

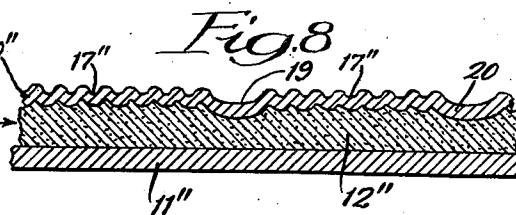
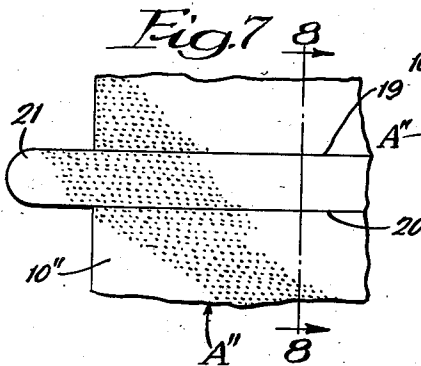
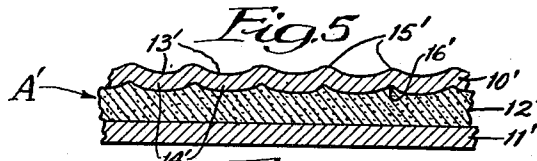
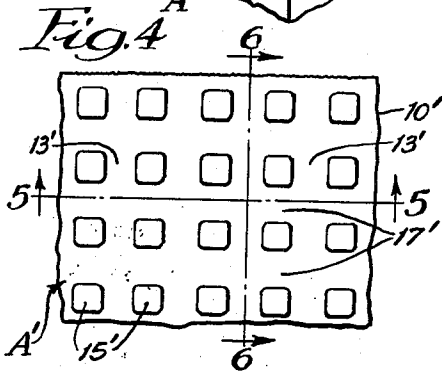
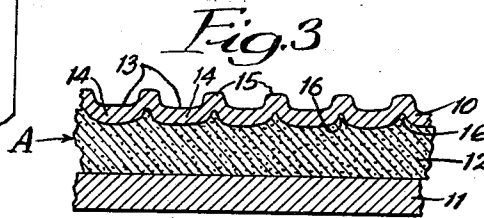
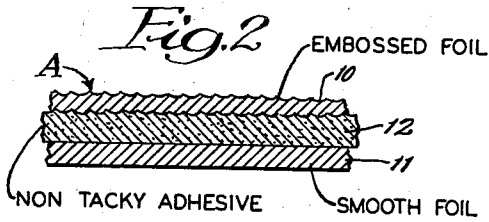
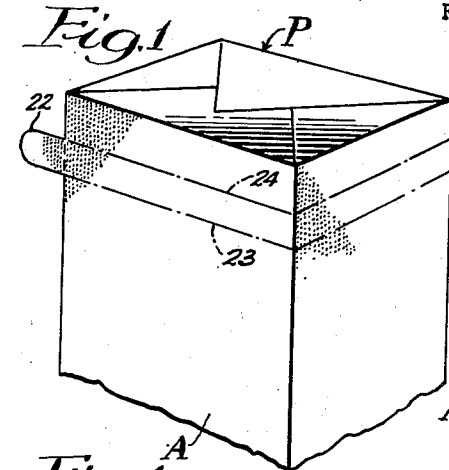
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DIRECTIONALLY-ORIENTED TEARING METAL FOIL SHEET MATERIAL

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2,830,001

DIRECTIONALLY-ORIENTED TEARING METAL FOIL SHEET MATERIAL

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This invention relates to a directionally-oriented tearing metal foil sheet material. The sheet material of this invention has particular applicability as a uni-directional tear metal foil wrap. It will have other applications, however, as will be apparent from the following description.

The principal object of this invention is to provide a metal foil sheet material which has the property of tending to tear along directionally-oriented lines. Further objects and advantages will appear as the specification proceeds.

The invention is shown in illustrative embodiments, in which—

Fig. 1 is a perspective view of part of a package employing a metal foil wrap designed in accordance with the present invention; Fig. 2, an enlarged fragmentary cross-sectional view of one embodiment of a metal foil sheet material produced according to the present invention; Fig. 3, a somewhat enlarged view of the sheet material of Fig. 2, the section being the same as that of Fig. 2; Fig. 4, a plan view of a fragment of sheet material representing a modification of the sheet material of Figs. 2 and 3; Fig. 5, a sectional view of the sheet material of Fig. 4, taken on line 5-5 of that figure; Fig. 6, a sectional view of the same sheet material, taken on line 6-6 of Fig. 4; Fig. 7, a plan view of a fragment of a metal foil wrap representing a modification of the metal foil wrap shown on the package in Fig. 1; and Fig. 8, a sectional view of the metal foil wrap of Fig. 7, taken on line 8-8 of that figure.

In one of its embodiments, the metal foil sheet material of this invention comprises two superimposed sheets of metal foil with one of the sheets having a grid pattern embossed thereon, while the other sheet has smooth surfaces. These sheets are bonded together by a thin, flexible, non-tacky layer of an adhesive material. For example, looking first at Fig. 2 of the drawing, the sheet material A includes an embossed foil sheet 10, a smooth foil sheet 11, and an adhesive layer 12.

Fig. 3 shows the sheet material A of Fig. 2 in an enlarged cross-section. This figure is intended to illustrate that foil sheet 10 is embossed with a grid pattern, which, as illustrated, is preferably a rectilinear grid pattern. More specifically, the outer surface of embossed foil sheet 10 has two series of inwardly-extending grooves and on its inner surface two series of correspondingly inwardly-extending ridges. The cross-section of Fig. 3 shows only one of each of these two series of grooves and ridges, the grooves being designated by the number 13 and the corresponding ridges by the number 14. It will be observed that grooves 13 and ridges 14 are disposed in spaced-apart parallel relation, and it will be understood that the grooves and ridges of the other series

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will be likewise disposed in spaced-apart parallel relation while intersecting grooves and ridges 13 and 14 at substantially right angles form the rectilinear grid pattern of the embossing. As shown in Fig. 3, the outer surface of sheet 10 has outwardly-extending protuberances 15 and these are defined, as will be understood, by the intersecting grooves on this surface. Similarly, the inner surface of sheet 10 has correspondingly outwardly-extending indentations 16 defined by the intersecting ridges on this surface.

Figs. 4-6 show a modified sheet material A'. For purpose of ready comparison, the corresponding parts of this sheet material have been given the same numbers as the parts of the sheet material of Figs. 2 and 3, except that the numbers have been primed to indicate that the numbers are being applied to a modified embodiment. Sheet A' is made up of an embossed foil sheet 10', a smooth foil sheet 11', adhesively united by layer 12'. The rectilinear grid embossing of sheet 10' provides the outer surface of the sheet with a series of inwardly-extending grooves 13' intersected by a second series of inwardly-extending grooves 17', as shown more clearly in Fig. 4. These intersecting grooves define outwardly-extending protuberances 15'. The under surface of sheet 10' has two series of intersecting inwardly-extending ridges, one of which is shown in Fig. 5, being indicated by the number 14', and the other in Fig. 6 being indicated by the number 18'. The principal difference between the embodiment of Figs. 5 to 6 from that of Figs. 2 to 3 is that the intersecting grooves (or ridges) are not of the same depth (or height). More specifically, grooves 17' extend inwardly substantially further than grooves 13', as can easily be seen by comparing the section of Fig. 5 with that of Fig. 6. A similar statement would apply with respect to ridges 14' and 18', the ridges 18' extending inwardly substantially further than the ridges 14'.

Figs. 7 and 8 show a further modification. Here again, the corresponding parts have been given the same numbers, except that the numbers have been double primed. In this embodiment, the outer foil sheet 10'' is provided with two spaced-apart parallel grooves 19 and 20, which are aligned with grooves 17'', while extending inwardly substantially further and being substantially wider than the grooves 17''. If desired, as shown in Fig. 7, the sheet A'' can be provided with an outwardly-extending integral tab portion 21 which has its sides directly aligned with grooves 19 and 20, as shown more clearly in Fig. 7. In some applications, parallel grooves can be applied to foil sheet 11'' and arranged thereon in oppositely-disposed relation to grooves 19 and 20. Alternatively, such grooves in foil sheet 11'' can be substituted for grooves 19 and 20.

Fig. 1 shows a portion of a package P which might be an end of a chewing gum wrapper. The wrap can be formed in any of the materials just discussed. As illustrated in Fig. 1, it is formed from sheet material A of Figs. 2 and 3. One edge of the sheet material A is provided with a tab extension 22. This tab extension can be used for tearing the foil wrap along the dotted lines indicated by the numbers 23 and 24. For this purpose, the side edges of tab 22 and one series of the grooves in the embossed sheet of wrap A will be aligned. More specifically, the embossed foil sheet side 10 will be on the outside of the wrap, and tab 22 will be an integral extension of layer 10 as well as layers 11 and 12. The grooves 13 will extend in parallel alignment

with the side edges of tab 22, as indicated by the dotted lines 23 and 24.

In practicing this invention, a variety of different metal foils can be used. The preferred metal foil, however, is aluminum foil. Other metal foils which may be mentioned are lead, tin, inconel, stainless steel, copper, titanium, etc. Generally, aluminum foil and other metal foils range in thickness from as low as .2 mil to as great as 5 mils. It will usually be preferable to employ the foils in a soft or annealed condition. The embossing of the foils can be carried out in accordance with well known procedures. The form of the embossing on the foil will, of course, be controlled by the pattern of the engraving on the embossed roll. To form embossed foils having rectilinear grid patterns of the type preferred for use in the present invention, it will only be necessary to use an embossing roll having a complementary grid pattern. Since this is all in accordance with procedures well known in the art, it does not as such form a part of the present invention and it is not believed that it will be necessary to further discuss it herein.

The smooth and embossed foil sheets can be bonded or laminated with various metal-bonding adhesives. It is preferred, however, to employ an adhesive which sets or cures to a non-tacky condition. The adhesive layer is preferably relatively thin and has rather high degree of flexibility. It can also have some resilience, but it should not be hard or brittle. Among the specific classes of adhesives which can be mentioned are the thermosetting resin adhesives and the thermoplastic resin adhesives. Particularly good results can be obtained with thermosetting epoxy resin adhesives, such as those obtained by reacting an epoxy resin with a polyamide. In some embodiments of this invention, elastomeric adhesives can be used, such as the silicone resin adhesives.

While the theory of operation of the present invention is not as yet fully known, the general result obtained is that the metal foil sheet material tends to have a directionally-oriented tearing property. In the case of the embodiments of Figs. 2 and 3, for example, the metal foil sheet can be torn in a substantially straight line parallel to grooves 13 or at right angles to grooves 13, which is parallel to the grooves that intersect grooves 13. In the embodiment of Figs. 4-6, the sheet can be torn most readily in a straight line parallel to grooves 17'. The line of tear will tend to be confined within one of these grooves or between a very few of these grooves. Similarly, the sheet of Figs. 7 and 8 can be torn most readily along grooves 19 and 20.

This invention is further illustrated by the following specific examples.

Example I

A sheet material similar to that illustrated in Figs. 2 and 3 of the drawing is formed from a sheet of .5 mil embossed, soft aluminum foil and a sheet of .5 mil smooth surfaced, soft aluminum foil. The embossed sheet has a rectilinear grid pattern of the type previously described herein. The two sheets are laminated together with a thin layer of a thermosetting resin adhesive therebetween, the adhesive being applied in a thin film to both the embossed and plain surfaces to be bonded. The side of the embossed foil having the spaced points or protuberances is outermost. The adhesive used is an epoxy resin-polyamide formulation which can be prepared in the following way.

Sixty parts by weight of Epon 1001 is dissolved in 30 parts of toluol and 30 parts of methylethyl ketone. A second mixture is formed from 32 parts of Polyamide 115 11 parts toluol, and 3 parts butanol. 120 parts of the first mixture is combined with 46 parts of the second mixture to form the adhesive solution containing 55.4% solids. Epon 1001 is an epoxy resin manufactured by the Shell Chemical Company, which has an epoxide equivalent of 450 to 525. Polyamide 115 is a condensa-

tion product of dilinoleic acid and ethylene diamine produced by General Mills.

Example II

The procedure of Example I is followed except that a phenolic thermosetting resin adhesive is substituted for the epoxy resin adhesive. This adhesive is prepared in the following way. 100 parts of Plyophen 169 is combined with 100 parts by weight of a 10% solution of Butvar B-76 methylethyl ketone. Plyophen 169 is a phenol formaldehyde resin manufactured by Reichhold Chemicals of White Plains, New Jersey. The product contains 64 to 68% solids, the resin being dissolved in methanol. Butvar B-76 is a polyvinyl butyral resin in a 10% solids solution in methylethyl ketone. It is manufactured by the Monsanto Chemical Company. If desired, Naugatuck CV can be substituted for Butvar B-76, Naugatuck CV is a 10% solids solution of acrylonitrile rubber in methylethyl ketone, manufactured by the Naugatuck Chemical Company of Naugatuck, Connecticut.

While in the foregoing specification this invention has been described in relation to specific embodiments thereof and many details have been set forth for purpose of illustration, it will be readily apparent to those skilled in the art that the invention is susceptible to further embodiments and that many of the details described herein can be varied considerably without departing from the basic principles of the invention.

We claim:

1. A directionally-oriented tearing metal foil sheet material, comprising two superimposed sheets of similar metal foil having substantially the same thickness, one of said sheets having a grid pattern embossed thereon, the other of said sheets having smooth surfaces, and a thin, flexible, non-tacky layer of an adhesive material disposed between and in bonding relation with said sheets.

2. The sheet material of claim 1 in which said embossed grid pattern provides said one sheet of metal foil on its outer surface with two series of inwardly-extending grooves and on its inner surface with two series of correspondingly inwardly-extending ridges, the grooves and ridges in each of said series being disposed in spaced-apart parallel relation and the grooves and corresponding ridges of one series intersecting the grooves and corresponding ridges of the other series at approximately right angles, the said outer surface of said one sheet having outwardly-extending protuberances defined by said intersecting grooves and the inner surface of said one face having correspondingly outwardly-extending indentations defined by said intersecting ridges.

3. The sheet material of claim 2 in which the grooves of one of said two series of intersecting grooves extend inwardly substantially further than the grooves in the other of said series.

4. The sheet material of claim 2 in which at least two spaced-apart parallel grooves of one of said two series of intersecting grooves extend inwardly substantially further and are substantially wider than the other grooves of the same series.

5. A directionally-oriented tearing aluminum foil sheet material, comprising two superimposed sheets of aluminum foil of substantially the same thickness, one of said sheets having a rectilinear grid pattern embossed on its inner and outer surfaces, the other of said sheets having smooth surfaces, the grid pattern of said one sheet as viewed from its outer surface providing two series of inwardly-extending grooves, the grooves in each of said series being disposed in spaced-apart parallel relation and the grooves of one series intersecting the grooves of another series at approximately right angles, and a thin, flexible, non-tacky layer of an adhesive material disposed between and in bonding relation with said sheets, said adhesive being a thermosetting epoxy resin adhesive.

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6. The sheet material of claim 5 in which the grooves of one of said two series of intersecting grooves extend inwardly substantially further than the grooves in the other of said series.

7. The sheet material of claim 5 in which at least two spaced-apart parallel grooves of one of said two series of intersecting grooves extend inwardly substantially further and are substantially wider than the other grooves of the same series.

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