MAGNETIC CONNECTOR HAVING A UNITARY HOUSING

BACKGROUND

Portable electronic devices have become increasingly popular the past several years. Laptop and netbook computers, cell phones, portable media devices, and the like have become ubiquitous, and soon notebook and tablet computing devices will follow.

These devices include batteries that provide power. Unfortunately, these batteries need recharging. This recharging is often performed using a power cable having a connector insert or cable plug that mates with a connector receptacle on the portable device. Power can be supplied by a power transformer that receives power from a wall outlet, vehicle charging outlet, or other source. The power transformer converts the power from the outlet to a power level that can be used to charge the battery in a portable device. In some circumstances, these power cables may also convey signals between the portable device and a second electronic device.

The connector insert or cable plug may include circuitry inside of a plug housing. The plug housing typically is formed using several pieces that fit together around the circuitry. This patchwork of pieces used to form a plug housing can result in a housing having a less than optimal appearance.

The cable can include a conductor surrounded by an insulating layer. This conductor can be used to convey a power supply, such as a positive power supply voltage. The insulating layer can be further surrounded by a metallic braid layer that is used to convey ground. The braiding may be covered with a polyvinyl chloride coating. This coating provides a fire resistance to protect the electronic device in the event that the power transformer overheats or catches on fire. However, for various reasons, it is environmentally undesirable to use materials such as polyvinyl chloride. Unfortunately, halogen-free cables do not provide adequate fire resistance.

Thus, what is needed are improved power cables that have plug housings that provide an improved appearance as well as employ a halogen-free cable while providing adequate fire resistance.

SUMMARY

Accordingly, embodiments of the present invention provide power cables that include cable plug housings having an improved appearance as well as employing a halogen-free cable while providing adequate fire resistance.

A specific embodiment of the present invention provides a power cable having a cable plug or connector insert with a unitary (made from a single piece) or substantially unitary body. This body provides an improved appearance, greater strength and durability, and is simple to manufacture at a reduced cost. The cable plug can receive a power cable and may provide contacts for power transmission. The housing may be substantially unitary, that is, it may be made predominantly using a single piece of material. The single piece of material may be formed using metal, such as aluminum. The single piece of material may alternately be formed using plastic, ceramic, or other material. The single piece may be approximately cylindrical, or it may have other shapes, such as oval, square, or other shapes or combinations of shapes.

The contacts or terminals may extend from the cable plug housing and may be protected by a protrusion that mates with a connector receptacle on an electronic device. In various embodiments of the present invention, the protrusion is a magnetic element that is attracted to a second magnetic element in the connector receptacle. These magnetic elements may be magnets, attraction plates, or other types of magnetic elements, such as electromagnets. The attraction plates may be formed using a ferromagnetic material. In a specific embodiment of the present invention, the connector insert protrusion can include an attraction plate that is attracted to a magnetic element located in the connector receptacle.

Another specific embodiment of the present invention provides a power cable that is formed using halogen-free materials. To provide adequate fire protection, a strain relief formed using multiple materials is used. This strain relief can provide an interface between the cable and a housing, for example, a housing enclosing a power transformer. The strain relief can include a first, interior portion formed using a rigid, fire-resistant material. The fire-resistant material may be a polycarbonate, polycarbonate ABS (PC/ABS) blend, or other appropriate material. The strain relief may include a second, exterior portion formed using a flexible material. This material may be a thermoplastic elastomer (TPE), fluorinated ethylene propylene (FEP), or other appropriate material.

Various embodiments of the present invention may incorporate one or more of these and the other features described herein. A better understanding of the nature and advantages of the present invention may be gained by reference to the following detailed description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a power cable assembly according to an embodiment of the present invention;

FIG. **2** illustrates a cable plug according to an embodiment of the present invention;

FIG. **3** illustrates components that may be used to construct a cable plug according to an embodiment of the present invention;

FIG. **4** illustrates a side view of a portion of a cable plug according to an embodiment of the present invention;

FIG. **5** illustrates portions of a strain relief according to an embodiment of the present invention; and

FIG. **6** illustrates a strain relief according to an embodiment of the present invention.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

FIG. **1** illustrates a power cable assembly **100** according to an embodiment of the present invention. This figure, as with the other included figures, is shown for illustrative purposes and does not limit either the possible embodiments of the present invention or the claims.

Power cable assembly **100** may be used for providing power to an electronic device, such as a laptop, netbook, notebook, tablet computer, media player, portable media player, cell phone, or other type of electronic device. Cable assembly **100** may also be used to convey signals between such devices. Cable assembly **100** may include cable plug **105** and strain relief **140** connected together via cable **150**.

Cable plug **105** may mate with a compatible connector receptacle (not shown.) Cable plug **105** may include housing **110**, attraction plate **125**, and strain relief **115**. Housing **110** may be unitary or substantially unitary. This unitary construction can provide a connector plug **105** having an improved appearance, increased strength, and reduced manufacturing costs. Housing **110** may be formed using metal, such as aluminum, plastic, ceramic, or other material.

Attraction plate **125** may be formed around contacts **130**. Attraction plate **125** may have two axes of symmetry, allow-