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(54) Interior panel element

(57) The invention relates to an element for internal wall/ceiling panelling of ship interiors, particularly for fire insulation in high-speed ships, chiefly those made of aluminium. The invention is based on manufacturing the edge frame (1) of the element from perforated and shaped sheet metal section which encircles around the element at all of its edges and then attaching to such an edge frame a lightweight sheet cladding (2), which acts as a covering panel of the element. Such an element can be developed into the most preferred embodiment of the invention by filling the space between the edge frame (1) and the sheet cladding (2) with a fire-resistant insulation material (7, 8), particularly mineral wool.

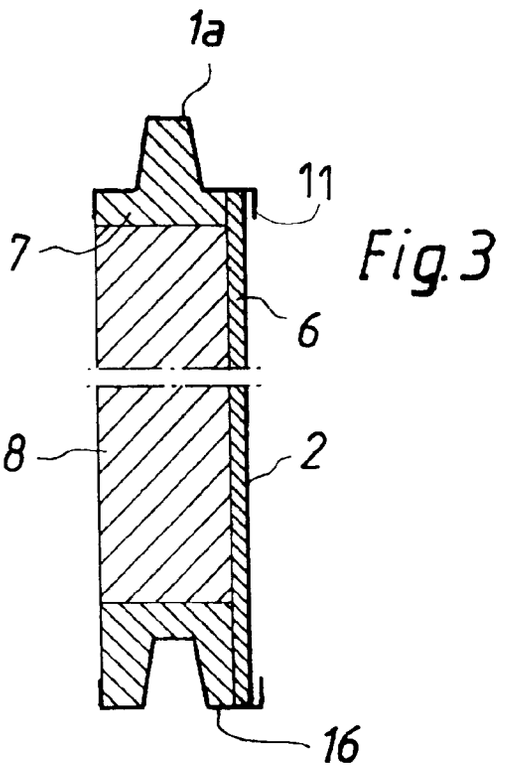

Fig. 3

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Description

The present invention relates to an interior panel element according to the preamble of claim 1 for internal panelling in ships and particularly an element according to claim 7 for fire insulation in high-speed ships, chiefly those made of aluminium.

In the construction of faster ships, a problem arises from keeping the ship's lightweight sufficiently low. A factor significantly contributing to the ship's weight is formed by different fire insulation constructions and panelling structures. The drawbacks of these structures include the high weight per unit area of the materials used therein, the wetting of the these materials, particularly the lighter grades, which over a longer time span results in appreciable weight increase. Elimination of fire hazard in ships with aluminium constructions is particularly important, because aluminium undergoes a significant loss of its structural strength at temperatures as low as 200 °C.

FI patent application 760,634 discloses a fire-resistant insulation element comprising a fire insulation material disposed between two sheet steel claddings. The edges of the element are provided with tongue-and-groove shapes so that the element edges can be abutted so as to achieve a fire-resistant, flush seam with a fully planar surface over the abutted elements. In this element the structural stiffness of the element is achieved by a shell structure formed by said sheet steel claddings and by bonding the cladding sheets of the opposite sides to each other by means of the insulation. Obviously, the element becomes necessarily rather heavy because the two cladding sheets must be sufficiently stiff and the insulation material must be mechanically durable. Hard and stiff insulation materials have a high weight per unit area, and with tightening requirements of higher fire safety classifications, thicker insulations must be used resulting in a significant increase in the ship's lightweight which is intolerable in the construction of high-speed ships.

FI Pat. No. 76,973 discloses an element structure in which a wall is formed from a number of panels comprising parallel mounted continuous sections moulded into a U-shape. The inside space of the continuous section is filled with an insulation acting as a sound isolation and fire retarding insulation. A seal placed between the abutted sections serves to attenuate vibrations transmitted by ship's hull structures. Also this structure is intended for use as load-bearing wall, and therefore, its weight is rather high, because it has to take all the weight of equipment mounted on the wall. As the wall is assembled from high lengths of such premoulded panel sections, a given unit area of the wall will have an excessively high weight. A further shortcoming of the structure is the gap remaining between the continuous section panels that worsens the fire resistance performance of the wall.

Also in SE Pat. No. 305,604 and N Pat. No. 135,102 are disclosed structures suited for use as panelling and fire insulation materials in ships and other maritime applications.

All these elements are handicapped by their nonelastic behaviour in a fire situation. As most of these structures are intended for use as at least partially load-bearing walls, they must have sufficient stiffness to take the weight of all the equipment hung on them as well as other loads imposed on them including vibrations and bending moments occurring in a vessel. In a fire situation the thermal expansion of the elements may cause warping which can detach the elements from their mounting fixtures or make them separate at the interelement seams, whereby the fire protection capability of the elements is lost.

It is an object of the present invention to provide an interior panel element which has a weight per unit area that is lighter than that of prior-art elements and is cost-efficient in production and easy to install.

It is a particular object of the present invention to provide a lightweight fire protection element offering a degree of protection compatible with classification requirements combined with minimized weight per unit area.

The goal of the invention is achieved by means of fabricating the edge frame of the cassette-type element from a perforated and shaped sheet metal section which encircles about all edges of the cassette element and then attaching to this edge frame section a lightweight sheet cladding acting as interior covering surface of the element.

The above-described element can be developed into the most preferred embodiment, a fire insulation element, of the invention by filling the space between the edge frame and the sheet cladding with a fire-resistant insulation material, particularly mineral wool.

More specifically, the element according to the invention is characterized by what is stated in the characterizing parts of claims 1 and 7.

The invention provides significant benefits.

By virtue of the invention, interior coverings with lower weights per unit area than in the prior art can be manufactured and the visual appearance of the covering is easily modifiable. Owing to the encircling edge frame, the size of the element can be freely selected, because each edge of the element has a load-bearing surface, whereby the elements can be joined to other elements on all of its edges, which is not true for most of prior-art elements. The elements can be manufactured flexibly to order, tailored for point of application, and they can be installed directly to be as drafted in plans on the wall or ceiling to be covered. The elements may also be detached from the wall or ceiling one by one thus making it possible to service the equipment or structures located behind the panel without the need for dismantling the entire wall. The prefabricated interior panel element can be dimensioned according to the point of use, whereby installation works at the actual

worksite remain minor. The element can be installed without the use of additional joisting/framing or similar supports. In this fashion the shipyard need not perform any assembly work nor handling of insulation materials during the rigging of a ship, which makes work planning and execution easier. Several different insulation materials can be used in the fire-resistant panel element, and as the insulation need not bear the weight of the element, softer and lighter insulations can be used thus achieving a substantial reduction in the panel weight per unit area. When required, hard insulation can be used at the element edges and on the sides facing the cladding of the element. Such a hard insulation makes it possible to increase the stiffness of the element and improve its fire resistance. The sheet cladding of the element can be made from strips having their edges bent inward and attached together by spot-welding, for instance. By varying the width of the bent flange, the stiffness of the element may be controlled and simultaneously the cladding of the element can be made sufficiently stiff even when very thin covering materials are used. The fabrication of the element cladding from strips makes it possible to produce large-area elements with a facing of an extremely thin sheet metal. By virtue of such a structure, large panel elements can be fabricated from materials manufactured only in limited widths thus permitting the use of long, narrow material strips for covering large areas. Then, the size of an individual element will not any more be limited by the rolling widths of available raw materials. In fact, narrow rolling widths have posed a problem in the use of thin sheet materials. The perforated totally encircling edge frame prevents warping of the edge frame in fire situations, whereby the fireproofness of the seams is improved essentially. Thus, the fire protection capability of the panel element remains good even in fire, because fire cannot escape behind the element via separating seam. By virtue of its controlled elasticity, a wall installed from the panel elements offers good sound and vibration insulation.

In the following the invention will be explained in greater detail with reference to the appended drawings, in which

Fig. 1 is a front view of an embodiment of the interior panel element;

Fig. 2 is a sectional view of the embodiment shown in Fig. 1;

Fig. 3 is another sectional view of the embodiment shown in Fig. 1;

Figs. 4 - 6 show details of the panel element illustrated in Fig. 1; and

Fig. 7 shows a mounting fixture suited for mounting the panel elements according to the invention on framing structures.

Referring to Fig. 1, the panel element illustrated therein comprises an edge frame 1 made from a perforated sheet metal section encircling the entire perimeter of the panel element. One long edge of the exemplifying element is provided with a tongue shape, while the other long edge has a compatible groove shape, and the short edges are made flat. The dimensions of the element are 1000 mm by 2000 mm. Such panel elements are easy to install into a contiguous surface, and if necessary, elements with suitable shapes such a triangle, parallelogram and others can be made for the corners and other points of the surface to be covered. The sheet cladding is made from eight strips 2 running parallel to the shorter edge of the panel element, the strips being attached to each other by spot-welding together angled flanges 18, 19 formed to the edges of the strips 2. A possible embodiment of the seam between the strips is shown in Fig. 4 in which the edge of one strip 2 is provided with a single angle bend 19, while the edge of the adjoining strip 2 has a backfolded bend 18 that folds over the simple bend 19. The height of the seam determines the stiffness of the sheet cladding, and thus, the stiffness of the entire panel element. The sheet cladding is fixed to the edge frame 1, advantageously, by means of spot-welding. The edge frame 1 of the panel element and the strips 2 of the sheet cladding are made from stainless sheet steel by bending. The strips 2 are manufactured with the help of a special tool from plain sheet steel, whereby onto the surface of the sheet cladding is embossed a desired pattern such as a diamond pattern, for instance, while the same tool simultaneously makes the bends along the edges of the strips. The depth of the embossed pattern can be varied according to the requirements of the raw material and point of application, and if necessary, very deep embossments can be made. The strips must be made from a plain sheet, because in a ready-embossed sheet the pre-made pattern would cause bulging/buckling at the edge areas during their bending thus making the bends ill-defined. While the material thickness of the edge frame 1 and the proportion of perforated holes relative to the total surface area of the edge frame are obviously selected according to the application, the material thickness is advantageously 0.2 - 0.4 mm and the proportion of the perforated holes approx. 50 % of the total area. The cladding sheet may be very thin, e.g., below 0.4 mm and sheet thicknesses even below 0.2 mm are advantageously used if minimum panel weight is desirable.

When the panel element is used for surface panelling only, the cladding material can be varied and the insulation of the element may be omitted. In the opposite case of manufacturing the panel element for use as a fire protection element, the cladding must be of sheet steel and the inside of the element must be filled with a suitable insulation material 9, 10 in order to prevent fire and heat from reaching structures located behind the element. Conventionally, different grades of mineral wool are used as insulation in these applications. The

lightest possible fire protection element is achieved by filling the volume bordered by the edge frame 1 and the sheet cladding with soft and light mineral wool. Here, the mineral wool is attached to the element with the help of sodium silicate and support wires 5. The number of the support wires 5 is two in the direction of the longer edge of the element and three in the direction of the shorter edge. The ends of the support wires 5 can be attached to the edge frame, and the crossing points of the wires 5 may be connected with the help of fixtures such as eyelets 4, twisted from a wire in the manner shown in Fig. 6, through which the wires are threaded.

The insulation 9, 10 stays well fixed in the element tied with the help of sodium silicate and the support wires 5, and the wires may even be omitted if the element is used in a horizonal position in, e.g., a ceiling. Usually, the insulation is assembled from a number of layers 9, 10 covered by a foil. In such a multilayer structure, different kinds of mineral wools may be used in the superimposed layers.

Now referring to Fig. 3, the element is shown sectioned along the plane III - III. Additionally, this drawing shows an example of an insulation arrangement different from that illustrated in Fig. 2 in such a manner that ceramic wool 6, 7 of high temperature resistance is cut to shape and mounted behind the sheet cladding 2 tightly against the edge frame. The cavity enclosed by the ceramic wool 6, 7 is filled with soft mineral wool 8 of thermal insulation grade that may further be sealed inside a foil to prevent wetting of the wool. While this alternative insulation arrangement has the advantages of improved humidity and fire resistance as well as higher stiffness, it is heavier than the above-described element structure due to the use of the ceramic wool 6, 7.

Fig. 3 also illustrates the structure of the tongue-and-groove edges of the frame 1. The tongue edge 1a forms a ridge with a cross section shaped as a truncated cone centered on the edge of the frame 1, and correspondingly, the groove edge 1b provides a compatible inward recessed cross section on the edge of the element frame. The edge of both the tongue and the groove section, 1a, 1b, respectively, remaining on the sheet cladding side of the frame section forms a lip 11 bent toward the center of the element. The sheet cladding is attached to the frame 1 so that a small gap remains between the surface of the cladding and the lip 11. Resultingly, when the elements are installed abutting at their frame edges, the interelement seams can be concealed by means of a seal mould strip with lip edges which facilitate the fastening of the mould under said frame section lips. The interelement seam may also be caulked with a sealant to improve its water-tightness and fire resistance. Such a structure is particularly advantageous in fire protection elements, because thermal expansion at elevated temperature in a fire compresses the seams tighter together. As each element in such a situation acts elastically by virtue of the perforated edge frame, no distortion of the seams can occur even if a simple abutting seam is used as described above for the short edges of the element.

Installation of the elements on wall or ceiling structures can be accomplished using a mounting fixture such as that illustrated in Fig. 7, for instance. The body of the fixture comprises two tubular elements: a body pipe 12 and a threaded, smaller-diameter pipe 13 attached to the end thereof. The outer surface of the threaded pipe 13 has a thread permitting the mounting of the pipe into a threaded hole made on a bulkhead, or alternatively, in a plain hole using a polyamide nut 20. The opposite end of the body pipe 12 has an internal thread for a screw 14, and additionally, the fixture comprises an insulating bushing 15 and a washer 17. The fixture is mounted on the bulkhead at a crossing point of element seams and the insulating bushing 15 is inserted on the body pipe 12. Next, the elements are installed in place, whereby the body pipe 12 coincides with the interelement seam so that the pipe end remains slightly below the element surface, or maximally, extends flush with the element surface. Then, the washer 17 can be placed over the crossing point of the seams and the screw 17 is tightened in place, whereby the washer 17 compresses the elements against the insulating bushing. Such a mounting fixture is advantageous owing to its small thermally conductive area due to the tubular body part.

Besides those described above, the present invention may have alternative embodiments.

Referring to Fig. 5, an element structure is shown suited for use in locations which require water-tightness as the covering is subject to splash water or must be washable. Then, the interelement seam can be provided with a fold illustrated in Fig. 5 that guides water possibly entering the seam so as to flow at the lower edge of the seam to the outside of the covering. Water-tightness may also be improved by way of suitably varying the seam structure, and in fact, the shape of the edge frame of the element can be selected rather freely, since the element retains its elasticity properties even if the shape of the edge frame section is modified. The proportion of the perforated holes relative to the total area of the frame edge may be varied, while a relative hole area of 50 % is approximately optimal, and the relative hole area should be in the range 30 - 70 % to achieve desired elasticity, or alternatively, stiffness for the frame. Further, the proportional area of holes to be perforated is dependent on the thickness of the frame material and the shape of the frame section. As mentioned above, the material of the sheet cladding may be varied according to point of application. Furthermore, the surface of the sheet cladding can be provided with different kinds of embossed patterns, which may be utilized to improve the stiffness of the sheet cladding. While the seams of the sheet structures of the panel element are advantageously made using spot-welding, obviously other joining methods can be used as well. The support wires of the thermal insulation are advantageously of stainless steel, but

such steel wires may obviously be replaced by suitable wires made of, e.g., synthetic materials.

Claims

1. An element for internal panelling, said element comprising an edge frame structure (1) for joining the element to other abutting elements and at least one sheet cladding (2, 3) attached to the edge frame structure (1) so as to act as a covering panel, **characterized** in that

   - the edge frame (1) encircles around all edges of the element, and
   - the edge frame (1) is fabricated from perforated sheet steel.

2. An element as defined in claim 1, **characterized** in that the proportion of the perforated holes is 30 - 70 % of the total material area of the edge frame (1).

3. An element as defined in claim 1, **characterized** in that the proportion of the perforated holes is approx. 50 % of the total material area of the edge frame (1).

4. An element as defined in any foregoing claim, **characterized** in that the section of said edge frame (1) is provided with a tongue shape (1a) on at least one edge of the element and at least one other edge of the element is correspondingly provided with a compatible groove shape (1b) of the edge section.

5. An element as defined in any foregoing claim, **characterized** in that on at least two edges of the element the outer surface of the section of said edge frame is flat.

6. An element as defined in any foregoing claim, **characterized** in that said sheet cladding is made from at least two strips (2) having those edges at which the adjoining strips are to be attached together bent so as to form a flange (18, 19) angled from the surface of the strip (2) and then attaching the angled flanges (18, 19) of the adjoining strips to each other so as to form a contiguous cladding (2).

7. An element as defined in any of claims 1 - 6, **characterized** in that the thickness of the facing sheet used in said sheet cladding (2) is less than 0.2 mm.

8. An element for fire-resistant panelling, said element comprising

   - an edge frame structure (1) for joining the element to other abutting elements,
   - at least one sheet cladding (2, 3) attached to the edge frame structure (1) so as to act as a covering panel, and
   - fire-resistant insulation material disposed in the space bordered by the edge frame structure (1) and the sheet cladding (2, 3),

   characterized in that

   - the edge frame (1) encircles around all edges of the element, and
   - the edge frame (1) is fabricated from perforated sheet steel.

9. An element as defined in claim 8, **characterized** in that the proportion of the perforated holes is 30 - 70 % of the total material area of the edge frame (1).

10. An element as defined in claim 8, **characterized** in that the proportion of the perforated holes is 50 % of the total material area of the edge frame (1).

11. An element as defined in any foregoing claims 8 - 10, **characterized** in that said sheet cladding is made from at least two strips (2) having their edges bent inward at the edges to be attached to an adjoining strip so as to form a flange (18, 19) angled from the surface of the strip (2) and then attaching the angled flanges (18, 19) of the adjoining strips (2) to each other so as to form a contiguous cladding board.

12. An element as defined in any foregoing claims 8 - 11, **characterized** in that said insulation is tied to the element frame by means of wires (5) running over the insulation at the rear side of the element, said wires being attached at their ends to said edge frame (1) and adapted to run through eyelets (4) made to twisted wires attached to the angled flanges (18, 19) of said sheet cladding strips (2).

13. An element as defined in claim 12, **characterized** in that said insulation comprises at least two mineral wool layers (9, 10) separated from each other by means of a foil.

14. An element as defined in any claims 8 - 11, **characterized** in that said insulation comprises ceramic wool (6, 7) disposed behind the sheet cladding (2, 3) tightly against the edge frame (1), while the rest of the insulation is of a softer and lighter grade of mineral wool.

15. An element as defined in any claims 8 - 14, **characterized** by a lip (11) made to the edge frame (1) so as to run around the perimeter of each element

at a distance from said sheet cladding (2) and angled toward the center of the element, and by a seal mould strip with lip edges which facilitate the fastening of the mould under said frame section lips thus concealing the interelement seam.

16. An element as defined in any of claims 8 - 15, **characterized** in that the thickness of the facing sheet used in said sheet cladding (2) is less than 0.2 mm.

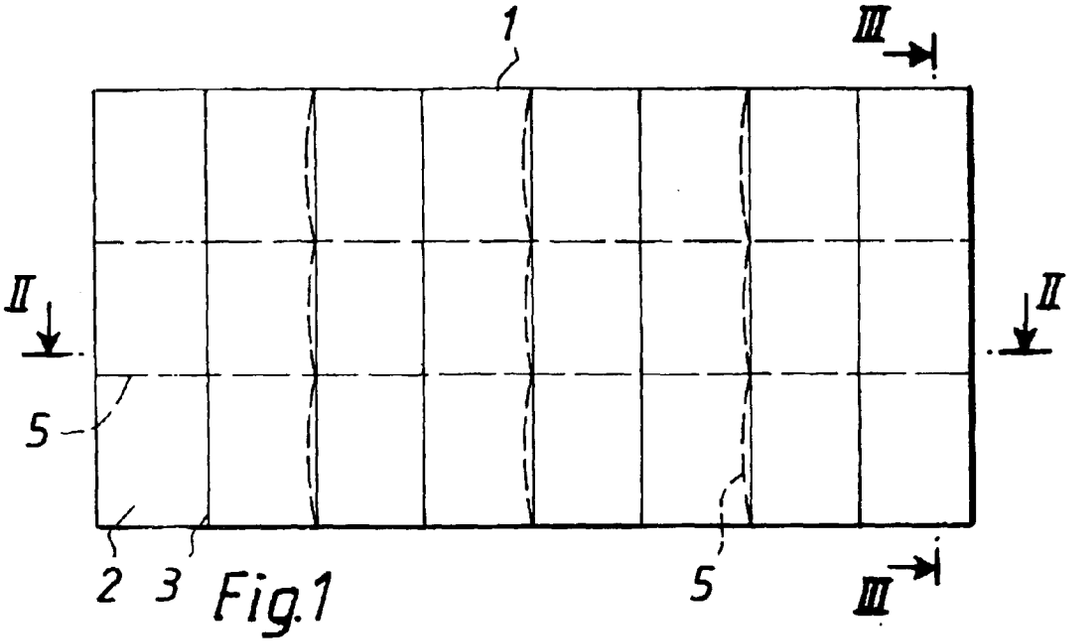

Fig.1

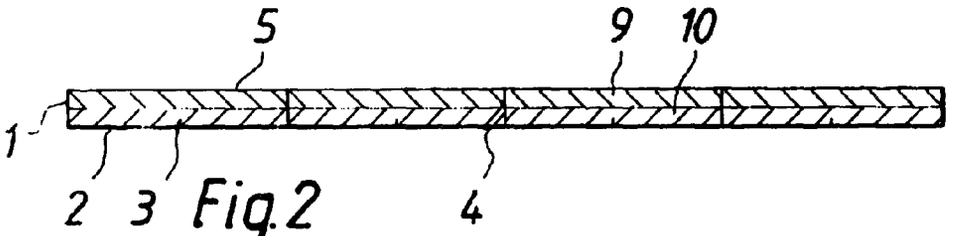

Fig.2

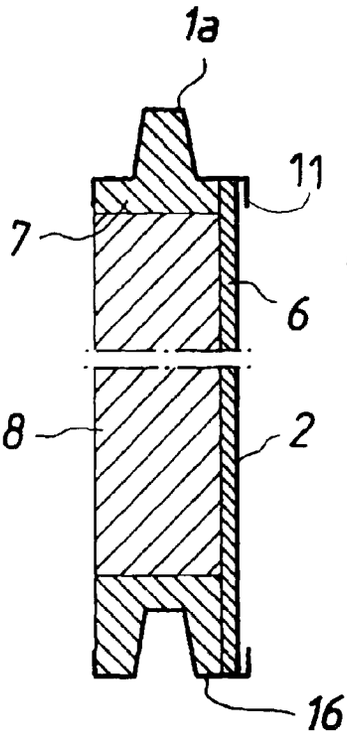

Fig.3

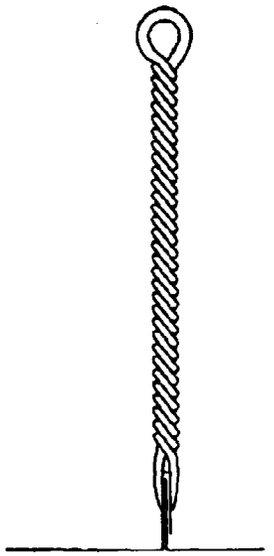

FIG. 6

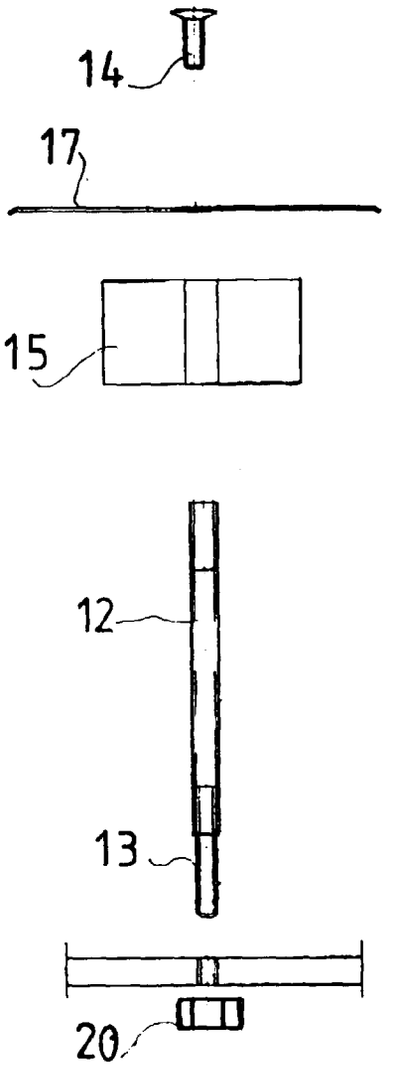

FIG. 7

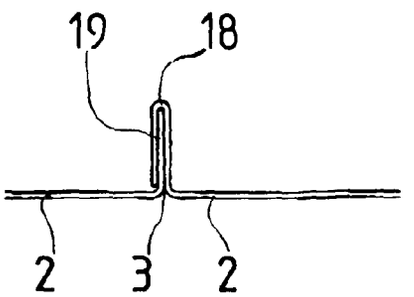

FIG. 4

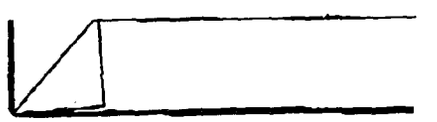

FIG. 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 85 0013

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X,P	DE-A-43 33 745 (E.PERRAKIS) * column 1, line 34 - line 38; figures 1-4 * * column 2, line 67 - column 3, line 53 * ---	1-5, 7-10,16	B63B3/68 E04F13/12
A	FR-A-1 006 370 (G.SAINT.MARTIN) * figures * ---	1-3,8-10	
A	FR-A-2 618 472 (LA RHENANE SA) * claims; figures * ---	1,8,13, 14	
A	FR-A-2 333 915 (STORA KOPPARBERGS BERGSLAGS AB) * figures * ---	6,11	
A	GB-A-114 675 (J.DAVIES) * page 4, line 25 - line 45; figures 1-4 * -----	12	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B63B E04F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 May 1996	Stierman, E

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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