide a socket, or sockets, to which a peripheral piece of equipment can be connected for receiving directly from the host the low voltage DC power it requires. The socket(s) are connected electrically to the outputs of a power supply (or regulator) of a host for providing the low voltage needed to power the peripheral. The power supply may be mounted on the rear face of a computer. The principal feature of the invention resides in the use of a connector for connecting the host DC power to the peripheral DC power usage device. The connector comprises pins connected to a selected resistor in the power supply. The resistor value (i.e., resistance) is selected to produce a pre-determined control voltage which is fed back to a DC to DC converter in the host's internal power supply. The converter comprises a pulse width modulation control device. The control voltage determines the duty cycle (i.e., pulse width) of the modulation to reduce the output from a maximum voltage to an appropriate voltage suitable for the particular peripheral power usage device. Thus, by simply selecting the appropriate connector (or cable) having the proper pins correlated to a selected resistor previously installed in the power supply, the voltage level for the corresponding peripheral device is automatically selected. In an alternative embodiment, the DC power distribution apparatus of the invention comprises a standalone unit having one or more universal ports for receiving a cable with a connector containing the appropriate pins for a selected DC power usage device.

UK Patent Application GB 2,322,972 relates to a universal computer power supply unit. A DC power output access panel (1) is included in a computer power supply unit or a computer power supply system to provide DC power to the external devices connected to the host computer system, such as printers, external fax modems, multimedia speakers, scanners, video conference cameras and many other external media drives. An AC power output socket may also be provided (FIGS. 2,4). The panel (1) may include DC sockets of different sizes (eg A2,A4), LED indicators (A1) and fuses (A3). The panel may be embodied as a separate unit (10, FIG. 5) connected to the rest of the supply unit (9) by a cable (11).

UK Patent Application GB 2,256,319 relates to a computer system having a power supply unit 2comprising a cabinet 4carrying a fan 24 on a removable front panel 18, and a slidably removable circuit board 28 carrying the power supply circuitry 30, whereby the circuit board can be readily replaced/repaired. The computer system includes a disk drive module received in aperture (51) (e.g. FIG. 57) in the front panel of a cabinet (48). The module can be in either of three alternative orientations relative to the cabinet so that the cabinet can be used in different orientations with the disk drive module remaining the same way up. The computer system can receive plug-in cards in sockets (64, 68) (FIGS. 8, 9) on alternative mounting housings (82) located adjacent the back of the cabinet (48).

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of a computer power supply according to an embodiment of the present invention

(wherein the power supply is shown with a wired motherboard cable and with integral sockets for receiving removable plugs of power cables);

FIG. 2 is a front view of a computer power supply according to an embodiment of the present invention (wherein the power supply is shown with a motherboard socket for receiving a removable motherboard cable and with integral power sockets for receiving removable plugs of power cables);

FIG. 3 is a table illustrating conventional form factors commonly employed for terminating personal computer power cables;

FIG. 4 is a rear view of the power supply of FIG. 2 (showing a rear ventilation fan, a power input, a voltage selector and a main power switch);

FIG. 5 is a perspective view of a computer power supply according to another embodiment of the present invention (showing the clamshell nature of the housing of this embodiment);

FIGS. 6A–6E are front perspective, rear perspective, left side perspective, right side perspective, and top views of the bottom portion of the power supply shown in FIG. 5 (showing the internal components thereof and the manner in which the power supply is constructed);

FIG. 7 is a perspective view showing the ease of plugging power supply cables into the respective sockets of the power supply of FIGS. 5 and 6A–6E;

FIG. 8 is a rear perspective view of a computer power supply according to another embodiment of the present invention (in which a portion of various panels of the enclosure are formed of a translucent or clear material which is ultraviolet reactive so as to glow when subjected to ultraviolet radiation).

FIGS. 9A and 9B show views of a cable/plug assembly for use with a power supply according to an embodiment of the present invention;

FIGS. 10A–10H show views of covers for plastic injection molded type plugs according to embodiments of the present invention;

FIG. 11 shows another embodiment of a power supply according to the present invention; and

FIG. 12 shows another embodiment of a power supply according to the present invention.

Among those benefits and improvements that have been disclosed, other objects and advantages of this invention will become apparent from the following description taken in conjunction with the accompanying figures. The figures constitute a part of this specification and include illustrative embodiments of the present invention and illustrate various objects and features thereof.

DETAILED DESCRIPTION OF THE INVENTION

Detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely illustrative of the invention that may be embodied in various forms. In addition, each of the examples given in connection with the various embodiments of the invention are intended to be illustrative, and not restrictive. Further, the figures are not necessarily to scale, some features may be exaggerated to show details of particular components. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a representative basis for teaching one skilled in the art to variously employ the present invention.

Referring now to a brief description of a number of embodiments of the present invention, it is noted that one of these embodiments relates to a computer power supply including at least one electrical socket which is electrically coupled to a DC source by way of an electrically conductive path which includes no wires disposed exteriorly of the housing of the power supply. This socket may be accessible from the exterior of the power supply housing to permit the physical and electrical connection of the socket to a plug of a removable cable for providing DC power to any desired component of a computer. The socket and plug may be of any desired form factor and may include any number and configuration of electrical terminals as required for making connections to a given component disposed within the computer.

Further, another embodiment of the present invention relates to a computer power supply having output sockets configured to reduce or eliminate the presence of unsightly and/or wasteful unused power supply cables within the enclosure of the computer.

Further still, another embodiment of the present invention relates to a method of installing a power supply in a computer using only the number of necessary power supply cables for a given computer configuration (e.g., for a computer configuration utilizing a given number and type of components). That is, only the number of cables needed at a given time may need be installed.

Further still, another embodiment of the present invention relates to a method of installing a power supply in a computer using power supply cables of a specific length appropriate for a given computer configuration (e.g., for a computer configuration utilizing a given number and type of components). That is, such removable cables may be selected to be of a sufficient length to reach a given component without excess (which excess may be unsightly and/or wasteful (e.g., in terms of wasted material and/or in terms of a needless amount of electrical resistance being added to the power distribution path)).

Referring now to FIG. 1, a front view showing a modular cable configuration of a power supply according to one embodiment of the present invention is shown. Specifically, the power supply **110** comprises a housing including front panel **112** through which is formed a grommeted hole **114**. The grommeted hole **114** receives a motherboard cable **116** having a motherboard plug **118** on an end thereof.

The front panel **112** further includes a plurality of holes for receiving sockets **120**, **122** and **124** for supplying 12 volt power, auxiliary power and peripheral power, respectively. In one example (which example is intended to be illustrative and not restrictive), the sockets **120**, **122** and **124** may be mounted on a printed circuit board (such printed circuit board may be in turn affixed to the inside of the front panel (e.g., via mounting screws **125**)).

The invention may further comprise a plurality of cables configured with plugs **132**, **134** and **136** at both ends to form a 12 volt power cable **126**, an auxiliary power cable **128** and peripheral power cables **130**, respectively. The plugs **132**, **134** and **136** may be configured to plug at one end of a respective cable into respective sockets **120**, **122** and **124**. In addition, the plugs **132**, **134** and **136** may be configured to plug at the other end of a respective cable into corresponding sockets formed in certain components contained within the device (e.g., personal computer) in which the power supply **110** is used.

In one example (which example is intended to be illustrative and not restrictive), sockets **120**, **122** and **124** as well

as plugs **132**, **134** and **136** may be of a conventional form factor and may be male or female as required.

In another example (which example is intended to be illustrative and not restrictive), motherboard cable **116** and motherboard socket **118** may be of a conventional form factor (the socket **118** may be male or female as required).

In another example (which example is intended to be illustrative and not restrictive), sockets **120**, **122** and **124** may be positioned through individual holes, appropriately configured, formed in the front panel **112** of the power supply **110** (see FIG. **1**).

In another example (which example is intended to be illustrative and not restrictive), sockets **132**, **134** and **136** may be integrally formed with each other as an integral connector **138** (see FIG. **2**).

In another example (which example is intended to be illustrative and not restrictive), an individual socket and/or an integral connector may be attached to the power supply **110** with a flange. In a more specific example (which example is intended to be illustrative and not restrictive), the socket or integral connector may be positioned through a correspondingly configured hole in the front panel **112** such that the flange rests on the outside surface of the front panel **112** with the socket or integral connector being held into position (e.g., by spring-loaded tabs).

Of note, while the motherboard cable **116** is hard-wired to the power supply **110** in the embodiment shown in FIG. **1**, the motherboard cable would be configured as a modular cable (not shown) with plugs formed on both ends in the embodiment shown in FIG. **2**. More particularly, the embodiment shown in FIG. **2** includes a motherboard socket **140** positioned through a corresponding hole formed in the front panel **112** of the power supply **110**. This motherboard socket **140** would, of course, be configured to receive one plug of the modular motherboard cable (while the other plug of the modular motherboard cable would be received by a socket fixed to the motherboard).

Referring now to FIG. **3**, it is noted that this FIG. illustrates a number of conventional connector form factors typically employed in power supplies (e.g., power supplies for personal computers). Specifically, power supplies typically include a motherboard (or main power) cable with a plug of the type of plug **118**, an auxiliary power cable (or aux power) with a plug of the type of plug **134**, a 12 volt power cable with a plug of the type of plug **132** and peripheral power cable with a plug of the type of plug **136**. In addition, while floppy drives have been widely used in the past, their prevalence has dwindled over the years. Nevertheless, the power supply **110** of the invention may include a floppy power cable having a plug of the type of plug **142** formed on the ends thereof such that one end plugs into a corresponding floppy power socket positioned through a hole in the front panel **112** of the power supply **110** and the other end plugs into the floppy drive. Of course, it should be appreciated that while the plugs shown in FIG. **5** may be in common use today, other plugs may be employed in the future and may, without departing from the spirit and scope of the present invention, be utilized.

Referring now to FIG. **4**, a rear panel of power supply **110** according to an embodiment of the present invention is shown. As seen in this Fig., mounted to the rear panel **144** of the power supply **110** may be a conventional input socket **146** (e.g., a 115V or 230V input socket), a conventional voltage selection switch **148** (e.g., 115V versus 230V) and a conventional on/off switch **150**. The input socket **146** may be, for example, of the conventional type used within the personal computer industry which allows connection of a power cord thereto to supply current from a receptacle or other outlet to the power supply **110**. Further, the supply of power may be controlled by the on/off switch **150**. Further still, the voltage switch **148** may be, for example, of the conventional type in the industry to allow selection of 115V versus 230V operation of the power supply **110**.

FIG. **4** also illustrates a circulation fan **152** mounted to the rear panel **144** (e.g., with appropriate grill work that allows the flow of air through the power supply **110** to exit the same via vent holes **154** formed in the front panel **112** of the power supply **110** (see FIG. **2**). In one example (which example is intended to be illustrative and not restrictive), another circulation fan **156** may be provided in the top panel **158** of the power supply **110**.

Referring now to FIG. **5**, one example (which example is intended to be illustrative and not restrictive), of the construction of the power supply housing is shown. More particularly, it is seen in this example that the power supply **110** may comprise two complementary U-shaped portions **110U** and **110L** that fit together in a clamshell manner (to be secured together by appropriate fasteners) to thereby essentially fully enclose the power supply circuitry therein. This FIG. **5** also shows that in one example (which example is intended to be illustrative and not restrictive), a removable cap may be snapped into each unused socket to prevent contamination thereof.

Of note, the power supply **110** may facilitate the compact and efficient positioning of the power supply circuitry within the interior of the power supply **110**. In this regard, it must first be pointed out that the present invention is not limited to any particular power supply circuit type, topography, or rating. For example, existing power supply circuit designs may be employed to provide output power in different voltages (e.g., 3.3V, 5V, 12V) and/or in different amounts (e.g., 300 or 400 watts). In addition, it is contemplated that future designs of power supply circuits will be developed and may be incorporated into the power supply of the present invention without departing from the spirit and scope thereof.

In any case, it is known today that typical power supply circuits will generally comprise some basic components. FIGS. **6A**, **6B**, **6C**, **6D** and **6E** illustrate a layout for the basic components of a typical power supply that may employed. As shown, a power supply circuit may be conventionally mounted on a printed circuit board permanently affixed to the bottom panel of the lower portion **110L** of the power supply **110** by appropriate stand-offs or insulators common in the industry. Line voltage from the input socket **146** is connected through the on/off switch **150** to the input power line of the printed circuit board. Connected to the printed circuit board are the input filter capacitors **164** and transformer **166** (heat sinks **168** may be thermally connected to the power transistors). Output circuitry **170** is also mounted to the printed circuit board. The motherboard socket **140** is wired to the printed circuit board. Likewise, the 12 volt power socket, the auxiliary power socket and the peripheral power socket (collectively identified as integrated connector **138**) are wired to the printed circuit board. Further, the voltage selection switch **148** is wired to the printed circuit board. Further still, circulation fans **152** and **156** are either wired to the printed circuit board or otherwise configured to receive power.

In one example (which example is intended to be illustrative and not restrictive), the heat sinks **168** may comprise a generally elongated design aligned relative to the airflow created between the circulation fan **152** and vent holes **154**

to facilitate the flow of air across the heat sinks **168** upon operation of the circulation fan **152**.

As mentioned above, the 12 volt power, auxiliary power and peripheral power sockets may be formed together as an integral unit. In one example (which example is intended to be illustrative and not restrictive), the integral unit may be produced by injection molding or other manufacturing technique to define the integral connector **138**.

In another example, terminals of the 12 volt power, auxiliary power and peripheral power sockets may be connected by means of buses **172**, **174** and **176** (see FIG. **6**B) to supply ground and plus and minus voltages to the respective terminals of the sockets. That the sockets may be integrally formed together as the integral connector **138** may help achieve a substantial degree of modularity, and aesthetic benefits.

Similarly, motherboard socket **140** may be molded as an integral unit which may be mounted through its corresponding hole in the front panel **112**. Further, motherboard socket **140** may be connected to the printed circuit board by means of connector **178** (see FIGS. **6**B and **6**C).

Referring now to FIG. **7**, it is again seen that the power supply **110** may facilitate the use of a separate modular motherboard cable **116** (connected to power supply **110** via plug **118** and socket **140**) as well as separate modular 12 volt power, auxiliary power and peripheral cables, which can be individually plugged at one end into their respective sockets of the power supply **110** and at their other ends to the respective components inside the device receiving the power, such as a personal computer (this FIG. **7** shows use of only peripheral power cable **130** in addition to modular motherboard cable **116**—of course, any other desired combination of cables may be utilized).

Accordingly, only those cables that are needed for a particular configuration need be utilized (in one example (which example is intended to be illustrative and not restrictive), only those cables that are needed for a particular configuration of a personal computer with certain installed components need be utilized). Of course, as additional components are added, additional cables may simply be plugged into the power supply **110** and into the component for use. Likewise, as any components are removed, the respective cables may simply be unplugged from the power supply **110**.

Further benefits (e.g., aesthetic benefits) may be attained by providing one or more elements that are reactive to ultraviolet (UV) light. For example (which example is intended to be illustrative and not restrictive), one or more panels (e.g., the top panel **158** and/or the side panels **180**) may include a transparent or translucent panel insert **182** that is reactive to UV light (see e.g., FIG. **8**). In another example (which example is intended to be illustrative and not restrictive), all or part of fan **152** and/or **156** (e.g., the fan housing and/or the fan blades) may be reactive to UV light (see e.g., FIG. **5**). In another example (which example is intended to be illustrative and not restrictive), all or part of one or more of the cables removably connected to the power supply may be reactive to UV light.

Of note, any element described herein as being reactive to UV light may be made so by appropriate manufacturing and/or treatment (e.g., an element may have a UV light reactive coating applied thereto and/or an element may be formed (entirely or in part) of a material which is UV light reactive). Further, any element described herein as being reactive to UV light may give off visible light when UV light is applied thereto. In one example (which example is intended to be illustrative and not restrictive), the visible light given off may be of a color selected from the group including, but not limited to: (a) green; (b) blue; (c) red; (d) orange; (e) yellow; and (f) white. In another example (which example is intended to be illustrative and not restrictive), any element described herein as being reactive to UV light may give off visible light of a color which differs from a color of the element when it is not subjected to UV light (e.g., an element which appears clear, transparent, translucent or white in the presence of visible light may appear green, blue or red in the presence of UV light).

In another example (which example is intended to be illustrative and not restrictive), the UV light may be provided at least in part by a UV light source disposed within the power supply (e.g., by an annular UV light positioned concentrically about a fan hub and/or disposed elsewhere within the power supply). In another example (which example is intended to be illustrative and not restrictive), the UV light may be provided at least in part by a UV light source disposed outside of the power supply.

Referring now to FIG. **9**A, one example (which example is intended to be illustrative and not restrictive) of a cable/plug assembly for use with a power supply according to an embodiment of the present invention is shown. As seen in this FIG. **9**A, the cable assembly **900** includes first plug **902** and second plug **904**. As further seen in this FIG. **9**A, individual wires **906** may be bundled together within casing **908** and metallic sheath **910** may be utilized to help eliminate or reduce electromagnetic interference.

Of note, this FIG. **9**A depicts two types of plugs—first plug **902** (which is a unique plastic injection molded type plug) and second plug **904** (which is a conventional type of plug). While this example shows cable assembly **900** utilizing one of each type of plug, other combinations may, of course, be utilized (e.g., the cable assembly may utilize two unique plastic injection molded type plugs or the cable assembly may utilize two conventional type plugs).

Referring now to FIG. **9**B, a more detailed view of the individual wires **906** in the vicinity of each of first plug **902** and second plug **904** is shown. More particularly, the tight containment of individual wires **906** by casing **908** and metallic sheath **910** in the vicinity of first plug **902** is contrasted with the uncontained individual wires **906** in the vicinity of second plug **904**.

Referring now to FIGS. **10**A–**10**H, various examples (which examples are intended to be illustrative and not restrictive) of covers for unique plastic injection molded type plugs according to embodiments of the present invention are shown.

More particularly, FIGS. **10**A and **10**B show, respectively, a perspective view and a top view of a 24 PIN plastic injection molded cover. Further, FIGS. **10**C and **10**D show, respectively, perspective views of two types of 4 PIN plastic injection molded covers. Further still, FIG. **10**E shows a perspective view of an SATA plastic injection molded cover. Further still, FIG. **10**F shows a perspective view of a 3 PIN (for fan) plastic injection molded cover. Further still, FIGS. **10**G and **10**H show various views of 4 PIN plastic injection molded covers.

Referring now to FIG. **11**, another embodiment of a power supply according to the present invention is shown. More particularly, as seen in this FIG. **11**, the power supply **1100** may include 24 pin motherboard socket(s) **1101**, SATA2 socket(s) **1103**, 12V socket(s) **1105**, P4/12V socket(s) **1107** and/or PCI Express socket(s) **1109**.

Referring now to FIG. **12**, another embodiment of a power supply according to the present invention is shown (this embodiment is similar to the embodiment shown in

FIG. 4, with the following additions). More particularly, as seen in this FIG. 12, the power supply may include output switch **1201**, AC output socket **1203** (e.g., for outputting 115V or 230V) and/or DC output socket **1205** (e.g., for outputting 3.3V, 5V, 12V). Of note, such output switch **1201**, AC output socket **1203** and/or DC output socket **1205** may be accessible from outside of the device in which the power supply is installed (e.g., personal computer). Of further note, either or both of AC output socket **1203** and/or DC output socket **1205** may be switched, that is, capable of being turned on and off (e.g., the AC output socket **1203** and the DC output socket **1205** may be switched together by output switch **1201** or separately by distinct dedicated switches (not shown)). Of still further note, there may be any desired number of AC output sockets **1203** and/or DC output sockets **1205**. Of still further note, the AC output socket **1203** and/or DC output socket **1205** may each be of any desired physical and/or electrical configuration (e.g., AC output voltage of 115V and/or 230V; DC output voltage of 3.3V, 5V and/or 12V).

While a number of embodiments of the present invention have been described, it is understood that these embodiments are illustrative only, and not restrictive, and that many modifications may become apparent to those of ordinary skill in the art. For example, while the present invention has been described primarily for use with a computer (e.g., a personal computer), the invention may be used in any device requiring a power supply. Further, each socket may include one or more electrically conductive terminals for interfacing with corresponding electrically conductive terminal(s) of a mating plug (e.g., each socket may have one or more electrically conductive pins for interfacing with corresponding electrically conductive receptacles(s) of a mating plug or each socket may have one or more electrically conductive receptacles for interfacing with corresponding electrically conductive pins(s) of a mating plug). Further still, when multiple sockets are formed into an integral connector, each of the sockets of the integral connector may be of the same type (or form factor) or the integral connector may include sockets of different types (or form factors). Further still, multiple sockets may be provided by forming multiple recesses within an integral connector. Further still, the socket(s) may be mounted to (and/or accessible through) a panel of the housing of the power supply. Further still, each socket may be mounted by being mechanically coupled to a panel of the power supply housing, by being mounted to a printed circuit board located inside the housing and/or by being made integral with one or more other sockets (e.g., as part of an integral connector). Further still, the sockets may include one or more electrical terminals disposed within a recess in the socket (whereby the terminals disposed within the recess are protected from making electrical contact with anything other than a mating plug which may be plugged into the socket). Further still, any desired number of sockets may be utilized. Further still, a power supply according to the present invention may receive one or more input voltage/current levels and may supply one or more output voltage/current levels (dedicated input and/or output circuitry may be utilized). Further still, the present invention may utilize one or more proprietary sockets/plugs (as opposed to sockets/plugs of a conventional form factor/electrical configuration). Further still, the sockets may be installed essentially flush with the outer surface of the panel in which they are placed. Further still, the present invention may provide improved airflow within the case of the device being powered by the power supply (e.g., improved airflow within a computer). This improved airflow may result at least in part from the absence of unnecessary cabling and/or the use of the shortest possible cabling. Further still, while 115V and 230V have primarily been used herein with reference to the AC voltage level, it should be appreciated that these may be considered nominal voltages and other voltages may of course be used with the invention (e.g., 110V, 120V, 220V, 240V). Further still, one or more of the sockets may be covered by one or more removable covers (e.g., to help prevent the shorting-out of the electrical terminals and/or to help prevent dust or debris from collecting in the sockets). Further still, any other part(s) of the power supply may be UV light reactive. Further still, any steps described herein may be carried out in any desired order.

What is claimed is:

1. A personal computer power supply installed within a computer case of a personal computer for receiving AC current from an AC current source and providing DC current from the power supply to at least three components wherein each component disposed within the computer case is selected from the group including: (a) a motherboard; (b) a magnetic disc drive; (c) an optical disc drive; (d) an input/output card; (e) a memory card; (f) a sound card; (g) a gaming card; (h) a video card; (i) a network card; (j) network hub; and (k) a cooling device comprising:

a power supply housing having an interior volume defined by a top panel, a bottom panel and a plurality of side panels;

AC to DC circuitry fixed within the interior volume of the power supply housing;

at least three DC output sockets, wherein each of the DC output sockets is fixed to one of the top panel, bottom panel and side panels of the power supply housing, and wherein at least two of the DC output sockets have different configurations;

a plurality of component cables, wherein each of the component cables has at least two ends, wherein a first end of each of the component cables has a plug that is directly mated with a respective DC output socket and a second end of each of the component cables is directly mated with at least one of the components;

wherein the AC to DC circuitry receives AC current from the AC current source;

wherein the AC to DC circuitry converts the received AC current into DC current and supplies the DC current to each DC output socket via a wired connection; and

wherein each DC output socket is in a position such that, when the power supply is installed within the computer case, each DC output socket is disposed inside of the computer case.

2. The power supply of claim **1**, wherein the power supply includes at least one fan assembly including a fan housing and a fan blade and at least one of the fan housing and the fan blade is coated with a material that is reactive to UV light.

3. The power supply of claim **1**, wherein at least a portion of at least one of the component cables is coated with a material that is reactive to UV light.

4. A personal computer power supply installed within a computer case of a personal computer for receiving AC current from an AC current source and providing DC current from the power supply to at least three components wherein each component disposed within the computer case is selected from the group including: (a) a motherboard; (b) a magnetic disc drive; (c) an optical disc drive; (d) an input/output card; (e) a memory card; (f) a sound card; (g) a gaming card; (h) a video card; (i) a network card; (j) network hub; and (k) a cooling device comprising:

a power supply housing having an interior volume defined by a top panel, a bottom panel and a plurality of side panels;

AC to DC circuitry fixed within the interior volume of the power supply housing;

at least two DC output sockets, wherein each of the DC output sockets is fixed to one of the top panel, bottom panel and side panels of the power supply housing;

at least one DC output cable, wherein a first end of the DC output cable is fixed to the power supply housing, wherein a second end of the DC output cable terminates with at least one DC output cable plug or cable socket;

a plurality of component cables, wherein each of the component cables has at least two ends, wherein a first end of each of the component cables has a plug that is directly mated with a one of the at least two DC output socket or the at least one DC output cable plug or cable socket and a second end of each of the component cables is directly mated with at least one of the components;

wherein the AC to DC circuitry receives AC current from the AC current source;

wherein the AC to DC circuitry converts the received AC current into DC current and supplies the DC current to each DC output socket or DC output cable plug or cable socket;

wherein each DC output socket is in a position such that, when the power supply is installed within the computer case, each DC output socket is disposed inside of the computer case; and

wherein the DC output plug is in a position such that, when the power supply is installed within the computer case, the DC output plug is disposed inside of the computer case.

5. The power supply of claim 4, wherein the power supply includes at least one fan assembly including a fan housing and a fan blade and at least one of the fan housing and the fan blade is coated with a material that is reactive to UV light.

6. The power supply of claim 4, wherein at least a portion of at least one of the component cables is coated with a material that is reactive to UV light.

7. A personal computer power supply installed within a computer case of a personal computer for receiving AC current from an AC current source and providing DC current from the power supply to at least three components wherein each component disposed within the computer case is selected from the group including: (a) a motherboard; (b) a magnetic disc drive; (c) an optical disc drive; (d) an input/output card; (e) a memory card; (f) a sound card; (g) a gaming card; (h) a video card; (i) a network card; (j) network hub; and (k) a cooling device comprising:

a power supply housing having an interior volume defined by a top panel, a bottom panel and a plurality of side panels;

AC to DC circuitry disposed within the interior volume of the power supply housing;

at least one DC output cable, wherein a first end of the DC output cable is fixed to the power supply housing, wherein a second end of the DC output cable terminates with at least three DC output cable plugs or sockets, wherein at least two DC output cable plugs or sockets have different configurations;

a plurality of component cables, wherein each of the component cables has at least two ends, wherein a first end of each of the component cables is directly mated with a respective DC output cable plug or DC output cable socket and a second end of each of the component cables is directly mated with at least one of the components;

wherein the AC to DC circuitry receives AC current from the AC current source;

wherein the AC to DC circuitry converts the received AC current into DC current and supplies the DC current to each DC output cable plug or DC output cable socket; and

wherein each DC output plug is in a position such that, when the power supply is installed within the computer case, each DC output plug is disposed inside of the computer case.

8. The power supply of claim 7, wherein the power supply includes at least one fan assembly including a fan housing and a fan blade and at least one of the fan housing and the fan blade is coated with a material that is reactive to UV light.

9. The power supply of claim 7, wherein at least a portion of at least one of the component cables is coated with a material that is reactive to UV light.

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