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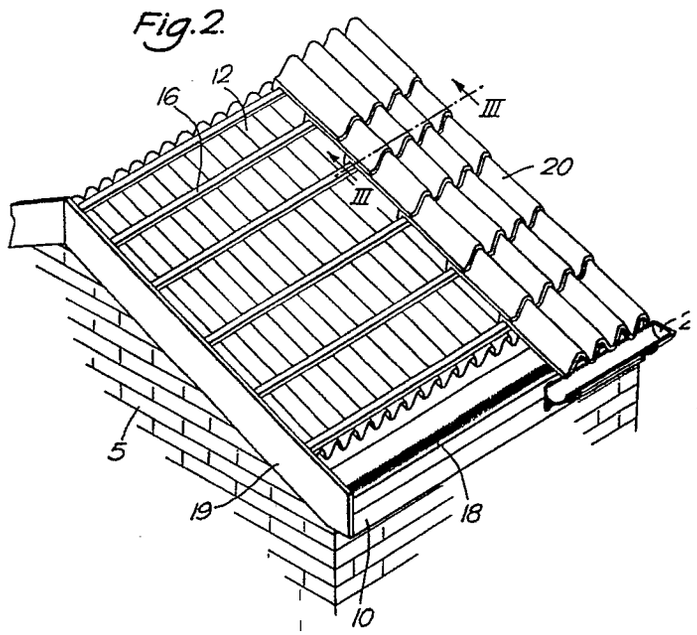
(54) Roof structure.

(57) A roof structure comprises a roof-supporting framework 1 over which a layer of corrugated waterproof sheeting 12 is placed to cover the entire roof structure in a waterproof manner. Tiles or slates are placed over the corrugated sheeting. The sheeting is formed from fibres impregnated with bitumen

Fig.2.



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The invention relates to roofing, and is particularly suitable for the construction of tiled or slated roofs.

In a conventional roof, sheets of underlay, such as roofing felt, are laid over a timber framework formed by the rafters, and tiles or slates are laid on top of the underlay. The underlay thus forms a secondary barrier to water penetration. Low-pitch roofs of this type are particularly prone to problems, a major one being that of water ingress. As the roof is relatively flat, water or snow may collect on the tiles or slates and then seep between the tiles or slates. The low pitch of the roof also means that wind can blow water underneath the tiles or slates. Pantiles are particularly likely to allow water to creep beneath them, due to their shape.

Once water has entered under the tiles or slates, the roofing felt underlay is the only barrier to prevent water from entering the building. Often it does not prove to be an effective barrier, as the roofing felt tends to sag between the rafters on which it is laid, creating gaps between adjacent overlapping sheets.

Another disadvantage of known tiled or slated roofs is that there is little ventilation between the tiles and the underlay. This can cause problems in cold weather, as warm humid air inside the building condenses on the cold surface of the underlay, and the moisture cannot escape due to the lack of ventilation. Therefore, the moisture re-enters the building.

A further drawback of known tiled or slated roof structures is that they provide very little thermal insulation.

The invention provides a roof structure comprising a roof supporting structure, corrugated waterproof sheeting supported by the roof-supporting structure and covering substantially the entire roof structure in a watertight manner, and tiles or slates overlaying the corrugated waterproof sheeting.

An embodiment of the invention will further be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a partly cut-away schematic diagram of a building, showing a roof structure according to the present invention at an intermediate stage of construction;

Figure 2 is a partly cut-away schematic diagram of the roof struction of figure 1 at a later stage of construction;

Figure 3 is a fragmentary section along the line III-III of figure 2, on an enlarged scale;

Figure 4 is a partly cut-away fragmentary view of a modified roof structure according to the present invention;

Figure 5 is a fragmentary section along the line V-V of Figure 4;

Figure 6 is a partly cut-away fragmentary view of a further modified roof structure according to the present invention;

Figure 7 is a fragmentary section along the line VII-VII of Figure 6;

Figure 8 is a partly cut-away fragmentary view of another roof structure in accordance with the invention; and

Figure 9 is a fragmentary section along the line IX-IX of Figure 8.

The roof shown in the drawings comprises a timber framework on which sheets of corrugated waterproof material 12 are laid. Slates or tiles 20 of stone, clay, or concrete are then laid on top of the corrugated sheeting.

To provide the framework, as shown in figure 1, roof trusses 1 are fixed in position extending from a ridgeboard 2 to a wall 3 of the building in the conventional manner. An undercloak 4 is fitted flush to the top of each gable wall 5 of the building at this stage. Purlins 6 are fixed across the roof trusses 1 at regular intervals, perpendicular to the trusses.

An apron of waterproof material 7 may be fitted at the eaves of the roof structure, supported by plywood 8 and an inclined chamfered board 9 secured to a fascia board 10. The outer edge of the apron overhangs the fascia board.

Supporting battens 11 are laid on top of the purlins, parallel to the roof trusses. The supporting battens 11 are spaced apart at regular intervals, to coincide with whole numbers of corrugations of corrugated waterproof sheets 12 (figs. 2 and 3) and are fixed in place by nails or analogous means to the purlins. The corrugated sheets 12 are laid on top of the framework of roof trusses 1, purlins 6 and supporting battens 11, so that the corrugations run parallel to the roof trusses and supporting battens. Each supporting batten runs underneath a crest 13 (fig. 3) of a corrugation of the corrugated sheets. The corrugated sheets are preferably about 3mm thick and made into a monolayer from organic fibres impregnated with bitumen under high pressure and at high temperature. Such a corrugated material is sold under the Trade Mark "Onduline" by Onduline Building Products Ltd., London.

Several sheets of corrugated material may be used in the construction of a roof, and each sheet overlaps its neighbours. Where the overlap is between adjacent sheets at different heights on the roof, the sheets are arranged so that the lower edge of the higher sheet overlays the upper edge of the lowe sheet. Therefore, any water running down the corrugations does not enter the building at these overlaps. The layer of corrugated material covers the entire roof structure in a watertight manner.

The corrugated sheets 12 are fixed in position

with nails 14 (fig. 3). The nails are positioned at regular intervals, and each nail passes through a crest 13 (fig. 3) of a corrugation and into a purlin 6. Thus, the corrugated sheets 12 are supported by a framework of purlins 6 and roof trusses.

A gas-permeable filler 15 made of polyethylene foam is positioned on the lowest purlin 6a, and the corrugated sheets 12 fit flush onto the filler. The filler 15 prevents the entry into the roof structure of dust, birds and other foreign material, whilst still permitting the passage of air.

Tiling battens 16 (figs. 2 and 3) are laid on top of corrugated sheets 12, parallel to the purlins 6 and spaced at regular intervals at a pitch appropriate to the size and type of tile or slate. The tiling battens 16 are fixed in position with nails 17 (fig. 3). Each nail passes through a crest 13 of a corrugation of the corrugated sheets, and into one of the supporting battens 11 which lies beneath the crest of the corrugation (fig. 3). Thus, the tiling battens 16 are supported by the corrugated sheets 12 and the supporting battens 11.

A bird comb 18 may be positioned at the eaves of the roof structure to prevent the entry of birds. A bargeboard 19 is fixed at the junction of the roof with the side walls 5.

Tiles or slates 20 are hung on the tiling battens 16 in the normal manner, and guttering 21 may be fitted to the fascia board 10 at the eaves in the usual way.

Figures 4 and 5 show a modification of the roof structure of Figures 1 to 3.

In the embodiment of Figures 4 and 5, the purlins 6 are set at regular intervals corresponding to the gauge of the tiles or slates eventually to be used. The supporting battens 11 are omitted, the corrugated sheeting 12 being placed directly over the purlins 6. The tiling battens 16 are placed directly over the purlins and secured in place by nailing to the purlins 6 Rigid steel bridge members 40 are placed at intervals over the ridges in the corrugated sheet and underneath the tiling battens at the points where the tiling battens are nailed to the purlins to support the tiling battens and prevent them crushing the corrugations in the sheeting. As can be seen in Figure 5 the bridge members are in the shape of an inverted U with a cross piece 43 and two diverging legs 44. The bottoms of the legs are curved to form smooth feet 41 which rest on the sheeting and do not damage it. The height H of the bridge member 40 corresponds to the depth of the corrugations and the spacing W of the feet 41 of the bridge member corresponds to the width of the corrugations. Each nail which secures the tiling batten to the purlin also passes through a hole 42 in the bridge member and through the crest of the corrugation in the sheeting and thus serves to hold the corrugated sheeting and bridging member in place. The bridging members do not prevent air flowing up the spaces formed by the corrugations from the eaves to the ridge of the roof on both sides of the sheeting. In other respects the embodiment of Figures 4 and 5 is the same as that of Figures 1 to 3.

Figures 6 and 7 show a modification of the embodiment of Figures 4 and 5 which is identical in every respect except that the bridge members 40 are omitted. The tiling battens 16 are nailed to the purlins 6 through the crests of the corrugations, care being taken when driving in the nails not to drive them in too far and thus distort the corrugations of the sheeting.

Figure 8 and 9 show another roof structure in accordance with the invention. In this embodiment of roof-supporting structure is formed by weatherboarding 52. The weatherboarding runs horizontally at right angles to the trusses and each piece of weatherboarding overlaps the adjacent piece lower down the slope of the roof.

Corrugated waterproof sheeting 53 is secured over the weatherboarding by nails which pass through the crests of the corrugations. Care is taken when securing the sheeting not to drive the nail in too far so as to distort the corrugations. the sheets are overlapped as in the previous embodiments so as to provide a watertight layer over the entire roof-supporting structure. The sheeting may be of the same material as described with reference to the preceding embodiments.

Spanish tiles are then laid on the surface of the corrugated sheeting. The Spanish tiles have a part frusto-conical shape so as to be larger at one end than the other. A first layer 54 of tiles is laid in columns across the roof with their concave side uppermost and their smaller ends pointing down the roof. The tiles are supported on either side at 56 by the sides of the corrugations. Each tile overlaps the adjacent tile lower down the roof.

A second layer 57 of tiles is then laid over the first layer in columns across the width of the roof. The tiles of the second layer have their convex sides uppermost and their layer ends pointing down the roof. The side edges of each tile sits on the concave surfaces of two horizontally-adjacent tiles of the lower layer and each tile of the upper layer overlaps the adjacent tile in the upper layer lower down the roof. In this way the layers of tiles form a second waterproof layer to the roof. The tiles stay in place without nailing by their own weight and the friction between adjacent tiles and between the tiles and the corrugated sheeting. The ridge is finished with ridge tiles in a conventional manner. It will be noted that the sheeting is chosen so that the spacing between troughs in the corrugations is a whole number multiple of the desired horizontal spacing of the columns of tiles. Because

the tiles sit in the troughs in the corrugated sheets they are more stably located in position than when conventional methods for laying Spanish tiles are used.

By using the corrugated waterproof underlayer the overlap between tiles can be decreased compared with conventional methods of laying Spanish roof tiles without running a risk of water penetration, resulting in a reduction in the number of tiles required.

The invention, therefore, provides a highly waterproof roof structure, as protection is provided both by the tiles or slates and by the underlaying sheet of corrugated material. The invention is particularly useful for low-pitch roofs or roofs with badly fitting tiles or slates, as even when water does seep between the tiles, it is prevented from entering the building by the corrugated waterproof underlay. Any water entering the roof simply runs down the troughs of the corrugations and leaves the building. Good waterproof sealing is possible between adjacent sheets of the waterproof material, so that water does not enter the building through gaps between the underlay sheets as can happen with conventional roofs. This effective sealing is partly due to the overlap of corrugations between adjacent sheets, which provides an interlocking junction between sheets, and partly due to the high bitumen content of the material used, so that one sheet adheres to the other.

The positioning of nails through the crests of the corrugated sheets further prevents water seeping into the building. Any water present within the roof structure will collect in the troughs of the corrugated sheets, and as nails only perforate the crests, the likelihood of water entering building through these perforations is reduced.

The invention also enables air-flow through the roof, due to the corrugated nature of the waterproof sheets, allowing evaporation of moisture present within the roof structure.

A roof structure according to the invention is also thermally insulating. This results partly from the thickness of the corrugated sheets and partly from holding air within the structure due to the corrugations.

By using a single corrugated, waterproof sheet of material such as is sold under the Trade Mark "Onduline", as described in the embodiment above, beneath the tiles or slates on a roof, improved waterproofing, ventilation and thermal insulation can be achieved with a single material; an advantage not found in the prior art.

Claims

1. A roof structure comprising a roof supporting structure, corrugated waterproof sheeting supported by the structure and covering substantially the entire roof structure in a watertight manner, and tiles or slates overlaying the corrugated waterproof sheeting.

2. A roof structure according to claim 1 in which the corrugated waterproof sheeting is attached to the roof supporting structure by nails or other fixing means which pass through crests of the corrugations in the sheeting.

3. A roof structure according to claim 1 or 2 in which the tiles are supported directly on the corrugated sheeting.

4. A roof structure according to claim 1 or 2 in which tiling battens are supported over the sheeting and the tiles or slates are supported by the tiling battens.

5. A roof structure according to claim 4 in which the tiling battens are attached to the roof supporting structure by nails or other fixing means extending into the roof supporting structure through crests of the corrugations in the sheeting.

6. A roof structure according to claim 4 or 5 in which spacer means are provided between the roof supporting structure and the tiling battens for supporting the tiling batten at the points where the tiling battens are secured to the roof-supporting structure.

7. A roof structure according to claim 4 or 5 in which the roof supporting structure includes supporting battens positioned so that each lies under a different crest in the corrugations of the sheeting, the tiling battens being attached to the supporting battens by nails or other fixing means.

8. A roof structure according to claim 4 or 5 in which the roof structure includes purlins spaced at intervals corresponding to the gauge of the tiles or slates and the tiling battens lie over the parallel to the purlins and are attached to the purlins by nails or other fixing means.

9. A roof structure according to any of the preceding claim in which the roof supporting structure comprises purlins perpendicular to roof trusses or rafters and supporting battens extending parallel to the roof trusses or rafters and supported by the purlins.

10. A roof structure according to claim 9 in which the corrugations of the sheeting are parallel to the roof trusses, and each supporting batten lies under the crest of a corrugation in the sheeting.

11. A roof structure according to claim 8 or 9 in which the corrugated waterproof sheeting is attached to the purlins by nails or other fixing means passing through crests of the corrugations in the sheeting.

12. A roof structure according to any of claims 9, 10 or 11 in which the tiling battens are attached to the supporting battens by nails through crests of

the corrugations in the sheeting, the tiling battens being perpendicular to the roof trusses or rafters.

13. A roof structure according to any of claims 4 to 12 a rigid bridge member is placed over the crest of the corrugation at each point where the tiling batten is nailed to the roof-supporting structure to support the tiling batten.

14. A roof structure according to any of claims 1 to 7 which the roof-supporting structure comprises roof trusses or rafters covered by weatherboarding.

15. A roof structure according to any preceding claim in which the corrugated waterproof sheeting comprises fibres impregnated with bitumen.

16. A roof structure according to claim 15 in which the fibres are oganic.

17. A roof structure according to claim 15 or 16 in which the fibres are impregnated with bitumen under high pressure.

18. A roof structure according to any of claims 15, 16 or 17 in which the fibres are impregnated with bitumen at high temperatures.

19. A roof structure according to any preceding claim in which the corrugated waterproof sheeting is approximately 3mm thick.

20. A roof structure according to any preceding claim in which an air-permeable filling material fills the space between the corrugated waterproof sheeting and the roof supporting structure at a position near to the eaves of the roof.

21. A roof structure according to claim 20 in which the air-permeable filling material is polyethylene foam.

22. A roof structure according to any of the preceding claims 4 to 15 in which the roof-supporting structure includes purlins and in which an apron of waterproof material extends from the lowest purlin of the roof structure to the lowest edge of the roof, supported by an inclined board.

23. A method of constructing a roof comprising fixing corrugated waterproof sheeting onto a roof supporting framework, and placing tiles or slates over the corrugated sheeting.

24. A method according to claim 23 including the steps of fixing tiling battens over the sheeting and fixing the tiles or slates to the tiling battens.

25. A method according to claim 24 further comprising fixing purlins onto roof trusses, perpendicular to the roof trusses, and fixing supporting battens parallel to the roof trusses onto the purlins to form the roof supporting framework; and fixing the tiling battens perpendicular to the roof trusses.

Fig.1.

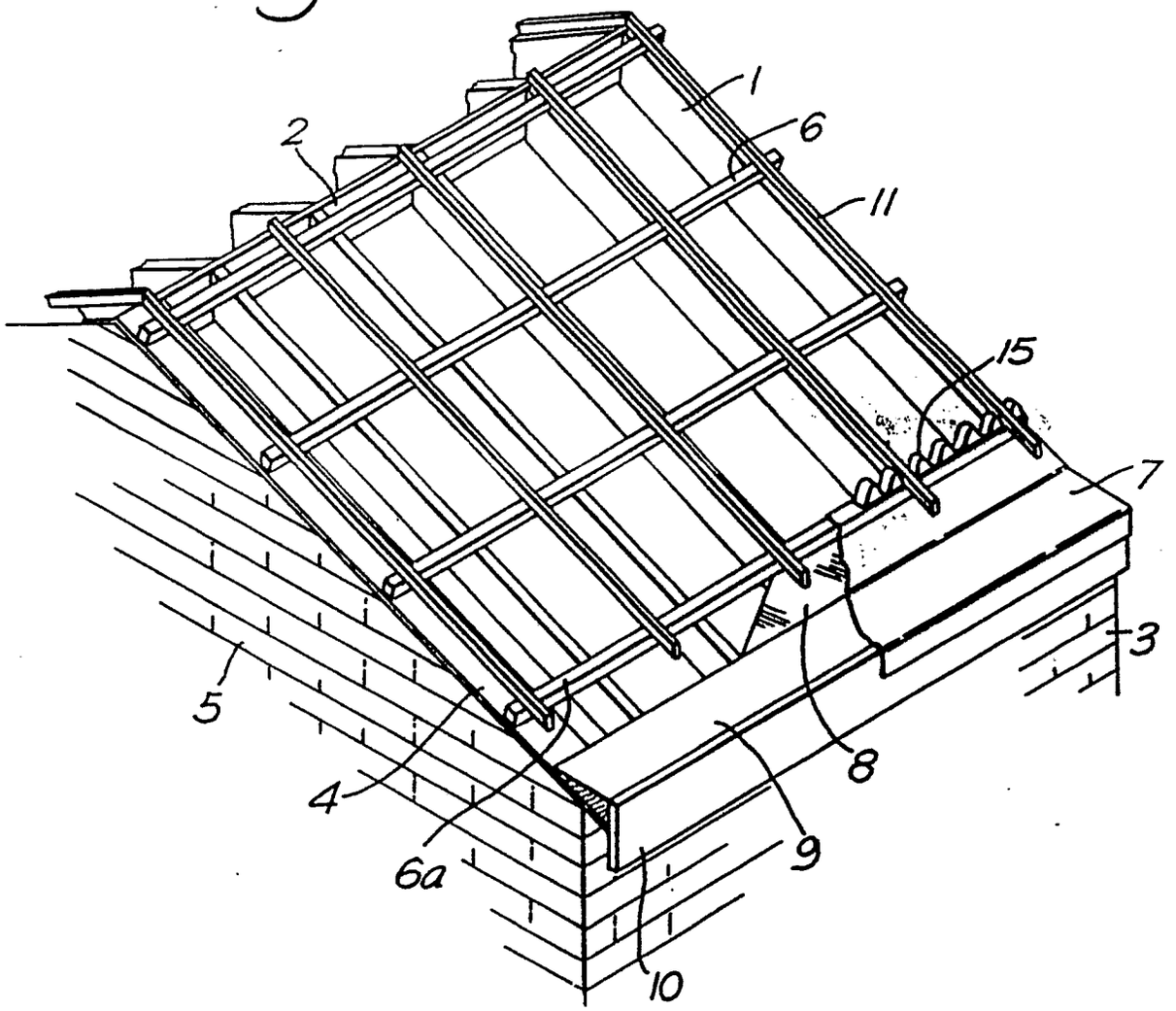


Fig.2.

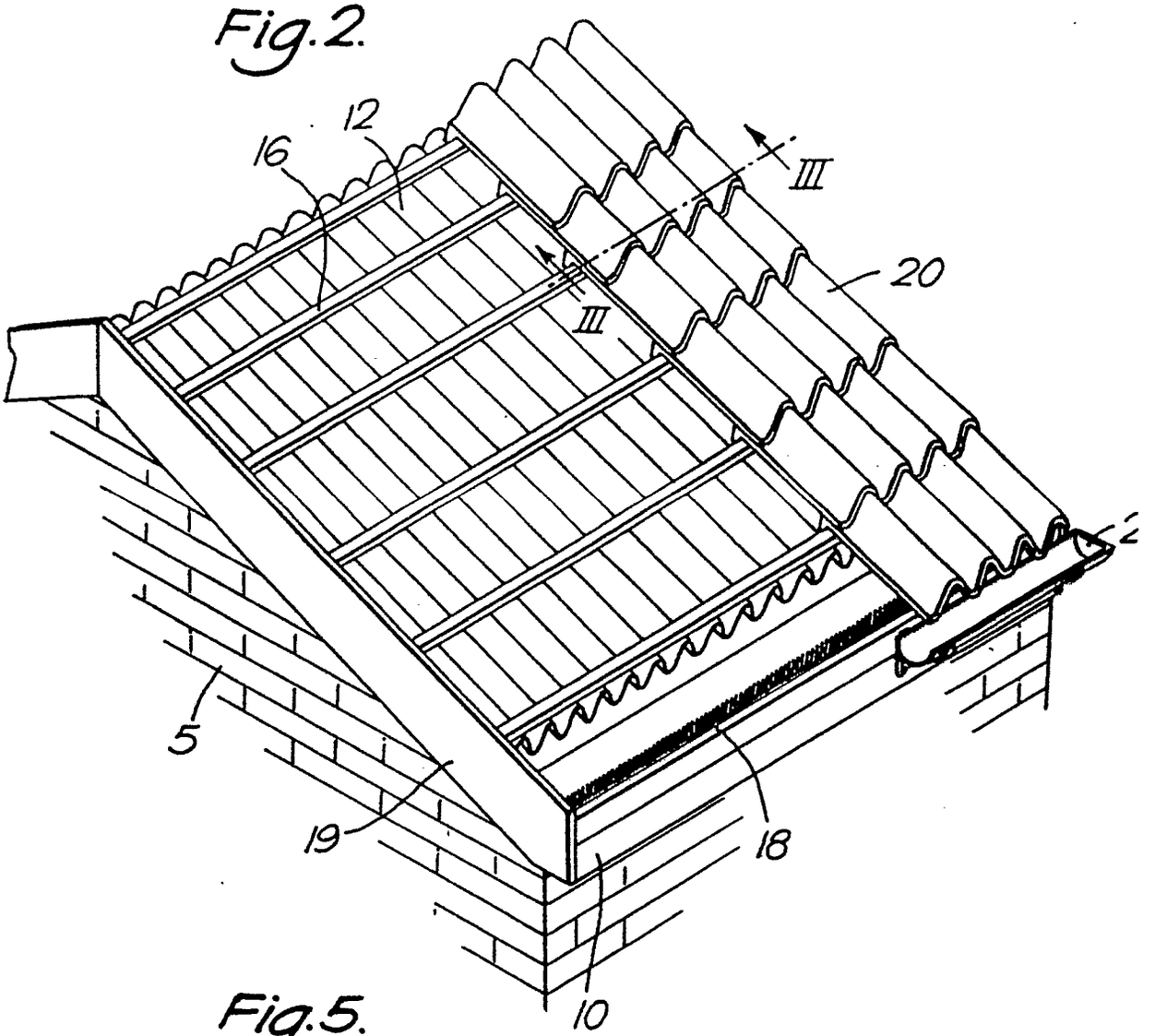


Fig.5.

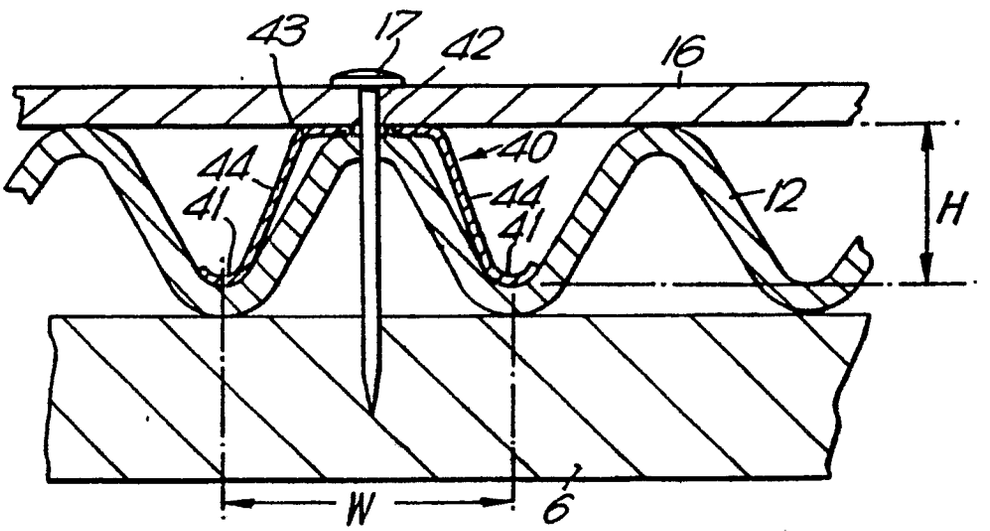


Fig.3.

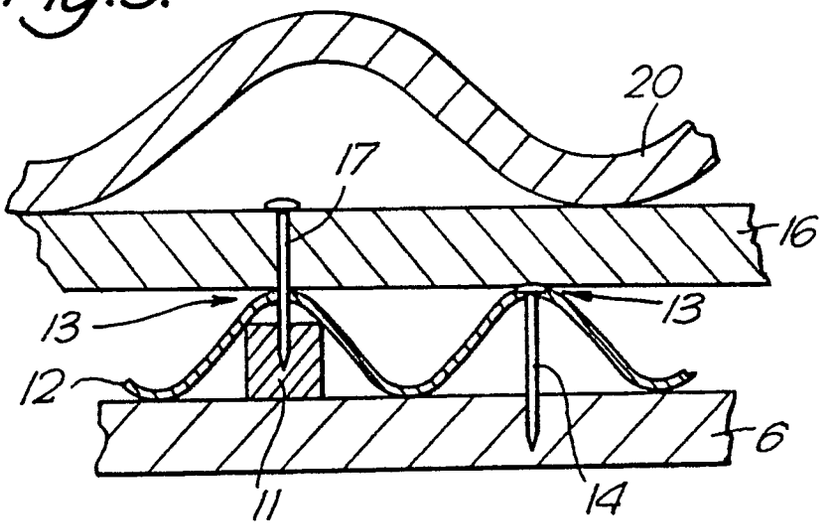


Fig.4.

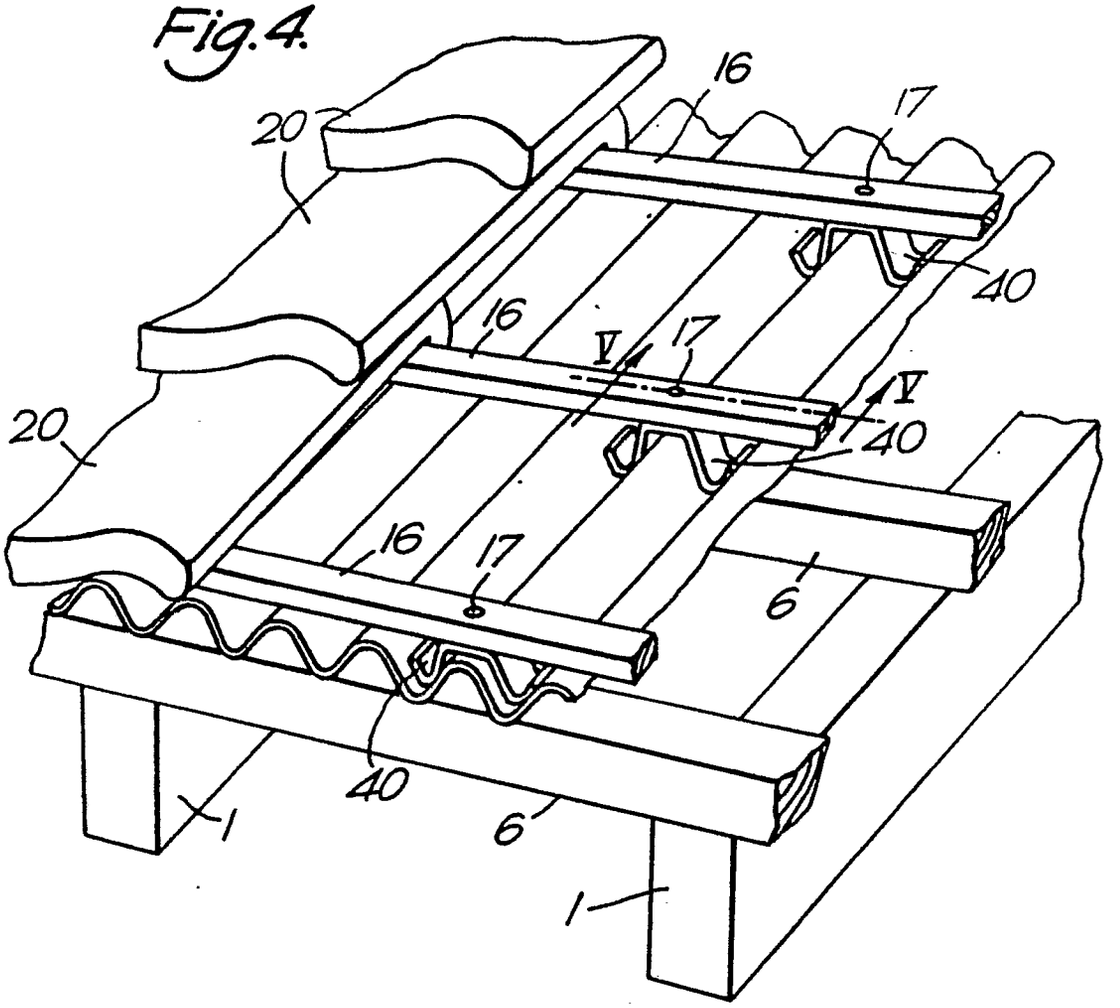


Fig.6.

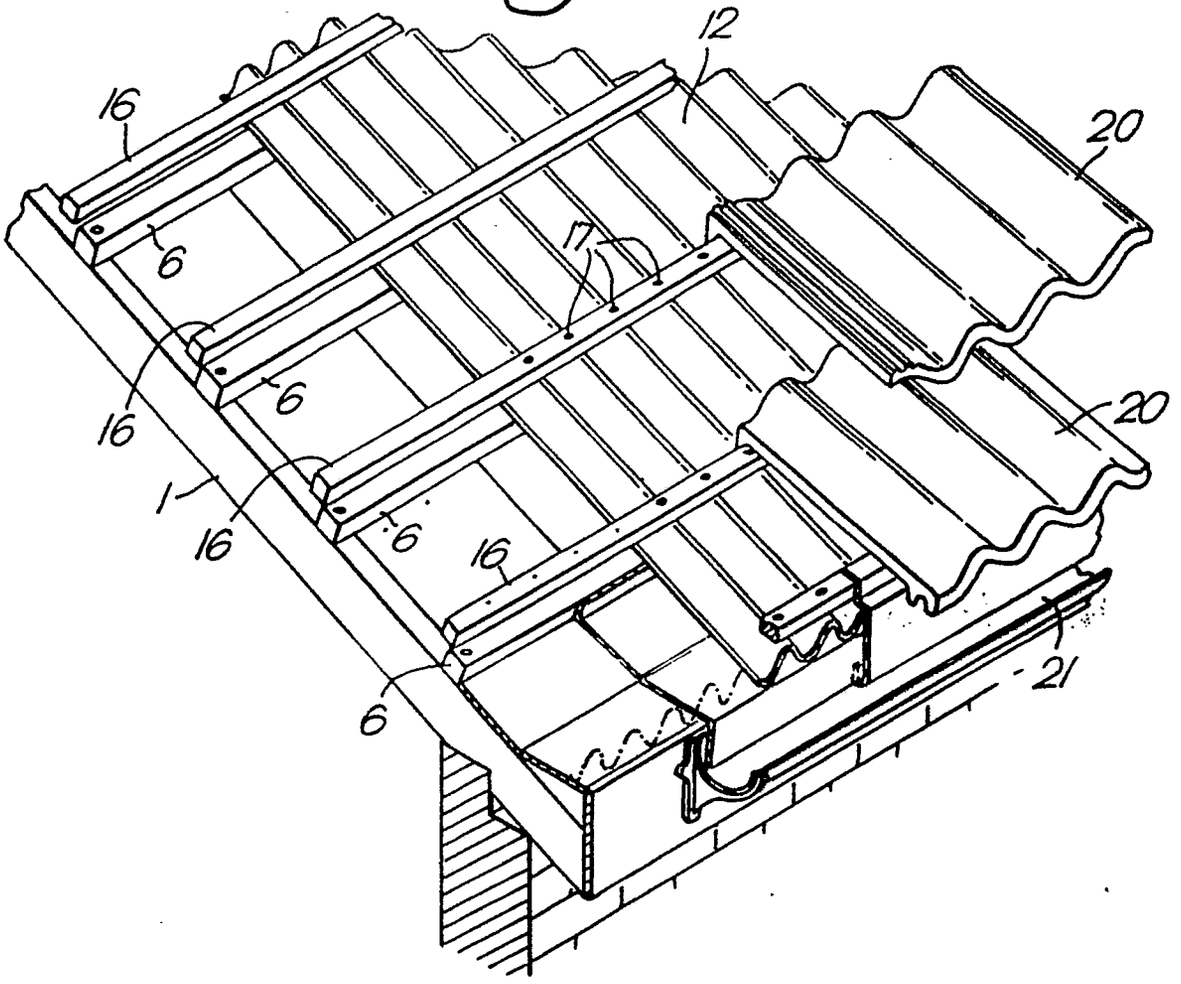


Fig.7.

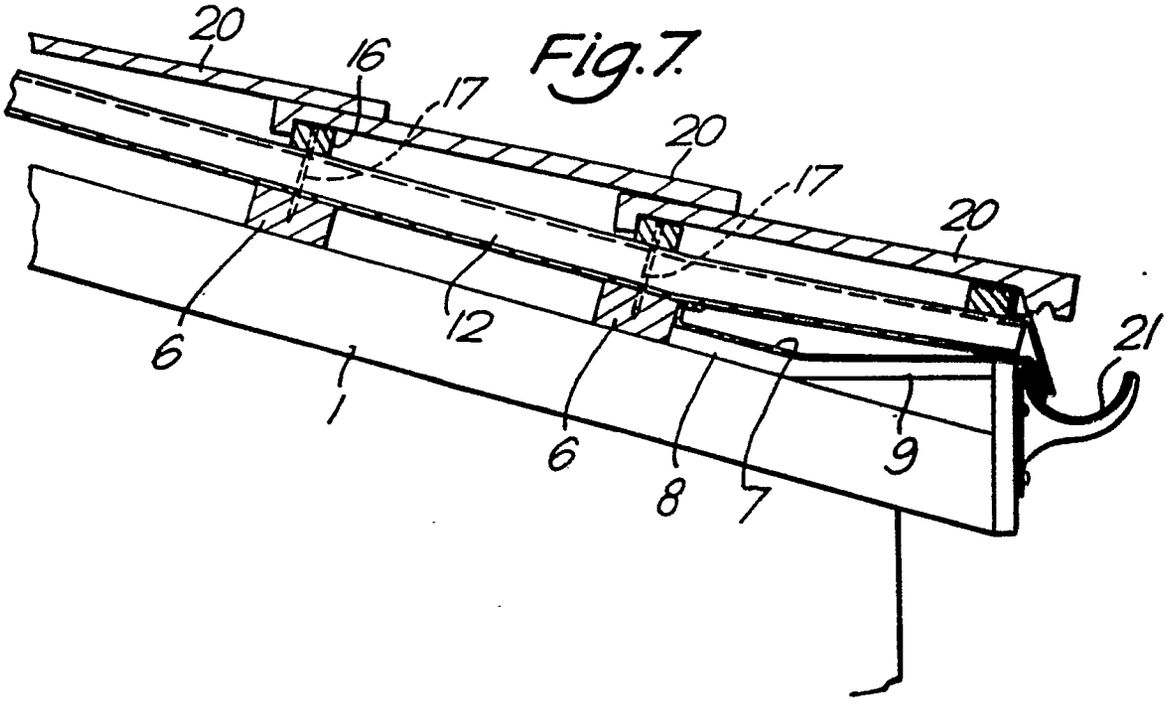


Fig.8.

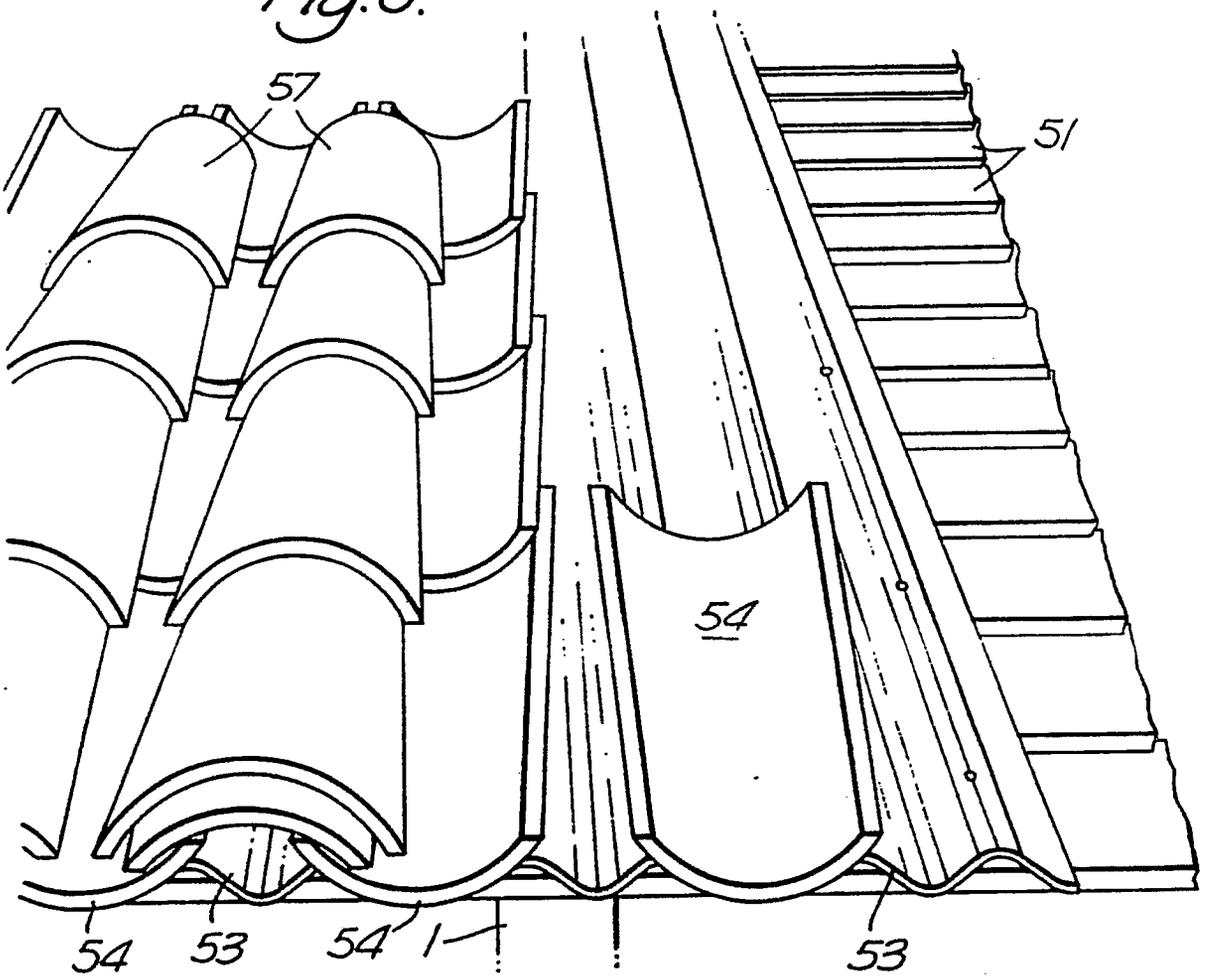
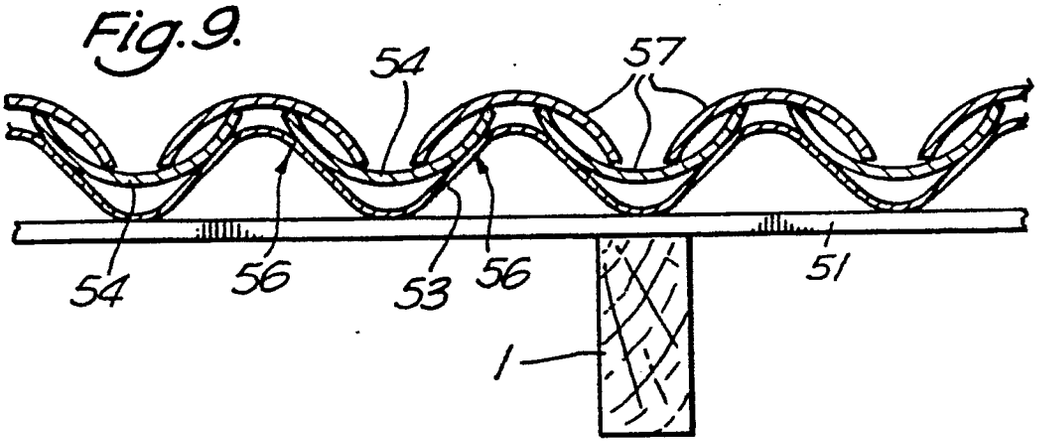


Fig.9.



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EUROPEAN SEARCH REPORT

Application Number

EP 90 30 4149

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.5)
X	CH-A- 219 877 (KNABENHANS) * Whole document *	1,2,4-6,14,23,24	E 04 D 12/00 E 04 D 1/34 E 04 D 3/36
Y		8-13,20-22,25	
A		3,7,15-19	

X	CAHIER DU CSTB, no. 1298, January/February 1975, pages 1-10, Centre Scientifique et Technique du Batiment, Paris, FR, Avis no. 5/73-39; "Avis sur les éléments supports de tuiles CANALIT PL et GL" * Pages 3,4; figure 7 *	1,3,19,23	

A	IDEM	8	

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A		1,3	

Y	DE-U-8 632 630 (BIEBER) * Abstract; figures 1,2 *	13	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27-06-1990	RIGHETTI R.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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T : theory or principle underlying the invention
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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
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A	DE-A-1 784 371	7,10	
Y	FR-A-2 098 475 (VER. DEUTSCHE METALLWERKE) * Page 2, lines 17-29; claims 1,2; figures 1-4 *	20-22	
A	US-A-4 690 839 (TAKASHI IWASAKI et al.) * Column 2, lines 19-43; column 5, lines 42-68; figure 1 *	15-19	
A	FR-A-1 223 464 (COMPAGNIE INDUSTRIELLE DE MATERIEL DE TRANSPORT) * Page 1, column 2, lines 17-31; figure 2 *	7	
A	FR-A-2 500 039 (PIOCH) * Page 2, lines 22-28; figures 1,3,4,5 *	1,21	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
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A		8	
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TECHNICAL FIELDS SEARCHED (Int. Cl.5)

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