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SPECIFICATION

SHIELDING SYSTEM FOR PC CARDS

Field of the Invention

This invention generally relates to the art of IC cards and, particularly, to an IC card and electrical connector assembly having an improved shielding system.

Background of the Invention

Generally, IC cards, such as memory cards, are data input devices which are electrically connected to an electronic apparatus or storage device, such as a word processor, personal computer or other electronic apparatus. The data stored in the card is transferred to the electronic apparatus. Memory cards are portable instruments which are readily inserted and extracted from a connector apparatus used with the card for removably coupling the card to a printed circuit board, for instance.

An IC card conventionally includes a frame which is generally rectangular and includes an opening in either a top surface or a bottom surface thereof or, in some constructions, in both surfaces. The opening receives a circuit board assembly, and a panel or cover closes the opening and encloses the circuit board assembly within the frame. Often, a pair of panels or covers sandwich the frame and the circuit board assembly therebetween. The cover panels may be of conductive material, such as sheet metal alloy.

The circuit board assembly of an IC card conventionally includes a generally planar dielectric substrate with circuit traces and at least one electrical component mounted thereon. The electrical component(s) may include semi-conductor devices, integrated circuits, batteries or the like.

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The IC card also includes an electrical receptacle connector provided at one end of the IC card for mating the card to a computer or other device which will utilize the card's memory and/or perform computer operations on data which is stored in the IC card and/or received from the outside environment.

Some IC or memory cards are generally denoted as "input/output" or "I/O" cards which connect the computer or other device to a variety of peripheral devices and systems. Such I/O cards provide all the functional options and flexibility of conventional I/O circuit boards or connector assemblies but are contained in thin compact card envelopes. I/O cards address the computer through special connectors associated with connective slots at the end of the card opposite the receptacle connector. These connectors often are called I/O connectors. In the high speed data transmission applications in which many I/O cards are used, it is necessary to shield the I/O connector interfaces to avoid radio frequency interference (RFI) and electromagnetic interference (EMI) caused by energy both inside and outside the system, thus "hardening" the system to the ingress and egress of radiated emissions.

Heretofore, in order to provide RFI and EMI protection, the I/O connectors at the end of the IC card typically have their own shields. The shields are stamped and formed of sheet metal material similar to the shields of other common shielded electrical connectors. Within the IC card system, the individual shields of the individual IC connectors then are grounded to an internal ground circuit on the circuit board assembly of the IC card. The internal ground circuit, in turn, is grounded to one or more of the cover panels of the IC card. Since IC cards are now being used for a variety of applications, more than one I/O connector often is required at the end of the IC card for simultaneous connection to the peripheral equipment discussed above.

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A problem with shielding the individual I/O connectors by stamping, forming and assembling a discrete shield for each connector as in the prior art, is that such procedures can be very expensive in terms of cost and labor, and can add tremendously to the overall cost of the card. Since the cover panels of the IC cards can be made of conductive shielding material, the present invention proposes to solve these problems by providing a shielding system which is integral or coupled directly to the conductive cover panels, thereby completely eliminating the need for individual shields for the individual I/O connectors.

Summary of the Invention

An object, therefore, of the invention is to provide a new and improved shielding system for the connectors of an IC or memory card.

In the exemplary embodiment of the invention, an IC card is disclosed to include a generally rectangular frame having a front insertion end and a rear I/O end. A circuit board assembly is mounted on the frame. A receptacle connector is provided at the front insertion end of the frame. I/O connector means are provided at the rear I/O end of the frame. A pair of conductive cover panels sandwich the circuit board assembly therebetween and expose a mating face of each of the receptacle connector and the I/O connector means exteriorly of the frame. Shield means are coupled to at least one of the conductive cover panels at the rear I/O end of the frame, independent of the I/O connector, for shielding the interface of the I/O connector and a complementary mating connector.

As disclosed herein, the shield means is provided by a face plate at the rear I/O end of the frame. In one embodiment of the invention, the face plate is separate from but coupled directly to at least one of the conductive cover panels. In another embodiment, the face plate is

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formed integral with one of the conductive cover panels. In a further embodiment, the face plate is formed integral with both of the pair of conductive cover panels in a clam shell-type configuration.

The face plate includes at least one aperture for insertion therethrough of the complementary mating connector. The shield means is provided by a shroud integral with the face plate and projecting from the face plate around the aperture about the interface of the I/O connector and the complementary mating connector.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

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Brief Description of the Drawings

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

FIGURE 1 is an exploded perspective view of an IC card embodying the concepts of the invention, wherein the shield means is integral with the bottom conductive cover panel;

FIGURE 2 is a perspective view of the integral shield means and cover panel of Figure 1;

FIGURE 3 is a perspective view of a shield means according to a second embodiment of the invention, incorporating a face plate which is coupled directly to the cover panels;

FIGURE 4 is a perspective view looking toward the opposite side of the face plate in Figure 3; and

FIGURE 5 is a perspective view of a shield means according to a third embodiment of the invention, wherein the shield means is integral with both conductive cover panels in a clam shell-type configuration.

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Detailed Description of the Preferred Embodiments

Referring to the drawings in greater detail, and first to Figure 1, the shielding system of the invention is embodied in an IC card, generally designated 10, which includes a generally rectangular frame 12 having a front insertion end 14 and a rear I/O end 16. The frame is open, at least at the top 18 thereof, for receiving a circuit board assembly, generally designated 20. A pair of conductive cover panels, including a top cover panel 22 and a bottom cover panel 24, are secured to the frame and sandwich the circuit board assembly therebetween. The circuit board assembly includes a generally planar dielectric substrate 26 having circuit traces 28 and 30 and at least one electrical component 32 mounted thereon. The electrical component(s) may include semi-conductor devices, integrated circuits, batteries or the like.

Still referring to Figure 1, a typical IC card 10 includes a receptacle connector 34 at the front insertion end 14. The receptacle connector includes terminals having front mating portions 36 and rear tail portions 38. Receptacle connector 34, including front mating portions 36 of the terminals, is provided for mating the card to a computer or other device which will utilize the card's memory and/or perform computer operations on data which is stored in the IC card and/or received from the outside environment through I/O connector means described immediately below. The receptacle connector is electrically connected to circuit traces 28 by rear tail portions 38 of the terminals of the connector.

An I/O connector means 40 is mounted at rear I/O end 16 of the frame and includes a plurality of connective openings or slots 42 which define connector sockets. I/O connector means 40 includes a plurality of terminals (not shown) connected to circuit traces 30 on substrate 26 of circuit board assembly 20. Although a plurality of connector sockets 42 are formed in a singular I/O connector

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means 40 spanning the width of the IC card, it should be understood that a plurality of individual I/O connectors having their own separate connector sockets often might be provided at I/O end 14 of the IC card, rather than the singular receptacle connector means 40. Regardless, one or more complementary mating plug connectors, generally designated 44, are insertable into connector sockets 42 for mating with the terminals therein regardless of whether a single connector means 40 is provided or a plurality of individual I/O connectors are provided. The I/O connector means 40 at I/O end 16 of the IC card is provided for interfacing data between an outside environment, such as a computer or computer-related electronic device (not shown) and circuit board assembly 20. Because connector means 40 is adapted to interface data between the circuit board assembly and the outside environment, it is therefore sometimes referred to an "input/output" or "I/O" connector or connector means.

As stated in the "Background", above, heretofore, prior art IC cards utilized I/O connectors or connector means which were provided with their own individual shields to provide RFI and EMI protection. The individual shields typically have been stamped and formed of sheet metal material and assembled to the I/O connectors prior to assembling the I/O connectors in the IC card. This requires separate stamping, forming and assembly steps which can be very expensive in terms of cost and labor.

Referring to Figure 2 in conjunction with Figure 1, the invention is embodied in a shield means, generally designated 50, which is coupled to at least one of the conductive cover panels 22 and/or 24 at rear I/O end 26 of the IC card. Shield means 50 is totally independent of I/O connector means 40. Therefore, the I/O connector means can be fabricated without a shield and assembled in the IC card, eliminating the pre-fabrication steps for the shields of the prior art. Yet, shield means 50 is effective for

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shielding the interface of I/O connector means 40 and the complementary mating plug connector or connectors 44.

More particularly, shield means 50 includes a face plate 52 which is formed integrally with bottom cover panel 24, along a front edge 54 of the panel. A plurality of apertures 56 are formed in the face plate. These apertures are alignable with and are of the same size and shape as connector sockets 42 in I/O connector means 40. It can be seen that the individual apertures may vary in configuration for keying purposes to ensure that the proper mating plug connector 44 is inserted into the correct aperture. A plurality of shielding shrouds 58 are formed integrally with face plate 52 and projects rearwardly thereof. These shrouds are insertable into connector sockets 42 to completely surround the terminal interfaces between I/O connector means 40 and complementary mating plug connectors 42, thereby providing an excellent shielding function or RFI and EMI protection for the interfaces. Again, shrouds 58 may be of different cross-sectional configurations corresponding to the different configurations of apertures 56 and connector sockets 42, such as for keying purposes, for example. Lastly, rearwardly projecting tabs 60 are formed at a top edge 62 of face plate 52. These tabs are effective to directly couple the face plate and shielding shrouds 58 to top conductive cover panel 22. Therefore, shielding means 50 is coupled directly to both conductive cover panels 22 and 24, while face plate 52 is integral with only the bottom conductive cover panel.

In manufacture, face plate 52 and rearwardly projecting tabs 60 are stamped and formed at the same time as fabricating bottom conductive cover panel 24. During the same processing step or steps, shrouds 58 can be drawn from the same integral metal material. This singular process is tremendously less expensive than forming

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individual shields for the individual I/O connectors or connector means at the I/O end 16 of the IC card.

It should be understood that, while the concepts of the invention have been described above in relation to shielding the I/O connector means 40 at the rear I/O end of the IC card, the same concepts could be applied in the event that the front receptacle connector means 34 has to be shielded. Front shield means can be formed integral with or coupled directly to one or more of the conductive cover panels to shield the connecting interface at the front of the IC card.

Figures 3 and 4 show a second embodiment of the invention, wherein a shield means, generally designated 50A, is formed independently of either of the cover panels. Shield means 50A is substantially identical to shield means 50, in that shield means 50A includes a face plate 52 having a plurality of apertures 56 formed therein, with corresponding rearwardly projecting shrouds 58 formed about the apertures. Again, tabs 60 directly couple shield means 50A with top conductive cover panel 22. However, rather than forming shield means 50A integral with bottom conductive cover panel 64, additional tabs 60A are formed along a bottom edge 64 of face plate 52 as best seen in Figure 4. The bottom tabs are effective to couple face plate 52, along with shrouds 58, directly to bottom conductive cover panel 24. Side tabs 66 may be provided for mounting the face plate onto frame 12, as by appropriate adhesives or the like. Again, shield means 50A in Figures 3 and 4 provides an excellent shielding function for the connecting interfaces of I/O connector means 40 and completely eliminates forming separate shields for the I/O connectors.

Figure 5 shows a third embodiment of a shield means, generally designated 50B, which is formed integrally with both conductive cover panels 20 and 24 in a clam shell-type configuration. As with shield means 50 and 50A,

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shield means 50B includes a face plate 52 having a plurality of apertures 42 formed therein, with respective shielding shrouds 58 surrounding the apertures and projecting rearwardly of the face plate. The shielding shrouds 58, again, are effective to surround and shield the terminal connecting interfaces between complementary mating plug connectors 44 and I/O connector means 40 within connector sockets 42.

Lastly, referring back to Figure 1, complementary mating connector 44 has its own shield 68 having integrally formed fingers 70 which are cantilevered in a flexible fashion projecting outwardly from the connector. These fingers, being of a the conductive material of the shield, engage within shrouds 58 to common the shield of the mating connector with shield means 50, 50A or 50B. The shield means of the card, in turn, is coupled directly to one or more of the conductive cover panels 22 and/or 24. In many IC cards, the cover panels are grounded to a ground circuit on circuit board assembly 20 which, through ground terminals in receptacle connector means 34, are grounded to the equipment which receives the IC card. Therefore, the shield means 50, 50A or 50B of the invention is effective in the commoning chain to ground the outside environment represented by mating plug connector 44 with the internal electronic device which receives the IC card.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

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CLAIMS

1. An IC card (10), comprising:

a generally rectangular frame (12) having a front insertion end (14) and a rear I/O end (16);

a circuit board assembly (20) mounted on the frame;

receptacle connector means (34) at the front insertion end of the frame;

I/O connector means (40) at the rear I/O end of the frame;

a pair of conductive cover panels (22,24) sandwiching the circuit board assembly (20) therebetween leaving at least a mating face of each of the receptacle connector means (34) and the I/O connector means (40) exposed exteriorly of the frame; and

shield means (50,50A,50B) coupled to at least one of the conductive cover panels (22,24) at the rear I/O end of the frame, independent of the I/O connector means, for shielding the interface of the I/O connector and a complementary mating connector (44).

2. The IC card of claim 1 wherein said shield means (50,50B) is integral with at least one of the conductive cover panels (22,24).

3. The IC card of claim 2 wherein said shield means (50B) is integral with both conductive cover panels (22,24) in a clam shell-type configuration.

4. The IC card of claim 3 wherein said shield means (50,50A,50B) comprises a face plate (52) at said rear end of the frame.

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5. The IC card of claim 2 wherein said shield means (50,50A,50B) comprises a face plate (52) at said rear end of the frame.

6. The IC card of claim 1 wherein said shield means (50,50A,50B) comprises a face plate (52) engaged with said at least one conductive cover panel (22,24) at said rear I/O end of the frame.

7. The IC card of claim 6 wherein said shield means (50,50A,50B) includes a shroud (58) projecting from the face plate (52) about the interface of the I/O connector means (40) and the complementary mating connector (44).

8. The IC card of claim 6 wherein said face plate (52) includes an aperture (56) for insertion therethrough of said complementary mating connector (44).

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9. The IC card of claim 8 wherein said shield means (50,50A,50B) includes a shroud (58) projecting from the face plate (52) around said aperture (56).

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ABSTRACT

SHIELDING SYSTEM FOR PC CARDS

An IC card (10) includes a generally rectangular frame (12) having front and rear ends (14,16). A circuit board assembly (20) is mounted on the frame. An unshielded connector (40) is mounted on the frame at one end thereof. A pair of cover panels (22,24) sandwich the circuit board assembly therebetween, leaving at least a mating face of the connector (40) exposed exteriorly of the frame for interfacing with a complementary mating connector (44). At least one of the cover panels (22,24) is conductive. A shield (50,50A,50B) is coupled to the conductive cover panel, independent of the connector (40), for shielding the interface of the connector with the complementary mating connector.

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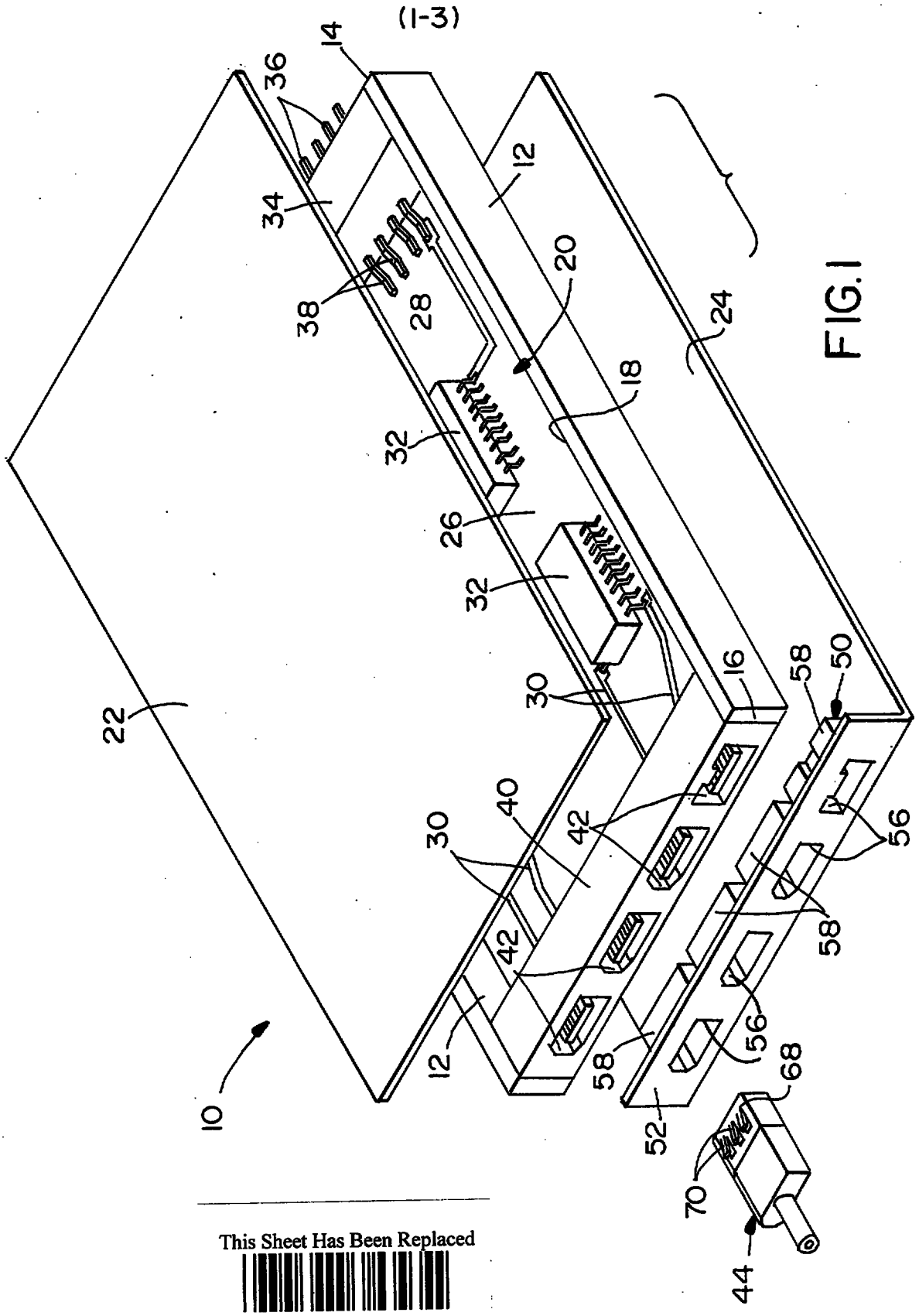

FIG. 1

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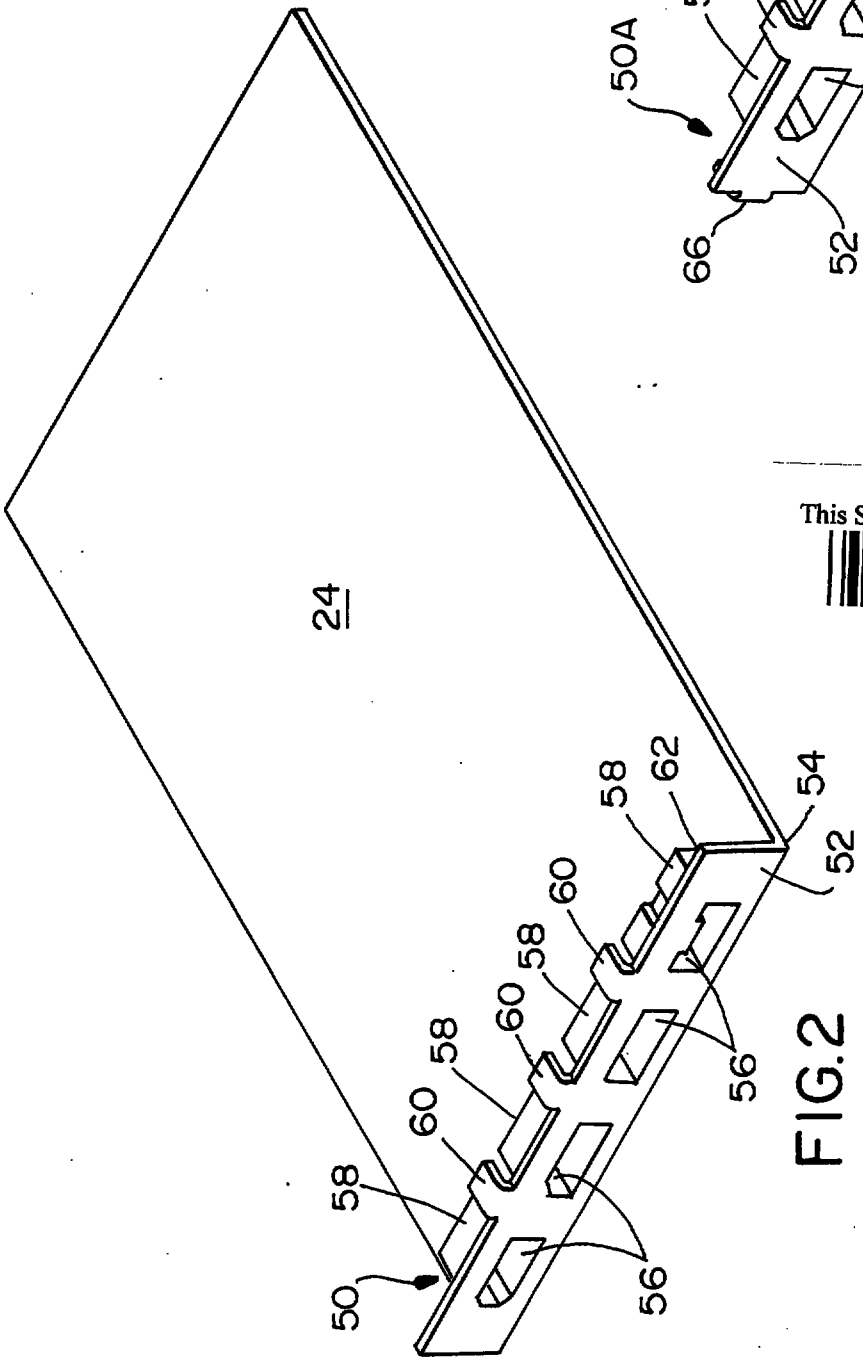

FIG.2

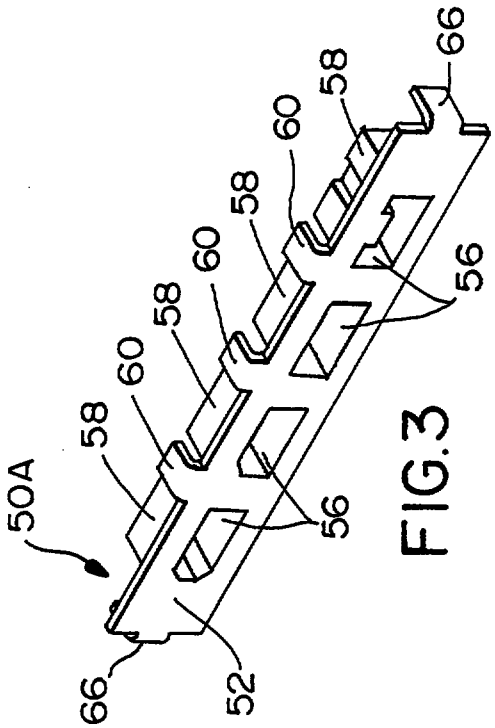

FIG.3

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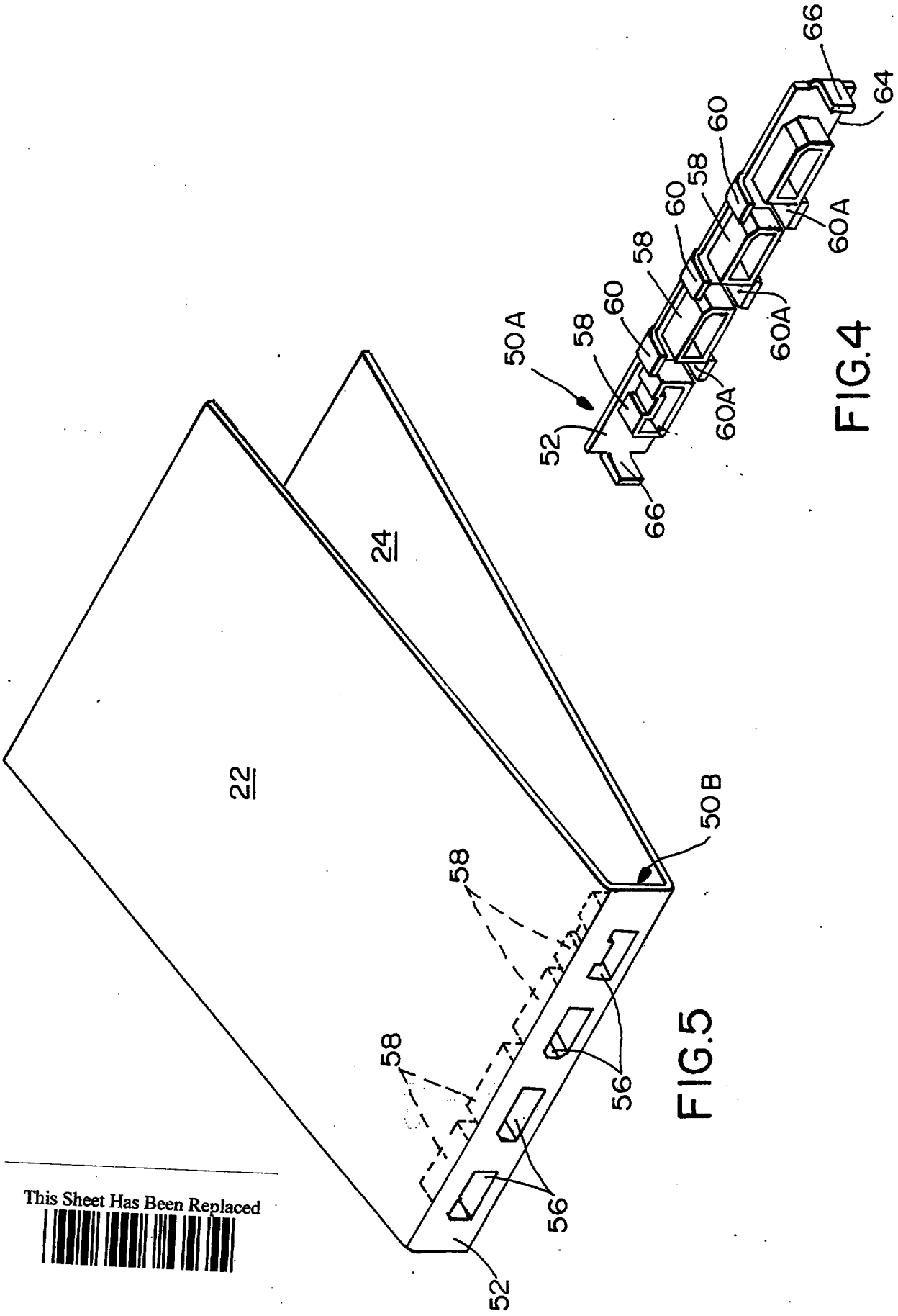

FIG.4

FIG.5

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SPECIFICATION

SHIELDING SYSTEM FOR PC CARDS

Field of the Invention

This invention generally relates to the art of IC cards and, particularly, to an IC card and electrical connector assembly having an improved shielding system.

Background of the Invention

Generally, IC cards, such as memory cards, are data input devices which are electrically connected to an electronic apparatus or storage device, such as a word processor, personal computer or other electronic apparatus. The data stored in the card is transferred to the electronic apparatus. Memory cards are portable instruments which are readily inserted and extracted from a connector apparatus used with the card for removably coupling the card to a printed circuit board, for instance.

An IC card conventionally includes a frame which is generally rectangular and includes an opening in either a top surface or a bottom surface thereof or, in some constructions, in both surfaces. The opening receives a circuit board assembly, and a panel or cover closes the opening and encloses the circuit board assembly within the frame. Often, a pair of panels or covers sandwich the frame and the circuit board assembly therebetween. The cover panels may be of conductive material, such as sheet metal alloy.

The circuit board assembly of an IC card conventionally includes a generally planar dielectric substrate with circuit traces and at least one electrical component mounted thereon. The electrical component(s) may include semi-conductor devices, integrated circuits, batteries or the like.

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The IC card also includes an electrical receptacle connector provided at one end of the IC card for mating the card to a computer or other device which will utilize the card's memory and/or perform computer operations on data which is stored in the IC card and/or received from the outside environment.

Some IC or memory cards are generally denoted as "input/output" or "I/O" cards which connect the computer or other device to a variety of peripheral devices and systems. Such I/O cards provide all the functional options and flexibility of conventional I/O circuit boards or connector assemblies but are contained in thin compact card envelopes. I/O cards address the computer through special connectors associated with connective slots at the end of the card opposite the receptacle connector. These connectors often are called I/O connectors. In the high speed data transmission applications in which many I/O cards are used, it is necessary to shield the I/O connector interfaces to avoid radio frequency interference (RFI) and electromagnetic interference (EMI) caused by energy both inside and outside the system, thus "hardening" the system to the ingress and egress of radiated emissions.

Heretofore, in order to provide RFI and EMI protection, the I/O connectors at the end of the IC card typically have their own shields. The shields are stamped and formed of sheet metal material similar to the shields of other common shielded electrical connectors. Within the IC card system, the individual shields of the individual IC connectors then are grounded to an internal ground circuit on the circuit board assembly of the IC card. The internal ground circuit, in turn, is grounded to one or more of the cover panels of the IC card. Since IC cards are now being used for a variety of applications, more than one I/O connector often is required at the end of the IC card for simultaneous connection to the peripheral equipment discussed above.

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A problem with shielding the individual I/O connectors by stamping, forming and assembling a discrete shield for each connector as in the prior art, is that such procedures can be very expensive in terms of cost and labor, and can add tremendously to the overall cost of the card. Since the cover panels of the IC cards can be made of conductive shielding material, the present invention proposes to solve these problems by providing a shielding system which is integral or coupled directly to the conductive cover panels, thereby completely eliminating the need for individual shields for the individual I/O connectors.

Summary of the Invention

An object, therefore, of the invention is to provide a new and improved shielding system for the connectors of an IC or memory card.

In the exemplary embodiment of the invention, an IC card is disclosed to include a generally rectangular frame having a front insertion end and a rear I/O end. A circuit board assembly is mounted on the frame. A receptacle connector is provided at the front insertion end of the frame. I/O connector means are provided at the rear I/O end of the frame. A pair of conductive cover panels sandwich the circuit board assembly therebetween and expose a mating face of each of the receptacle connector and the I/O connector means exteriorly of the frame. Shield means are coupled to at least one of the conductive cover panels at the rear I/O end of the frame, independent of the I/O connector, for shielding the interface of the I/O connector and a complementary mating connector.

As disclosed herein, the shield means is provided by a face plate at the rear I/O end of the frame. In one embodiment of the invention, the face plate is separate from but coupled directly to at least one of the conductive cover panels. In another embodiment, the face plate is

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formed integral with one of the conductive cover panels. In a further embodiment, the face plate is formed integral with both of the pair of conductive cover panels in a clam shell-type configuration.

The face plate includes at least one aperture for insertion therethrough of the complementary mating connector. The shield means is provided by a shroud integral with the face plate and projecting from the face plate around the aperture about the interface of the I/O connector and the complementary mating connector.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

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Brief Description of the Drawings

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

FIGURE 1 is an exploded perspective view of an IC card embodying the concepts of the invention, wherein the shield means is integral with the bottom conductive cover panel;

FIGURE 2 is a perspective view of the integral shield means and cover panel of Figure 1;

FIGURE 3 is a perspective view of a shield means according to a second embodiment of the invention, incorporating a face plate which is coupled directly to the cover panels;

FIGURE 4 is a perspective view looking toward the opposite side of the face plate in Figure 3; and

FIGURE 5 is a perspective view of a shield means according to a third embodiment of the invention, wherein the shield means is integral with both conductive cover panels in a clam shell-type configuration.

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Detailed Description of the Preferred Embodiments

Referring to the drawings in greater detail, and first to Figure 1, the shielding system of the invention is embodied in an IC card, generally designated 10, which includes a generally rectangular frame 12 having a front insertion end 14 and a rear I/O end 16. The frame is open, at least at the top 18 thereof, for receiving a circuit board assembly, generally designated 20. A pair of conductive cover panels, including a top cover panel 22 and a bottom cover panel 24, are secured to the frame and sandwich the circuit board assembly therebetween. The circuit board assembly includes a generally planar dielectric substrate 26 having circuit traces 28 and 30 and at least one electrical component 32 mounted thereon. The electrical component(s) may include semi-conductor devices, integrated circuits, batteries or the like.

Still referring to Figure 1, a typical IC card 10 includes a receptacle connector 34 at the front insertion end 14. The receptacle connector includes terminals having front mating portions 36 and rear tail portions 38. Receptacle connector 34, including front mating portions 36 of the terminals, is provided for mating the card to a computer or other device which will utilize the card's memory and/or perform computer operations on data which is stored in the IC card and/or received from the outside environment through I/O connector means described immediately below. The receptacle connector is electrically connected to circuit traces 28 by rear tail portions 38 of the terminals of the connector.

An I/O connector means 40 is mounted at rear I/O end 16 of the frame and includes a plurality of connective openings or slots 42 which define connector sockets. I/O connector means 40 includes a plurality of terminals (not shown) connected to circuit traces 30 on substrate 26 of circuit board assembly 20. Although a plurality of connector sockets 42 are formed in a singular I/O connector

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means 40 spanning the width of the IC card, it should be understood that a plurality of individual I/O connectors having their own separate connector sockets often might be provided at I/O end 14 of the IC card, rather than the singular receptacle connector means 40. Regardless, one or more complementary mating plug connectors, generally designated 44, are insertable into connector sockets 42 for mating with the terminals therein regardless of whether a single connector means 40 is provided or a plurality of individual I/O connectors are provided. The I/O connector means 40 at I/O end 16 of the IC card is provided for interfacing data between an outside environment, such as a computer or computer-related electronic device (not shown) and circuit board assembly 20. Because connector means 40 is adapted to interface data between the circuit board assembly and the outside environment, it is therefore sometimes referred to an "input/output" or "I/O" connector or connector means.

As stated in the "Background", above, heretofore, prior art IC cards utilized I/O connectors or connector means which were provided with their own individual shields to provide RFI and EMI protection. The individual shields typically have been stamped and formed of sheet metal material and assembled to the I/O connectors prior to assembling the I/O connectors in the IC card. This requires separate stamping, forming and assembly steps which can be very expensive in terms of cost and labor.

Referring to Figure 2 in conjunction with Figure 1, the invention is embodied in a shield means, generally designated 50, which is coupled to at least one of the conductive cover panels 22 and/or 24 at rear I/O end 26 of the IC card. Shield means 50 is totally independent of I/O connector means 40. Therefore, the I/O connector means can be fabricated without a shield and assembled in the IC card, eliminating the pre-fabrication steps for the shields of the prior art. Yet, shield means 50 is effective for

shielding the interface of I/O connector means 40 and the complementary mating plug connector or connectors 44.

More particularly, shield means 50 includes a face plate 52 which is formed integrally with bottom cover panel 24, along a front edge 54 of the panel. A plurality of apertures 56 are formed in the face plate. These apertures are alignable with and are of the same size and shape as connector sockets 42 in I/O connector means 40. It can be seen that the individual apertures may vary in configuration for keying purposes to ensure that the proper mating plug connector 44 is inserted into the correct aperture. A plurality of shielding shrouds 58 are formed integrally with face plate 52 and projects rearwardly thereof. These shrouds are insertable into connector sockets 42 to completely surround the terminal interfaces between I/O connector means 40 and complementary mating plug connectors 42, thereby providing an excellent shielding function or RFI and EMI protection for the interfaces. Again, shrouds 58 may be of different cross-sectional configurations corresponding to the different configurations of apertures 56 and connector sockets 42, such as for keying purposes, for example. Lastly, rearwardly projecting tabs 60 are formed at a top edge 62 of face plate 52. These tabs are effective to directly couple the face plate and shielding shrouds 58 to top conductive cover panel 22. Therefore, shielding means 50 is coupled directly to both conductive cover panels 22 and 24, while face plate 52 is integral with only the bottom conductive cover panel.

In manufacture, face plate 52 and rearwardly projecting tabs 60 are stamped and formed at the same time as fabricating bottom conductive cover panel 24. During the same processing step or steps, shrouds 58 can be drawn from the same integral metal material. This singular process is tremendously less expensive than forming

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individual shields for the individual I/O connectors or connector means at the I/O end 16 of the IC card.

It should be understood that, while the concepts of the invention have been described above in relation to shielding the I/O connector means 40 at the rear I/O end of the IC card, the same concepts could be applied in the event that the front receptacle connector means 34 has to be shielded. Front shield means can be formed integral with or coupled directly to one or more of the conductive cover panels to shield the connecting interface at the front of the IC card.

Figures 3 and 4 show a second embodiment of the invention, wherein a shield means, generally designated 50A, is formed independently of either of the cover panels. Shield means 50A is substantially identical to shield means 50, in that shield means 50A includes a face plate 52 having a plurality of apertures 56 formed therein, with corresponding rearwardly projecting shrouds 58 formed about the apertures. Again, tabs 60 directly couple shield means 50A with top conductive cover panel 22. However, rather than forming shield means 50A integral with bottom conductive cover panel 64, additional tabs 60A are formed along a bottom edge 64 of face plate 52 as best seen in Figure 4. The bottom tabs are effective to couple face plate 52, along with shrouds 58, directly to bottom conductive cover panel 24. Side tabs 66 may be provided for mounting the face plate onto frame 12, as by appropriate adhesives or the like. Again, shield means 50A in Figures 3 and 4 provides an excellent shielding function for the connecting interfaces of I/O connector means 40 and completely eliminates forming separate shields for the I/O connectors.

Figure 5 shows a third embodiment of a shield means, generally designated 50B, which is formed integrally with both conductive cover panels 20 and 24 in a clam shell-type configuration. As with shield means 50 and 50A,

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shield means 50B includes a face plate 52 having a plurality of apertures 42 formed therein, with respective shielding shrouds 58 surrounding the apertures and projecting rearwardly of the face plate. The shielding shrouds 58, again, are effective to surround and shield the terminal connecting interfaces between complementary mating plug connectors 44 and I/O connector means 40 within connector sockets 42.

Lastly, referring back to Figure 1, complementary mating connector 44 has its own shield 68 having integrally formed fingers 70 which are cantilevered in a flexible fashion projecting outwardly from the connector. These fingers, being of a the conductive material of the shield, engage within shrouds 58 to common the shield of the mating connector with shield means 50, 50A or 50B. The shield means of the card, in turn, is coupled directly to one or more of the conductive cover panels 22 and/or 24. In many IC cards, the cover panels are grounded to a ground circuit on circuit board assembly 20 which, through ground terminals in receptacle connector means 34, are grounded to the equipment which receives the IC card. Therefore, the shield means 50, 50A or 50B of the invention is effective in the commoning chain to ground the outside environment represented by mating plug connector 44 with the internal electronic device which receives the IC card.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

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CLAIMS

1. An IC card (10), comprising:

a generally rectangular frame (12) having a front insertion end (14) and a rear I/O end (16);

a circuit board assembly (20) mounted on the frame;

receptacle connector means (34) at the front insertion end of the frame;

I/O connector means (40) at the rear I/O end of the frame;

a pair of conductive cover panels (22,24) sandwiching the circuit board assembly (20) therebetween leaving at least a mating face of each of the receptacle connector means (34) and the I/O connector means (40) exposed exteriorly of the frame; and

shield means (50,50A,50B) coupled to at least one of the conductive cover panels (22,24) at the rear I/O end of the frame, independent of the I/O connector means, for shielding the interface of the I/O connector and a complementary mating connector (44).

2. The IC card of claim 1 wherein said shield means (50,50B) is integral with at least one of the conductive cover panels (22,24).

3. The IC card of claim 2 wherein said shield means (50B) is integral with both conductive cover panels (22,24) in a clam shell-type configuration.

4. The IC card of claim 3 wherein said shield means (50,50A,50B) comprises a face plate (52) at said rear end of the frame.

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5. The IC card of claim 2 wherein said shield means (50,50A,50B) comprises a face plate (52) at said rear end of the frame.

6. The IC card of claim 1 wherein said shield means (50,50A,50B) comprises a face plate (52) engaged with said at least one conductive cover panel (22,24) at said rear I/O end of the frame.

7. The IC card of claim 6 wherein said shield means (50,50A,50B) includes a shroud (58) projecting from the face plate (52) about the interface of the I/O connector means (40) and the complementary mating connector (44).

8. The IC card of claim 6 wherein said face plate (52) includes an aperture (56) for insertion therethrough of said complementary mating connector (44).

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9. The IC card of claim 8 wherein said shield means (50,50A,50B) includes a shroud (58) projecting from the face plate (52) around said aperture (56).

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ABSTRACT

SHIELDING SYSTEM FOR PC CARDS

An IC card (10) includes a generally rectangular frame (12) having front and rear ends (14,16). A circuit board assembly (20) is mounted on the frame. An unshielded connector (40) is mounted on the frame at one end thereof. A pair of cover panels (22,24) sandwich the circuit board assembly therebetween, leaving at least a mating face of the connector (40) exposed exteriorly of the frame for interfacing with a complementary mating connector (44). At least one of the cover panels (22,24) is conductive. A shield (50,50A,50B) is coupled to the conductive cover panel, independent of the connector (40), for shielding the interface of the connector with the complementary mating connector.

FIG. 1

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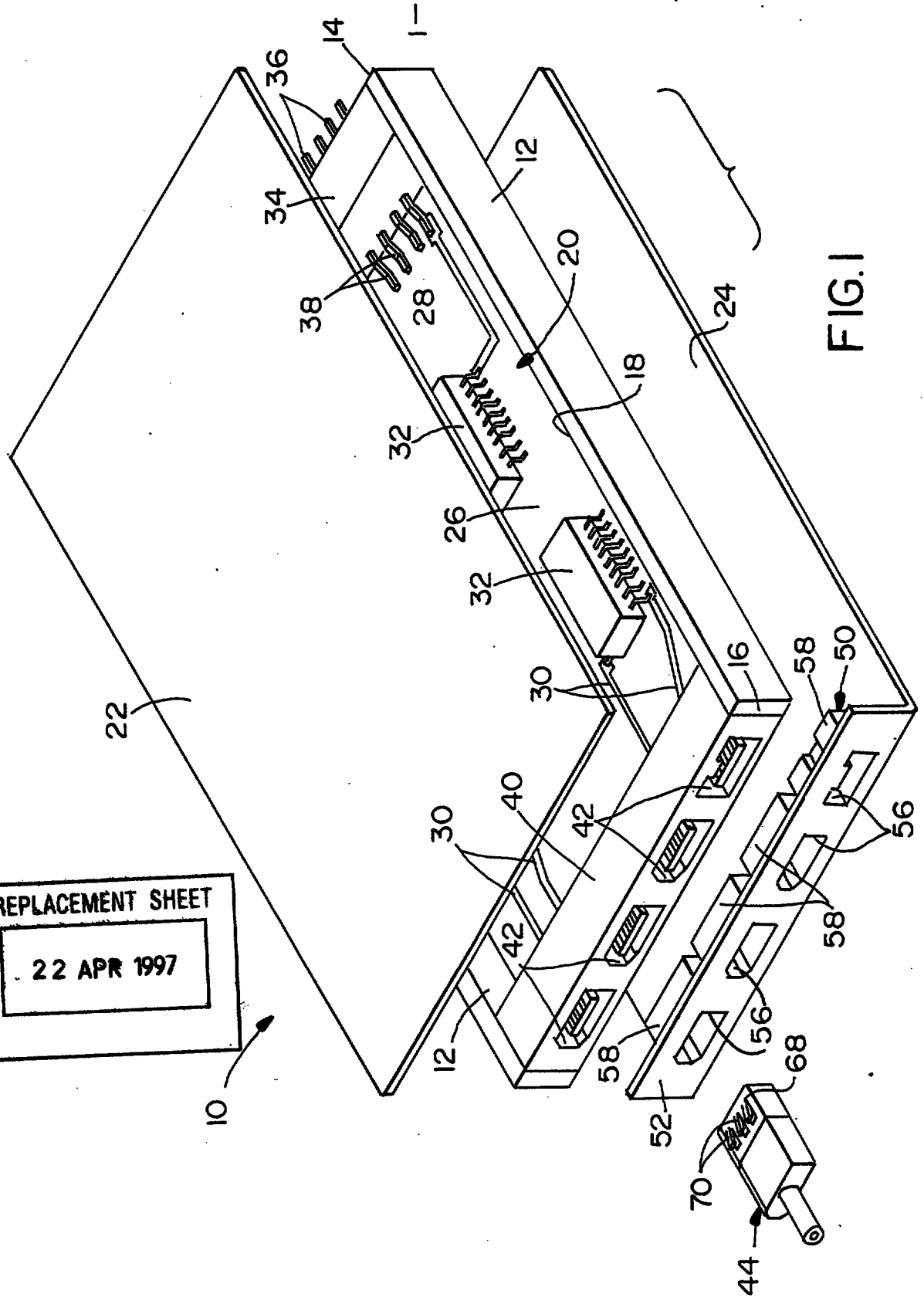

FIG. 1

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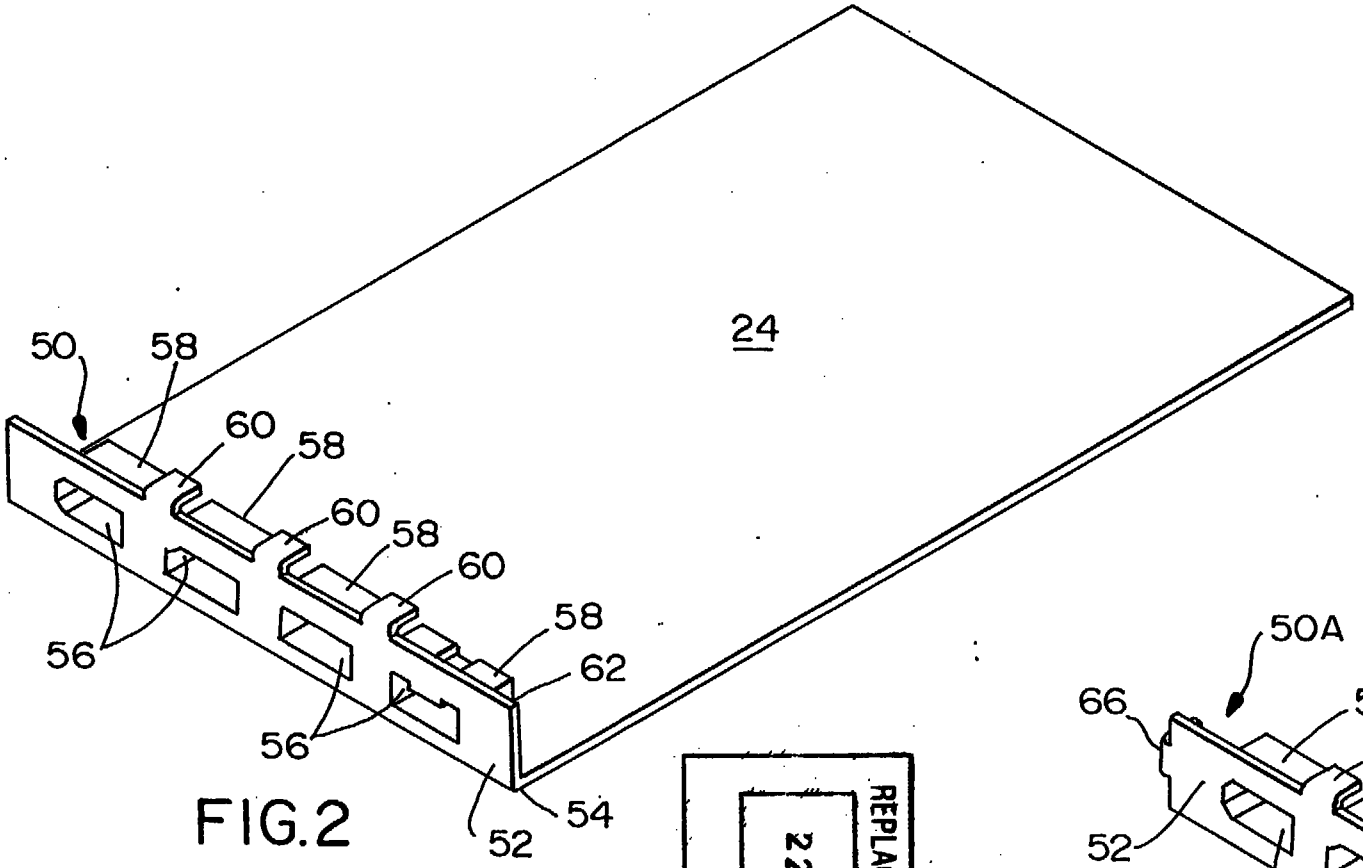

FIG.2

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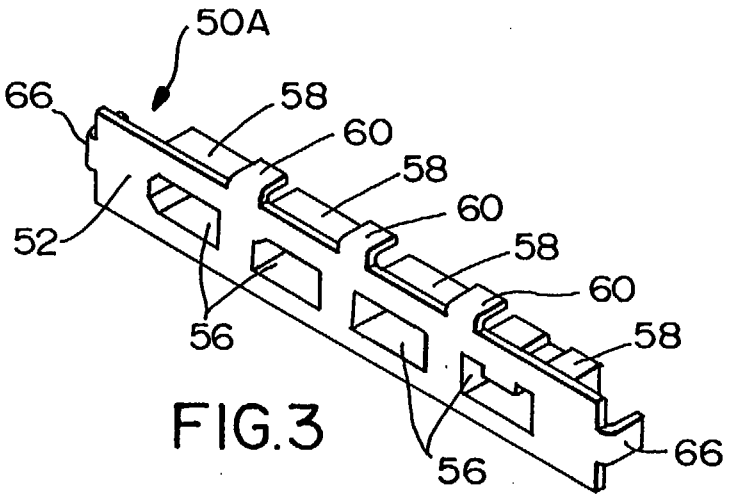

FIG.3

12

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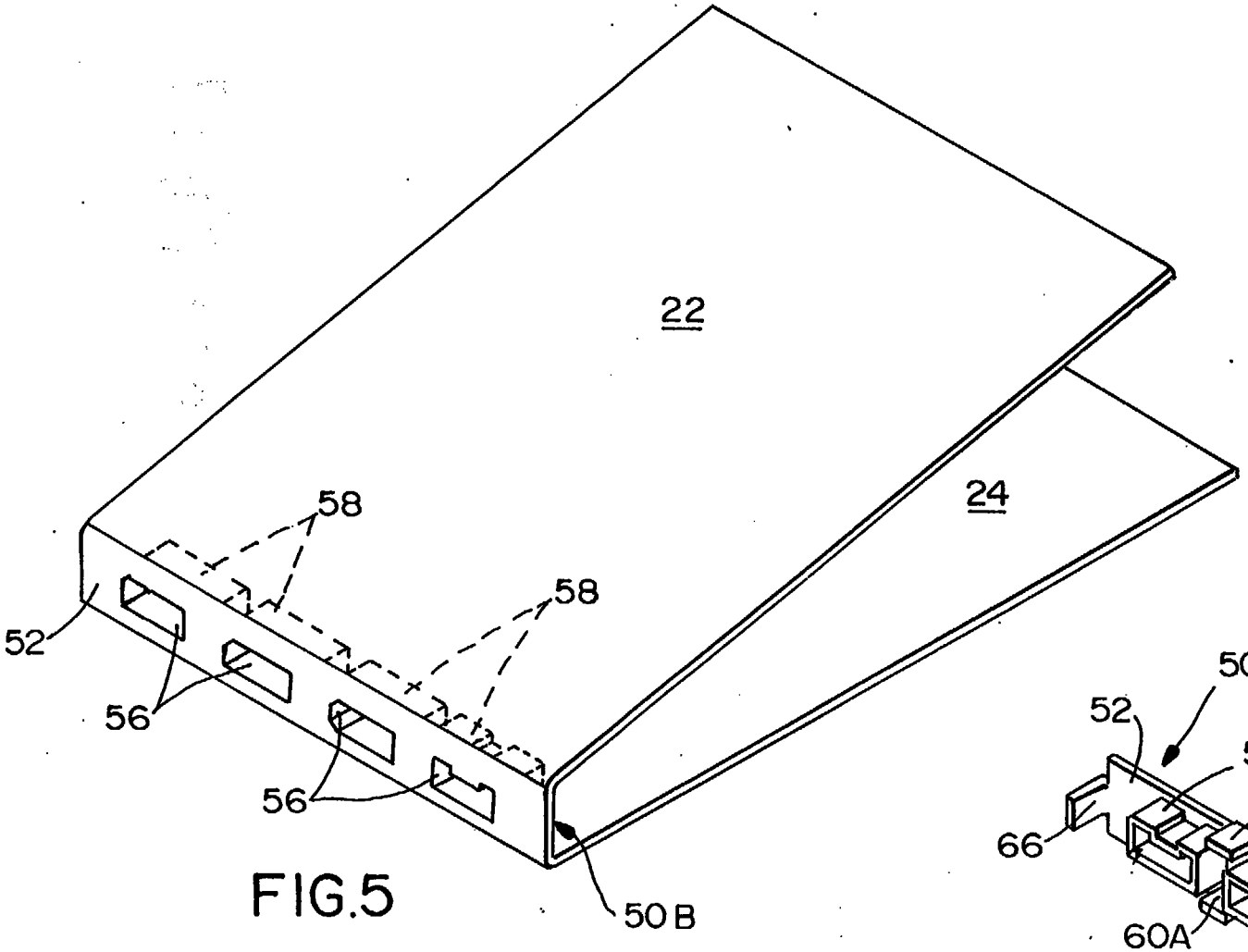

FIG.5

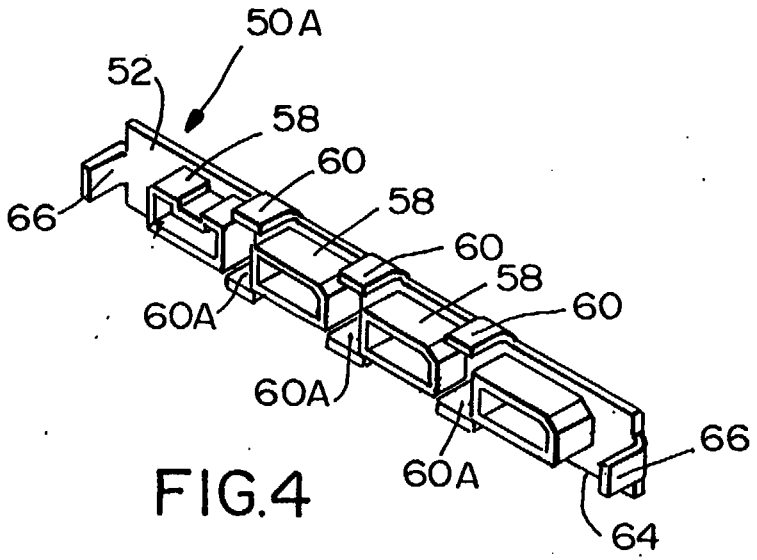

FIG.4