(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 October 2001 (18.10.2001)

PCT

(10) International Publication Number
WO 01/77458 A1

(51) International Patent Classification[7]: E04D 3/36, 3/363, 3/30

(21) International Application Number: PCT/ZA01/00037

(22) International Filing Date: 6 April 2001 (06.04.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2000/1738 6 April 2000 (06.04.2000) ZA

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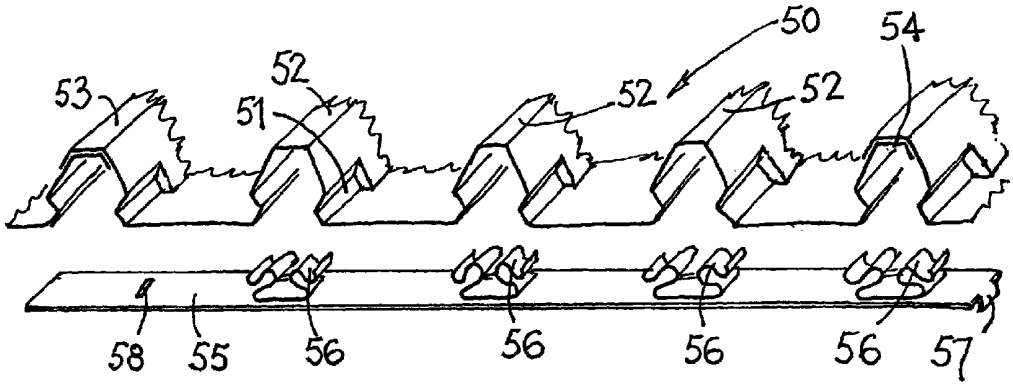
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ROOFING SHEETS AND FIXING



(57) **Abstract:** Widely used box type roof sheets, are fixed by concealed (non-perforating) fixings by means of indentations formed in the side walls of the ridges of the sheet profile and fixing clips engaging the indentations. Expansion and contraction of the roof sheets is accommodated by these fixings. Fixing strips can be used to locate the clips on the roof structure. Sliders which have profiles that match the ridge profiles can be interposed between the roof sheet and the clips to avoid scratching or gouging of the sheet during expansion and contraction movement.

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ROOFING SHEETS AND FIXING

THE FIELD OF THE INVENTION

This invention lies in the field of roofing and refers in particular to roofing sheets and roof sheet fixings. The invention could also be applied in the context of cladding surfaces in addition to roofing.

THE EXISTING ART

The admonition that the quality a roof is critical to the whole investment which it covers, not only in the building and its internal finishes, but also its contents (e.g. stock and produce in a warehouse, etc.), tends to be observed in the breach, despite its obvious soundness. Consequently, enormous amounts are spent annually in repairs and replacements to roofing and to underlying building structures and finishes damaged by water and their contents.

A very long established roofing material is of box rib type, for example sold under the trademarks "IBR" or "NURIB", still extensively used despite newer profiles having been brought to the market. A prominent example of the box rib type, "IBR", has a profile forming two plateaus between two outer and one middle ridge, the ridge enclosing a trapezoidal shape. Broadly, box rib type profiles form simple and snug overlaps both at end and side joints between contiguous sheets. A key reason for the longevity on the market of box rib types (despite the admonition referred to), is low cost. Merely for exemplary purposes, typical cost comparisons in a currency of the inventor's country, are a basic per square meter cost for IBR of 25-87 as opposed to 39-46 and 51-55 for two examples of more modern profiles. This comparison excludes fixings which are in general more expensive for the newer profiles thus accentuating the adverse cost comparison of them. There is thus economic attraction to use this well established box rib profile.

The problem of using roofing sheets having the box rib type of profile is the tendency for leakage that they have, compared to modern profiles, which have concealed fixing (i.e. fixing which does not perforate the sheet). One of the prominent causes of leaks in box rib is that the fastenings to loosen, resulting in

leaks developing. The underlying reason is the substantial expansion and contraction of each roofing sheet which occurs on a daily cycle, from the heat of the day to the cold of the night (as well as seasonally). Over the length of a typical sheet, for example 15 metres, a 12 millimetre movement will occur due to expansion and contraction resulting from a 60 degree Celsius temperature swing, which is not unusual. This movement causes tearing of the fixing hole in the sheet and loosening of the fixing screw or nail in the purlin, the sealing washer used on top of the sheet under the screw or nail head then fails to seal and leakage ensues. Over time the purlin rots or rusts and deterioration of further structures and finishes takes place.

The more modern profiles which have entered the market give effect to two principles, firstly the roof sheet remains unperforated and secondly the fixings allow sliding of the roof sheet relative to the fixing. These two principles are attainable only by use of more complex profiles than box rib profiles and fixings which are more costly than screws or nails. Examples of two products of this type currently on the market are sold under the trademarks "CRAFTLOCK" and "CLIPLOCK".

THE INVENTION

The present invention provides a roofing sheet which has a box rib type profile extending over the length of the sheet but having at intermittent positions indentations on one or both surfaces of the sheet, together with fixings which engage the indentations from behind the sheet without perforation.

Preferably these indentations are provided in the walls of ridges of the sheet profile and more preferably near the crown or crest of the ridges. These indentations provide formations which engage with fixings located at the intermittent positions during erection. Thus suitable fixings adapted so to engage without perforation of the sheet. are preferably supplied with the said roofing sheets, in appropriate numbers. Each indentation at the upper or the lower surface of the sheet provides a corresponding prominence on the opposite surface behind the sheet and in

principle a complex indentation can be provided which has indentations and prominences on both surfaces. It is highly desirable in most applications, where expansion and contraction due to heating and cooling of the sheets in use must be accommodated, that the indentations are long enough to allow sliding movement between the sheet and the engaging fixing, sufficient to accommodate the movement arising from heating and cooling.

The indentations may be in the form of dimples, or a series of dimples and in this example it is preferred that in addition to the clip the sheet is provided with slider pieces, that is pieces with the same profile as the sheet but of a short length, to be located between the clip and the sheet. The slider pieces are advantageous (even with the indentations described heretofore) to protect the sheet against scratching or gouging by the fixing clip as the sheet moves under expansion and contraction.

In accordance with a preferred embodiment of the invention, the fixings are elongated base strips, carrying several clips, extending in use transversely to the lengths of the sheets and establishing during fixing and maintaining during use the side overlap dimension between contiguous sheets. Preferably the strips are adapted so that they can be connected during erection and remain connected to each other during use so as to extend unbroken over the width (transverse to the lengths of the sheets) of the roof. This prevents spreading (i.e. the development of inaccurate side overlaps with resulting sometimes in skewing of sheets and generally overlaps which may have inadequate sealing).

A preferred embodiment of the invention includes also sliders which are short lengths of sheet material having a profile that matches the profile of the ridges of the roof sheet. The sliders are interposed between the clip and the roof sheet and enhance the freedom of the roof sheet to slide with respect to the clips during expansion and contraction, without scratching or gouging of the roof sheet.

The present invention also provides a method of fixing roof sheets of the invention which comprises laying and securing fixings to purlins or other roof structural

supports, then laying and pressing down onto the fixings the roof sheets of the invention so as to engage with the fixings.

The method of the invention optionally can include a preliminary step of forming in box type roof sheets indentations at intermittent positions along the sheet lengths, the positions coinciding with positions at which fixings will be secured on the roof structural supports. Thus in this option, the roof sheets in accordance with the invention will only be formed when this preliminary step is performed. The positions and spacing of the intermittent positions for the indentations can be determined according to a protocol which is observed also for the positions of the fixings on the roof structural supports. The use of a protocol allows the sheets according to the invention to be manufactured in a factory, with the attendant advantages of that. Observing the same protocol during erection ensures that the fixings and the indentations match up and engage as they should. Alternatively, the indentations can be formed by use of a hand tool (whether powered, or not) on site, during erection. This will be the indicated method where a standardised protocol for fixings is not present. End laps of sheets can be handled in the usual way, side laps can be made more secure, if required by use of stitching fasteners, e.g. self tapping screws, or pop rivets.

Producing the indentations on site may be implemented by using a hand tool which actuates a male die and female die, the one below the sheet and the other above, the tool having long enough handles to give sufficient leverage to be able to apply the required forces.

The invention can be applied not only with straight sheets, but also with bull-nosed and cranked sheets.

THE DRAWINGS

The invention will be more fully described by way of non-limiting examples, with reference to the drawings, in which: -

figure 1 is a plan view on a roof, drawn partly schematically,

figure 2 is an elevation on an end of a roof sheet used on the roof,

figure 3 is a cross sectional elevation on section III-III of figure 1,

figure 4 is an isometric view of the roof sheet,

figure 5 is an isometric view of a fixing used,

figure 6 is an isometric view of an alternative fixing used,

figure 7 is an end elevation of the fixing used to fix the roof,

figure 8 is an end elevation of flashing arrangements,

figure 9 is an isometric view of a clip used in the flashing arrangement.

figure 10 is a sectioned oblique view of a roof sheet and an oblique view of a fixing strip and another clip design, for the sheet,

figure 11 is an end view of the sheet shown in figure 10 with the clips engaged ,

figure 12 is an end view of a roof another sheet profile,

figure 13 is an end view of a roof sheet with another profile according to an embodiment of the the invention,

figure 14 shows a fixing clip for the profile of figure 13,

figure 15 is an end view of a roof sheet with yet another profile according to another embodiment

of the invention, with a fixing clip and a slider for it,

figure 16 is a series of end views showing four successive steps marked (a), (b), (c) and (d), of fixing a roof sheet using the sheet, clips and slider shown in figure 15,

figure 17 is an end view of a roof sheet with a ridge profile like that shown in figure 15, with another fixing clip, showing the roof sheet in the process of being pressed onto the clip,

figure 18 is an end view of the same roof sheet ridge profile and clip shown in figure 17, with the roof sheet pressed onto the clip,

and

figure 19 is an end view of a roof sheet ridge profile with indentations pressed on the inner surfaces of the ridge.

NON-LIMITING EXAMPLES OF THE INVENTION

Figure 1 shows as an exemplary section of a roof using the invention six sheets numbered 1 to 6. The sheets are laid onto purlins 7, 8 and 9 running transversely to the sheets, the purlins supported by roof structural components which are not shown. The sheets overlap at their longitudinal edges or sides at 11, 12, 13 and 14 and at their transverse edges or ends at 15, 16 and 17. Of course, this principle can be extended to larger areas. This is one of the advantages of trapezoidal box type profiles, that overlapping is easy. The drawing of figure 1 is simplified in that it does not show the ridges of the profile and hence not the indentations according ~~to the invention. The drawing does, however, convey the point that sheets of the~~ invention can be overlapped in the simple way of, for example, IBR sheets, with the key difference that the sheets of the invention are not perforated, but have concealed fixing. The term of art "concealed fixing" means fixed without perforation of the sheet by the use of clips underneath the sheet. Thus the invention is

directed at achieving the simplicity and low cost of, for example, IBR sheets, avoiding complex and costly sheets like, for example, CLIPLOCK and CRAFTLOCK sheets, but preserving the secret fixing and sliding movement which allows for expansion and contraction.

Figures 2 and 4 show how the invention achieves these advantages. The sheet has a simple box type profile, for example, an IBR profile 18 as seen in figure 2 or another trapezoidal profile 19 as seen in figure 4, but into this profile at positions located over purlins when erected, indentations 20 are made in the ridges of the profile. These are pressed either in a factory at predetermined centres or standardised centres which are applied also to the spacing between purlin centres, or can be pressed on site, either on the ground after measuring up the purlin centre spacing or when the sheet is placed onto an adjacent sheet with the required overlap and taking the positions for the indentations directly from the purlins. In the factory a male-female die set can be used in a jig designed to accept the sheets and automated or manually controlled. On site a hand die set can be used, provided in a suitable hand held tool or implement for the male die and with a female counterpart to be placed temporarily under the sheet along a line which corresponds with or is measured so that it will correspond with the purlin position. Factory pressing can also provide indentations at more than one standardised spacing, to accommodate different purlin spacing options for different roofing specifications. The drawings of the indentations in the figures show the indentations somewhat exaggerated for ease of illustration as a sufficient hold down of sheets can be achieved with relatively slight indentation. The indentations 20 have a length which is sufficient to accommodate movement of the roof sheet relative to the fixing clips due to expansion and contraction.

~~Figure 3 shows a preferred fixing clip in a sheet sectioned at III-III in figure 1. The~~ clip 21 is made of a .material having suitable elasticity and strength, e.g a spring steel or merely a fairly high carbon/high yield/low extension steel, but having enough elasticity to serve the purpose. The clips are mounted (e.g. by riveting or brazing, etc.) to a base strip 23 which is a standard length, conveniently related to

the sheet width (a length equal to the sheet width with a sufficient joining length added). The strips are fixed to the purlins 24 by roof screws 25, joined end to end for the necessary total width to be roofed, (e.g. screw 25a joins the next strip 24a and so on). The clip 21 has two protruding parts 22 which inter-engage with the protrusions which correspond on the underside of the clip to the indentations 20 which have been made in the sheet. An upper bulbous part 26 of the clip provides a suitable elasticity coefficient for the action of the clip, an action which allows the sheet to be pressed down onto the clip when fixing the roof but holds the sheet down in use. The clip 21a works at the side overlap 27 between two contiguous sheets A and B.

Figure 5 shows the fixing clips 21 on a strip 23 which have been referred to with respect to figure 3. The holes 28 and 29 allow joining of successive strips end to end at fixed centre distances. This controls the transverse accuracy of the overlap of the sheets and prevents spreading. The other holes 30 allow fixing the strips to a purlin, fewer holes may be sufficient.

Figure 6 shows a fixing strip 31 which has holes 32 for fixing to a purlin, the two end holes also allowing strips to be joined end to end to preserve transverse dimensional accuracy in the roof to be erected. The strip carries fixing clips 33 which fix a roof sheet according to the invention.

Figure 7 shows how the clips of figure 6 fix the roof sheets by interengaging with the protrusions on the underneath surfaces of the clip which correspond to the indentations 20 according to the invention. In this case, the clips span the valleys or trays 34 of the profile

~~Figure 8 shows flashing 35 which is fixed against a wall 36 which the roofing abuts.~~

Figure 9 shows a clip 37 which the invention provides which can be clipped onto the top of a ridge of the roof sheet 38 which according to the invention has been provided with indentations 20. The clip is riveted at 40 to the flashing, but can slide

on the roof sheet to accommodate expansion and contraction of the sheet. The clip 37 has an upper flat surface 41, two inclined sides 42, a flange 43 and two inwardly directed flanges 44 which hold under the edges of the indentations of the roof sheet.

Figure 10 shows a roof sheet 50 having a similar profile to that shown in preceding figures, sectioned at indentations 51 in the profile. Each sheet has three inner ridges 52 and a ridge 53, 54 along each longitudinal edge or side edge. Below the sheet is shown a strip 55 which carries four clips 56 bent into a kind of double "S" shape profile, from a material which has a sufficient spring property. The strip has a tab 57 at one end and a slot 58 near the other end. A number of similar strips are joined end to end by inserting the tab of one into the slot of the next. The strips are then fixed to the purlins or other roof structure. Then the sheets are pressed down onto the strips with the ridges clipping onto the clips, at the indentations in the ridges, so fixing the sheets without perforating them. The strips maintain the spacing of sheets accurately. The clip near the end of the strip having the tab clips into the overlap ridges of contiguous sheets. The overlap can be stitched to ensure positively that the overlaps remain tightly together, using fasteners such as self tapping screws or pop rivets, for example.

Figure 11 shows the manner in which the clips fix the sheet, more clearly, with the strips and clips fixed by screws 62 on purlin 63 the screws passing also through the clips. The double "S" shape of the clips provides a movement of the free ends 59 of each clip which is described by the arrows 60, 61. The ends move downwards and inwardly, that is towards each other in each clip, as indicated by arrow 61 when the sheet is pressed down and the clip enters the profile. When an upward force is exerted on the sheet (e.g. by wind generated pressure differentials) tending to lift the sheet out of engagement with the clips, the free ends of each clip tend to move outwardly, in the direction indicted by arrows 60. At the same time the looped parts 67 of the clips bear against each other providing a firm reaction preventing the easy further deformation of the clip. This causes the clips to tend, under such forces, to hold the sheet ever more tightly by the ends 59 engaging ever more firmly the

indentations 64 of the indented ridges. To accommodate the movement of the free ends of the clips when the sheet is pressed down onto the clips to fix the sheet, the parts 68 of the indentations are not horizontal but inclined to the horizontal (as indicated by the strips and purlins) and tangential to the arc of movement of the free ends of the clips as indicated by the arrows 60, 61.

Figure 12 shows a profile 66 which has indentations 65 about 50% of the ridge depth, clips used with this sheet would have appropriate dimensions.

Figures 13 and 14 show the ridge of another profile 70, with a fixing clip 71 for it. The ridge profile has indentations 75 which could be described as wedge shaped or tapering. Again the ends 72 of the clip will tend to bend outwards when the roof sheet is being pulled upwards (e.g. due to lower air pressure above the sheet than below it as can occur in storm strength winds). So the clip will tend to hold all the more strongly, the more it is pulled. Similarly to the clips shown in figure 11, these clips have arms which engage the roof sheet profile, which arms extend outwardly and downwardly, this give them the action described of holding harder, the harder the roof sheet pulls upwardly. The clip has two optional limbs 73 which are pressed out of the arms and steady the sheet transversely and provide a reaction force against the action force exerted by the ends72 of the arms.
The clip is secured at its base 74 to the supporting structure.

Figure 15 shows the preferred embodiment of the invention. The ridge of the roof sheet 80 has the indentations 81 near the crest 82 of the profile which has an advantage that the indenting action draws material from near the crest which is less vulnerable to adverse distortion than the material near the valley or tray 83 of the profile.

The clip is much like the one shown in figure 13, but with arms 84 that go higher up to match the higher position of the indentation. The ends 87 of the arms bear downwardly and outwardly against a sliding piece 86 and through that against the indentations of the ridge profile. The clip has an indentation 85 at its base which

locates it in a supporting strip (to be explained with reference to figure 16 below). The clip is secured to the supporting structure at its base, e.g. by roof nails.

This embodiment shows the important feature of a sliding piece 86 which is a short length which has the same profile as the ridge of the roof sheet (or a profile that fits into the roof profile snugly). The clip thus acts against the sliding piece which in turn holds the roof profile. The roof sheet can slide against the sliding piece as the roof sheet expands and contracts, without a risk of the roof sheet being gouged by the sharp ends of the clip arms. The sliding piece is thus a refinement of the invention which can be applied to any of the profiles and clips of the invention. It enhances the object of the invention of a concealed fixing (unperforated roof sheet) which allows for expansion and contraction freely.

Figure 16 is useful in showing the steps of the method of the invention, as well as further structural aspects.

As shown in figure 16(a), a strip 90 has a number of holes 91 in at a regular and accurate spacing apart, which correspond to the spacing between ridges of the profile of the roof sheet to be used. The strip is secured (or just positioned) to the roof support purlins or other structure. The strip could be made strong enough to serve as the purlins themselves.

As shown in figure 16(b), the clips 92 (e.g. of a shape as shown in figure 15) are located by means of the indentations in their bases engaging in the holes in the strip. The clips are secured to the roof structure and hence secure the strips.

As shown in figure 16(c), the sliders 93 are fitted over the clips.

As shown in figure 16(d) the roof sheet 94 is pressed down onto the clips with a "snap" fit.

Side laps between adjacent sheets can be dealt with by a normal overlap, both sheets at the overlap clipping onto the clips. If necessary, additional fixing for the overlap can be provided. e.g by means of an externally applied clip which engages in the indentations.

Figures 17 and 18 show an alternative form of clip 100, with indentations 101 near the crest 102 of the ridge profile 103. The clip has limbs which extend towards each other and are deflected to nearly touch while the clip deflects to allow the roof sheet ridge to be pressed down onto the clip to be held by it. When the clip is holding the roof sheet the limbs spring outwardly again. A wedging component may be inserted between the limbs to hold them apart, extending from the underneath surface of the ridge.

Figure 19 shows a roof sheet ridge profile 110 having indentations 111 formed on the inner surfaces of the ridge, with a suitable clip 112 to engage the indentations. The clip is shown fixed on a spacing strip 113. Figure 19 is really just to show that the indentations can be applied on the inner surfaces as well as the outer, in all the profiles illustrated. The tool used to apply the indentations would have a male projection on an inner die and a female depression on an outer die, for this purpose. A slider may be added.

List of Reference Numerals

1	roof sheet
2	roof sheet
3	roof sheet
4	roof sheet
5	roof sheet
6	roof sheet
7	purlin
8	purlin
9	purlin
11	longitudinal edge overlap
12	longitudinal edge overlap
13	longitudinal edge overlap
14	longitudinal edge overlap
15	transverse edge (end) overlap
16	transverse edge (end) overlap
17	transverse edge (end) overlap
18	IBR profile
19	trapezoidal profile
20	indentations
21	clip
23	base strip
24/24a	purlins
25/25a	25 roof screws
26	bulbous part of clip
27	side overlap
28	hole in strip
29	hole in strip
30	hole in strip
31	fixing strip

32	hole in fixing strip
33	fixing clips
34	valley or tray of profile
35	flashing
36	wall
37	clip
38	ridge of roof sheet
40	riveting to flashing
41	upper flat surface of clip
41	inclined side of clip
42	inclined side of clip
43	flange of clip
44	inwardly directed flange of clip
50	roof sheet
51	indentations in roof sheet
52	inner ridges of sheet
53	ridge along longitudinal edge of sheet
54	ridge along longitudinal edge of sheet
55	strip
56	clips
57	tab of strip
58	slot of strip
59	free ends of clip
60	arrow
61	arrow
62	screws
63	purlin
64	indentations
65	indentations
66	profile
67	looped parts of clip
68	inclined parts of clip

70	profile
71	clip
72	ends of profile
73	limbs of profile
74	base of profile
80	ridge profile of roof sheet
81	indentations in ridge profile
82	crest of ridge
83	valley or tray of roof sheet profile
84	arms of clip
85	indentation in base of clip
86	sliding piece
87	ends of clip arms
90	strip
91	holes in strip for locating clips
92	clips
93	slider
94	roof sheet

CLAIMS:

1. A roofing sheet which has a box rib type profile of ridges and valleys extending over the length of the sheet but having at intermittent positions indented formations on one or both outer and/or inner surfaces of the ridges of the sheet, together with fixings which engage the formations on the inner surfaces of the sheet, from behind the sheet, without perforation of the sheet, to hold the sheet down on support structure.

2. A roofing sheet and fixings as claimed in claim 1, in which the indentations are provided in the walls of ridges of the sheet profile near the crests of the ridges.

3. A roofing sheet and fixings as claimed in either one of claims 1 or 2, in which the indentations are in the form of dimples, or a series of dimples.

4. A roofing sheet and fixings as claimed in claim 3, in which, in addition to the fixings, the sheet is provided with slider pieces, that is pieces with a profile that matches the ridges of the roof sheet but of a short length, to be located between the clip and the sheet.

5. A roofing sheet and fixings as claimed in any one of claims 1 to 4, in which the fixings further include elongated base strips, carrying several clips, the base strips extending in use transversely to the lengths of the sheets.

6. A roofing sheet and fixings as claimed in claim 5, in which the strips are adapted so that they can be connected during erection and remain ~~connected to each other during use so as to extend unbroken over the width~~ (transverse to the lengths of the sheets) of the roof.

7. A roofing sheet and fixings as claimed in any one of claims 1 to 6, in which the fixings further include sliders which are short lengths of sheet material having a profile that matches the profile of the ridges of the roof sheet.

8. A roofing sheet and fixings as herein described and as illustrated in figures 3 to 5 of the drawings.

9. A roofing sheet and fixings as herein described and as illustrated in figures 6 and 7 of the drawings.

10. A roofing sheet and fixings as herein described and as illustrated in figures 10 and 11 of the drawings.

11. A roofing sheet and fixings as herein described and as illustrated in figures 13 and 14 of the drawings.

12. A roofing sheet and fixings as herein described and as illustrated in figures 15 and 16 of the drawings.

13. A roofing sheet and fixings as herein described and as illustrated in figures 17 and 18 of the drawings.

14. A roofing sheet and fixings as herein described and as illustrated in figure 19 of the drawings.

15. A method of fixing roof sheets as claimed in any one of claims 1 to 14, which comprises laying and securing fixings to purlins or other roof structural ~~supports, then laying and pressing down onto the fixings the roof sheets of~~ the invention so as to engage with the fixings.

16. A method as claimed in claim 15, which includes a preliminary step of forming in box type roof sheets indentations at intermittent positions along

the sheet lengths, the positions coinciding with positions at which fixings will be secured on the roof structural supports.

17. A method as claimed in claim 16, producing the indentations on site by using a hand tool which actuates a male die and female die, the one below the sheet and the other above, the tool having long enough handles to give sufficient leverage to be able to apply the required forces.

18. A method as herein generally described.

FIG. 1

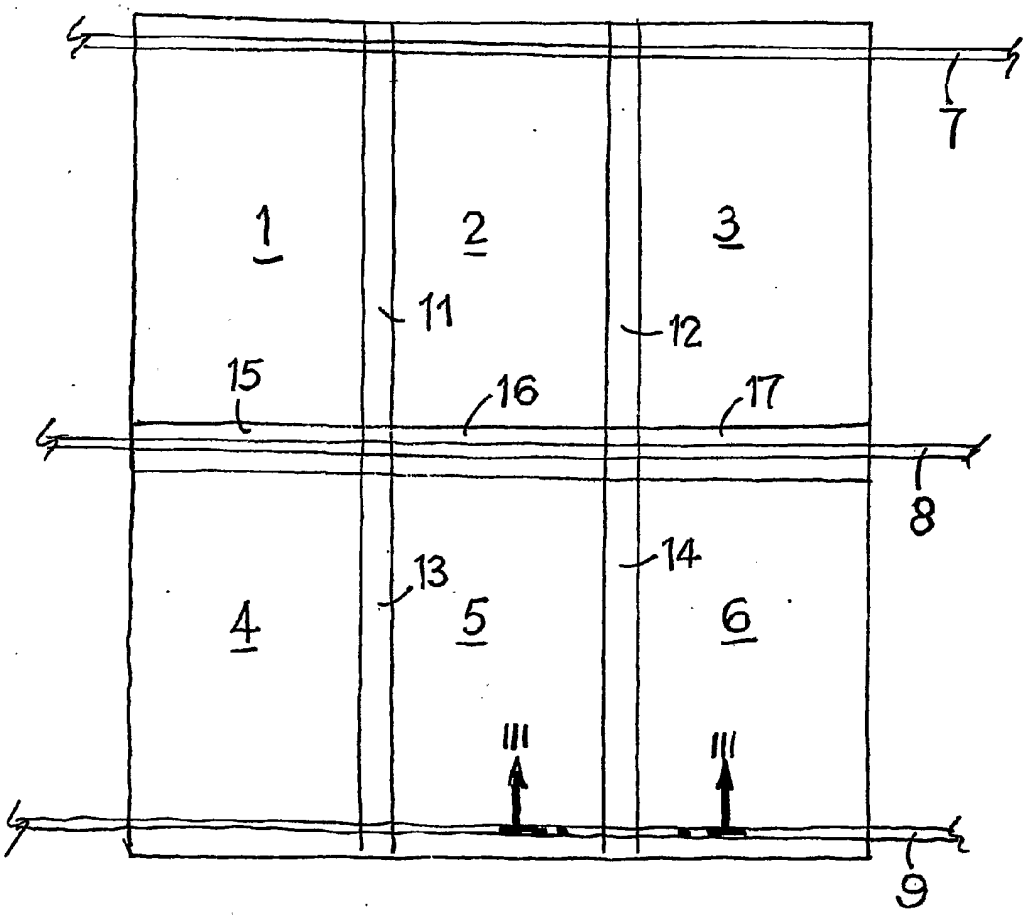

FIG. 2

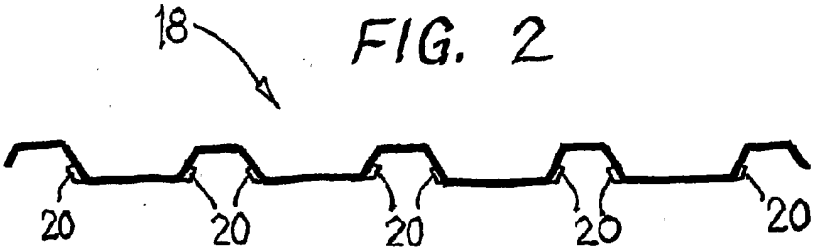

FIG. 3

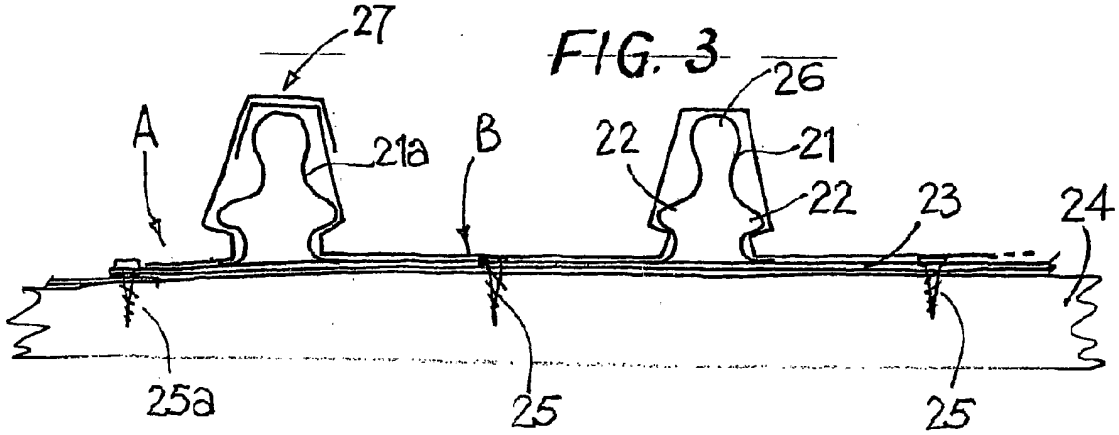

FIG. 4

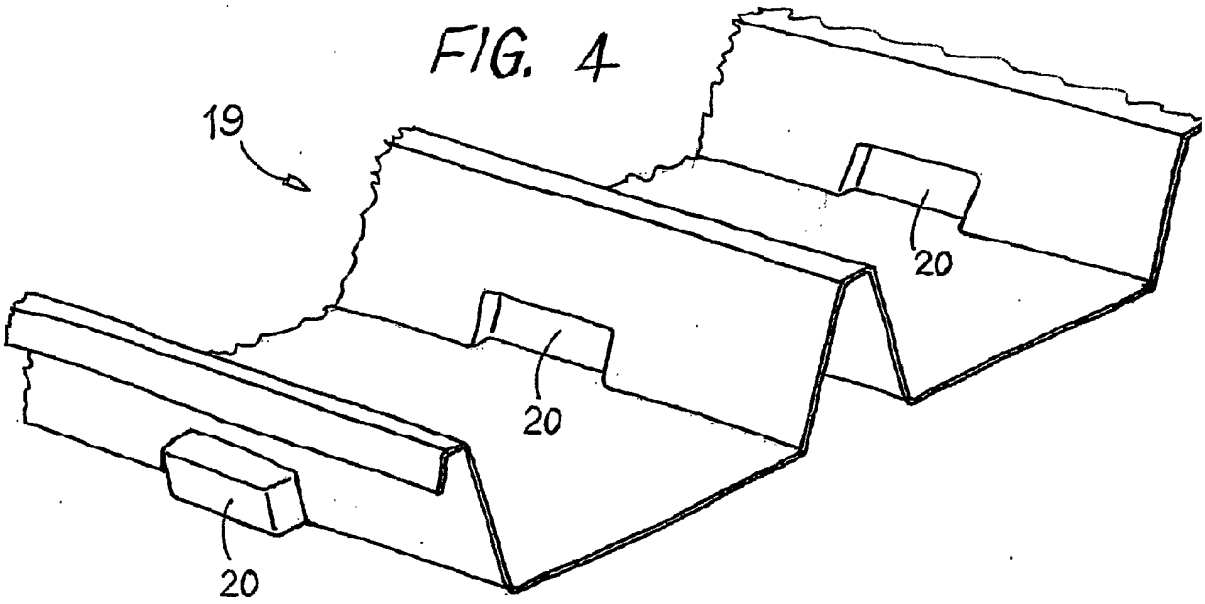

FIG. 5

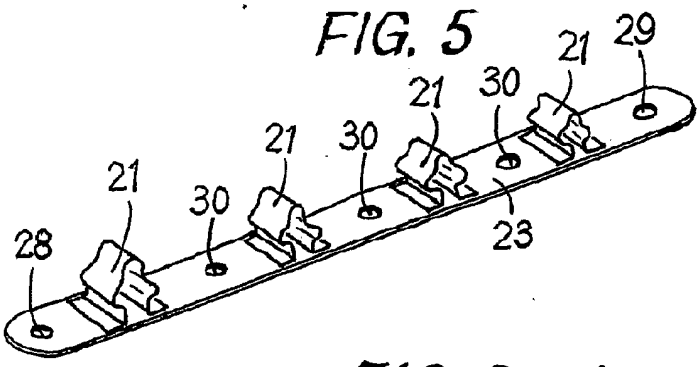

FIG. 6

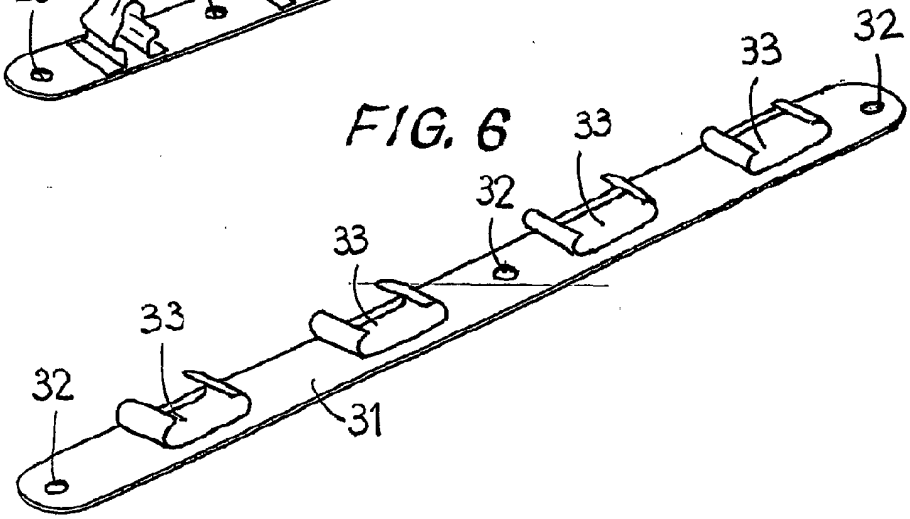

FIG. 7

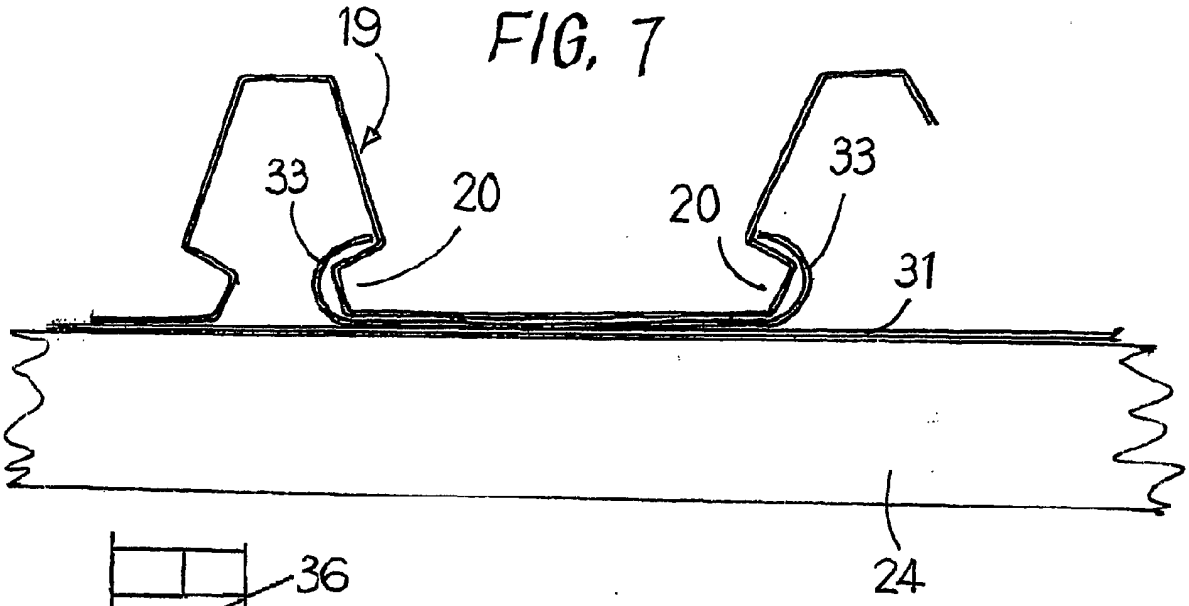

FIG. 8

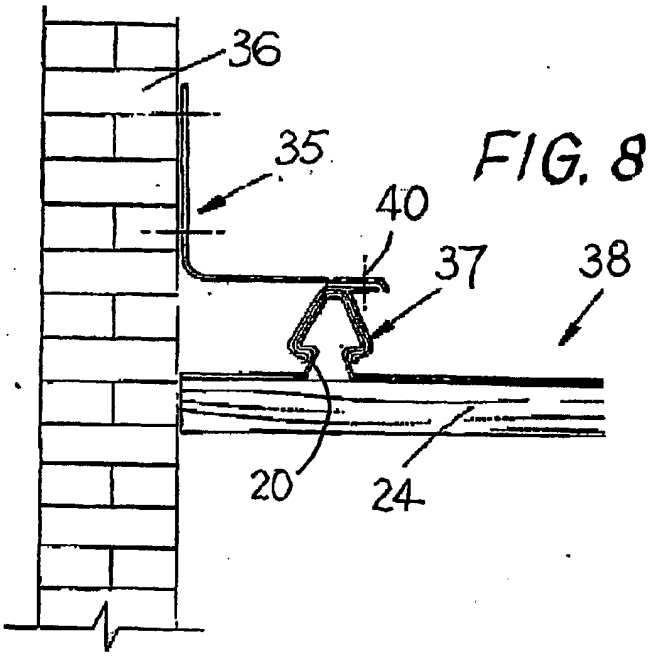

FIG. 9

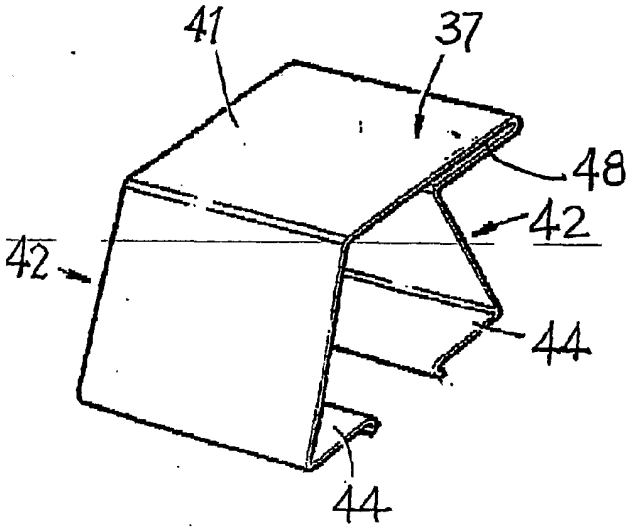

FIG. 10

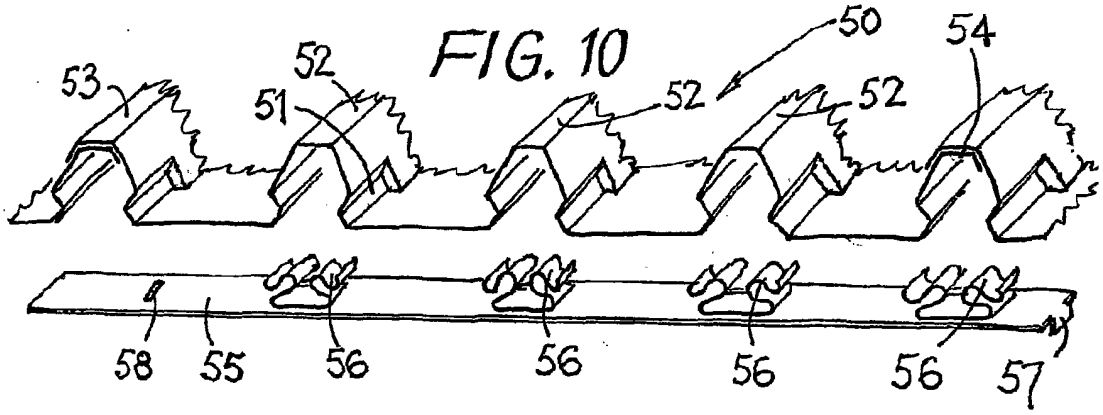

FIG. 11

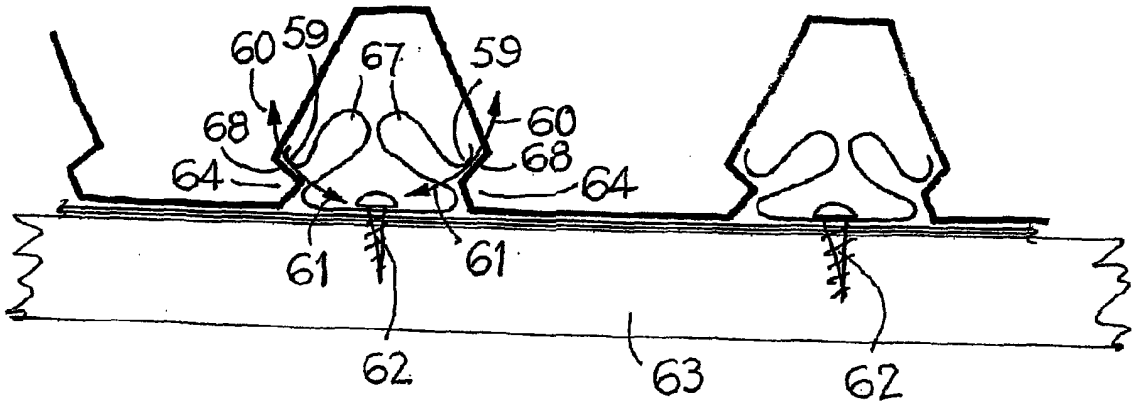

FIG. 12

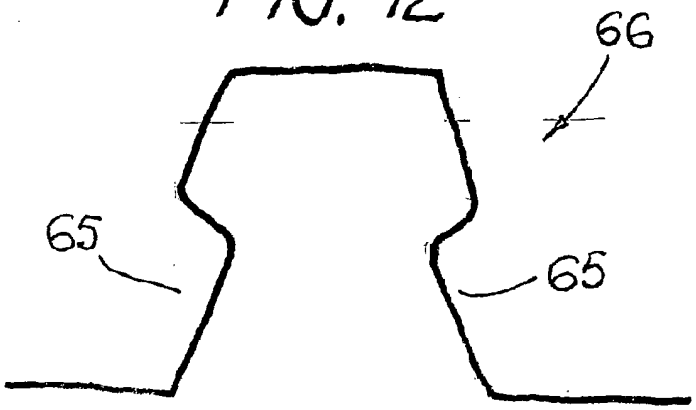

FIG. 13

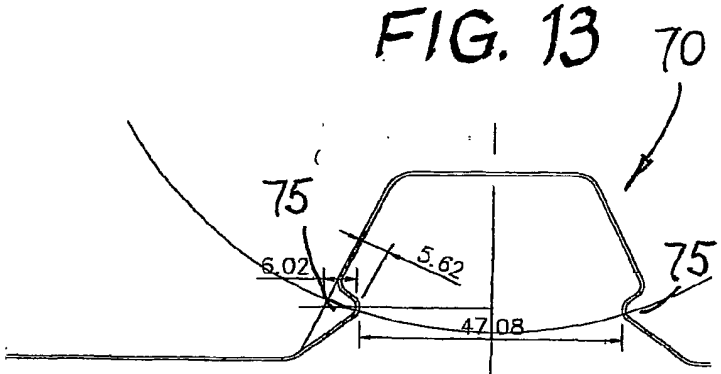

FIG. 14

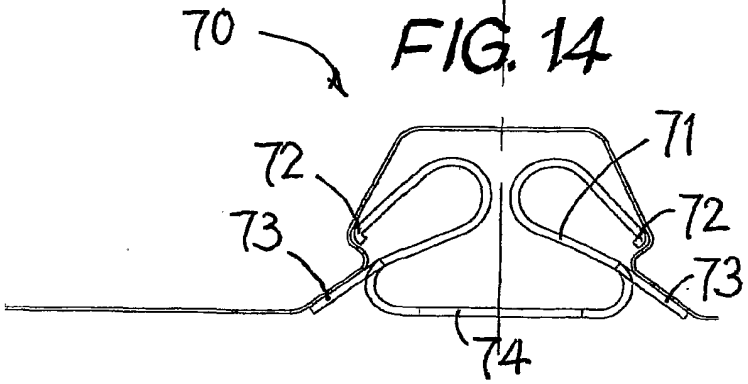

FIG. 17

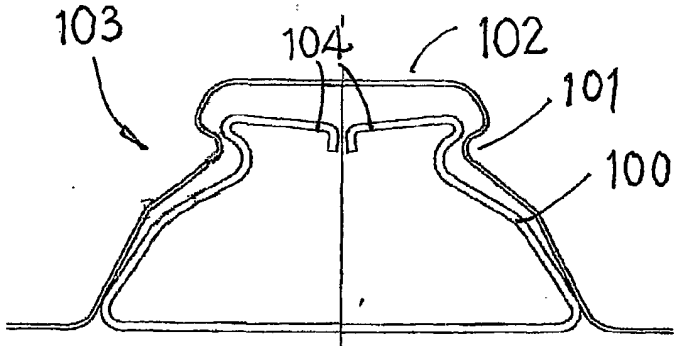

FIG. 18

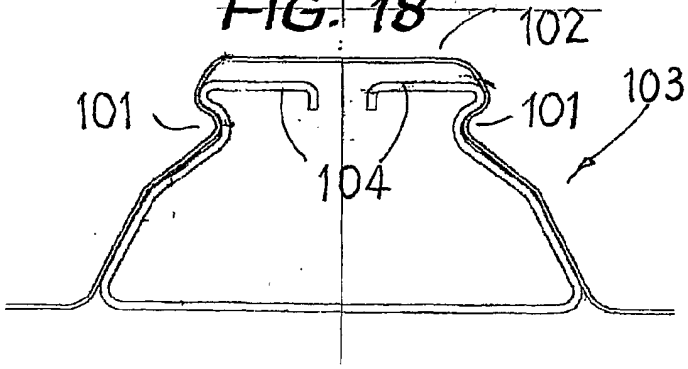

FIG. 15

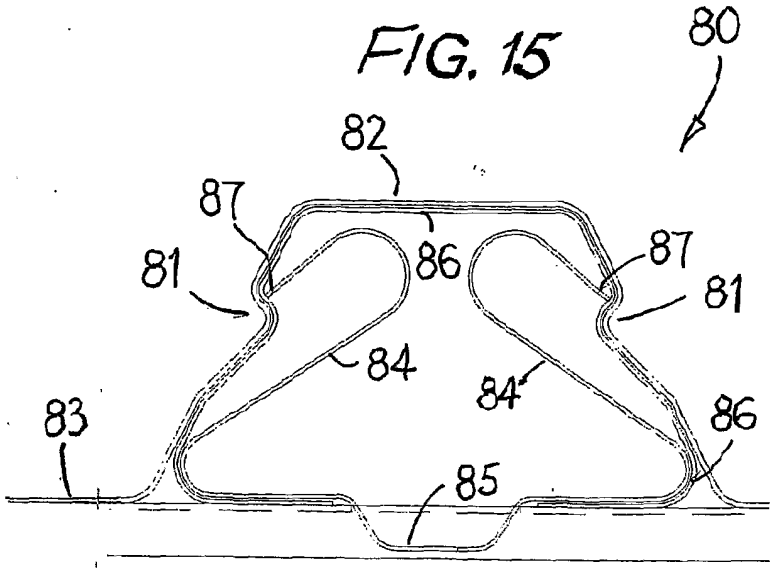
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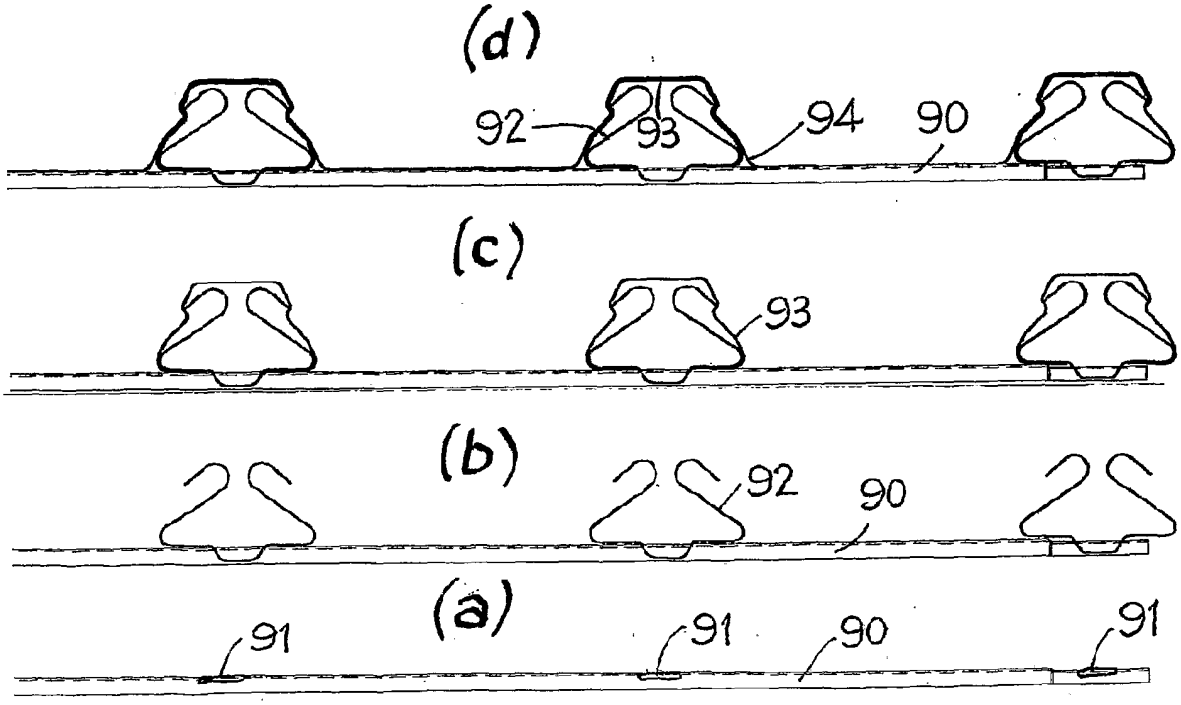
FIG. 16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(c)
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(b)
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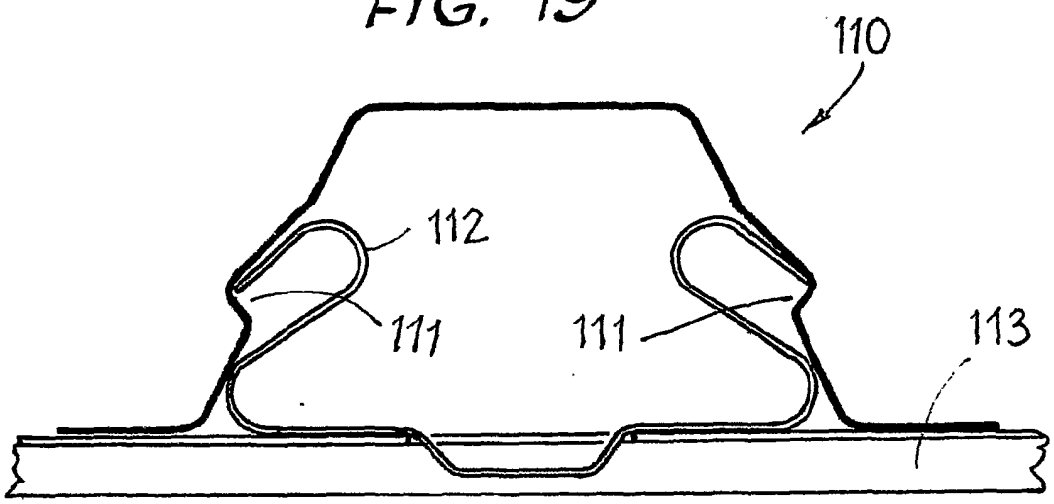
FIG. 19



INTERNATIONAL SEARCH REPORT

International Application No
PCT/ZA 01/00037

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E04D3/36 E04D3/363 E04D3/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E04D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	EP 0 476 524 A (ISCOM SRL) 25 March 1992 (1992-03-25) the whole document	1,3,4,7 5,6,15 17
Y	WO 91 12392 A (STRAMIT IND) 22 August 1991 (1991-08-22) claims 1,15-18,26,27; figures 1-16	5,6
Y A	US 4 486 998 A (HAGUE JAMES G) 11 December 1984 (1984-12-11) claim 1; figures 1-10	15 4-7
A	US 3 754 366 A (JANSSON J ET AL) 28 August 1973 (1973-08-28) column 2, line 55 -column 3, line 36	1,16

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
28 June 2001	09/07/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Hendrickx, X

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/ZA 01/00037

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