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H4J JK J36Q

(56) Documents Cited

GB 2217896 A **EP 0168228 A2** **US 5675396 A**
US 4614406 A

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INT CL⁶ G02F 1/13 , H04M 1/02
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(54) Abstract Title

Display device employing a conformable metallic gasket to prevent electrostatic charge build-up

(57) An electronic device 100, such as a wireless telephony device, has a housing 104, a display 324 and a gasket 300. The gasket 300 is compressible, and has a metallic layer on the surface 305 that is in contact with the display. The metallic layer is sufficiently compliant to conform to the surface of the display, and may be connected to a ground potential 328 on a circuit board 320. This prevents build up of harmful electrostatic charge on the display.

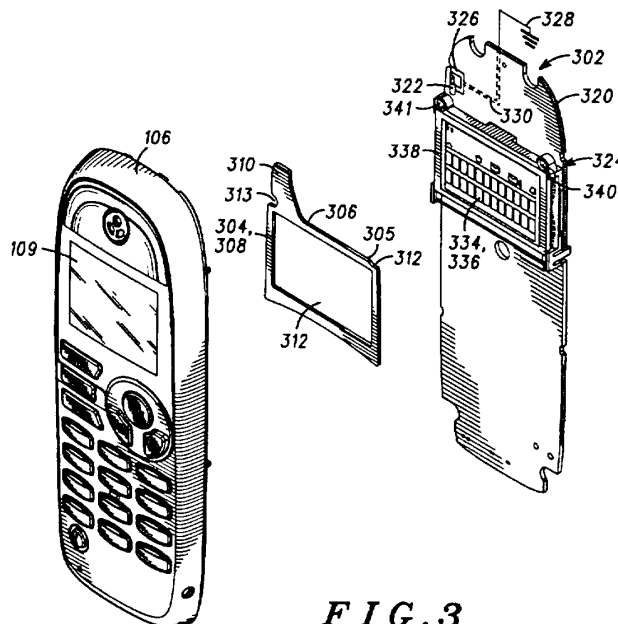


FIG. 3

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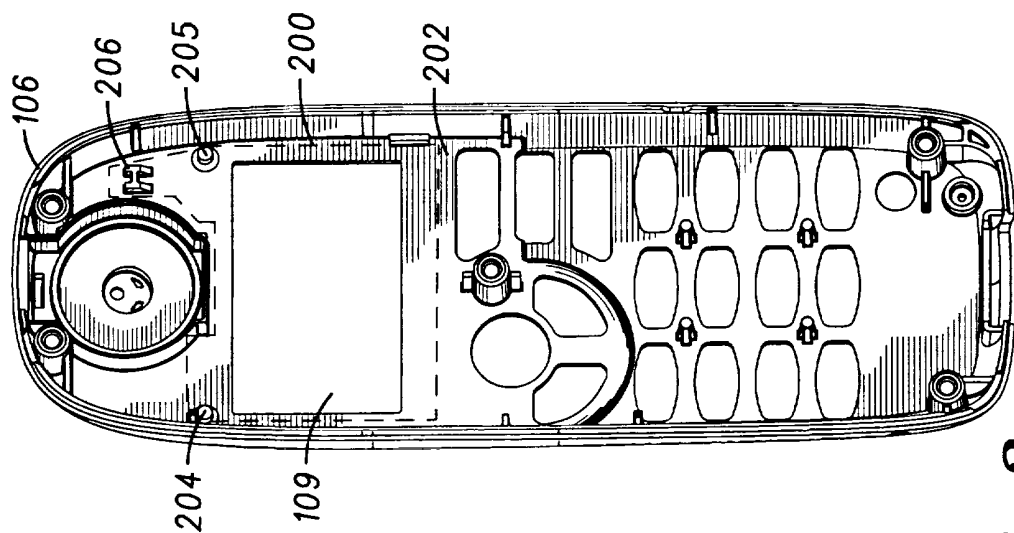
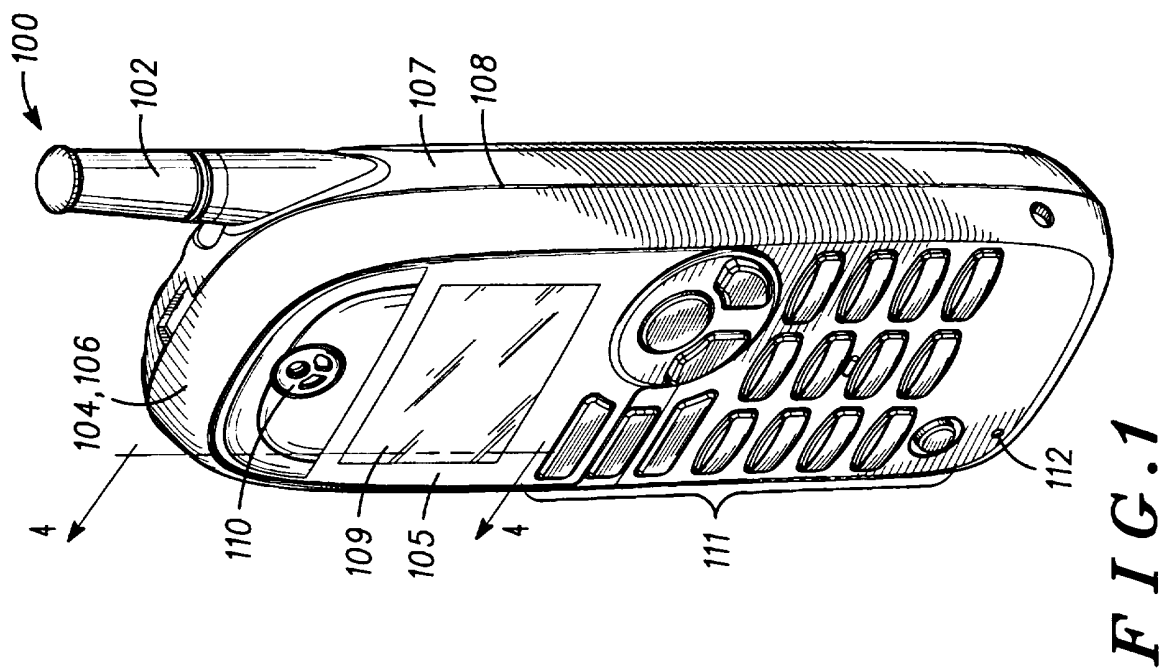


FIG. 2

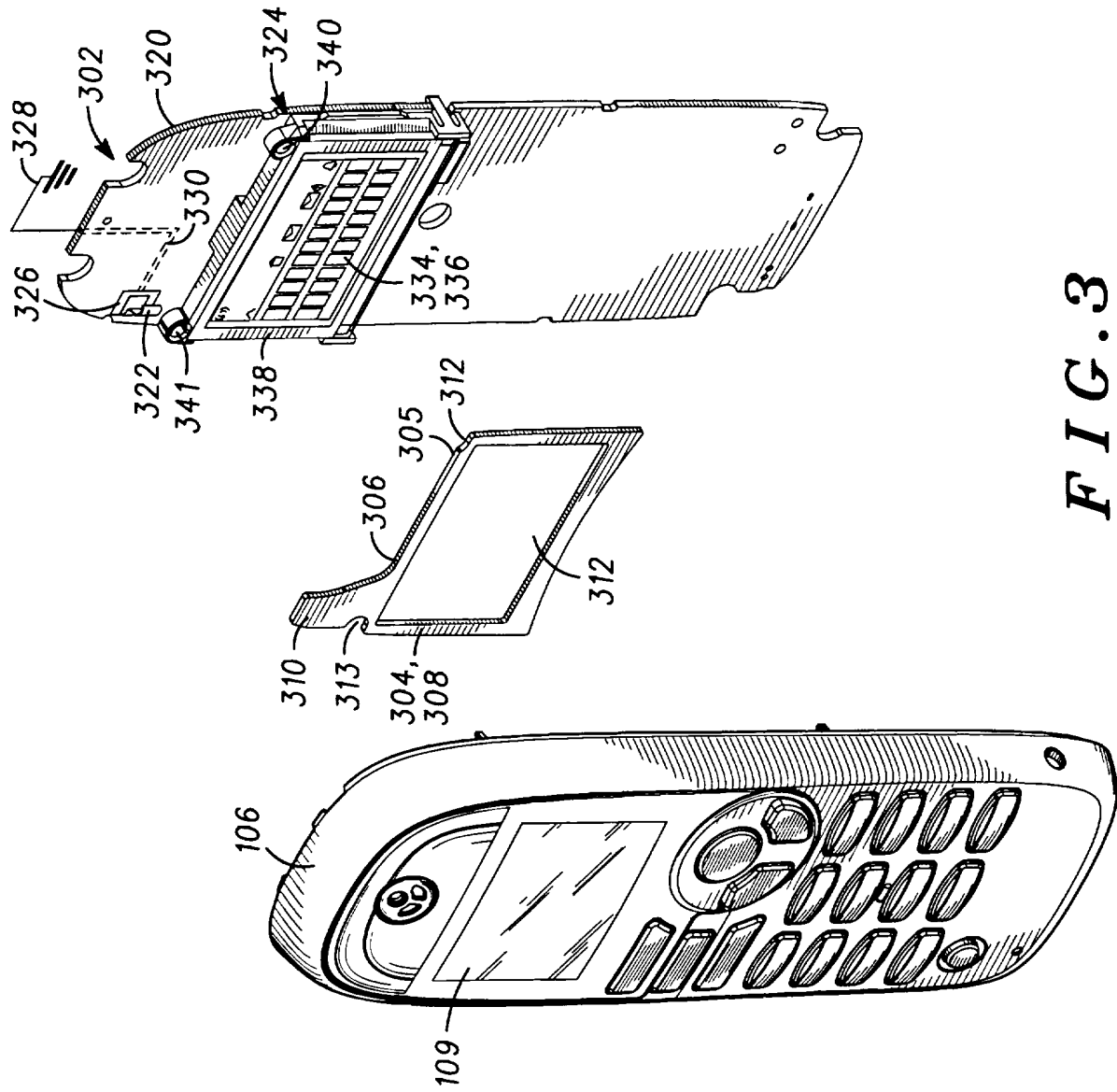


FIG. 3

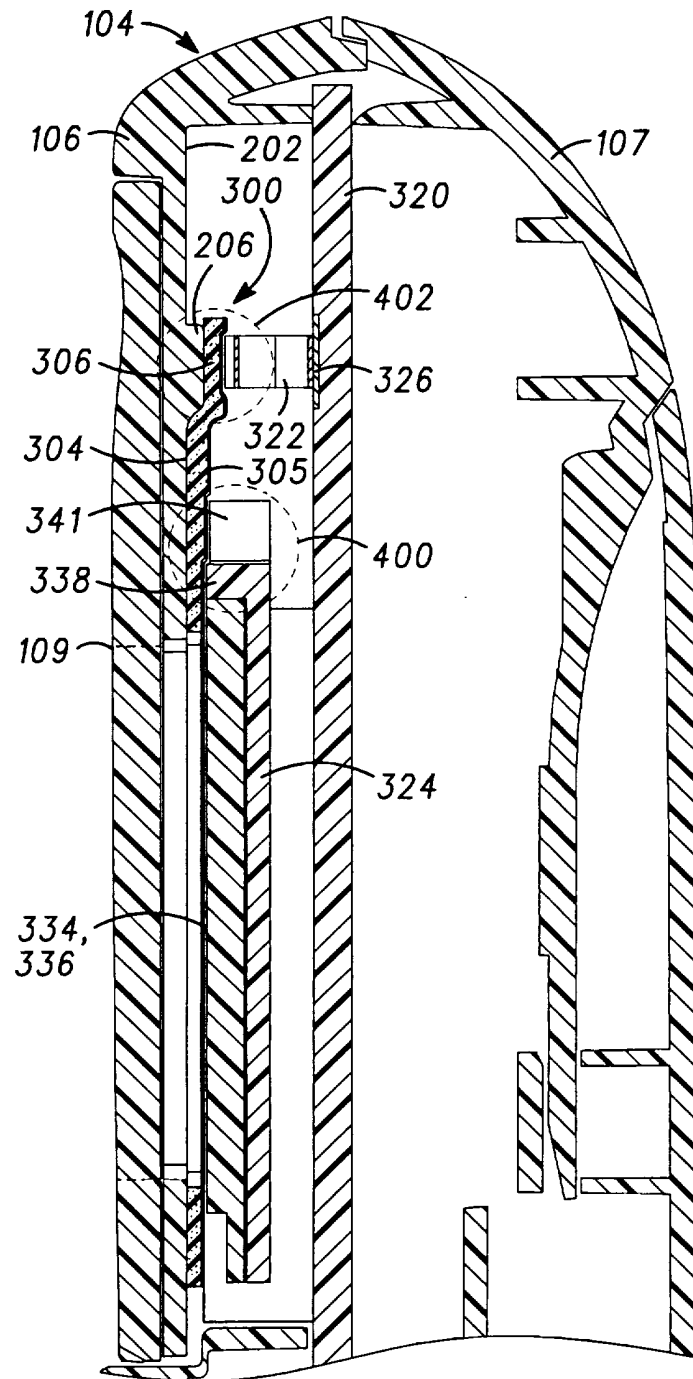


FIG. 4

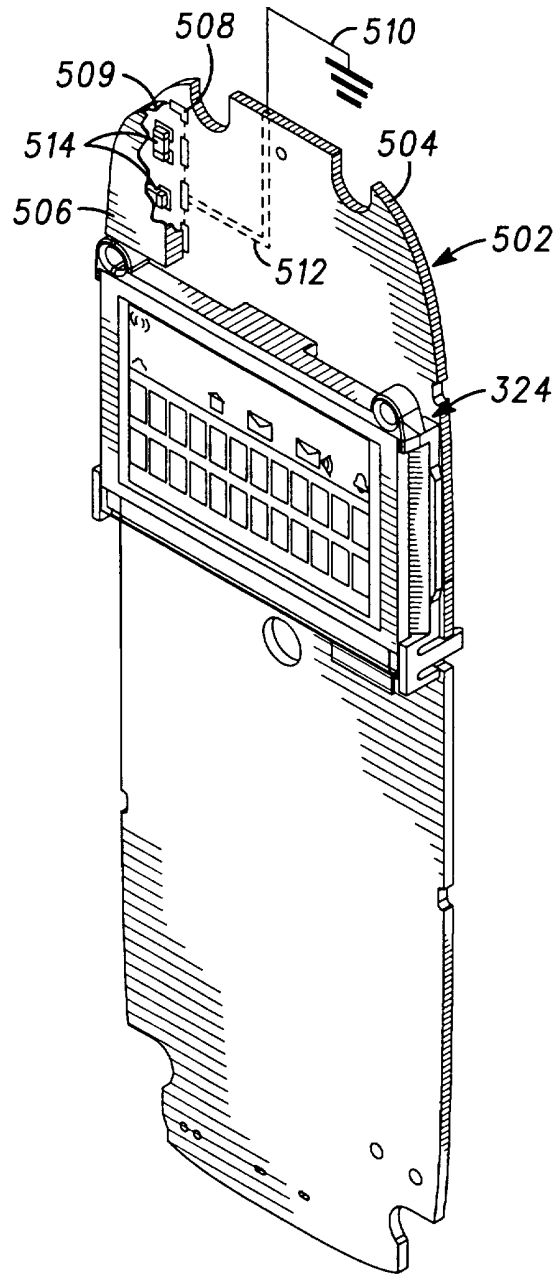


FIG. 5

ELECTRONIC DEVICE EMPLOYING A CONFORMABLE METALLIC
DISPLAY GASKET

Field of the Invention

The present invention relates generally to electronic devices employing displays and, more particularly, to electronic devices employing electrostatic charge protection for displays.

Background of the Invention

Recent technological advancements have made miniaturization of electronic devices possible. One such device is a portable wireless telephony device, such as a cellular telephone or pager. Because of its portability, the device is frequently handled by the user and, thereby, subjected to electrostatic charges transferred from the user. Once in contact with the device, the electrostatic charges can damage electronic components of the device.

One such electronic component of the device that is particularly susceptible to electrostatic charges is the display, which must reside on, or very close to, the surface of the device housing so as to be viewable by the user. It is known from U.S. Patent No. 5,247,291 to protect a display from electrostatic charges by forming conductive patterns around the display on a circuit board underlying the display and placing the underlying circuit board at a right angle to an additional circuit board containing additional circuitry, including the display control circuit. Unfortunately, in miniaturized devices, circuit board area is not readily available for conductive patterns and thin form factors can not accommodate such right angle board configurations.

Therefore, what is needed is an improved way of protecting a display from electrostatic charges that is compatible with thin form factors and minimizes use of circuit board area.

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Brief Description of the Drawings

FIG. 1 is a perspective view of an electronic device employing a conformable metallic display gasket;

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FIG. 2 is a slight perspective view of an inner surface of a front housing portion of the electronic device of FIG. 1;

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FIG. 3 is a partial, exploded perspective view of the electronic device of FIG. 1 showing the front housing portion, the conformable metallic display gasket, and a circuit board assembly, the circuit board assembly having a metallic contact, a display, and a circuit board;

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FIG. 4 is an enlarged, partial cross sectional view of the electronic device of FIG. 1 taken along section lines 4-4 in FIG. 1; and

FIG. 5 is a perspective view of an alternate circuit board assembly having an alternate metallic contact.

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Detailed Description of the Preferred Embodiments

An electronic device, such as a wireless telephony device, has a housing, a display, and a gasket. The gasket has a first surface, a second surface and a compressible material disposed between the first and second surfaces. The first surface contacts the housing. The second surface contacts the display and is formed of metallic material sufficiently pliable to conform to the display and, thereby, ensure reliable contact with the display. Unlike the prior art, the conformable gasket is sufficiently thin so as to be compatible with thin form factors, resides off-board between

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the housing and the display, and employs a metallic material to direct harmful electrostatic charges away from the display.

An electronic device 100 is shown in FIG. 1 as a wireless telephony device or, more specifically, as a portable cellular telephone. The device
5 100 employs an antenna 102 and a transceiver circuit to communicate wireless signals to and from one or more remote devices. The antenna is 102 carried on a housing 104 of the device 100, while the transceiver circuit is disposed within the housing 104 and thereby hidden from view in FIG. 1. The housing 104 is formed from plastic injection molded front and
10 rear housing portions 106 and 107, which are matable along junction line 108. The front housing portion 106 has an elongated rectangular front surface 105 carrying a speaker bezel 110, a keypad 111, and a microphone opening 112. A rectangular transparent display window 109 is formed in the front surface 105 between the speaker bezel 110 and the
15 keypad 111. A gasket receiving site 200, shown in FIG. 2, is defined on an inner surface 202 of the front housing portion 106 surrounding the display window 109. The gasket receiving site 200 has a pair of locating pegs 204 and 205 and a platform 206. Prior to mating the front and rear housing portions 106 and 107, a gasket 300, shown in FIG. 3, is
20 assembled to the gasket receiving site 200 of FIG. 2 and a circuit board assembly 302 of FIG. 3 is positioned in the front housing portion 106 over the gasket 300.

The gasket 300 is formed from a substantially planar, multi-layered composition of, primarily, a compressible material and a metallic material.
25 In the illustrated embodiment, a front surface 304 of the gasket 300 is composed of a plastic material, such as a layer of mylar approximately 0.08 mm thick; a rear surface 305 of the gasket 300 is composed of a sufficiently pliable metallic material, such as a layer of aluminum foil approximately 0.03 mm thick; and a center 306 of the gasket 300
30 disposed between the front and rear surfaces 304 and 305 is composed of a compressible foam material, such as a layer of Poron™ material having an uncompressed thickness of approximately 0.8 mm. The front surface 304 is joined to the center 306 by a layer of adhesive approximately 0.04 mm thick. The rear surface 305 is joined to the center 306 by a layer of
35 adhesive approximately 0.03 mm thick. A layer of adhesive approximately

0.04 mm thick is also deposited on the front surface 304 for securing the gasket 300 to the gasket receiving site 200 of FIG. 2. The resulting multi-layered composition is approximately 1 mm in thickness and is compressible to approximately 0.8 mm in thickness. It will be recognized that recitation above of the specific materials and thicknesses of the multi-layered composition is by example only and that other suitable multi-layered compositions that provide a metallic surface layer and are 20-25% compressible may alternatively be employed herein.

The gasket 300 is die cut from the multi-layered composition to have a rectangular body 308 and a substantially rectangular arm 310 integral with the body 308. A rectangular opening 312, which is dimensioned to be slightly larger than the display window 109 of the front housing portion 106, extends through a central portion of the body 308 and, thereby, defines the body 308 as a rectangular frame structure. A locating slot 312 is formed in a right, top corner of the body 308. The arm 310 extends from a left, top corner of the body 308 in a direction away from the opening 312. A locating slot 313 is formed in the arm 310 where the arm 310 meets the left, top corner of the body 308.

The gasket 300 is assembled to the front housing portion 106 by contacting the front surface 304 of the gasket 300 to the gasket receiving site 200 of FIG. 2. To ensure accurate assembly of the gasket 300 of FIG. 3, the gasket 300 is positioned on the gasket receiving site 200 such that the locating slots 312 and 313 of the gasket 300 partially receive the locating pegs 204 and 205 of the gasket receiving site 200, respectively; the opening 312 of the body 308 of the gasket 300 is in alignment with the display window 109 of the front housing portion 106; and the distal end of the arm 310 of the gasket 300 rests on the platform 206 of the gasket receiving site 200. Once positioned, the adhesive on the front surface 304 of the gasket 300 adheres to the gasket receiving site 200, thereby, securing the gasket 300 to the front housing portion 106.

The circuit board assembly 302 primarily includes a circuit board 320, a metallic contact 322 and a display 324. Additional circuitry and components of the circuit board assembly 302 that are commonly found in the device 100 of FIG. 1, such as transceiver and control circuitry, have been removed from FIG. 3 for the purposes of clarity. The circuit board

320 carries a metallic pad 326 that is electrically connected to an electrical ground 328 of the circuit board 320 via a metallic trace 330 disposed within the circuit board 320. The metallic contact 322, which is illustrated in FIG. 3 as a metallic spring finger, is carried on, and secured to, the metallic pad 326. The display 324 is mounted on the circuit board 320 proximate to the metallic contact 322. The display 324 is rectangular and has a front surface 334 sized to be larger than the display window 109 of the front housing portion 106. The front surface 334 has a display area 336 for visually displaying information, such as graphic icons and alpha numeric characters, and a frame area 338 surrounding the display area 336. The frame area 338 has locating bosses 340 and 341 at respective top right and top left corners thereof.

The circuit board assembly 302 is assembled to the front housing portion 106 by positioning the circuit board assembly 302 such that the display 324 and the metallic contact 322 contact the rear surface 305 of the gasket 300. To ensure accurate assembly, the circuit board assembly 302 is positioned such that the locating pegs 204 and 205 reside concentrically within the locating bosses 340 and 341 of the display 324, respectively. As a result of such positioning, the display area 336 of the front surface 334 of the display 324 is in alignment with the opening 312 of the body 308 of the gasket 300 and the display window 109 of the front housing portion 106; the frame area 338 of the front surface 334 of the display 324 is in contact with the body 308 of the gasket 300; and the distal end of the metallic contact 322 is in contact with the arm 310 of the gasket 300.

Upon joining the front and rear housing portions 106 and 107, as discussed above with reference to FIG. 1, the gasket 300 of FIG. 3 is compressed by the display 324 and the metallic contact 322. The metallic material of the rear surface 305 of the gasket 300 at the body 308 conforms to the frame area 338 of the front surface 334 of the display 324 to ensure tight and reliable contact. The distal end of the metallic spring finger, which defines the metallic contact 322 in FIG. 3, deflects towards the circuit board 320 and is received by the metallic material of the rear surface 305 of the gasket 300 at the arm 310 opposite the platform 206 of the front housing portion 106 of FIG. 2. The platform 206 loads the

metallic spring finger such that the rear surface 305 of the gasket 300 at the arm 310 conforms to the distal end of the metallic spring finger so as to ensure a reliable electrical connection between the metallic material of the rear surface 305 of the gasket 300 and the electrical ground 328 of the circuit board assembly 302. FIG. 4 illustrates the compressible and conformable features 400 and 402 of the gasket 300 with respect to the frame area 338 of the display 324 and the metallic contact 322, respectively. It will be recognized that the gasket 300 contacts the display 324 and the metallic contact 322 as described above, and that the spacing between the rear surface 305 of the gasket 300 and both the display 324 and the metallic contact 322 shown in FIG. 4 is for purposes of illustrative clarity only.

Once fully assembled, the device 100 of FIG. 1 is suitable for portable or handheld operation by a user and the display 324 of FIG. 3 is protected from damage caused by electrostatic charges. In operation, electrostatic charges transferred from the user to the display window 109 of the housing 104 of the device 100 will be attracted to the metallic material of the rear surface 305 of the gasket 300. Once attracted to the gasket 300, the electrostatic charges will be safely discharged to the electrical ground 328 of the circuit board 320 via the conductive path created by the body 308 of the gasket 300, the arm 310 of the gasket 300, the metallic contact 322, the metallic pad 326, and the trace 330. In addition to conducting electrostatic charges for purposes of discharging, the gasket 300 also performs its traditional function of preventing foreign material from entering the area between the display window 109 and the display area 336 of the display 324 and, thereby, obscuring viewability of the display area 336.

An alternate circuit board assembly 502 of FIG. 5 can be employed to electrically ground the gasket 300 of FIG. 3. The alternate circuit board assembly 502 employs the display 324 of FIG. 3 along with an alternate circuit board 504 of FIG. 5 and an alternate metallic contact 506, which is shown in FIG. 5 as a metallic shield. The alternate circuit board 504 carries a plurality of intercoupled metallic pads 508 (some of which are viewable via a cutaway portion 509 of the metallic shield), which are further coupled to an electrical ground 510 of the alternate circuit board

504 via a trace 512 of the alternate circuit board 504. The plurality of metallic pads 508 surround circuitry 514 (some of which is viewable via the cutaway portion 509) disposed on the alternate circuit board 504. The circuitry 514 is susceptible to electromagnetic interference and is enclosed
5 by the metallic shield, which is electrically coupled to the plurality of metallic pads 508. Upon assembly of the alternate circuit board assembly 502 over the gasket 300, the rear surface 305 of the gasket 300 at the arm 310 rests upon, and in contact with, the metallic shield thereby electrically connecting the metallic material of the rear surface 305 of the
10 gasket 300 to the electrical ground 510. In this arrangement, the metallic shield functions as the alternate metallic contact 506.

Thus, it can be seen that unlike the prior art assemblies that require right angled board configurations for protecting a display from electrostatic charges, the gasket 300, when compressed, adds only a minimal
15 thickness, such as 0.8 mm, to the device 100. This is particularly desirable as it permits reduction in the thickness of handheld devices and, thereby, eases a user's ability to hold the device in a single hand. Although shown to be specifically incorporated into a cellular telephone, it will be recognized that the gasket 300 may also be beneficially used in
20 other portable devices that employ an elongated front surface having a display viewable therefrom. These devices include, but are not limited to, two-way radios, radiotelephones, pagers, laptop computers, personal digital assistants, landline telephones, cordless telephones, and the like. While particular embodiments of the present invention have been shown,
25 described, and preferred, modifications may be made and it is therefore intended in the appended claims to cover all such changes and modifications which fall within the true spirit and scope of the invention.

Claims

1. An electronic device comprising:
 - a housing;
 - a display; and
 - a gasket having a first surface, a second surface and a
- 5 compressible material disposed therebetween, the first surface contacting the housing, the second surface contacting the display, the second surface formed of metallic material sufficiently pliable to conform to the display and, thereby, ensure reliable contact therewith.
2. The electronic device according to claim 1 further comprising:
 - a circuit board having an electrical ground;
 - at least one metallic pad carried on the circuit board and
- 5 connected to the electrical ground; and
- wherein
 - the display is mounted on the circuit board, and
 - the second surface of the gasket is electrically connected to the at least one metallic pad.
3. The electronic device according to claim 2 further comprising a metallic spring finger coupled to the at least one metallic pad, a distal end of the metallic spring finger received by the second surface of the gasket.

4. The electronic device according to claim 2
wherein
the circuit board includes circuitry disposed thereon, the
circuitry susceptible to electromagnetic interference, and
5 the at least one metallic pad comprises a plurality of metallic
pads surrounding the circuitry; and
further comprising a metallic shield coupled to the plurality of
metallic pads and enclosing the circuitry, the metallic shield in contact with
the second surface of the gasket.
5. The electronic device according to claim 1 wherein the metallic material
of the second surface of the gasket is foil.
6. The electronic device according to claim 1 wherein the compressible
material is foam.
7. The electronic device according to claim 1 wherein the first surface of
the gasket is adhered to the housing.
8. The electronic device according to claim 1 wherein
the housing comprises a display window,
the display comprises a front surface sized to be larger than the
display window, the front surface having a display area and a frame area
5 surrounding the display area, the display area in alignment with the
display window, and
the gasket comprises an opening therethrough, the opening sized
to be larger than the display window and the display area, the gasket
contacting the frame area, the opening of the gasket in alignment with the
10 display window and the display area.

9. The electronic device according to claim 8

further comprising:

a circuit board having an electrical ground;

at least one metallic pad carried on the circuit board and

5 connected to the electrical ground; and

wherein

the display is mounted on the circuit board,

the gasket further comprises a body,

the opening is formed in the body, and

10 the gasket further comprises an arm integrally joined to the
body, the arm extending from the body in a direction opposite the opening,
the arm is electrically connected to the at least one metallic pad.

10. A portable wireless telephony device comprising:

a housing comprising a display window and a gasket receiving site
defined on an inner surface of the housing surrounding the display
window;

5 a circuit board assembly positioned in the housing, the circuit board
assembly comprising a circuit board having an electrical ground, at least
one metallic contact carried on the circuit board and connected to the
electrical ground, and a display carried on the circuit board, the display
having a display area and a frame area surrounding the display area, the
10 display area in alignment with the display window, the frame area in
alignment with the gasket receiving site; and

a gasket having a first surface, a second surface and a
compressible material disposed therebetween, the first surface contacting
the gasket receiving site of the housing, the second surface contacting the
15 frame area of the display and the at least one metallic contact, the second
surface formed of metallic material sufficiently pliable to conform to the
frame area of the display and a distal end of the at least one metallic

- 20 contact, thereby, ensuring reliable contact sufficient for safe discharging of electrostatic charges at the display window.



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Claims searched: All

Examiner: Matthew Lincoln
Date of search: 5 July 1999

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): G5C (CHC, CHD)

Int Cl (Ed.6): G02F 1/13; H04M 1/02

Other: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	GB 2217896 A (CHERRY) Figure 2, page 10	1, 5, 6
A	EP 0168228 A2 (SHARP) Whole document	
Y	US 5675396 (TSUNEHIRO) Figure 2, column 2 line 54 to column 3 line 24 in particular	2, 3, 7 to 10
X	US 4614406 (MOTOI) Figure 1, column 7 line 57 to column 8 line 19, and column 10 lines 7-30	1, 2, 5 to 10

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.