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NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
BRADY CONVERTING AB	04/16/2015

RECEIVING PARTY DATA

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PROPERTY NUMBERS Total: 1

Property Type	Number
Patent Number:	8481867

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SIGNATURE:	/Michael D. Marston/
DATE SIGNED:	04/16/2015

Total Attachments: 34
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ASSIGNMENT (*this "Assignment"*)

WHEREAS, Brady Converting AB, of Bultgatan 31A, Kungalv 442 40, Sweden ("Assignor"), has acquired rights in an invention (the "Invention") as fully set forth and described in United States of America Patent No. 8,481,867 (the "'867 patent") filed on July 7, 2011; and

WHEREAS, LTI Flexible Products, Inc., with its principal place of business at 600 S. McClure Road, Modesto, CA, 95357 ("Assignee"), is desirous of acquiring title and interest in and to the Invention and the '867 Patent; and

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged:

Assignment. Assignor hereby sells, transfers and assigns unto Assignee, its successors and assigns, free and clear of all liens, security interests, liabilities and encumbrances, the full and exclusive right, title and interest in and to the Invention, and the '867 patent, subject to the attached royalty agreement with Martin Book, to be held and enjoyed by Assignee for its own use and benefit, for the full term, as fully and entirely as the same would have been held and enjoyed by Assignor had this Assignment not been made.

Assignor further assigns, sells, transfers and conveys to Assignee, its successors and assigns all claims for damages and all remedies arising out of any violation of the rights assigned hereby that may have accrued prior to the date of this Assignment or may accrue hereafter, including, but not limited to, the right to sue for, collect, and retain damages for any infringement of any patent issued for the Invention in any jurisdiction before or after issuance.

Further Assistance. Assignor hereby promises and agrees, upon request, to execute all papers and all instruments necessary, expedient and permissible to procure and to convey to the Assignee title and interest in and to the Invention.

Successors in Interest. This Assignment shall be binding upon and inure to the benefit of the respective heirs, successors, legal representatives and assigns of the Assignor and Assignee.

Power to Insert. The undersigned hereby grants the firm of Botkin & Hall, LLP the power to insert on this Assignment any further identification which may be necessary or desirable in order to comply with the rules of the United States Patent and Trademark Office for recordation of this document.

4/16/2015
Date

Louis Bolognini, Secretary of Brady Corporation

ASSIGNMENT OF INTELLECTUAL PROPERTY RIGHTS

AGREEMENT made on this 8th day of December, 2010 between Brady Converting AB (hereinafter BRADY) and Alf Martin Book (hereinafter BOOK).

WHEREAS; BOOK was employed by BRADY and made an invention which has been reported to BRADY in accordance with the enclosed Invention Disclosure Form, Exhibit 1, (hereinafter the "Invention") which falls within BRADY's scope of business activities under which BRADY has the right to acquire the invention under Swedish law and Collective Agreement;

WHEREAS; BRADY is interested in acquiring all intellectual property rights including but not limited to patents, designs, and know-how;

WHEREAS; BRADY is willing to compensate BOOK for the assignment of his rights through an initial lump sum payment and a running royalty calculated on the basis of the invoiced net sales of the grounding pad products incorporating the Invention;

WHEREAS; BRADY intends to file patent applications for a conductive grounding pad in accordance with the enclosed draft, Exhibit 2, internationally.

The Parties agree to the following:

1. Assignment

BOOK does hereby in consideration of 70,000 SEK (paid as net salary) and running royalties under this Agreement sell, assign, transfer and deliver unto BRADY, its successors and assigns, all right, title and interest in the INVENTION in the United States and throughout the world and under the patent applications and patents, together with any and all improvements and inventions disclosed therein, and all other patents, patent applications, patent rights and inventor's certificates

thereof, and other intellectual property rights therefore and therein, including, without limitation, any application for patents, designs or computer chip protection in Sweden and abroad, all divisions and continuations thereof, all rights to claim and sue for past infringement thereunder, all rights to file applications on any such inventions or improvements in such states or nations as BRADY may choose, all patents which may be granted on any such improvements or inventions by states or nations throughout the world, or by any other authority, entity or organization, and all applications therefore.

The royalty payments paid pursuant to this Agreement are not and will not be paid as salary. BOOK is responsible for all taxes on any royalty amount received.

BRADY may assign, transfer, license or otherwise dispose of all rights it obtains pursuant to this Agreement.

2. Further Assurances

BOOK hereby covenants and agrees, for himself and his successors and assigns, that at BRADY's request any and all applications, affidavits, assignments and other instruments will be made, executed and delivered as may be necessary or desirable to secure for and vest in BRADY, its successors and assigns, any improvements, inventions, right, title, interest, application, patent, patent right or any other right or property covered by this Assignment.

3. Cooperation

BOOK agrees that BRADY will, upon request, be promptly provided with all pertinent facts and documents relating to said inventions, patents, patent applications and equivalents as may be known or accessible to BOOK, and that BOOK will, at BRADY's expense, cooperate and testify as to the same in any interference , litigation or proceeding related thereto and will promptly execute and deliver to BRADY, his assigns or his legal representatives, without further additional consideration, any

and all papers, instruments or affidavits required, render all necessary assistance, and do such additional acts as BRADY may deem necessary and advisable to apply for, obtain, maintain, issue and enforce said inventions, applications, patents and equivalents thereof which may be deemed necessary or desirable by BRADY to carry out the purposes thereof.

4. Publication or disclosure of confidential matter.

BOOK shall not at any time, except as properly required in the conduct of the normal business of BRADY or except as authorized in writing by BRADY, publish, disclose or use any secret or confidential information relating to any aspect of the business of BRADY.

5. Royalties

In addition to the initial payment referenced above, BRADY shall pay to BOOK an additional amount conditional upon and relating to sales of products manufactured and sold in accordance with grounding pads utilizing the INVENTION (hereinafter the PRODUCTS) in the form of a royalty amounting to one half of one percent (0.5%) of the NET SALES PRICE of the PRODUCTS by BRADY and its assignees or licensees. For purposes of clarity, royalty will only be owed on the grounding pad component part utilizing the Invention and not on any other component or compilation of components.

After commercial launch of a Product, the royalties are due and payable within thirty days following every calendar year. Payments shall be accompanied by records of BRADY showing the amount of relevant goods sold during the previous calendar year. The report will also include the volume of sales per country. Brady will also provide BOOK with a bi-annual forecast report after commercial launch. The first report will be due within 45 days of commercial launch and subsequent forecast reports will be due with the annual royalty report and mid-year. The report shall also include a non-binding estimated forecast for sales in the following year. The forecast shall identify, to the extent

reasonably capable of being estimated by Brady, the number of potential customers, numbers of device models within which the Product is used, and the projected volumes of Products to be sold. Brady will use its best effort to comply with the following format in the bi-annual forecast report:

Customer	Project	Component/project	Value/component
X1	y1		
	y2		
X2	y3		
	y4		
	y5		

If know to Brady and not prohibited by any confidentiality obligation (at Brady's sole discretion), Brady will include in the report a list of the commercial names of devices which utilize the Product.

NET SALES PRICE means the invoiced price of the PRODUCTS to the customers of BRADY and its assignees or licensees less freight, taxes, customs, export charges and reasonable discounts as actually allowed in arms-length transactions

BRADY shall keep full clear and accurate records with respect to the PRODUCTS. BOOK shall have the right to by use of a neutral accountant and of his own expense to examine and audit during normal business hours such records and accounts as may under recognized accounting practices contain information bearing upon the amount of royalty payable under this Agreement. What is revealed during such audit is to be kept confidential by the accountant except for the figures relevant to the calculation of royalties.

7. Disputes and governing law

This Agreement shall be governed by the laws of Sweden and any possible disputes shall be settled by arbitration by three arbitrators in accordance with the Swedish Act on Arbitration (SFS 1999:116).

The arbitration shall take place in Gothenburg, Sweden, and the language shall be English.

This Agreement has been mutually negotiated by BOOK and BRADY. Both parties have had the opportunity to seek legal counsel and any provision hereof may not be construed adversely to a Party on the basis that the Party prepared it.

This Agreement has been executed in duplicate, whereof each party has taken one specimen.

Dated: 8/12 -10

Martin Book

Dated: 8/12-10

BRADY CONVERTING AB

Niclas Emanuelsson

EXHIBIT 1.

Invention Disclosure Form

This form is provided to help you organize your thoughts about your invention. There's nothing "magic" about it. Do whatever you need to do in order to explain your invention in such a way as to be clear to one who is not familiar with it.

- Be careful to describe what, specifically, makes your invention *different from what has gone before*. Avoid general statements that your invention is "better" - why is it better, or what makes it better?
- If you use any unusual terms, or ordinary terms in an unusual way, explain them.
- In addition to describing all the parts, describe *how the parts work together*.
- Why did you do things the way you did them, and not some other way? How else could you have accomplished the same end?
- In answering the questions, do not limit yourself to exactly the prototype you have in front of you, or to the very best way you might think your invention might be built. Allow your imagination to run - how else might this invention work? How far would it need to be changed before you say, "that's not my invention any more"? Are there less desirable, but still useful, ways of making the invention work?
- It's as important to point out what is *not* part of your invention (that is, what is "old") as it is to carefully explain what is new. Has the design, or part of the design, been used before, even if for a different purpose? How else have people accomplished the same function as your invention in the past?
- What are the possible problems? Under what circumstances might your invention *not* work? Are there critical parts, dimensions, ingredients?
- Drawings are always helpful, and if you are e-mailing the form you can include them electronically in one of the standard graphic formats (PCX, GIF, JPG) or as a drawing file in AutoCAD DXF or DWG formats.

Name of Inventor(s): Martin Book

Address: Nolviks Kile 68, 42363 Torslanda

Telephone: +4670377 4040

Fax:

E-mail: martin_book$@bradycorp.com

Name of Invention: Two layer conductive grounding pad

Brief Description

Describe the invention in general terms: What does it do? How does it do it?

The product called a grounding pad can be used for grounding different parts but and connects different components electrically but not limiting to this functionality. It is built up with two layers of conductive material like copper and connection between these two layers are done with either conductive adhesive or welding together with a spring functioning material like foam in-between the conductive layers, example polyurethane foam (Rogers, Poron or similar). In the bottom layer of the copper there is also a conductive layer of adhesive which is used to bond the part to one of the two components in which the . The conductive adhesive is leading electrical current through to the bottom copper layer. This layer then leads the electrical current to the area where the second copper layer is connected to the first with a weld or conductive adhesive layer. The conductive adhesive connects the two copper layers in z led and leads the current through to the second copper layer whereas the weld would lead the current traigh the two layers. The second copper layer which has the same size and position as the first layer but also with the foam in-between is pressed toward the second component which should be grounded with the force generated by the compression of the spring effect from the foam.

There are already conductive foams used for this type of applications. The key benefit of this solution is the cost efficient way to produce the part with this new structure with two layers. The material waist is minimized and the production speed increased with reduced cost as a result. Another key benefit is that it is possible to produce very thin contact with spring function since the spring effect is not related to the stiffness of the copper but with a separate spring material. This enables to use very thin conductive film and produce very thin grounding pad or spring contacts.

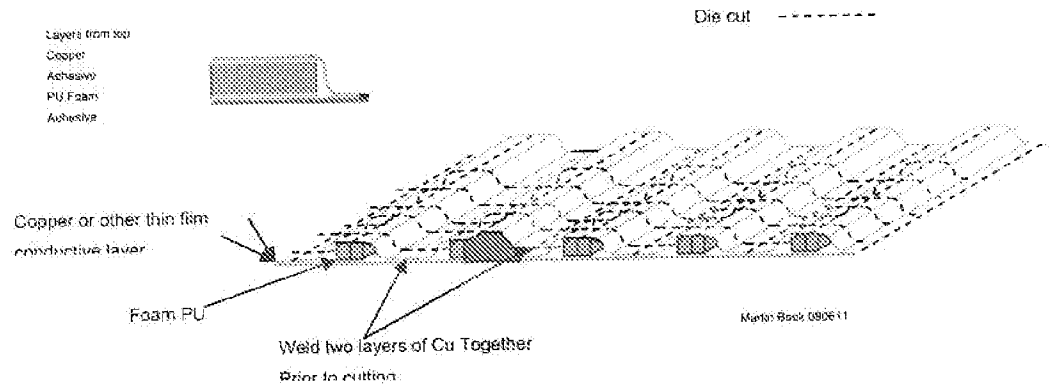
Instead of welding or conductive adhesive: we could use potentially use lettering copper and have melting plastic and then use ultra sonic welding to melt only the plastic and still have contact between the copper. Soldering paste and heat could be used to join the two layers together. Other conductive welding method could potentially also be used.

Details of the Invention:

- **What parts (steps, if a method) make up the invention, in its best (preferred) form?** The new structure of using two layers of thin film copper with conductive adhesive instead of a folded copper. The production layout and structure of the parts minimizing material waste. The solution built up with thin copper and spring foam enables producing very thin contacts or grounding parts. The solution having a non plated copper layer creating better conductivity the thin coated layer or conductive foam. The solutions does not require compression of foam to achieve conductivity.
- **What does each contribute to the invention?** The new structure makes it possible to produce in a different more efficient way reducing material waste and increasing production speed. In addition the foam use makes it possible to use very thin copper for conductive layers resulting in a possibility to have very thin spring loaded contacts or grounding points. Furthermore it is easy to change properties by just changing the foam characteristic without changing tooling.

- **Which parts are new to this invention (in form or usage), which are old (conventional, used in the expected way)?** The use of two conductive layers (Copper) instead of one layer folded layer. The solution to weld the two layers together or use other conductive tape prior to cutting. The structure of the part making it possible to produce parts with very limited waste. The solution to use foam in-between conductive layers (Copper or other metals) which can be changed to create different thicknesses and spring effects.
- **In what way do the parts interact to make the invention work?** The use of two conductive layers (Copper) enables producing the parts with very little waste and enables a higher production speed with more parts at the same time. The use of standard foams enables changing to different thicknesses easily.
- **For each part, indicate if the part (or its form or interconnection) is *ESSENTIAL* to the invention - that is, for each part, ask, "if this part were left out, or changed, would the remaining device still be my invention?" Or, "if this part were changed or left out, would the invention still work?** If the welding or conductive adhesive was left outside another method to join the two layers could be used. This is key to connect the two layers and the two layers is important to get less waste material. If it was possible to fold copper in multiple lines with no waste then this would be an equally good solution from a material use perspective but the production speed might be lower.

- If possible, use labeled sketches to detail your invention. Be sure all essential parts are shown on the sketch, and try not to include extraneous details. Measurements are not required, unless they are essential to the operation of the invention.



Alternatives

You have described the best way to build (perform) your invention. Now consider the alternatives.

Structural Alternatives:

- In what ways could the parts (steps) be changed or equivalent parts substituted without changing the basic invention? Alternative method to bond the two layers of copper. Use alternative spring material then Poron, Fix the bottom layer with some other method like soldering instead of conductive adhesive. See more idea below.
- Is there a generic description for any of the parts you listed (i.e. "fastener" instead of "Machine Screw", or "plastic" instead of "polypropylene")?
- Could the functions of any of the parts be changed, combined, eliminated?
- What could be added to make the invention work better? A solution that fix the two layers very well.ie welding, alternative method can be soldering.
- What could be left out?

Alternate Use: Can your invention be used for anything other than its preferred use? Except for grounding it could be used to contact two layers with various distance, and where it should only be fixed to one of the two components

Limitations: When will the invention *not* work? It will not work in high temperature when the function of the elastic spring effect material is

melting or not working. It will not work if there is no compression of the foam if we can not get a conductive adhesive which is conduction without having constant pressure.

- Are there any critical ranges of size, weight, pressure, etc. for any of the parts of your invention? (i.e. "the cap must be made of steel with a Rockwell hardness of 32-56") To work well the conductive adhesive needs the pressure from the compression since this result in better conductivity. The copper or thin metal layer needs to be thin to not affect the spring affect of the foam. This is also material dependant.
- Must some parts be made of specific substances? The adhesive needs to be conductive and the conductive thin layer needs to be possible to join together with welding or other method. The copper or other material might need to have protective plating like gold or similar to avoid oxidation.

In order to be patentable, an invention must be NOVEL, USEFUL and NOT OBVIOUS to one skilled in the art, based upon everything which was available at the time of the invention.

State of the Art: Consider what was already in existence (whether patented or not) before the invention.

- How is the function of the invention being done today? It is either a copper folded over a foam. Or it is a conductive foam with conductive adhesive in the bottom. (GS 8000) Another version is fabric over foam which is a poron (PU) core where a conductive material is wrapped 390 degrees over lapping the ends this is then cut in to single pieces after conductive adhesive is applied.
- What is the closest device (method) you are aware of to your invention? The fabric over foam.
- Is there something, which performs the same function in a different way? Yes see above.
- Is there any combination of existing devices (methods) which would be similar to your invention?
- How does your invention perform its function different from, or better than, these prior devices (methods)? Not sure about the production method of fabric over foam but I assume only one line is produce at a time which means it might not be as efficient. For conductive foam the material is very expensive and the conductivity is very much depending on the compression of the material. Fabric over foam has a very similar functionality but I am not sure if this is possible to produce as thin.
- How are they similar?

Resources for search:

- If you hadn't invented the invention, where would you go to find one? Gore, other Korean supplier of fabric over foam.
- What catalogs, publications, etc. would you look in? Internet.
- To what extent have you looked? We have looked at solutions for this and found suitable ones to sell.
- Who would be likely to purchase or use the invention? Mobile phone manufacturers. Grounding pads are used in an average of one part per phone. If you add some of the potential contacts then the volume is much bigger.
- Do you know of any publications, which might describe the invention or its competitors?

You may not get a patent on an invention which was already patented, or described in a printed publication, or in public use or on sale either: (a) by others, before you invented it, or (*for US patent applications only*) (b) by anyone, more than one year before you apply for a patent.

Date of Invention: "Invention" means a combination of conception (coming up with the idea of the invention) and reduction to practice (building it, or applying for a patent).

- Conception: When did you first begin to work on the invention? 2009-05-01
- Reduction to Practice: Has the invention been built? If so, when? It was built prototypes by just cutting material with scissors with conductive adhesive but some problems were found related to this and now we are altering joining methods for copper.

Publications: Has the invention ever been described in any printed form, by anyone? If so, where and when? No.

Prior Filings: Have you filed a Disclosure Document or Provisional Patent Application on this invention, or has there been an application for patent in the USA or elsewhere? NO. NDA needs to be checked with Nokia and Pulse.

- Type of Filing:
- Date of Filing:
- Serial Number:
- Where filed:

Public Use: Has the invention ever been shown or used in public? If so, where and when?

Samples has been showed to Nokia at meeting. These were manually produced and had conductive adhesive bonding the layers.

Sale: Has the invention ever been sold? If so, where and when? No.

Other Inventors: Is there anyone else who contributed to the conception or reduction to practice of the invention, in more than a purely mechanical way? After the conductive adhesive seems to be difficult to join the copper, Ake Dagberg suggested using ultra sonic welding. This is normally used for plastic but we found out that it might be possible to use a modified version to join copper.

Other ideas I have for this to use soldering past and solder the area by dispensing paste and then heat continuously prior to cutting. A continuous electro welding could also be performed but most of these techniques needs to be done before any PER liner is placed to copper bottom layer since it is not conductive and probably can not be welded through.

Rights in Others: Are you under any obligation to assign any rights in the invention to others?

- Was the invention developed in the course of your employment, or using any facilities belonging to your employer?
  If so, the employer may have rights to the invention. The idea came up at home in the evening after thinking about why we could not have lower cost production method for this type of part and why we buy fabric over foam instead of producing alternative components ourselves. After this a brainstorming session was held to look at other better production methods. However the conclusion was that there was not really with the same material utilization.
- Do you have an agreement with your employer that you will assign any inventions you may make to the employer? No.
- Was the invention developed in the course of a consulting agreement with someone else? No.
  If so, did you agree that any inventions belong to them?
- Was there any funding of the development of the invention by any party (government agency, school, etc.) who might claim rights in the invention? No.
- Was any equipment or facilities used in the development of the invention which was funded by or belongs to any government agency? No.

Any additional notes or comments?

_____

Be sure to sign and date the form, and have it witnessed by someone who is not an inventor.

Signed: _____

Dated:

Read, witnessed and understood: _____

Date:

EXHIBIT 2

CONDUCTIVE GROUNDING PAD

CROSS-REFERENCE TO RELATED APPLICATIONS

None

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

None

FIELD OF THE INVENTION

[0001] This invention relates to grounding pads. In one aspect the invention relates to grounding pads comprising a single conductor layer and a single layer of compressive foam while in another aspect, the invention relates to grounding pads comprising two conductor layers separated by a single layer of compressive foam. In yet another aspect, the invention relates to electrical devices comprising one or the other of these grounding pads while in still another aspect, the invention relates to methods of constructing these grounding pads.

BACKGROUND OF THE INVENTION

[0002] Grounding pads, also known as electromagnetic interference (EMI) gaskets, are used in a variety of applications in which electromagnetic radiation can interfere in the operation of an electrical device, e.g., a cell phone, television, monitor or the like. These pads typically comprise an electrical conductor, e.g., copper foil, with means of joining the conductor to one or more electrical components within the device in which it, i.e., the pad, is located. These means include mechanical fasteners, welds, solder and conductive adhesives. Some pads also require a compressive feature, e.g., foam, so that they will conform to

[0003] Figure 1 is a schematic drawing of one such pad. Grounding pad 10 comprises copper conductor 11 folded into a Z-shape configuration. Top horizontal leg or layer 11a is electrically connected with bottom horizontal leg or layer 11c by diagonal leg 11b. In the space between conductor legs 11a and 11b is compressible foam 12a, and in the space between conductor legs 11b and 11c is compressible foam 12b. The foam may or may not be electrically conductive. On the external facial surfaces of conductor legs 11a and 11c is optional adhesive 13a and 13b, respectively. The adhesive is typically a pressure sensitive adhesive (PSA), and it is typically electrically conductive. In operation typically one horizontal leg of the Z-folded conductor is attached by the PSA to an electrically conductive shield while the other horizontal leg of the Z-folded conductor is attached by the PSA to an electrical ground, e.g., a ground trace of a printed circuit board. Alternatively, conductor legs 11a and 11c can attach to the shield and ground, respectively, by other means, e.g., weld, solder, mechanical fastener and the like. In the presence of electromagnetic radiation, e.g., static electricity, electrical current is captured by the shield and directed through the Z-folded conductor to the ground thus protecting the device in which the pad is located from damage.

[0004] While functional, current pads with a Z-shape folded conductor are difficult and expensive to manufacture. Foam is difficult to insert into the spaces between the legs of the folded conductor, and the connecting diagonal leg adds to the cost of manufacture. Accordingly, grounding pads with more cost effective designs and manufacturing processes are of interest to the various industries in which grounding pads are used.

SUMMARY OF THE INVENTION

[0005] In one embodiment the invention is a compressible grounding pad with two conductor layers separated by a compressible foam layer, the pad comprising:

(A) A first conductor layer, e.g., copper foil, having opposing first (top) and second (bottom) facial surfaces;

(B) A first adhesive layer having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the first adhesive layer in direct contact with a part of the bottom facial surface of the first conductor layer, the first conductor layer extending beyond the first adhesive layer;

(C) A foam layer having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the foam layer in direct contact with the bottom facial surface of the first adhesive layer;

(D) A second adhesive layer having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the second adhesive layer in direct contact with the bottom facial surface of the foam layer;

(E) A second conductor layer, e.g., copper foil, having opposing first (top) and second (bottom) facial surfaces, a part of the top facial surface of the second conductor layer in direct contact with the bottom facial surface of the second adhesive layer, the second conductor layer extending beyond the second adhesive layer such that a part of the top facial surface of the second conductor layer joins with a part of the bottom facial surface of the first conductor layer;

(F) An electrically conductive third adhesive layer having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the third adhesive layer in direct contact with the bottom facial surface of the second conductor layer; and

(G) An optional release liner having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the release liner in direct contact with the bottom facial surface of the third adhesive layer.

[0006] The first and second conductor layers can be joined to one another by any one of a number of different means, e.g., welding, soldering, conductive adhesive, mechanical fastener, etc. The first and second adhesives and the foam are typically and preferably electrically non-conductive.

[0007] In one embodiment the invention is a compressible grounding pad with one conductor layer and one compressible foam layer, the pad comprising:

(A) A conductor layer, e.g., copper foil, having opposing first (top) and second (bottom) facial surfaces;

(B) A first adhesive layer having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the first adhesive layer in direct contact with a part of the bottom facial surface of the conductor layer, the conductor layer extending beyond the first adhesive layer;

(C) A foam layer having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the foam layer in direct contact with the bottom facial surface of the first adhesive layer;

(D) An electrically conductive second adhesive layer having opposing first (top) and second (bottom) facial surfaces, a part of the top facial surface of the second adhesive layer in direct contact with the bottom facial surface of the foam layer, the second adhesive layer extending beyond the foam layer such that a part of the top facial surface of the second adhesive layer joins with a part of the bottom facial surface of the conductor layer; and

(E) An optional release liner having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the release liner in direct contact with the bottom facial surface of the second adhesive layer.

[0008] The conductor and second adhesive layer are joined to one another through the natural action of the second adhesive layer. The first adhesive and the foam are typically and preferably electrically non-conductive.

[0009] In one embodiment the invention is a method of constructing a compressible grounding pad with two conductor layers separated by a compressible foam layer, the method comprising the steps of:

(A) Attaching a first conductor layer having opposing first and second facial surfaces to a compressible foam layer also having opposing first and second facial surfaces such that (1) the second facial surface of the

first conductor layer is joined to the first facial surface of the foam layer, and (2) the first conductor layer extends beyond the foam layer to form an extended section of the first conductor layer that is not joined to the foam layer;

(B) Attaching a second conductor layer having opposing first and second facial surfaces to the compressible foam layer such that (1) the first facial surface of the second conductor layer is joined to the second facial surface of the foam layer, and (2) the second conductor layer extends beyond the foam layer to form an extended section of the second conductor layer that is not joined to the foam layer; and

(C) Joining the second facial surface of the extended section of the first conductor layer with the first facial surface of the extended section of the second conductor layer.

[0010] In one embodiment the first and second conductor layers are joined to the foam layer by a PSA while the extended sections of the first and second conductor layers are joined to one another by a weld, solder, adhesive or mechanical fastener.

[0011] In one embodiment the invention is a method of constructing a compressible grounding pad with one conductor layer and one compressible foam layer, the method comprising the steps of:

(A) Attaching a conductor layer having opposing first and second facial surfaces to a compressible foam layer also having opposing first and second facial surfaces such that (1) the second facial surface of the conductor layer is joined to the first facial surface of the foam layer, and (2) the conductor layer extends beyond the foam layer to form an extended section of the conductor layer that is not joined to the foam layer;

(B) Attaching an electrically conductive adhesive layer having opposing first and second facial surfaces to the compressible foam layer such that (1) the first facial surface of the electrically conductive adhesive layer is joined to the second facial surface of the foam layer, and (2) the electrically conductive adhesive layer extends beyond the foam layer to

form an extended section of the electrically conductive adhesive layer that is not joined to the foam layer; and

(C) Joining the second facial surface of the extended section of the conductor layer with the first facial surface of the extended section of the electrically conductive adhesive layer.

[0012] In one embodiment the conductor layer is joined to the foam layer by a PSA while the extended sections of the conductor layer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Figure 1 is a schematic illustration of a prior art compressible grounding pad.

[0014] Figure 2 is a schematic illustration of one embodiment of a compressible grounding pad of this invention with two conductor layers.

[0015] Figure 3 is a schematic illustration of one embodiment of a compressible grounding pad of this invention with one conductor layer.

[0016] Figure 4 is a schematic illustration of one embodiment of a sheet of grounding pads comprising two conductor layers separated by a compressible foam layer and before die cutting the sheet into individual grounding pads.

[0017] Figure 5 is a schematic illustration of one embodiment of a sheet of grounding pads comprising one conductor layer and one compressible foam layer and before die cutting the sheet into individual grounding pads.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] Unless stated to the contrary, implicit from the context, or customary in the art, all parts and percents are based on weight and all test methods are current as of the filing date of this disclosure. For purposes of United States patent practice, the contents of any referenced patent, patent application or publication are incorporated by reference in their entirety (or its equivalent US version is so incorporated by reference) especially with

[0019] The numbers and numerical ranges in this disclosure are approximate, and thus may include values outside of the range unless otherwise indicated. Numerical ranges include all values from and including the lower and the upper values, in increments of one unit, provided that there is a separation of at least two units between any lower value and any higher value. As an example, if a compositional, physical or other property, such as, for example, thickness, weight percentages, *etc.*, is from 100 to 1,000, then the intent is that all individual values, such as 100, 101, 102, etc., and sub ranges, such as 100 to 144, 155 to 170, 197 to 200, etc., are expressly enumerated. For ranges containing values which are less than one or containing fractional numbers greater than one (e.g., 0.01, 0.1, 1.1, *etc.*), one unit is considered to be 0.001, 0.01 or 0.1, as appropriate. For ranges containing single digit numbers less than ten (e.g., 1 to 5), one unit is typically considered to be 0.1. These are only examples of what is specifically intended, and all possible combinations of numerical values between the lowest value and the highest value enumerated, are to be considered to be expressly stated in this disclosure. Numerical ranges and values are provided within this disclosure for, among other things, pad and layer dimensions.

[0020] "Comprising", "including", "having" and like terms are not intended to exclude the presence of any additional component, step or procedure, whether or not the same is specifically disclosed. In order to avoid any doubt, all compositions claimed through use of the term "comprising" may include one or more additional component substances, parts and/or materials unless stated to the contrary. In contrast, the term, "consisting essentially of" excludes from the scope of any succeeding recitation any other component, step or procedure, excepting those that are not essential to operability. The term "consisting of" excludes any

[0021] "Facial surface", "planar surface", "top surface", "bottom surface" and the like are used in distinction to "edge surface". If rectangular in shape or configuration, a layer will comprise two opposing facial surfaces joined by four edge surfaces (two opposing pairs of edge surfaces, each pair intersecting the other pair at right angles). If circular in configuration, then the layer will comprise two opposing facial surfaces joined by one continuous edge surface. The layers can be of any size and shape and as such, so can the planar and edge surfaces, e.g., thin or thick, polygonal or circular, flat or wavy, etc.

[0022] "Pressure sensitive adhesive," "PSA" and like terms mean an adhesive which bonds to an application surface as a result of applied pressure as opposed to the evaporation or absorption of a solvent to form a solid material bond.

[0023] "Direct contact", "intimate contact" and like terms mean that two surfaces or layers are in physical contact with one another so as to form an interface without an intermediate or intervening layer or material.

Grounding Pad Comprising Two-Conductor Layers

[0024] Figure 2 is a schematic illustration of a compressible grounding pad with two conductor layers separated by a compressible foam layer. Compressible grounding pad 20 comprises first conductor layer 21 having opposing first or top facial surface 21a and second or bottom facial surface 21b. Conductor 21 can comprise any electrically conductive material, but typically comprises copper or aluminum. Typically and preferably conductor 21 is copper foil. Typically and preferably the conductor 21 has a thickness of __ to __, more typically of __ to __ and even more typically of __ to __, microns (μm).

[0025] Part of bottom facial surface 21b is in direct contact with first or top facial surface 22a of first adhesive layer 22 which can comprise any adhesive that exhibits good adhesion both to first conductor 21and foam

acrylic based **[Correct?]** comprising a polymer of an alkyl ester of an acrylic acid or methacrylic acid as a main component. It should not be limited to this since there are a number of different adhesives. The adhesive is typically electrically non-conductive. (But can also be electrical conductive) Typically and preferably the first adhesive layer has a thickness of __ to __, more typically of __ to __ and even more typically of __ to __, microns (μm).

[0026] Bottom facial surface 22b is in direct contact with first or top facial surface 23a of foam 23 which can comprise any material that exhibits good compression properties. Representative foams include, but are not limited to, polyurethane, polyolefin (e.g., polyethylene, polypropylene, polyisoprene, etc.), natural and synthetic rubbers, and the like. The foam is typically electrically non-conductive, and it typically and preferably has a pre-compressive thickness of __ to __, more typically of __ to __ and even more typically of __ to __, microns (μm). Typically, the foam can compress to less than half of its pre-compressive thickness with minimal compressive force **[Correct? Can we quantify or otherwise describe how much force such foam might experience in use?]**.

The compressive force is depending on what grade of foam is used. The grounding pad will be designed to fit the specific application resulting in a variation of minimal compressive force. The minimum and maximum compression force is depending on the specific application in which the grounding pad is designed for.

[0027] Bottom facial surface 23b is in direct contact with top facial surface 24a of second adhesive layer 24. Typically, but not necessarily, second adhesive layer 24 is of the same composition and thickness as first adhesive layer 22.

[0028] Bottom facial surface 24b is in direct contact with part of top facial surface 25a of second conductor 25 which typically, but not necessarily, has the same composition and thickness of first conductor layer 21. Both first conductor layers 21 and 25 extend beyond their respective neighboring adhesive layers 22 and 24 sufficiently far enough so as to form extended sections that (1) are not in direct contact with adhesive layers 22 and 24, and (2) can join with one another by any convenient means, e.g., welding, soldering, conductive adhesive, mechanical fastener (e.g., rivet, clip, etc.). The joining of the two conductor layers is such that (1) bottom facial surface 21b of first conductor layer 21 joins to top facial surface 25a of second conductor layer 25, and (2) an electrical current can flow from one conductor to the other conductor substantially unimpeded.

[0029] Bottom facial surface 25b is in direct contact with top facial surface 26a of third adhesive layer 26. Third adhesive layer 26 is also typically and preferably a PSA, but one that is electrically conductive. These adhesives can be of the same composition as the first and second adhesives but filled with electrically conductive particles, e.g., copper or aluminum metal, electrically conductive polymeric materials, etc. This third adhesive layer is sufficiently electrically conductive so as to pass any electrical current from the second conductor layer to the substrate surface (not shown) to which it is attached through bottom facial surface 26b. The third adhesive layer typically and preferably has a thickness of __ to __, more typically of __ to __ and even more typically of __ to __, microns (μm).

[0030] Adhesive layer 26 is optionally and preferably protected by a release liner until grounding pad 20 is ready for use. Bottom facial surface 26b is typically and preferably in direct contact with the top facial surface of the release liner (not shown). Release liners are well known in the art, and representative examples include, but are not limited to, glassine paper and plastic film treated, e.g., sprayed, with a releasing agent such as a silicone-base releasing agent.

Grounding Pad Comprising One Conductor Layer

[0031] Figure 3 is a schematic illustration of a compressible grounding pad with one conductor layer and one compressible foam layer. Compressible grounding pad 30 comprises conductor layer 31 having opposing first or top facial surface 31a and second or bottom facial surface 31b. Conductor 31 can comprise any electrically conductive material, but typically comprises copper or aluminum. Typically and preferably conductor 21 is copper foil. Typically and preferably conductor 31 has a thickness of __ to __, more typically of __ to __ and even more typically of __ to __, microns (μm).

[0032] Part of bottom facial surface 31b is in direct contact with first or top facial surface 32a of first adhesive layer 32 which can comprise any adhesive that exhibits good adhesion both to first conductor 31and foam 33. Typically the adhesive is a PSA and is as described above for adhesive layers 22, 24 and 26. The adhesive is typically electrically non-conductive. Typically and preferably adhesive layer 32 has a thickness of __ to __, more typically of __ to __ and even more typically of __ to __, microns (μm).

[0033] Bottom facial surface 32b is in direct contact with first or top facial surface 33a of foam 33 which, like foam 23, can comprise any material that exhibits good compression properties. Representative foams include, but are not limited to, polyurethane, polyolefin (e.g., polyethylene, polypropylene, polyisoprene, etc.), natural and synthetic rubbers, and the like. The foam is typically electrically non-conductive, and it typically and preferably has a pre-compressive thickness of __ to __, more typically of __ to __ and even more typically of __ to __, microns (μm). Typically, the foam can compress to less than half of its pre-compressive thickness with minimal compressive force **[Correct? Can we quantify or otherwise describe how much force such foam might experience in use?]**. I am not sure if this is correct. I do not think that it will compress more then half of the distance after it has been pre-compressed. Normally the compression rate can not be that big. This is normally handled with a number of

[0034] Bottom facial surface 33b of foam 33 is in direct contact with top facial surface 34a of electrically conductive adhesive layer 34. This adhesive can be of the same composition as adhesive layer 32 but filled with electrically conductive particles, e.g., copper or aluminum metal, electrically conductive polymeric materials, etc. Adhesive layer 34 is sufficiently electrically conductive so as to pass any electrical current from the second conductor layer to the substrate surface (not shown) to which it is attached through bottom facial surface 34b. Adhesive layer 34 typically and preferably has a thickness of __ to __, more typically of __ to __ and even more typically of __ to __, microns (μm).

[0035] Both conductor layer 31 and electrically conductive adhesive layer 34 extend beyond their respective neighboring adhesive layer 32 and foam 33 sufficiently far enough so as to form extended sections that (1) are not in direct contact with adhesive layer 32 and foam 33, and (2) can join with one another such that (a) bottom facial surface 31b of conductor layer 31 joins to top facial surface 34a of adhesive layer 34, and (b) an electrical current can flow from the conductor to the electrically conductive adhesive substantially unimpeded.

[0036] Adhesive layer 34 is optionally and preferably protected by a release liner until grounding pad 30 is ready for use. Bottom facial surface 34b is typically and preferably in direct contact with the top facial surface of the release liner (not shown).

Construction of a Grounding Pad Comprising Two Conductor Layers

[0037] One method of constructing the compressible grounding pad with two conductor layers separated by a compressible foam layer is illustrated in Figure 4. This method comprises the steps of:

(A) Attaching first conductor layer 21 having opposing first and second facial surfaces to compressible foam layer 23 also having opposing first and second facial surfaces such that (1) the second facial surface of the

first conductor layer is joined to the first facial surface of the foam layer, and (2) the first conductor layer extends beyond the foam layer to form an extended section of the first conductor layer that is not joined to the foam layer;

(B) Attaching second conductor layer 25 having opposing first and second facial surfaces to compressible foam layer 23 such that (1) the first facial surface of the second conductor layer is joined to the second facial surface of the foam layer, and (2) the second conductor layer extends beyond the foam layer to form an extended section of the second conductor layer that is not joined to the foam layer; and

(C) Joining the second facial surface of the extended section of first conductor layer 21 with the first facial surface of the extended section of second conductor layer 25.

[0038] The two conductor layers are joined to the foam layer by way of an adhesive (not shown), and the two conductor layers are joined to one another by any suitable means, typically welding, using any one of a number of techniques well known in the art. The adhesive can be applied to the conductors and/or foam also by any one of a number of different methods, but typically the adhesive is first applied to the foam by coating or spraying, and then the conductors are brought into contact with the adhesive already on the foam. For conductor layer 25 the electrically conductive adhesive (26 in Figure 2) can be applied before or after it (conductor layer 25) is joined to foam 23 and/or conductor layer 21. Typically a release liner (not shown) covers the electrically conductive adhesive before it is applied to conductor layer 25. Once sheet of grounding pads 20A is constructed, the individual grounding pads (20 in Figure 2) are produced by die cutting the sheet along die cut lines 27. The grounding pads can be cut to any size and configuration that preserves the layer configuration of Figure 2.

Construction of a Grounding Pad Comprising One Conductor Layer

[0039] One method of constructing the compressible grounding pad with one conductor layer and one compressible foam layer is illustrated in Figure 5. This method comprises the steps of:

(A) Attaching conductor layer 31 having opposing first and second facial surfaces to compressible foam layer 33 also having opposing first and second facial surfaces such that (1) the second facial surface of conductor layer 31 is joined to the first facial surface of foam layer 33, and (2) conductor layer 31 extends beyond foam layer 33 to form an extended section of conductor layer 31 that is not joined to foam layer 33;

(B) Attaching electrically conductive adhesive layer 34 having opposing first and second facial surfaces to compressible foam layer 33 such that (1) the first facial surface of electrically conductive layer 34 is joined to the second facial surface of foam layer 33 and (2) electrically conductive adhesive layer 34 extends beyond foam layer 33 to form an extended section of electrically conductive adhesive layer 34 that is not joined to foam layer 33; and

(C) Joining the second facial surface of the extended section of conductor layer 31 with the first facial surface of the extended section of the electrically conductive adhesive layer 34.

[0040] The conductor layer is joined to the foam layer by way of an adhesive (not shown), and the conductor layer is joined to the electrically conductive adhesive through the action of the adhesive. The adhesive can be applied to the conductor and/or foam by any one of a number of different methods, but typically the adhesive is first applied to the foam by coating or spraying, and then the conductor is brought into contact with the adhesive already on the foam. Electrically conductive adhesive 34 can be applied before or after conductor layer 31 is joined to foam 33. Typically a release liner (not shown) covers the electrically conductive adhesive before it is applied to foam layer 33. Once sheet of grounding pads 30A is constructed, the individual grounding pads (30 in Figure 3) are produced by die cutting the sheet along die cut lines 27. The grounding pads can be

[0041] The methods of this invention for constructing grounding pads comprising one or two conductor layers and a compressible foam are extremely efficient and cost effective. They minimize conductor waste, e.g., they eliminate diagonal leg 11b in Figure 1, and they allow the production of large numbers in a relatively few steps. They also allow the production of very thin products since the compressibility of the pad is not related to the stiffness or thickness of the conductor layers. Rather compressibility is a function of the foam. This, in turn, allows for changing the physical properties of the pad by changing the foam, and not the production tooling.

[0042] The grounding pads of this invention are used for, among other things, connecting an electrically conductive shield to an electrical ground. This conductive interface is often required when mating surfaces of an electronic apparatus that are not exactly conformably dimensioned, e.g., gaps, voids and spaces are formed with the two surfaces are mated. This is common in such electrical devices as cell phones, calculators, instant messengers, cameras and the like. The compressible grounding pads of this invention fill these gaps, voids, etc., upon compression. Moreover, upon compression, the electrical conductivity of the electrical conductive adhesive increases because the electrical conducting particles within the adhesive are brought closer to one another.

[0043] Although the invention has been described with certain detail through the preceding specific embodiments, this detail is for the primary purpose of illustration. Many variations and modifications can be made by one skilled in the art without departing from the spirit and scope of the invention as described in the following claims.

What is claimed is:

1. A compressible grounding pad with two conductor layers separated by a compressible foam layer, the pad comprising:

(A) A first conductor layer having opposing first (top) and second (bottom) facial surfaces;

(B) A first adhesive layer having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the first adhesive layer in direct contact with a part of the bottom facial surface of the first conductor layer, the first conductor layer extending beyond the first adhesive layer;

(C) A foam layer having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the foam layer in direct contact with the bottom facial surface of the first adhesive layer;

(D) A second adhesive layer having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the second adhesive layer in direct contact with the bottom facial surface of the foam layer;

(E) A second conductor layer having opposing first (top) and second (bottom) facial surfaces, a part of the top facial surface of the second conductor layer in direct contact with the bottom facial surface of the second adhesive layer, the second conductor layer extending beyond the second adhesive layer such that a part of the top facial surface of the second conductor layer joins with a part of the bottom facial surface of the first conductor layer;

(F) An electrically conductive third adhesive layer having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the third adhesive layer in direct contact with the bottom facial surface of the second conductor layer; and

(G) An optional release liner having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the release liner in direct contact with the bottom facial surface of the third adhesive layer.

2. The grounding pad of Claim 1 in which each of the first and second conductor layers comprises at least one of copper and aluminum.

3. The grounding pad of Claim 2 in which each of the adhesive layers comprises a pressure sensitive adhesive.

4. The grounding pad of Claim 3 in which the first and second conductor layers are joined to one another by at least one of welding, soldering and adhesive.

5. A compressible grounding pad with one conductor layer and one compressible foam layer, the pad comprising:

(A) A conductor layer having opposing first (top) and second (bottom) facial surfaces;

(B) A first adhesive layer having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the first adhesive layer in direct contact with a part of the bottom facial surface of the conductor layer, the conductor layer extending beyond the first adhesive layer;

(C) A foam layer having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the foam layer in direct contact with the bottom facial surface of the first adhesive layer;

(D) An electrically conductive second adhesive layer having opposing first (top) and second (bottom) facial surfaces, a part of the top facial surface of the second adhesive layer in direct contact with the bottom facial surface of the foam layer, the second adhesive layer extending beyond the foam layer such that a part of the top facial surface of the second adhesive layer joins with a part of the bottom facial surface of the conductor layer; and

(E) An optional release liner having opposing first (top) and second (bottom) facial surfaces, the top facial surface of the release liner in direct contact with the bottom facial surface of the second adhesive layer.

6. The grounding pad of Claim 5 in which each of the first and second conductor layers comprises at least one of copper and aluminum.

7. The grounding pad of Claim 6 in which each of the adhesive layers comprises a pressure sensitive adhesive.

8. A method of constructing a compressible grounding pad with two conductor layers separated by a compressible foam layer, the method comprising the steps of:

(A) Attaching a first conductor layer having opposing first and second facial surfaces to a compressible foam layer also having opposing first and second facial surfaces such that (1) the second facial surface of the first conductor layer is joined to the first facial surface of the foam layer, and (2) the first conductor layer extends beyond the foam layer to form an extended section of the first conductor layer that is not joined to the foam layer;

(B) Attaching a second conductor layer having opposing first and second facial surfaces to the compressible foam layer such that (1) the first facial surface of the second conductor layer is joined to the second facial surface of the foam layer, and (2) the second conductor layer extends beyond the foam layer to form an extended section of the second conductor layer that is not joined to the foam layer; and

(C) Joining the second facial surface of the extended section of the first conductor layer with the first facial surface of the extended section of the second conductor layer.

9. The method of Claim 8 in which the first conductor and second conductor layers are attached to the foam with an adhesive.

10. The method of Claim 9 in which the first and second conductors are joined to one another by one of welding, soldering and the use of an adhesive.

11. A method of constructing a compressible grounding pad with one conductor layer and one compressible foam layer, the method comprising the steps of:

(A) Attaching a conductor layer having opposing first and second facial surfaces to a compressible foam layer also having opposing first and second facial surfaces such that (1) the second facial surface of the conductor layer is joined to the first facial surface of the foam layer, and (2) the conductor layer extends beyond the foam layer to form an extended section of the conductor layer that is not joined to the foam layer;

(B) Attaching an electrically conductive adhesive layer having opposing first and second facial surfaces to the compressible foam layer such that (1) the first facial surface of the electrically conductive adhesive layer is joined to the second facial surface of the foam layer, and (2) the conductive layer extends beyond the foam layer to form an extended section of the conductive layer that is not joined to the foam layer; and

(C) Joining the second facial surface of the extended section of the conductor layer with the first facial surface of the extended section of the electrically conductive adhesive layer.

12. The method of Claim 11 in which the conductor layer is attached to the foam layer with an adhesive.

13. The method of Claim 12 in which all of the adhesives are pressure sensitive adhesives.

14. An electronic apparatus comprising the grounding pad of any of Claims 1-7.

15. The electronic apparatus of Claim 14 in the form of a cell phone, calculator or instant messaging device.

ABSTRACT

Compressible grounding pads with two conductor layers separated by a compressible foam layer comprise:

(A) A first conductor layer, e.g., copper foil;

(B) A first adhesive layer in direct contact with a part of the first conductor layer, the first conductor layer extending beyond the first adhesive layer;

(C) A foam layer in direct contact with one facial side of the first adhesive layer;

(D) A second adhesive layer in direct contact with the opposite facial side of foam layer;

(E) A second conductor layer, e.g., copper foil, in direct contact with the second adhesive layer, the second conductor layer extending beyond the second adhesive layer such that the second conductor layer joins with the first conductor layer;

(F) An electrically conductive third adhesive layer in direct contact with the facial surface opposite the facial surface that is in direct contact with the second conductor layer; and

(G) An optional release liner in direct contact with the third adhesive layer.