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(11) **EP 1 460 196 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.09.2004 Bulletin 2004/39

(51) Int Cl.7: **E04D 1/06**, E04D 1/28,
E04D 1/26

(21) Application number: **04388023.6**

(22) Date of filing: **19.03.2004**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
AL HR LT LV MK

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(30) Priority: **21.03.2003 DK 200300436**

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(54) **A metal roofing element**

(57) A roofing element (10) with an upper surface (A) and a lower surface (B), comprising a plate-like metal core (20) coated with at least one upper uniform layer (25, 30, 35, 40) of coating and at least one lower uniform

layer (25, 30, 36) of coating, the thickness of said metal core (20) being selected in the range between about 0.2 mm and about 1.0 mm. The total weight of said layers (25, 30, 35, 36, 40) of coating is at minimum 400 g/m².

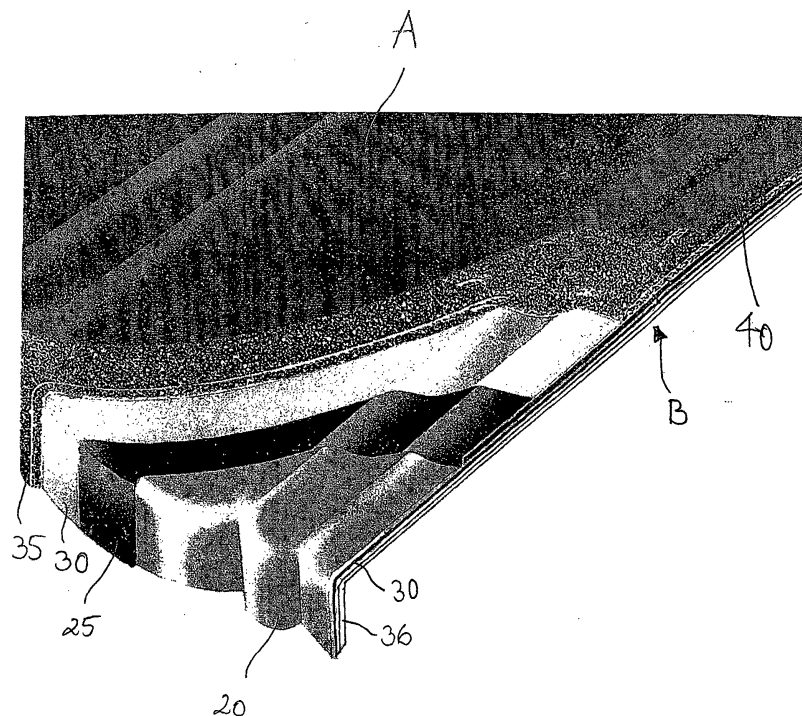


Fig. 4

Description

[0001] The present invention relates to a roofing element having a metallic central core.

[0002] It is well known to use roofing elements with a metallic core for covering small size building structures such as garages or shacks. For such purposes large size corrugated galvanized metal plates are often used. Even for housing constructions where high demands to the aesthetical appearance of the roof exist, vaulted metal tiles that simulate traditional ceramic tiles are well-known, one product being marketed under the trade name *Decra*® and another being disclosed in W098/29619 and in EP 1 253 260.

[0003] Rain-drops falling on roofing elements with a metallic core sometimes give rise to a sharp and unpleasant noise inside and outside the building structure covered by the roofing elements. This problem is of most concern when such roofing elements that have a flat and smooth upper surface are exposed to the rain. Products such as the aforementioned *Decra*® metal tiles that are provided with an upper layer of sand or a similar granular material for weather protection of the metal core are generally acceptable in that they provide a dampening of the noise generated by the rain through the effect of the rain-drops being decelerated upon hitting the upper layer which forms an uneven upper surface of the roofing element.

[0004] Providing vaulted metal tiles or metal roofing elements in general with a layer of a granular material is, however, costly, and prevents the manufacturer from offering metal roofing elements and vaulted metal tiles in particular with a shiny and smooth upper surface similar to the upper surface presented by glazed ceramic tiles. So far, the only solution to the latter problem has been to arrange the layer of sand on the lowermost surface of the metal roofing element, i.e. on the surface not visible from outside the building structure; this solution does not, however, bring about any reduction in the costs since complicated machinery for applying the layer of sand is still required.

[0005] The present invention aims at providing an improved roofing element which is preferably formed on the basis of a flat metal plate which is provided with a desired shape, such as that of a traditional vaulted ceramic tile, and which is treated in a cost-effective way to reduce noise generated by falling rain. This problem is solved in accordance with claim 1 in that at the roofing element has least one upper uniform layer of coating and at least one lower uniform layer of coating, the thickness of said metal core being selected in the range between about 0.2 mm and about 1.0 mm, and in that the total weight of the layers of coating is at minimum 400 g/m². By the term "uniform layer of coating" as used herein is meant a coating which covers the entire surface of the substratum and which yields a macroscopically even surface such as that obtained by application of paint or lacquer in a spraying process, in contrast to

the macroscopically uneven surface provided by a layer of coating in the form of sand or a similar granular material.

[0006] Preferably, the maximum total weight of the layers of coating amount to 1,000 g/m². An inverse relation preferably applies in the sense that metal cores of small thickness should preferably be provided with the higher amount of coating.

[0007] Through the invention, a low-cost product with smooth and even upper and lower surfaces is obtained which is highly acceptable in terms of only little noise being generated when the roof is exposed to rain and which may have the shiny or glossy appearance of conventional glazed ceramic roofing elements.

[0008] According to an embodiment of the invention of particular interest when simulated glazed and/or colored ceramic vaulted tiles are made, the proportion of the total weight of the upper uniform layers of coating is less than 33% of the total weight of all the layers of coating. This involves cost advantages in that only a thin layer of a relatively expensive upper coating with coloring additives need be applied.

[0009] According to an even more preferred embodiment of the invention, the thickness of the metal core is selected in the range between 0.35 mm and 0.9 mm, the total weight of said layers of coating being at minimum 450 g/m² and at maximum 650 g/m², the proportion of the total weight of the upper uniform layers of coating preferably being less than 25% of the total weight of the layers of coating.

[0010] The invention will now be explained in further details with reference to the drawing.

Fig. 1 shows a perspective view of a roofing element according to the invention,

Fig. 2 shows the roofing element of fig. 1 being laid out on a building roof,

Fig. 3 shows the final building roof comprising a plurality of the roofing elements shown in fig. 1,

Fig. 4 shows the layered structure of the roofing element, and

Fig. 5 shows results of sound tests performed on a metal roofing element according to the invention.

[0011] Fig. 1 shows an embodiment of a shaped metal roofing element 10 simulating seven juxtaposed traditional ceramic tiles. The roofing element 10 is formed on the basis of a flat metal plate which has been cut to appropriate dimensions, shaped to provide the desired form of the end-product and then coated in accordance with the present invention. The roofing element 10 is laid out on the rafters 8 that form the sub-structure of a building roof, as illustrated in fig. 2, to provide a finished roof as shown in fig. 3. According to one aspect of the inven-

tion, the upper surface of the roofing element visible from outside the building, i.e. the surface visible in figs. 1-3, may have reflective characteristics such that the assembled roof appears to be formed from traditional glazed ceramic tiles.

[0012] Fig. 4 shows an end view seen from above, i.e. showing the upper surface A normally exposed to rainwater, of an embodiment of a metal roofing element according to the invention where layers of the coating on the metal plate 20 have been partially removed for the sake of clarity to show the sequence of the uniform layers of coating. The metal roofing element 10 comprises a plate-like steel core 20 provided with uniform upper and lower coating layers 25 in a galvanizing process. A primer, typically made on an epoxy and/or polyester basis, forms a further uniform upper and lower coating layer 30. On each layer of the primer 30 a uniform upper and lower coating in the form of a layer 35, 36, respectively, of an acrylic based paint has been provided. The layer 36 of acrylic based paint on the lower side of the metal core 20 has a greater thickness than the layer 35 on the upper side of the metal core 20, the latter preferably being selected to provide the metal roofing element with a desired color. A final uniform layer 40 of a lacquer is provided on the layer 35 to form the upper surface of the roofing element.

[0013] The roofing element 10 shown in fig. 4 is at its end provided with deformed areas 12 whereby the roofing element may overlap an adjacent roofing element when laid out as shown in fig. 3. In the present text all references to the mass of the various layers 25, 30, 35, 36, 40 of coating provided on the metal core 20 will be made with respect to the surface area of the metal core, and not to the surface area covered by the deformed roofing element which may be much less depending on the shape that the roofing element assumes. Moreover, the dry weight of the coating is referred to, i.e. the weight of the coating when only insubstantial changes in the weight with time can be expected. It will be understood that the uppermost layers of coating may at times preferably be provided after the metal core 20 has been deformed from the flat state.

[0014] Fig. 5 is a graph illustrating the result of sound measurements performed on a flat non-deformed roofing product according to the invention, the metal core having a thickness of 0.43 mm. As shown, increasing the total weight per unit area of the coating layers up to about 400 g/m² leads to a significant reduction in the vibration time measured in ms, and, accordingly, to a corresponding reduction in the noise generated by raindrops falling on a roof covered by the roofing elements according to the invention.

[0015] In the embodiment of fig. 4, a metal core 20 having a thickness of 0.43 mm is used and the total mass of the coating layers 25, 30, 35 and 40 on the upper side of the metal core 20 is 100 g/m² while the total mass of the coating layers 25, 30 and 36 on the lower side of the metal core 20 is 400 g/m². In this example

the roofing element 10 has a weight of about 3.4 kg/m², again determined on the basis of the surface area of the metal core 20 and not on the area covered by the roofing element, and a thickness of about 2.5 mm. The coating layers serve as a protective covering, and the total weight of the coating layers determines the acoustical properties of the roofing elements. Accordingly, arranging most of the coating on the lower side, in particular through the application of a thicker layer of the acrylic based paint on the lower side, involves cost advantages in that only a thin layer 35 of the relatively expensive acrylic based paint with coloring additives need be applied.

Claims

1. A roofing element (10) with an upper surface (A) and a lower surface (B), said element (10) comprising a plate-like metal core (20) coated with at least one upper uniform layer (25, 30, 35, 40) of coating and at least one lower uniform layer (25, 30, 36) of coating, the thickness of said metal core (20) being selected in the range between about 0.2 mm and about 1.0 mm, **characterised in that** the total weight of said layers (25, 30, 35, 36, 40) of coating is at minimum 400 g/m².
2. A roofing element according to claim 1 wherein the proportion of the total weight of said upper uniform layers (25, 30, 35, 40) of coating is less than 33% of said total weight of said layers of coating.
3. A roofing element according to claims 1 or 2, **characterised in** at least two upper uniform layers of coating and at least two lower uniform layers of coating, said upper and lower layer (30) of coating nearest the metal core (20) comprising zinc and being deposited in a galvanising process.
4. A roofing element according to any of the preceding claims, at least one lower uniform layer (36) of coating being an acrylic based paint.
5. A roofing element according to any of the preceding claims, at least one upper uniform layer (35) of coating being an acrylic based paint containing a coloring matter.
6. A roofing element according to any of the preceding claims, said upper uniform layer (40) of coating farthest from said metal core (20) being a lacquer providing the roofing element (10) with a shiny upper surface.
7. A roofing element according to any of the preceding claims, at least one of said layers (25, 30, 35, 36, 40) of coating being applied in a spraying process.

8. A roofing element according to any of the preceding claims wherein the thickness of the metal core (20) is selected in the range between 0.35 mm and 0.9 mm and wherein the total weight of said layers (25, 30, 35, 36, 40) of coating is at minimum 450 g/m² and at maximum 650 g/m², the proportion of the total weight of said upper uniform layers (25, 30, 35, 40) of coating preferably being less than 25% of said total weight of said layers (25, 30, 35, 36, 40) of coating.

9. A shaped roofing element formed from an essentially flat metal roofing element as defined in any of the preceding claims.

10. A shaped roofing element according to claim 9, having a wavelike structure resembling a number of juxtaposed vaulted conventional ceramic tiles.

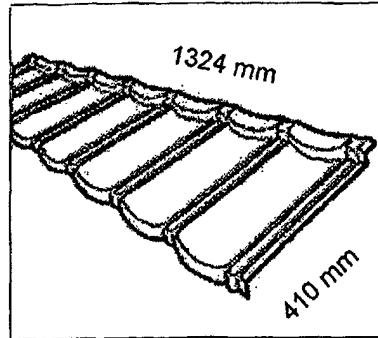


Fig. 1

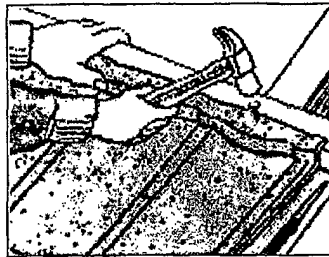


Fig. 2

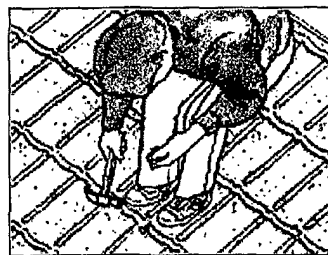


Fig. 3

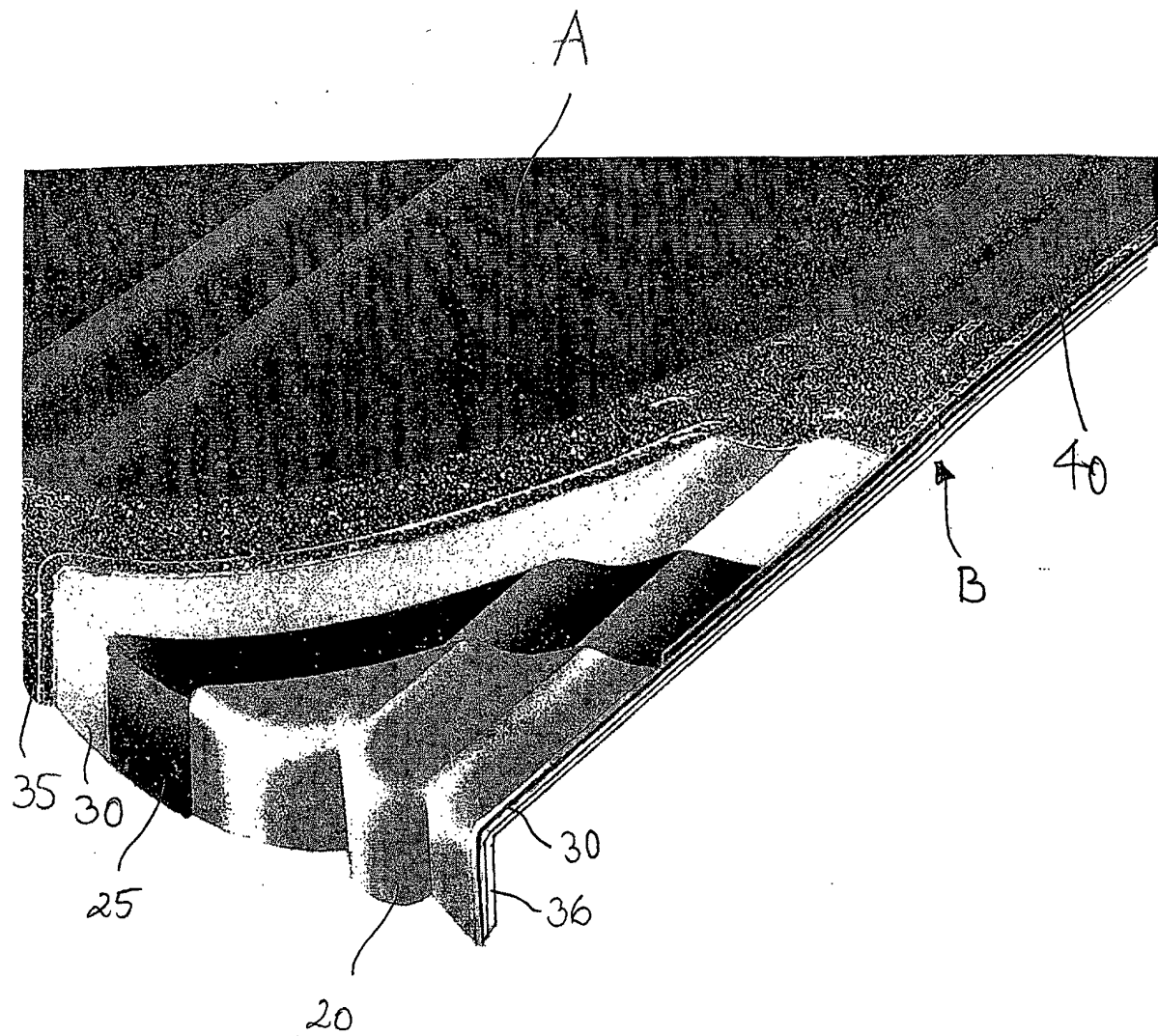


Fig. 4

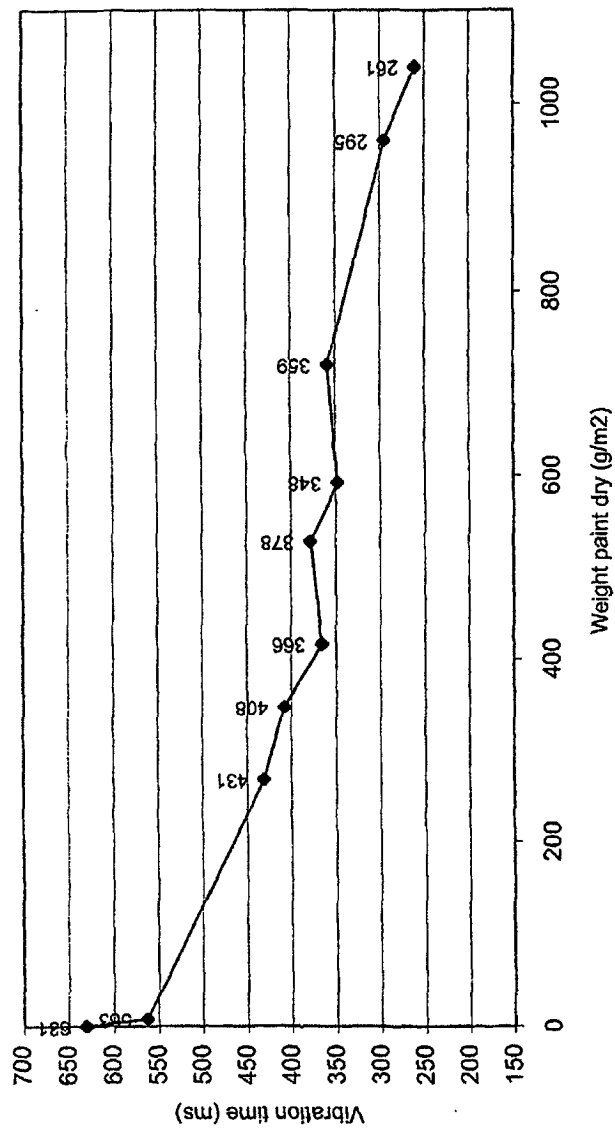


Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 04 38 8023

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.7)
X	FR 2 286 253 A (PREMILLIEU) 23 April 1976 (1976-04-23)	1-7, 9, 10	E04D1/06
A	* page 4, line 10 - line 39; figures *	8	E04D1/28
A	US 3 150 465 A (JOHNSON) 29 September 1964 (1964-09-29) * column 2, line 24 - line 64; figures 1, 2 *	1	E04D1/26
A	US 4 936 071 A (KARRFALT) 26 June 1990 (1990-06-26) * column 4, last paragraph - column 5, line 19; figures *	4, 5, 7	
A	FR 2 728 604 A (UNION MINIERE) 28 June 1996 (1996-06-28) * claims 1, 2 *	3-5	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			E04D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		14 July 2004	Righetti, R
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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 38 8023

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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14-07-2004

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 2286253	A	23-04-1976	FR 2286253 A1	23-04-1976
US 3150465	A	29-09-1964	NONE	
US 4936071	A	26-06-1990	CA 2021715 A1 MX 168778 B	06-03-1991 07-06-1993
FR 2728604	A	28-06-1996	FR 2728604 A1 AT 177810 T AU 4343096 A CA 2208312 A1 CN 1175297 A ,B CZ 9701949 A3 DE 69508437 D1 DE 69508437 T2 DK 804659 T3 WO 9620320 A1 EP 0804659 A1 ES 2133178 T3 GR 3030503 T3 HK 1008232 A1 HU 77267 A2 JP 11503500 T NO 972918 A PL 320788 A1 SK 82297 A3	28-06-1996 15-04-1999 19-07-1996 04-07-1996 04-03-1998 12-11-1997 22-04-1999 28-10-1999 11-10-1999 04-07-1996 05-11-1997 01-09-1999 29-10-1999 08-11-2002 02-03-1998 26-03-1999 25-08-1997 27-10-1997 04-02-1998

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