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(54) **HEAT SHIELD PANEL**

HITZESCHILD

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Description

[0001] This invention is concerned with a heat shield panel which comprises at least one sheet of metal.

[0002] It is well-known that sheets of metal can be strengthened by shaping them into corrugations, thereby enabling thinner sheets to be used for certain applications. For example, corrugated roofing sheets are widely used. However, because of the corrugating only increases stiffness transversely of the corrugations, such sheets have limited applications.

[0003] It is an object of the present invention to provide a heat shield panel which exhibits additional stiffness in all directions in the plane of the panel.

[0004] This object is achieved according to the invention by a heat shield panel with the features of claim 1. Claims 2 to 4 defined preferred embodiments of the invention.

[0005] The heat shield panel according to the invention has parallel upstanding ridges with troughs between them, these troughs having reentrant side walls. It is found that the panel has increased stiffness in all directions in the plane of the panel and can be bent into complex shapes. A method for manufacturing such a panel does not require expensive tooling. All that is required is one or two sets (depending on whether the same set is used for both corrugating operations) of corrugating rollers. Such corrugating rollers are well-known as they are used to corrugate metal sheets for, eg, roofing and to corrugate cardboard. Such rollers have sinusoidal ridges extending along their surfaces. A set of rollers comprises an upper and a lower roller whose ridges mesh with one another and press a sheet into corrugations as it passes through the nip between the rollers.

[0006] Although said angle between the corrugating directions can be as low as 10°, it is preferred that said angle is at least 30°, eg 45°, and, most preferably, said angle is substantially 90°.

[0007] The corrugating may be carried out by passing the sheet between two sets of corrugating rollers which are arranged to produce similar corrugations, ie the depth and spacing of the ridges on the corrugating rollers may be the same for both corrugating operations. Indeed, the same rollers could be used for both corrugating operations. However, it is possible to vary the corrugation depth and/or spacing between the corrugating operations, eg to vary the stiffness of the panel in different directions or to produce uniform stiffness.

[0008] Said corrugations extending in the first direction may be generally sinusoidal, when viewed in transverse cross-section. It is, however, possible to use corrugations with other cross-sections.

[0009] Although a heat shield panel according to the invention has a very complex shape, it can be manufactured very simply.

[0010] Preferably, the variation in height of the ridges is substantially sinusoidal. Of course, the troughs must conform to the width and height variations of the ridges.

Thus, said troughs vary in depth along their length with the greatest depth occurring at the narrowest points of the troughs. In some cases, the lowest points of the ridges may be lower than the highest points of the troughs, but, of course, such lowest and highest points are displaced from one another longitudinally of the ridges or troughs.

[0011] In order to reduce the overall thickness of the heat shield panel, the ridges may each have a crest which is substantially flat in a direction transverse to the length of the ridge.

[0012] A heat shield panel according to a preferred embodiment of the invention may be formed from, eg, aluminium or an alloy thereof or steel. For example, the sheets may have a thickness of at least 125 microns. Thicknesses of 0.3 to 1mm have been found to be appropriate but, clearly, depending on the metal involved, there is a limit to the thickness of sheet which can be formed into a panel according to the invention.

[0013] There now follows a detailed description, to be read with reference to the accompanying drawings, of a heat shield panel and its method of manufacture which are illustrative of the invention.

[0014] In the drawings:

Figure 1 is an enlarged plan view of a portion of an embodiment of a heat shield panel according to the invention;

Figure 2 is a cross-sectional view taken on the line II-II in Figure 1;

Figure 3 is a cross-sectional view taken on the line III-III in Figure 1;

Figure 4 is a cross-sectional view taken on the line IV-IV in Figure 1;

Figure 5 is a cross-sectional view of a portion of a heat shield panel incorporating two metal sheets; and

Figure 6 is a computer scan of a portion of an illustrative heat shield panel, according to an embodiment of the invention.

[0015] The illustrative method, which is not part of the invention as claimed, forms the heat shield panel 10 by shaping a sheet of metal 12, the sheet being made of aluminium alloy and being 0.3mm in thickness. At the beginning of the illustrative method, the sheet 12 is planar.

[0016] The illustrative method, firstly, comprises corrugating the sheet 12 with corrugations which extend parallel to one another in a first direction. These corrugations are of conventional form, being sinusoidal in transverse cross-section, and extend parallel to one another in the first direction across the sheet 12. This stage of the illustrative method is carried out by passing the sheet 12 between corrugating rollers of conventional type.

[0017] Next, the illustrative method comprises corrugating the already corrugated sheet 12 with corruga-

tions which extend parallel to one another in a second direction, said second direction being inclined at an angle of 90° to said first direction. This is carried out by passing said sheet 12 between similar corrugating rollers to those used in the first corrugating operation. However, in the second corrugating operation, the direction of travel of the sheet 12 relative to the rollers is at 90° to its direction of travel relative to the corrugating rollers in the first corrugating operation.

[0018] The illustrative heat shield panel 10 formed by the illustrative method is shown in the drawings. The sheet 12 is formed into a plurality of generally parallel upstanding ridges 20 separated by troughs 22. The longitudinal direction of the ridges 20 represents the longitudinal direction of the corrugations formed by the first corrugating operation, ie said first direction, but these corrugations have been deformed by the second corrugating operation, preformed at 90° to the first corrugating operation in said second direction. The shape of the ridges 20 and troughs 22 is complex and is described below.

[0019] Figure 1 shows, in plan view, a portion of the upper surface of the heat shield panel 10. The lower surface of the sheet 10, not shown, has a similar appearance to said upper surface except that the lower surface is off-set by half the spacing between adjacent ridges 20.

[0020] Each ridge 20 has a relatively broad crest. This crest varies in height along the ridge 20 (as shown in Figure 4) having peaks 20a and hollows 20b. As shown in Figure 2, the crest of the ridge 20 is dished downwardly at its peaks 20a but, as shown in Figure 3, the crest is substantially flat at its hollows 20b. As shown in Figures 1 to 3, the crest varies regularly in width along the ridge 20, having its greatest width at the hollows 20b and its smallest width at the peaks 20a. Figure 1 also illustrates that the narrowest points of the ridges 20 are spaced from one another along lines extending normally to the longitudinal direction of the ridges.

[0021] As shown in Figures 1 to 3, the troughs 22 each have a relatively broad bottom which corresponds to the shape of the crests of the ridges 20. Thus, each bottom has broad peaks 22a which are substantially flat in a direction transverse to the length of the trough 22 (see Figures 2 and 3), and narrow hollows 22b which are dished upwardly. From Figure 4 (where the trough bottom of the lower side of the sheet 12 is represented by the lower side of the Figure), it can be seen how the bottom varies in height along the trough 22. The bottom also varies regularly in width along the trough 20 (as shown in Figure 1).

[0022] As illustrated by Figures 2 and 3, the troughs 22 have side walls 24 (which also form the side walls of the ridges 20). These side walls 24 are reentrant so that the troughs 22 are narrower at their mouths between the crests of the ridges than at their bottoms. Each wall 24 follows the undulations of the trough 22 and meets the crest of one of the ridges 20 and the bottom of one of

the troughs 22 at an angle which is less than 90°.

[0023] The heat shield panel 10 derives stiffness from its shape and can be bent both about lines extending longitudinally of the ridges 20 and (less easily) about lines extending transversely thereof.

[0024] Figure 5 shows further embodiment of a heat shield panel 30 which comprises a shallow box formed by a bottom sheet 32 and a top sheet 34. Side walls of the box are formed by upwardly extending edges of the sheet 32. The top sheet 34 is turned over the edges of the bottom sheet 34 to join the sheets 32 and 34 together to close the box. The sheets 32 and 34 are formed of aluminium.

[0025] The heat shield panel 30 also comprises two panels 10 as described in relation to Figures 1 to 4 and shown in Figure 6. The shield 30 also comprises a layer of thermally insulating paper 36 which is disposed between the two panels 10. The paper 36 may, for example be formed from the material marketed under the trade name "Fiberfrax 970". One of these panels 10 rests on the upper surface of the bottom sheet 32 with the paper 36 on top of it and the other panel 10 is on top of the paper 36 and beneath the lower surface of the sheets 34.

[0026] The heat shield panel 30 can be utilised with either the lower surface of the sheet 32 or the upper surface of the sheet 34 facing a source of heat. The heat shield panel 30 has air trapped in it as the ridges 20 hold the sheets 32 and 34 apart. Modifications of the heat shield panel 30 can omit the paper 36 or may have only one panel 10 or more than two panels 10. The sheets 32 and 34 prevent dirt from accumulating in the folds of the panels 10.

[0027] Figure 6 illustrates the appearance of the illustrative heat shield panel 10 as scanned by a computer. The figure shows the ridges 20 and the troughs 22 and also the peaks 20a and 22a and the hollows 20b and 22b.

Claims

1. A heat shield panel (10; 30) which comprises at least one sheet of metal (12), characterised in that the sheet (10) is formed into a plurality of generally parallel upstanding ridges (20) separated by troughs (22), the troughs (22) having reentrant side walls (24), wherein each ridge (20) varies in width along its length in a regular manner and varies in height along the length of the ridge (20) with the greatest height occurring at the narrowest points of the ridge (20), and wherein said troughs (22) vary in depth along their length with the greatest depth occurring at the narrowest points of the troughs (22).
2. A heat shield panel according to claim 1, characterised in that the variation in the height of the ridges

(20) is substantially sinusoidal.

3. A heat shield panel according to either one of claims 1 and 2, characterised in that the panel (10; 30) is formed from aluminium or an alloy thereof.
4. A heat shield panel according to any one of claims 1 to 3, characterised in that said sheet of metal (12) has a thickness of 0.3 to 1 mm.

Patentansprüche

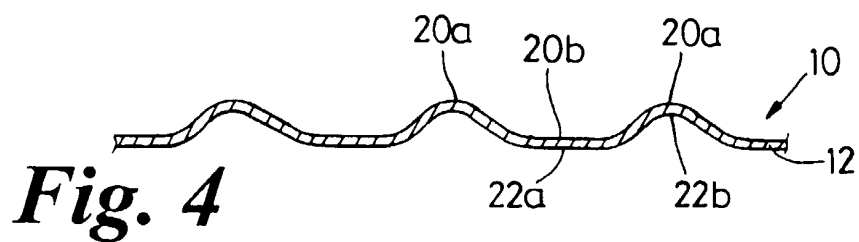
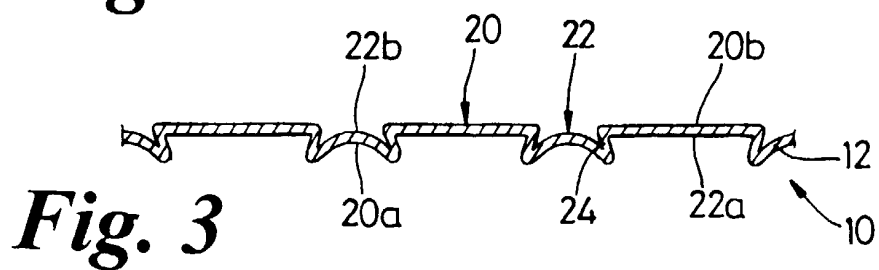
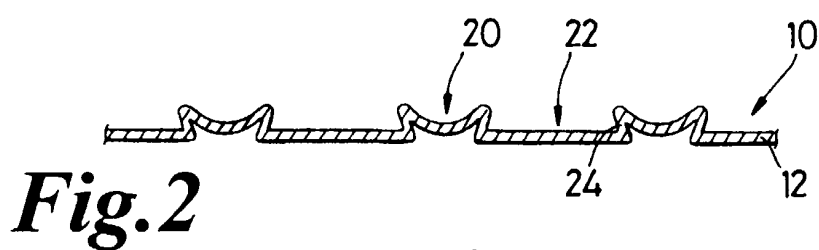
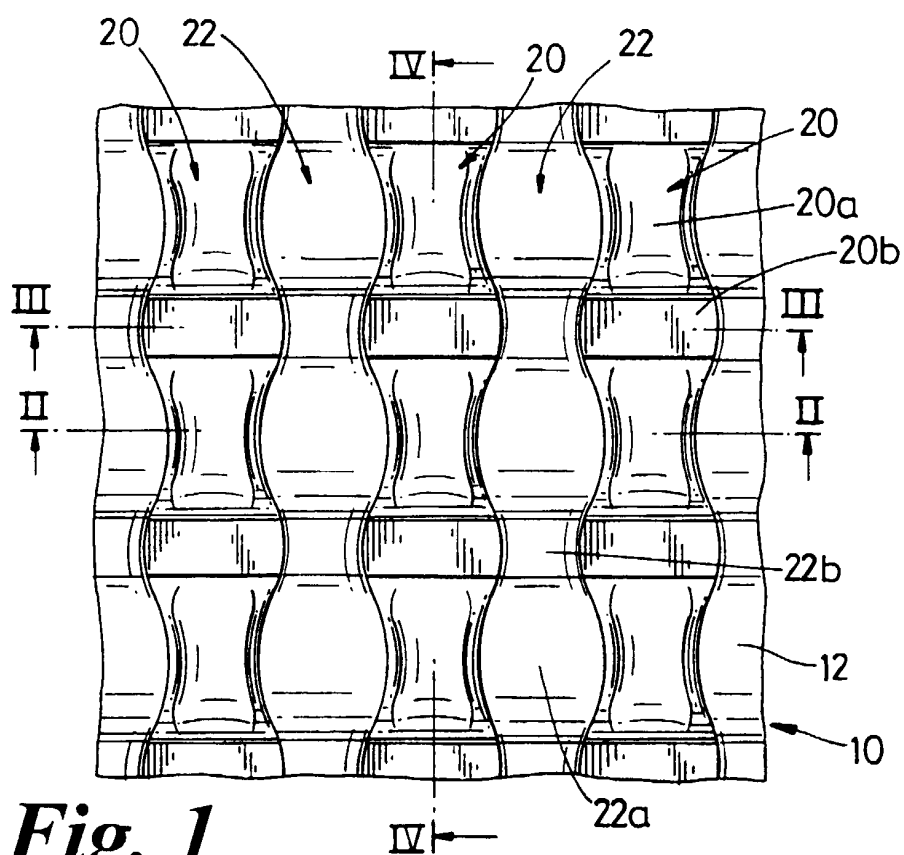
1. Hitzeschildpaneel bzw. -platte bzw. -tafel (10;30), welches mindestens eine Metallplatte bzw. -blech (12) umfasst, dadurch gekennzeichnet, dass das Blech (10) in eine Vielzahl von im allgemeinen hochstehende Grate bzw. Wulste bzw. Riffel bzw. Rücken bzw. Firste bzw. Stege (20) geformt ist, welche durch Mulden bzw. Rücksprünge (22) getrennt sind, wobei die Mulden (22) einspringende Seitenwände (24) aufweisen, wobei sich jeder Steg (20) in der Breite entlang seiner Länge in einer regelmäßigen Weise verändert und sich in der Höhe entlang der Länge des Steges (20) verändert, wobei die größte Höhe an den schmälsten Punkten des Steges (20) auftritt, und wobei die Mulden (22) sich in ihrer Tiefe entlang ihrer Länge verändern, wobei die größte Tiefe an den schmälsten Punkten der Mulden (22) auftritt.
2. Hitzeschildpaneel gemäß Anspruch 1, dadurch gekennzeichnet, dass die Veränderung in der Höhe der Stege (20) im wesentlichen Sinusform besitzt.
3. Hitzeschildpaneel gemäß einem der Ansprüche 1 und 2, dadurch gekennzeichnet, dass das Paneel (10;30) aus Aluminium oder einer Legierung davon ausgebildet ist.
4. Hitzeschildpaneel gemäß einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, dass das Metallblech (12) eine Dicke von 0,3 bis 1 mm aufweist.

Revendications

1. Bouclier thermique (10, 30) qui comprend au moins une tôle de métal (12), caractérisé en ce que la tôle (10) est façonnée en une pluralité de crêtes dressées généralement parallèles (20) séparées par des cratères (22), les cratères (22) comportant des parois latérales rentrantes (24), dans lequel chaque crête (20) change de largeur le long de sa longueur de manière régulière et change de hauteur le long de la longueur de la crête (20) avec la hauteur la plus grande se trouvant aux points les plus étroits de la crête (20), et dans lequel lesdits cratères (22)

changent de profondeur le long de leur longueur avec la profondeur la plus grande se trouvant aux points les plus étroits des cratères (22).

2. Bouclier thermique selon la revendication 1, caractérisé en ce que le changement de hauteur des crêtes (20) est sensiblement sinusoïdal.
3. Bouclier thermique selon l'une des revendications 1 et 2, caractérisé en ce que le bouclier (10, 30) est constitué d'aluminium ou d'un alliage de celui-ci.
4. Bouclier thermique selon l'une quelconque des revendications 1 à 3, caractérisé en ce que ladite tôle de métal (12) a une épaisseur de 0,3 à 1 mm.



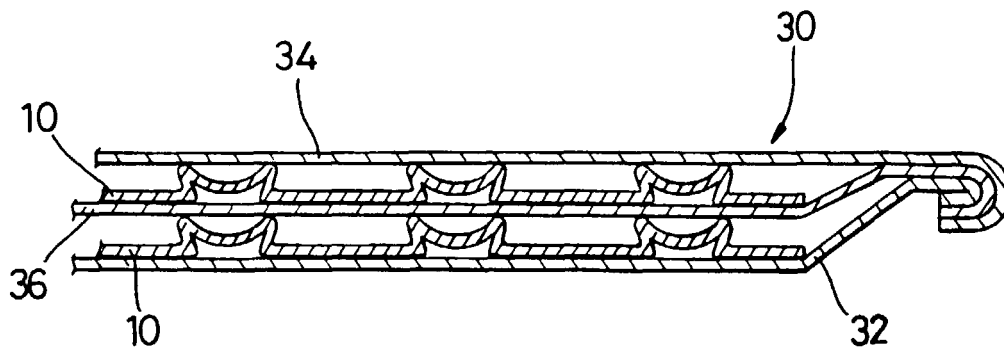


Fig. 5

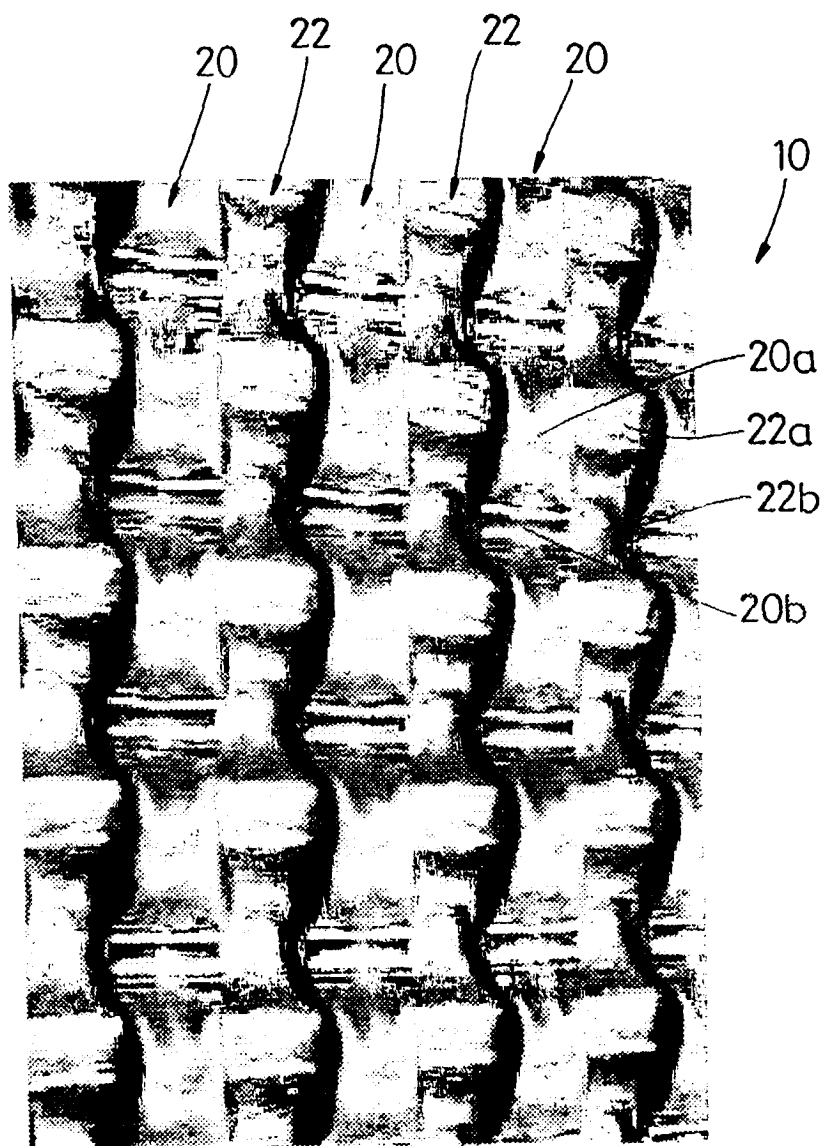


Fig. 6