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Sullhofer

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[54] **SELF-SUPPORTING INSULATING ELEMENT**

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[51] **Int. Cl.** **E04c 1/30,** E04c 2/22

[58] **Field of Search**.....52/618, 309, 450, 336

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Assistant Examiner—Henry E. Raduazo
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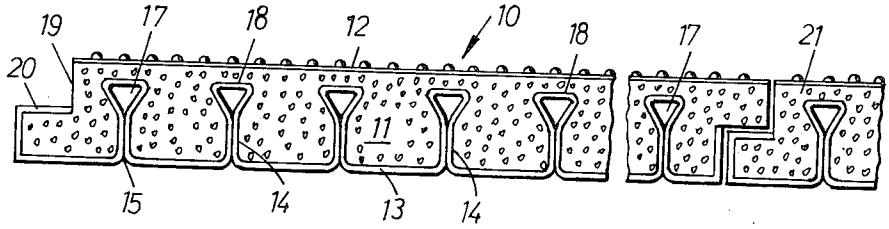
[57] **ABSTRACT**

A self-supporting insulating element for roofs and walls with an insulating core of hard foam material, especially polyurethane hard foam material, and with two cover layers one of which is formed by a reinforced metal sheet or reinforced web of synthetic material.

1 Claim, 2 Drawing Figures



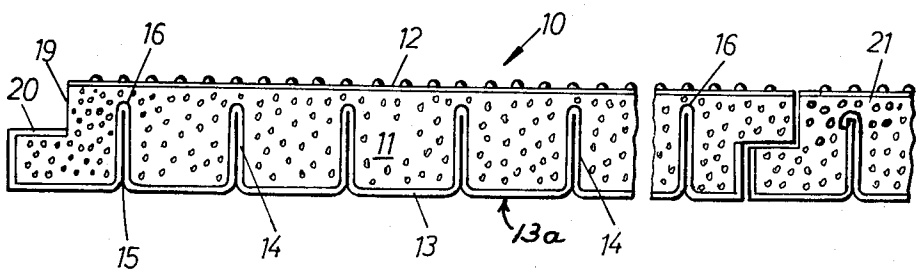


Fig.1

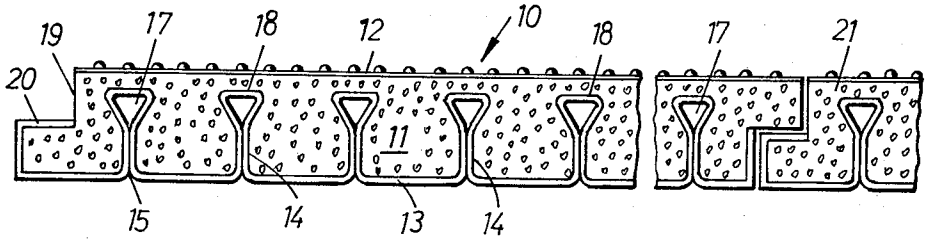


Fig.2

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SELF-SUPPORTING INSULATING ELEMENT

The present invention relates to a self-supporting insulating element for roofs and walls with an insulating core of hard foam, especially polyurethane hard foam, and two cover layers.

The heretofore known self-supporting insulating elements for roofing, in addition to an insulating core provided on both sides with a cover layer, are provided with a reinforcement which is designed as a profiled metal sheet. Depending on the design and the arrangement of this reinforcement, either a continuous uniform insulating effect is impossible or the element cannot be uniformly foamed. On its bottom side it is corrugated and forms a non-uniform surface which is not suitable as face.

It is, therefore, an object of the present invention to provide a self-supporting insulating element for roofs and walls with an insulating core of hard foam, especially polyurethane hard foam, and two cover layers which do not require an independent reinforcement, which can be foamed on the known double-belt conveyors in a single working operation and in a continuous manner, and which for roofing can be produced in the form of plates having a length extending from the ridge to the eaves of the roof.

It is another object of this invention to provide a self-supporting insulating element as set forth above which will overcome the drawbacks and shortcomings of heretofore known insulating elements of the type involved.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing, in which:

FIG. 1 illustrates a cross-section through an insulating element according to the invention and also shows an adjacent broken off element with webs designed as drawn-in plates with folds.

FIG. 2 is a cross-section through an insulating element according to the invention and an adjacent broken off element with webs formed by widened folds.

The insulating element according to the present invention is characterized primarily in that at least one of the cover layers is designed as reinforced metal sheet or as reinforced web of synthetic material. In this way, on one hand, a separate metal sheet or web of synthetic material as independent reinforcement is superfluous and, on the other hand, there is provided a stable self-supporting insulating element which forms a plate adapted to be walked on. In view of the reinforced metal sheet or the reinforced web of synthetic material, the insulating element will on one side have a smooth surface which is suitable as face.

According to a practical embodiment of the insulating element according to the invention, the reinforced metal plate or metal sheet is at even distances provided with webs which are arranged perpendicularly with regard to the cover layer and point in the direction of the core of the insulating element. In view of these webs, the planes of which are perpendicular to the plane of the plate or sheet, a high resistance moment against bending is obtained whereby the element can be subjected to such high loads that it can be walked on. The insulating element may be made of such a length that it will extend from the ridge to the eaves when used for roofing. In this way it is possible to carry out the roofing in a minimum of time by merely placing the insulating elements alongside each other and fastening the same.

If it is desired to form the webs from a continuous sheet metal plate, they may be designed as drawn-in folds. This can be done by edging or bending and folding while the root portions of all webs are located in one plane and form fine grooves in the cover layer.

According to a modified design of the insulating element according to the invention, the folds have their zenith portions widened so as to form a hollow chamber of triangular cross-section, one side of the triangle extending parallel to the cover layers. In this way a high resistance moment against torsion forces is obtained. In other words, the insulating element becomes particularly torsion resistant. By correspondingly dimensioning the height of the webs and the distance between the webs, the static loadability of the insulating element can be varied.

If the insulating element has its edges provided with a stepped fold, the reinforced metal sheet may, at least on one side of the insulating element, be pulled into the fold. In this way a better bearing surface or seat for the adjacent element and a good seal for the foam material is obtained.

According to a further modified design of the insulating element according to the invention the cover layer forming the reinforcement comprises a plurality of plates which are loosely placed against each other and which at the apex of the folds are folded together. In this way also smaller plates or webs can be employed for the reinforced cover layer.

Referring now to the drawing in detail, the insulating element **10** comprises an insulating core **11** of hard foam, especially polyurethane hard foam, which on both sides has firmly cemented thereto a cover layer **12** and **13** respectively. The cover layer **12**, which in the drawing forms the upper cover layer, is prefabricated as a web and consists of a burled diffusion-tight layer of hard polyvinylchloride or another suitable synthetic material, or may be applied in liquid form.

The cover layer **13** which in the drawing forms the lower cover layer is formed of a metal sheet or plate which has an outer surface **13***a* and folded sections **14** which extend substantially perpendicularly with regard to said surface **13***a* and extend into the insulating core **11**. These folded sections **14** form with the outer surface **13***a* a continuous plate or sheet and are formed, for instance, by edging or bending the sheet at certain distances and in certain directions. The folded sections **14** are folded so sharply that the two folded walls are tightly located against each other and at the bottom side of the insulating element **10** merely form longitudinal grooves **15** which are located at even distances from each other on the surface layer **13***a* and thereby form a good face.

By arranging the folded sections **14** at the lower cover layer **13**, the element can be foamed well from the top, and a continuous uniform insulating layer is obtained. When the insulating element is walked on, it is possible that the foam material above the apexes **16** of the folds **14** might be subjected to an increased specific surface load. In order to reduce the specific surface load under such circumstances, with the embodiment shown in FIG. **2**, the folded sections **14** have

their apex portion widened so as to form a hollow chamber **17** of triangular cross-section, one side, namely the side **18** of the triangle, being parallel to the cover layers **12** and **13**. In this way, the insulating element will have a higher supporting capability and a greater resistance against torsion forces. Furthermore, the increased specific surface load at the apexes **16** of the folded sections **14** is considerably reduced.

Instead of forming the lower cover layer **13** with the folded portions **14** of a single integral piece, it can also be composed of a plurality of plates which, in such an instance, will at the apexes **16** of the folded portions **14** be folded together as shown e.g. with the right-hand section of FIG. **1**. This manufacturing possibility may be selected when machines for rolling and folding the sheet metal into folded webs are not available. At the edge portions, the insulating element **10** is provided with a recess **19** into which is bent the free end **20** (see left-hand side of FIG. **1**, of the cover layer **13**. In this way a good bearing surface is created for the respective adjacent element **21**, and a good seal for the edge of the insulating core **11** is realized.

In view of the lower cover layer **13** being formed as a reinforced metal plate, it is possible to produce self-supporting insulating elements of considerable strength which rest only at their ends on the purlins of the roof construction and do not need any further support. The self-supporting insulating elements according to the invention extend from the ridge to the eaves of the roof and can in one working step from above mechanically be foamed on the well known double conveyor installations. The insulating elements are firmly connected to the burled outer layer either by the adhesiveness of the polyurethane hard foam or by foams which have a similar good adhesive property, and after having been installed are manually provided with a roof cover or may be provided with a roof skin forming the outer layer which extends beyond the adjacent or abutting edges of the insulating element and at said edges merely has to be welded or cemented.

The foam material up to the edges of the insulating element is enclosed in a diffusion-tight manner by the smooth or burled hard polyvinylchloride foil or by the lower cover layer made of other synthetic materials in the form of webs and suitable for this purpose or may be applied in liquid form. The edges are partially by the formed cover layer and partially by a sealing substance likewise closed in a diffusion-tight manner. As such sealing substance there may be employed the sealing substance disclosed in my co-pending application Ser. No. 801,087 filed Feb. 20, 1969, and more specifically consisting primarily of substances such as polyvinylchloride, polyethylene, polyester, paraffin, or the like. In this way the original favorable insulating effect of the polyurethane hard foam material is maintained.

It is, of course, to be understood that the present invention is, by no means, limited to the particular showing in the drawing, but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. A self-supporting insulating element for building structures, comprising two spaced cover layers forming the two sides of said panel, one of said cover layers being metal and having spaced folded sections extending perpendicular to the outer surface of said panel and toward the opposite cover layer with the two sides of each folded section extending inwardly from the surface parallel to and in contact with each other, said two sides of each section beyond the median plane of said element diverging to form a hollow chamber means of triangular cross section, said other cover layer being of synthetic material and spaced from said folded sections, and a core body of hard polyurethane foam between said cover layers, said core body filling the space between said folded sections and said cover layers and providing a continuous insulation layer adjacent said other cover layer and sustaining said folded sections against deformation to strengthen said structure further.

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