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(54) Title: ANTENNA GROUNDING SYSTEM AND METHOD

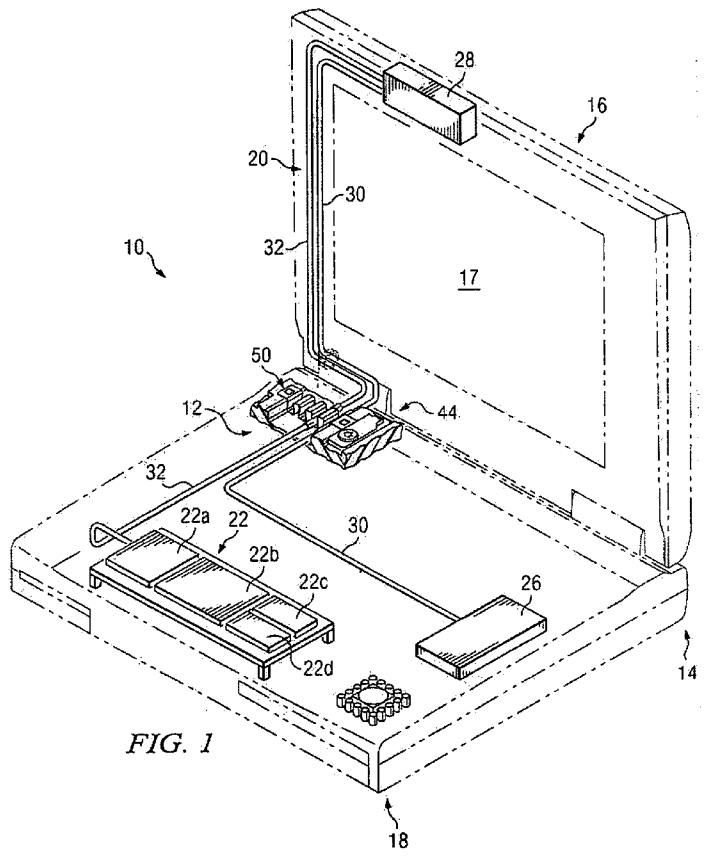


FIG. 1

(57) Abstract: An antenna grounding system (12) comprises an electronic device (10) having at first member (16, 18) movably coupled to a second member (16, 18), at least one cable (30, 32) extending between the first and second members (16, 18) and coupled to an antenna (28), and a clip (50) having at least two fingers (60) configured to receive the at least one cable (30, 32) therebetween and provide grounding for the at least one cable (30, 32).

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Declarations under Rule 4.17:

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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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ANTENNA GROUNDING SYSTEM AND METHOD

BACKGROUND

[0001] Many types of electronic devices are configured having wireless communication capabilities. However, wireless signals are susceptible to noise generated from various components of the electronic device, which can further adversely affect the strength of a wireless communication signal. For example, noise generated from computer chips within a laptop computer having a wireless communication device may overpower and/or adversely affect the wireless signal, thereby causing a network connection loss.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] FIGURE 1 is a diagram illustrating an electronic device in which an embodiment of an antenna grounding system is employed to advantage;

[0003] FIGURE 2 is an enlarged view of the antenna grounding system of FIGURE 1; and

[0004] FIGURE 3 is a diagram illustrating a section view of the antenna grounding system of FIGURES 1 and 2 taken along the line 3-3 of FIGURE 2.

DETAILED DESCRIPTION OF THE DRAWINGS

[0005] FIGURE 1 is a diagram illustrating an electronic device 10 in which an embodiment of an antenna grounding system 12 is employed to advantage. In the embodiment illustrated in FIGURE 1, electronic device 10 comprises a laptop or notebook computer device 14 comprising a display member 16 with a display screen 17 rotatably coupled to a base member 18. However, it should be understood that electronic device 10 may comprise any type of

electronic device such as, but not limited to, a desktop computer, a tablet personal computer, a handheld computing device, a music player, or any other type of portable or non-portable electronic device having wireless communications capabilities.

[0006] In the embodiment illustrated in FIGURE 1, electronic device 10 comprises a wireless communications assembly 20 for enabling wireless communications between electronic device 10 and a wireless communications network (e.g., wireless signals in the form of communication data and/or control signals). Antenna grounding system 12 is used to substantially reduce and/or eliminate noise or other interference (e.g., radio frequency interference, electromagnetic interference, and/or electromagnetic waves) generated by components within electronic device 10 such as, but not limited to, noise or interference caused by and/or otherwise associated with a circuit board 22 disposed within base member 18 (e.g., chips 22a, 22b, 22c and/or 22d disposed on circuit board 22) or any other noise-generating device or component disposed within electronic device 10. Wireless communications assembly 20 may be configured for a wireless wide area network (WWAN), a wireless local area network (WLAN) or any other type of wireless communications network.

[0007] In the embodiment illustrated in FIGURE 1, wireless communications assembly 20 comprises at least one wireless radio or module 26 disposed in base member 18, at least one antenna 28 disposed in display member 16, and cables 30 and 32 communicatively coupling module(s) 26 to antenna(s) 28. However, it should be understood that wireless communications assembly 20 may be otherwise configured (e.g., module 26 and antenna 28 both disposed in base member 18, module 26 and antenna 28 both disposed in display member 16, etc.). in FIGURE 1, two cables 30 and 32 are illustrated; however, it should be understood that a greater or fewer quantity of cables may be used for communicatively coupling antenna(s) 28 or any other type of component in display member 16 to module(s) 26 or any other type of component in base member 18. In some embodiments, cables 30 and 32 comprise coaxial cables; however, it should be understood that other types of cables 30 and 32 may be used. For example, in some embodiments, cables 30 and 32 may comprise an external braid surrounding a plurality of cable elements.

[0008] Generally, noise generated by circuit board 22, chips 22a-22d or other devices or components of electronic device 10 may interfere with and/or adversely affect the performance of wireless communications assembly 20 (e.g., the wireless signal strength). For example, noise generated by chip 22a may radiate onto cable 32 and propagate toward antenna 28, which may hinder the signal strength, thereby resulting in a network connection loss, especially when electronic device 10 is being used and/or wireless communications are being attempted near the outer edges or boundaries of a coverage area of a wireless network. Embodiments of system 12 substantially reduce and/or eliminate noise or other interference caused by components within electronic device 10 from adversely affecting the wireless communications. Embodiments of system 12 provide an intermediate conductive path to ground for cable 30 and/or 32 for re-directing all or a portion of any noise that may be radiated onto cables 30 and/or 32 away from antenna 28. For purposes herein, a ground is a direct electrical connection to a particular point in an electrical or electronic circuit, such as a chassis 44. The ground provides a point that can be considered to have zero voltage.

[0009] In the embodiment illustrated in FIGURE 1, grounding system 12 comprises a clip 50 configured to provide a conductive path to ground for cables 30 and 32 while also providing a retention force to provide strain relief for cables 30 and 32 (e.g., to provide strain relief in response to movement of display member 16 relative to base member 18). In FIGURE 1, clip 50 is disposed in base member 18 such that clip 50 receives cables 30 and 32 from display member 16 and provides a conductive path to ground for cables 30 and 32. However, it should be understood that clip 50 may be otherwise located (e.g., additionally or alternatively, in display member 16). In FIGURE 1, two cables 30 and 32 are illustrated as extending between display member 16 and base member 18; however, it should be understood that a greater or fewer quantity of cables may extend between display member 16 and base member 18, and clip 50 may be configured to accommodate a greater or fewer quantity of cables. Further, it should be understood that clip 50 may be used to provide a conductive path to ground for one or more cables that reside solely in one of members 16 and 18 (e.g., clip 50 may be configured to be conductively coupled to a particular cable that does not extend between display

member 16 and base member 18 but, instead, resides solely in one portion of electronic device 10).

[0010] FIGURE 2 is an enlarged diagram of grounding system 12, and FIGURE 3 is a diagram illustrating a section view of system 12 taken along the line 3-3 of FIGURE 2. In the embodiment illustrated in FIGURES 2 and 3, clip 50 comprises a number of fingers 60_1-60_5 forming a number of channels 64_1-64_4 therebetween for receiving cables 30 and 32 therein. It should be understood that the quantity of finger 60 and channels 64 may be varied to accommodate a greater or fewer quantity of cables. In the embodiment illustrated in FIGURES 2 and 3, fingers 60 are configured to form trapezoidal-shaped channels 64 such that fingers 60 and/or channels 64 apply a compressive retention force to cables 30 and 32 disposed within channels 64. For example, as illustrated in FIGURES 2 and 3, fingers 60 comprise a number of vertical members 70_1-70_8 having a number of cross members 72_1-72_8 extending therebetween. As best illustrated in FIGURE 3, referring to channel 64_1, for example, fingers 70_1 and 70_2 are formed having acute angles relative to cross member 72_1 such that channel 64_1 comprises a trapezoidal shape. Further, as illustrated in FIGURES 2 and 3, clip 50 is configured having an accordion-type shape having channels formed on opposite sides thereof (e.g., four channels 64_1-64_4 on one side of clip 50 with channels 74_1-74_3 formed on an opposite side thereof). Thus, in the embodiment illustrated in FIGURES 2 and 3, clip 50 is illustrated as having cables 30 and 32 disposed on one side thereof; however, it should be understood that cables may be coupled to both sides of clip 50 (e.g., disposed within channels 64 and 74).

[0011] As best illustrated in FIGURE 3, cables 30 and 32 are located and/or otherwise disposed within channels 64 (e.g., 64_3 and 64_4). The trapezoidal shape of channels 64 applies a compressive retention force to retain cables 30 and 32 therein, thereby providing strain relief for cables 30 and 32 to resist movement of cables 30 and 32 that may otherwise result in response to movement of display member 16 relative to base member 18 (FIGURE 1). Thus, for example, as best illustrated in FIGURE 3, channels 64 and 74 are formed having a variable width or lateral dimension as measured in the direction indicated by arrow 80 that varies relative to the depth of channels 64 and 74 as measured in the direction indicated by arrow 82. Thus, in

operation, cables 30 and 32 are installed and/or otherwise pressed into one of channels 64 and 74. Because the open portion of channels 64 and 74 is sized smaller than the base or closed portion of channels 64 and 74 (e.g., the base or closed portion of channels 64 and 74 formed by cross members 72), members 70 provide a compressive retention force to retain cables 30 and 32 therein.

[0012] In the embodiment illustrated in FIGURES 2 and 3, a portion of an outer jacket or insulator layer 90 of cables 30 and 32 is removed, thereby exposing at least a portion of cables 30 and 32 disposed beneath the insulator layer 90 (e.g., the shield layer of the cable). Embodiments of system 12 ground the portion of exposed cables 30 and 32 via clip 50 so as to substantially prevent or eliminate noise from propagating or continuing along a remaining portion of cables 30 and 32 to antenna 28.

[0013] In some embodiments, the portion of insulator layer 90 removed from cable 30 is located at an intermediate location of cables 30 and 32 in the location of clip 50 (e.g., a location of cables 30 and 32 disposed between antenna 28 and module 26 and/or circuit board 22) such that a gap or break in the insulator layer 90 is formed so that insulator layer 90 remains on cables 30 and 32 on each side of the grounded portion. Thus, for example, in the embodiment illustrated in FIGURES 2 and 3, insulator layer 90 is removed from at least a portion of cables 30 and 32 to form an exposed portion of cables 30 and 32 in the vicinity of clip 50, thereby resulting in insulator layer 90 remaining on cables 30 and 32 between clip 50 and module 26/circuit board 22 and between clip 50 and antenna 28. Insulator layer 90 is removed from an entire circumference of cables 30 and 32 to expose an underlying portion of cables 30 and 32.

[0014] In the embodiment illustrated in FIGURES 2 and 3, system 12 comprises a conductive element 92 for covering and/or grounding exposed portions of cable 30 and 32 (e.g., the portion of cables 30 and 32 where insulator layer 90 has been removed such that the removed insulator layer 90 is replaced with conductive element 92). In some embodiments, conductive element 92 comprises a conductive elastomer sleeve or tube having a hollow interior for receiving cables 30 and 32 therein (e.g., to facilitate sliding of the elastomer tube over an end of cables 30 and 32 and sliding of the elastomer tube along cables 30 and 32 to the locations of the

removed insulator layer 90). However, it should be understood that conductive element 92 may be otherwise configured (e.g., a conductive element wrapped around the exposed portions of cables 30 and 32 and otherwise secured to cables 30 and 32). In some embodiments, conductive element 92 comprises a spongy/compressible conductive elastomeric material; however, it should be understood that conductive element 92 may be otherwise configured (e.g., a non-elastomeric and/or non-spongy material). In the embodiment described above, a portion of insulator layer 90 is removed from cables 30 and 32 and the exposed portions of cables 30 and 32 are grounded by conductive contact of conductive element 92 with clip 50, thereby facilitating use of an off-the-shelf coaxial or other type of cable. However, it should be understood that cables 30 and 32 may be specially manufactured having an intermediate location formed with a conductive element or portion to enable grounding of an intermediate portion of cables 30 and 32 disposed beneath the insulator layer 90. Preferably, conductive element 90 covers the exposed portion of cables 30 and 32 and extends at least slightly onto and/or over insulator layer 90 remaining on cables 30 and 32.

[0015] In the embodiment illustrated in FIGURES 2 and 3, conductive element 92 is disposed in contact with clip 50, and clip 50 is conductively coupled to a portion of chassis 44 for grounding thereof. For example, in the embodiment illustrated in FIGURES 2 and 3, a portion 94 of clip 50 is conductively coupled to a portion of a hinge assembly 96 of electronic device 10 to provide a conductive path to ground. However, it should be understood that clip 50 may be conductively coupled to another portion of chassis 44 and/or elsewhere on electronic device 10. Clip 50 may be formed from copper, a copper alloy, or other type of conductive material. In the embodiment illustrated in FIGURES 2 and 3, clip 50 is coupled to one or more portions of a housing or other structure of electronic device 10. For example, in the embodiment illustrated in FIGURES 2 and 3, clip 50 is coupled to a keyboard deck portion 98 of a housing 100 of electronic device 10. However, it should be understood that clip 50 may be coupled to different portions/locations of electronic device 10. In some embodiments, clip 50 is heat-staked or fused to housing 100 (e.g., using pins that are designed to melt and hold clip 50 to housing 100 and/or otherwise melting/fusing clip 50 to housing 100). However, it should be understood

that clips, fasteners, or other types of devices or method may be used to secure clip 50 to electronic device 10.

[0016] Thus, embodiments of system 12 enable electronic device 10 to be manufactured such that clip 50 provides a conductive path to ground for cables associated with and/or otherwise connected to an antenna used for wireless communications for electronic device 10. Embodiments of system 12 also enable clip 50 to be manufactured to provide a retention force to cables attached and/or coupled thereto to resist movement of cables that may otherwise result from the movement of various components of electronic device 10. Thus, in some embodiments, electronic device 10 may be manufactured by movably coupling a first member to a second member, coupling at least one cable extending between the first and second members to an antenna, and conductively coupling a portion of the at least one cable to a clip, the clip having at least two fingers configured to receive the at least one cable therebetween. Electronic device 10 may also be manufactured by configuring the clip to apply a compressive retention force to the at least one cable. In some embodiment, electronic device 10 may be manufactured by conductively coupling the clip to a chassis of the electronic device, providing a grounding sleeve on at least a portion of the at least one cable, and locating the grounding sleeve between the at least two fingers of the clip. Embodiments of electronic device 10 may also be manufactured by providing a clip configured to receive at least one cable from an antenna, wherein the clip provides grounding for the at least one cable, and wherein the clip comprises at least one trapezoidal-shaped channel for receiving the at least one cable therein. Embodiments of electronic device 10 may also be manufactured by configuring the at least one trapezoidal-shaped channel to apply a retention force to the at least one cable. Embodiments of electronic device 10 may further be manufactured by conductively coupling the clip to a chassis of the electronic device, providing a grounding sleeve on at least a portion of the at least one cable, and locating the grounding sleeve in the at least one trapezoidal-shaped channel.

WHAT IS CLAIMED IS:

1. An antenna grounding system (12), comprising:

an electronic device (10) having at first member (16, 18) movably coupled to a second member (16, 18);

at least one cable (30, 32) extending between the first and second members (16, 18) and coupled to an antenna (28); and

a clip (50) having at least two fingers (60) configured to receive the at least one cable (30, 32) therebetween and provide grounding for the at least one cable (30, 32).

2. The system (12) of Claim 1, wherein the at least two fingers (60) are configured to apply a compressive retention force to the at least one cable (30, 32).

3. The system (12) of Claim 1, wherein the at least two fingers (60) form a channel (64, 74) for receiving the at least one cable (30, 32) therein.

4. The system (12) of Claim 1, wherein the clip (50) is coupled to a chassis (44) of the electronic device (10).

5. The system (12) of Claim 1, wherein the at least two fingers (60) form a trapezoidal-shaped channel (64, 74) for receiving the at least one cable (30, 32) therein.

6. The system (12) of Claim 1, wherein the at least one cable (30, 32) comprises a grounding sleeve (92).

7. The system (12) of Claim 6, wherein the clip (50) is conductively coupled to the grounding sleeve (92).

8. An antenna grounding system (12), comprising:

an electronic device (10) comprising an antenna (28) and a clip (50) configured to receive at least one cable (30, 32) from the antenna (28), wherein the clip (50) provides grounding for

the at least one cable (30, 32), and wherein the clip (50) comprises at least one trapezoidal-shaped channel (64, 74) for receiving the at least one cable (30, 32) therein.

9. The system (12) of Claim 8, wherein the at least one trapezoidal-shaped channel (64, 74) is configured to apply a retention force to the at least one cable (30, 32).

10. The system (12) of Claim 8, wherein the clip (50) is conductively coupled to a chassis (44) of the electronic device (10).

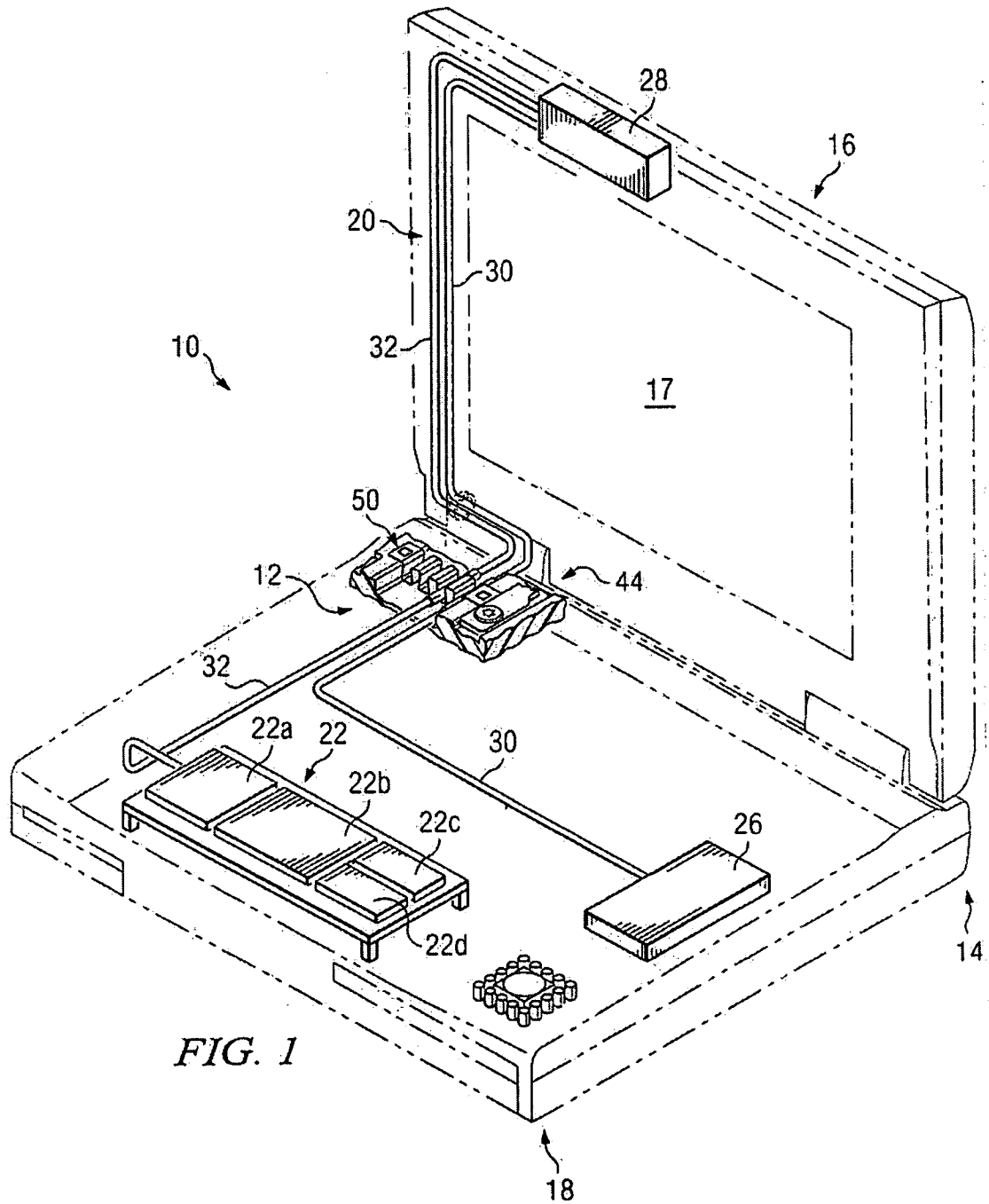


FIG. 1

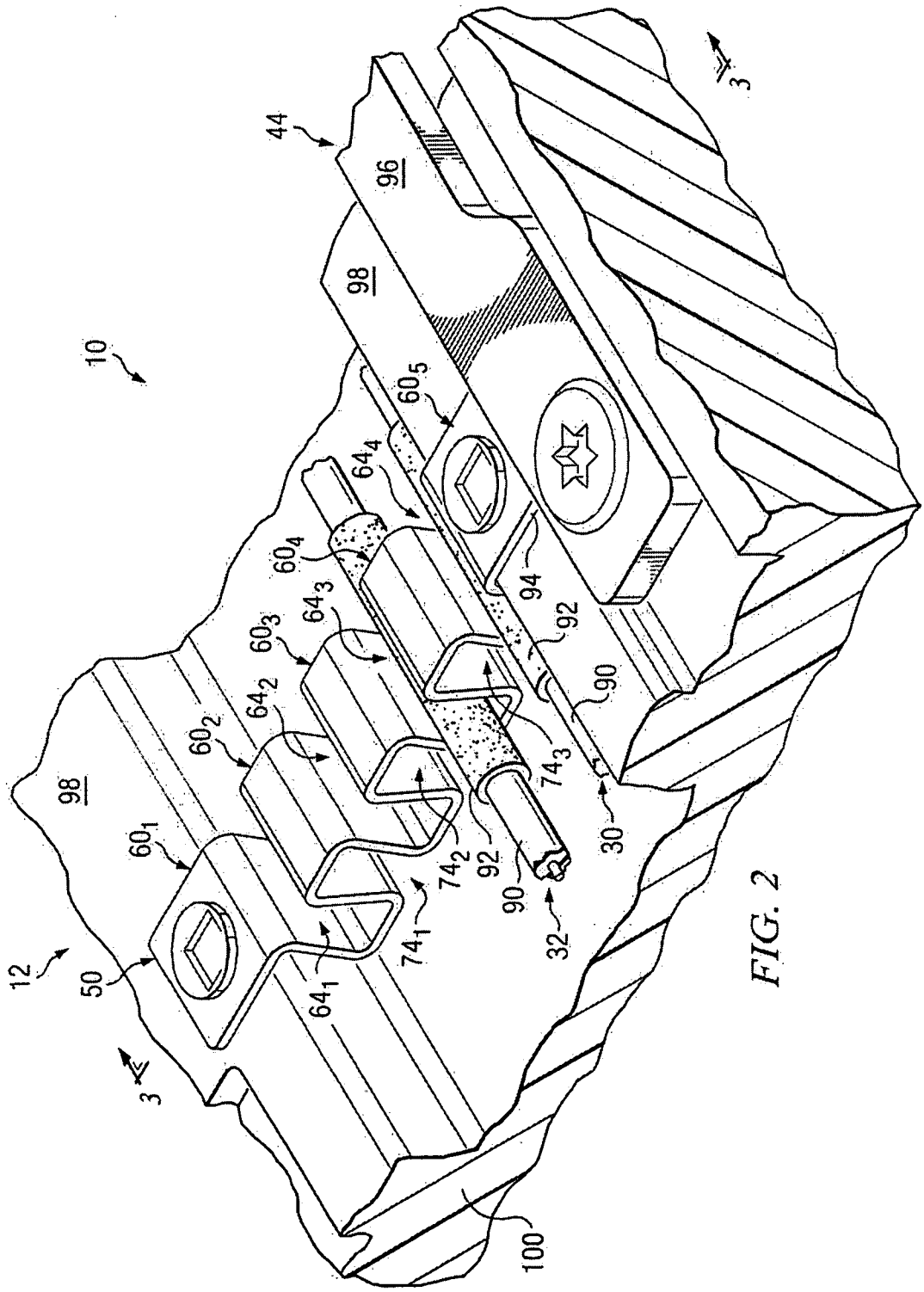

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FIG. 2

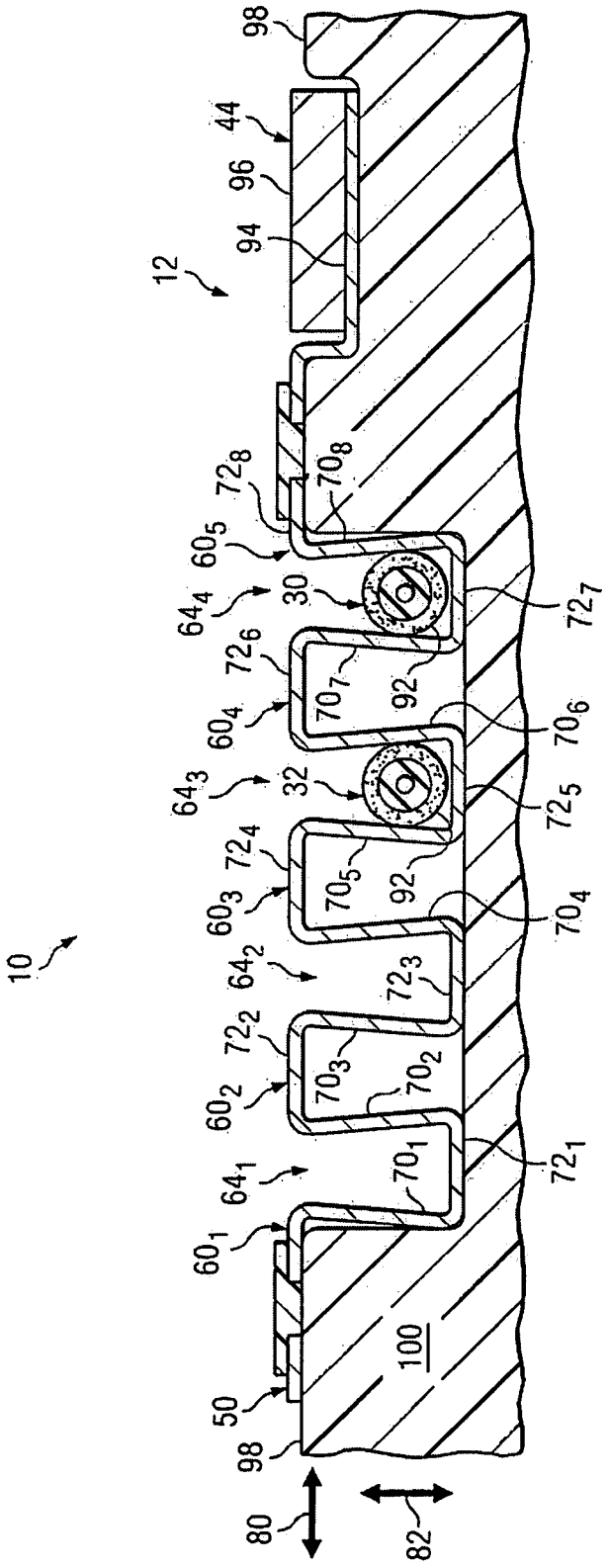

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FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/005356

A. CLASSIFICATION OF SUBJECT MATTER

H01Q 1/48(2006.01)i, G06F 1/16(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8: H01Q 1/48

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and applications for Utility models since 1975

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

eKIPASS(KIPO internal) "antenna", "ground", "noise", "cable", "sleeve"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2004335155 A (HITACHI CABLE CO., LTD.) 25 November 2004 See the abstract; paragraphs [16]-[19]; figure 1.	1-10
Y	EP 1583173 A1 (MITSUMI ELECTRIC CO., LTD.) 05 October 2005 See the abstract; paragraphs [24]-[25]; figures 3-4.	1-10
Y	US 5657029 A (IIJIMA, H. et al.) 12 August 1997 See the abstract; column 10, line 11 - column 10, line 25; figure 19.	1-10
A	US 20040174306 A1 (KATOH, K. et al.) 09 September 2004 See the abstract; claims 1-12; figures 1-4.	1-10

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2008/005356

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2004335155 A	25.11.2004	None	
EP 1583173 A1	05.10.2005	EP 1583173 B1	16.04.2008
		JP 2005295398 A	20.10.2005
		CN 1677750 A	05.10.2005
US 5657029 A	12.08.1997	JP 06276008 A	30.09.1994
US 20040174306 A1	09.09.2004	US 20060049999 A1	09.03.2006
		US 6972722 B2	06.12.2005
		US 7242354 B2	10.07.2007
		JP 2004266681 A	24.09.2004