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(54) Roof constructions.

(57) A roof construction comprises a purlin 1; internal liner sheet 2 having a plurality of load-carrying flattened peaks and valleys 6 and 7, fixed directly to the purlin 1; elongate metal space element 3 with expanded-slit perforations 10 fixed directly to the liner sheet 2 at right-angles to the purlins; and an external weather layer 4 fixed directly as a metal-to-metal connection to the top of spacer element 3. This construction provides the advantages of secure metal-to-metal fixing throughout together with surprisingly low thermal conductivity due to the perforations 10 and the configuration of sheet 2.

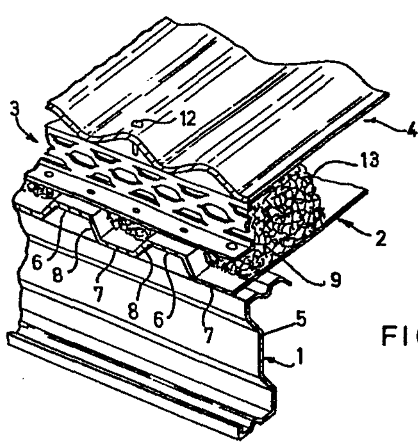

FIG.1.

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Croydon Printing Company Ltd.

Title: ROOF CONSTRUCTIONS

This invention relates to roof and wall constructions.

A known form of roof construction, based on cold-rolled metal sections, typically comprises the main structural members, transverse purlins, an outer cladding (weather) sheet and an inner lining sheet separated therefrom by a layer of thermal insulation.

For example, trusses comprising steel rafters can be arranged to constitute main structural members at say 6 metres spacing, with rafters running parallel from the wall to the ridge. Across these are secured, at for example 2 meters spacing horizontal purlins which can be of a generalised Z or rectangular C shape. This form of structure is well known and of itself does not constitute the present invention.

Hitherto, lining sheets have been secured over the purlins, as an inner roof surface. Above the lining sheets is located a layer of thermal insulation, and above this is the outer (weather) skin of asbestos or metal sheeting, usually corrugated.

In order to prevent the insulation from being crushed it is necessary to fasten a so-called "spacer" bar along the purlin, the lining sheet being located between the spacer bar and the purlin, and the cladding or weather layer being fastened to the top surface of the spacer bar. This spacer bar is again conveniently of a generalised Z shape or rectangular C-shape.

In practice, it has been found that the general thermal insulation thereby afforded is detrimentally affected by heat transfer through the purlin; lining spacer; and cladding layer where these come into contact. This heat-transfer leads to cold spots and cold lines on the inner lining surface at the places where this joins the purlins. These in turn lead to condensation and the risk of local damage to decoration, or of corrosion damage.

Accordingly, the practice hitherto has been to break the metal-to-metal contact (causing the heat transfer path) by some form of thermally-insulating barrier. Most commonly, separate polymer blocks, spaced along the purlin (above the lining sheet and just beneath the spacer bar) at say 300 mm. centres, have been used. Another expedient is to locate a continuous polymer or rubber strip along the top of the spacer bar, just beneath the cladding layer.

Both of these prior art expedients have similar disadvantages. They require the use of expensive fabricated materials, there is more complexity of assembly, and the strength of the roof against the usual static or dynamic loadings can be detrimentally affected since there is not ultimate metal-to-metal fastening.

We have now discovered that a roof construction can be made using a metal-to-metal fastening with suitable modified spacer bars and lining sheets without the occurence of detrimental cold spots and cold lines, and with the lining sheet itself performing a support function.

In one aspect the invention consists in a roof construction of the type in which an internal lining layer is fixed at the top of purlins by spacer elements themselves supporting the external weather-resistant cladding layer so as to define a space for containing thermal insulation wherein the lining layer is shaped to define a number of like load-carrying flattened peaks and valleys and the spacer element is perforated to decrease its thermal conductivity and is attached directly as a metal-to-metal connection to both the weather-resistant cladding layer and the lining layer.

The spacer element can be a cold-rolled mild steel section with opposite directed parallel flanges separated by a web,at substantially 90^{o} thereto, having a plurality of expanded longitudinal slits in the web.

The lining sheet can be a metal sheet possessing a number(from 6 to 15, usually from 3 to 7) of flattened ridges or peaks separated by a like number of complementary valleys extending along its length, the angle of the valley wall to the base being at least 40^{o} e.g. 40^{o}-70^{o}

or most preferably 40^{0} - 50^{0} so that perpendicular load-carrying strength is maximised. The peaks and valleys are usually 50 - 100mm wide and the sheet usually from 0.35 to 0.5mm thick.

The invention also extends to such a sheet or such a spacer bar per se. Moreover, a roof containing such a structure as a primary or component part also falls within the ambit of the invention.

The invention will be further described with reference to the accompanying drawings, in which:-
Figure 1 shows a diagrammatic general view of the essential features of a roof construction according to the invention,
Figure 2 shows in cross-section a suitable lining sheet,
Figure 3 shows in cross-section a suitable spacer bar, and
Figure 4 shows a part of the spacer bar of Figure 3 in front view.

Figure 1 shows in fragmentary view part of the roof structure, comprising transverse purlin 1, (which with other such purlins, not shown, arranged in parallel at say 2m. centres on rafters at say 6m. centres forms the basic load-supporting structure) lining sheet 2, spacer bar 3 and cladding weather sheet.4.

Purlins 1 are known per se as nestable and stackable cold-rolled steel purlins of a so-called "Zeta" as shown at 5. "Zed" and "Sigma sections may also be used. Lining sheet 2 is an important feature of the present invention and is also shown in more detail in the cross-section of Figure 2. It comprises a plurality of like flat peaks 6 and valleys 7, the side walls 8 of which are preferably at 45^{0}.

In a typical sheet five peaks and five valleys will be present. One side edge terminates (half-way) down a side wall 8 (at 8a), the other terminates (half-way) across a flattened peak 6, at 6a, although these proportions can be varied if desired. In contrast to the prior art lining sheet, and as can readily be seen from Figure 1, the lining sheet 2 must carry some load. Hence, the angle of the side walls should be sufficient to give crushing resistance (e.g. be from 40° to 70° and preferably from 40° to 50°) and the number of peaks and valleys, and their spacing also be adequate for this purpose. From 6 to 15 peaks plus valleys, each from 50 to 100mm wide in, for example 0.35 to 0.5mm cold-rolled mild steel is a preferred range. In the example given, each flat peak/valley floor is 80mm wide and the valley-to-peak outside thickness is 20mm. The lining sheet can be differently decorated or coated on its two surfaces.

Spacer bar 3 is another important feature of the invention, and may be made,for example, by the slitting and expansion methods, combined with cold-rolling, as described in British Patent 1 352 568. It has a generalised-shaped section as at 9 (see also Figure 3) with a number of slit and transversely expanded orifices 10 in its web portion. The spacer bar 3 is secured to the top flange of purlin 1 by screws 11 which pass through and secure the lining sheet 2.

This therefore provides a secure metal-to-metal fastening. The spacer bar 3 is slit enough at 10 to affect its thermal conductivity significantly, but is still strong enough for its primary function of support. Moreover, it is supported on the numerous flattened peaks 6 of the lining sheet 11 (rather than on polymer insulation blocks resting upon a flat purlin-contacting face of the prior art lining sheet) which also provides suitable mechanical strength for the construction.

Weather or cladding sheet 4, of corrugated metal or asbestos tile is attached to spacer bar 3 in conventional fashion at 12. The space between the inner surface of the weather sheet 4 and the outer surface of lining layer 2 is filled with suitable conventional thermal insulation 13.

Spacer bar 3, as shown in Figures 3 and 4, is typically from 40 to 100mm depth (e.g. 60mm) with a major upper flange 14 from 25 to 40mm wide (e.g. 35mm) and a minor lower flange 15 from 20 to 35mm wide (e.g. 25mm). The pattern of expanded orifices can vary in detail, but usually exhibits a central line 16 of wider orifices and two lines 17 of like narrower orifices extending one to each side of the central line.

CLAIMS.

1. A roof construction of the type in which an internal lining layer is fixed at the top of purlins by spacer elements themselves supporting the external weather-resistant cladding layer so as to define a space for containing thermal insulation, characterised in that (a) the lining layer is shaped to define a number of like load-carrying flattened peaks and valleys (b) the spacer element is perforated to decrease its thermal conductivity and (c) the spacer element is attached directly as a metal-to-metal connection to both the weather-resistant cladding layer and the lining layer.

2. A roof construction as claimed in claim 1 characterised in that the spacer bar is a cold-rolled mild steel section with oppositely directed parallel flanges separated by a web at substantially 90^{o} thereto and having a plurality of expanded longitudinal slits in the web.

3. A roof construction as claimed in claim 2 characterised in that the spacer bar has a major upper flange 25 to 40 mm wide, a minor lower flange 20 to 35 mm. wide and a web 40 to 100 mm. deep.

4. A roof construction as claimed in claim 1, 2 or 3 characterised in that the lining sheet possesses from 6 to 15 flattened ridges or peaks, separated by a like number of complementary valleys, extending along its length, the angle of each valley wall to its adjacent base being at least 40^{o}.

5. A roof construction as claimed in claim 4 characterised in that from 3 to 7 flattened ridges or peaks, and complementary valleys, are present and in that the valley wall angle is from 40^o - 50^o.

6. A roof characterised in that it contains as a primary or component part the construction as claimed in any one preceding claim.

7. A lining sheet for a roof construction, characterised in that it possesses from 6 to 15 flattened peaks or ridges, separated by complementary valleys, extending along its length, as a load-carrying structure, the angle of each valley wall to its adjacent base being at least 40^o.

8. A lining sheet as claimed in claim 7 characterised in that (a) from 3 to 7 flattened ridges or peaks and complementary valleys are present (b) the valley walls angle is 40^o - 70^o (c) the peaks and valleys are from 50 to 100 mm wide and (d) the sheet is from 0.35 to 0.5 mm thick.

9. A lining sheet as claimed in claim 8 characterised in that one side edge terminates substantially halfway down one side valley wall and the other side terminates substantially half-way across a flattened peak or ridge.

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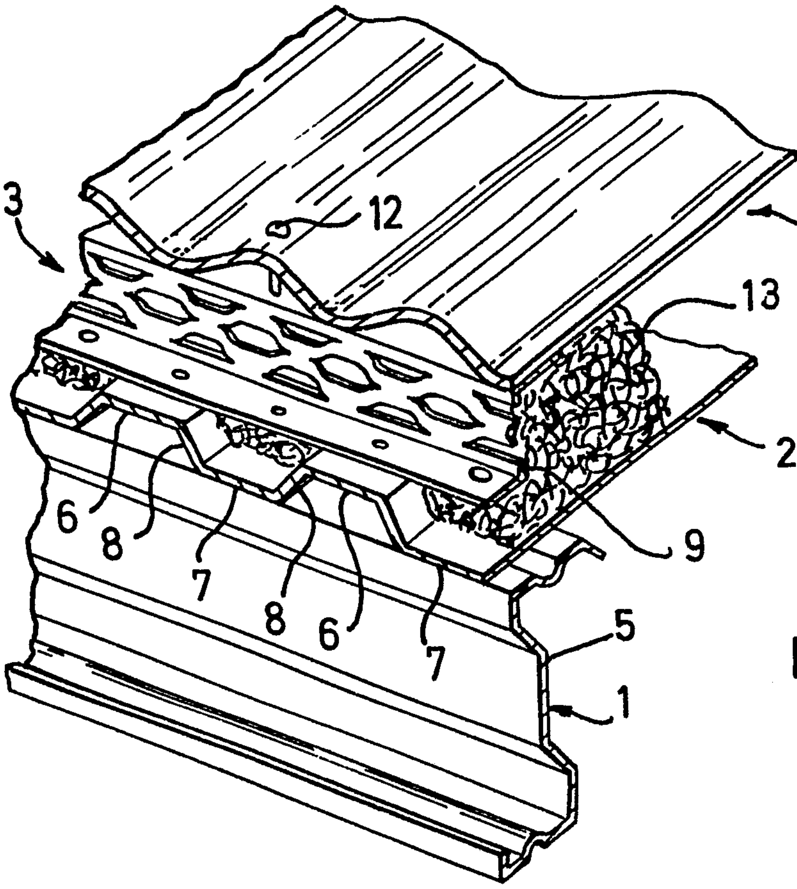

FIG.1.

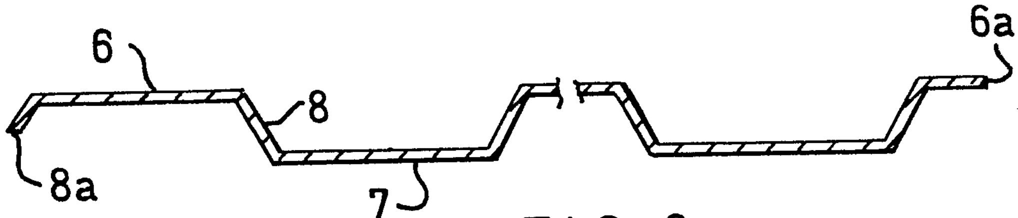

FIG.2.

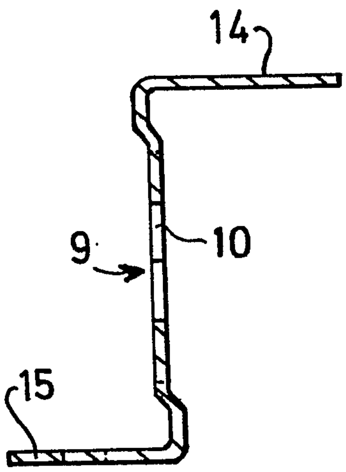

FIG.3.

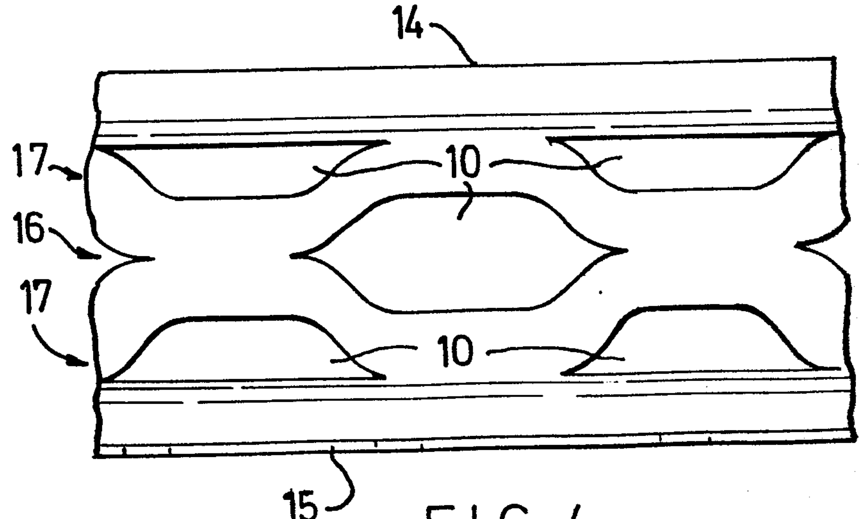

FIG.4.