



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

<p>(51) International Patent Classification <sup>6</sup> : E04D 3/363, 3/362, E04F 13/12, E04C 2/32</p>	A1	<p>(11) International Publication Number: <b>WO 00/23673</b></p> <p>(43) International Publication Date: 27 April 2000 (27.04.00)</p>
<p>(21) International Application Number: PCT/AU99/00889</p> <p>(22) International Filing Date: 15 October 1999 (15.10.99)</p> <p>(30) Priority Data: PP 6639 21 October 1998 (21.10.98) AU</p> <p>(71) Applicant (for all designated States except US): LENNOX (NT) PTY LTD [AU/AU]; BDO Mal Sciacca, 72 Cavenagh Street, Darwin, NT 0800 (AU).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): SMITH, David, Lennox [AU/AU]; 16 Sadgroves Crescent, Winnellie, Northern Territory 0820 (AU).</p> <p>(74) Agent: CARTER SMITH &amp; BEADLE; Qantas House, 2 Railway Parade, P.O. Box 557, Camberwell, Victoria 3124 (AU).</p>		<p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, 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, 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, ARIPO patent (GH, GM, KE, LS, MW, 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), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> <i>With international search report.</i></p>
<p>(54) Title: ROOF AND WALL SHEETING SYSTEM</p>		
<p>(57) Abstract</p> <p>A wall or roof cladding sheet (10) is designed to run across the slope of a roof or across a wall frame work. The sheet (10) comprises a panel section (20) having an upstanding rib (12) along one edge portion (13) and an upstanding wall (30) defining with the rib (12) a trough (28). The sheet (10) is fastened to a support by fasteners (40) engaged through the base (32) of the trough (28). The upper edge (18) of the rib (12) is turned inwardly and downwardly towards the panel section (20) to define a receptor channel (15). The other edge portion (26) has a downwardly turned flange (24) with a hook formation (21) which engages the receptor channel (15) of an adjacent sheet.</p>		

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## ROOF AND WALL SHEETING SYSTEM

### Field of the Invention

The present invention relates to a roof and wall cladding system suitable for forming the roof of a building structure or for cladding the walls of a structure. More particularly, the system is of the type where individual sheet coverings are secured directly to roof structures such as rafters or wall studs without the need for additional battens or purlins. Thus, the sheets extend across the roof slope or across the wall. The sheet coverings are formed such that fasteners used to secure the sheets to the building structure are concealed by an adjacent overlapping sheet covering. The system and sheet coverings of the invention find particular application in the building and construction industry.

### Background of the Invention

It is well known to secure metal sheeting, such as sheet metal which may be galvanised or may have another protective coating, such as powder coating or paint, to battens attached to rafters or to the chords of a trusses forming a roof frame, when installing the roof of a building structure. It is also known to fix sheeting material to the studs of the wall frame of a structure with the use of screws or other fasteners, to thereby clad the wall. However, the heads of fasteners used generally remain exposed directly to environmental conditions. In addition, the fasteners pass through the roof or wall sheeting leading to damage of any protective coating at the sites of the aperture in the sheet material. Accordingly, both the fasteners and the sites at which they pass through the sheet material are at risk of accelerated corrosion.

Once corrosion sets in, it can spread to adjacent areas in a relatively short period of time leading to unsightly marking and, in serious instances, access for water to seep through the sheet material and weakness in the fastening system.

### Background Art

It has been known to provide roof cladding sheets with edge formations which interengage with each other and with holddown brackets to secure the roofing sheet to a roof structure. With such arrangements, however, the holddown brackets are generally fastened to battens fixed to the roof rafters or truss cords

- 2 -

and the sheets are run with the edge portions thereof along the line of the slope of the roof. The use of battens adds to the cost of a roofing structure and, with the known overlapping cladding sheets, moisture can creep between overlapping sheets, and wind can sometimes lift an edge of a sheet to peel the roof back on  
5 itself.

Australian Patent Specification No 44402/72 discloses a roofing or decking sheet having edge portions adapted to interengage with the edge portions of adjacent like sheets. One edge portion has a longitudinal rib or socket along one edge with a water shedding overhang and an upturned opposite edge portion  
10 adapted to interengage the socket of an adjacent sheet thereby to lock the sheets to each other, and a fastener is used to fasten the first edge portion to a roofing structure. With this arrangement, however, the upper surface of the fastener is engaged by the overlying sheet along the other edge leading to potential stress points, improperly located edges where a fastener is incompletely driven home  
15 and corrosion due to capillary action causing seepage between the closely adjacent engaging sheets.

UK Patent Specification No 2,245,618A discloses a roofing sheet which has ribs extending along opposite edges of the building panel. Both ribs extend upwardly and include sloping surfaces with one rib having a shoulder while the  
20 other rib has a free lip end adapted to engage beneath the shoulder. The complimentary engagement is in the nature of a snap fit so that no further fastening means are needed. With this arrangement, however, the sheeting must be run so that the longitudinal edges run in the direction of the roof slope. Further, because the engagement is in the nature of a snap fit, it is possible that wind can  
25 engage beneath the free lip to peel back the roof sheet panel.

It is therefore desirable to provide an improved roof and wall sheeting system which obviates or at least ameliorates one or more of the difficulties or problems associated with prior roofing systems.

It is also desirable to provide an improved wall and roof sheeting system  
30 which may be mounted on a roof structure without the need for battens, purlins or other intermediate securing elements.

- 3 -

It is also desirable to provide an improved roof and wall sheeting system in which the panels are simply and easily formed, preferably by roll-forming, and are easy to assemble to form a weather-tight roof covering.

It is also desirable to provide an improved roof and wall sheeting system in which fasteners used to fasten an edge portion of a sheet are hidden and away from weather, contact with overlying sheets and substantially protected against dislodgement.

#### Summary of the Invention

In accordance with one aspect of the invention there is provided a roof or wall sheeting comprising an elongated panel section having an upstanding rib extending along and adjacent one longitudinal marginal edge, said rib terminating in an inwardly and downwardly extending flange directed towards the panel section and defining with the rib a receptor channel, the marginal edge outwardly of the rib being formed with an outer wall section defining a trough, the opposite marginal edge of the panel section having a downwardly and inwardly extending securing flange adapted to engage and interlock with the receptor of an adjacent similar sheet.

According to one embodiment of the invention the sheet covering is designed for covering the roof of a building structure. The sheet covering has the rib extending along a side region of the sheet covering and the trough consists of an area that lies outward of and alongside the rib and through which the sheet is secured to the building structure with the use of fasteners. The area of the sheet covering lying outward of the rib will usually be in the form of a strip of material through which the fasteners are able to be driven into the building structure to thereby secure the sheet covering in position across the slope of the roof. The strip may form the floor of the trough defined by the rib and the outer supporting wall formed outward of and extending alongside the strip, and which is able to provide support for a further sheet section when two sheet sections are overlapped.

A securing flange extends along the opposite side region of the sheet covering and a generally planar panel spaces the rib from the flange. The flange is adapted to engage with the receptor of a further sheet covering to thereby inhibit

lifting of one from the other when the sheet coverings are overlapped.

In the case of a sheet for use as wall cladding, the panel may be elevated relative to a base region of the rib. In this instance, the panel is preferably provided with a connecting region connecting the panel to the rib. The connecting  
5 region will usually comprise an inclined wall sloping from the panel in a direction generally toward the rib base region.

As the area of the sheet covering lying outwardly of the rib is covered by the overlying panel of a further sheet covering when two sheets are overlapped, any fasteners passing through the said area of the underlying sheet covering are  
10 also covered from direct exposure to environmental conditions in use thereby substantially inhibiting not only corrosion of the fasteners themselves but also corrosion at the sites the fasteners pass through the sheet covering. Generally, apertures will be drilled or punched through the trough of the sheet covering for reception of the fasteners at the time of securing the sheet covering to the building  
15 structure.

The sheet covering may be used for forming a roof on the building structure or alternatively, for cladding walls of the structure.

The sheet covering of the invention in its various embodiments provides a rapid and convenient building system for forming the roof or exterior wall surface  
20 of a house, shed or other building structure. In particular, the covering can be rapidly achieved by attaching an initial sheet covering in position and progressively overlapping subsequent sheet coverings, attaching each sheet covering to the building structure one at a time.

In order that the invention will be more readily understood, embodiments  
25 thereof will now be described with reference to the accompanying drawings.

#### Description of the Drawings

Fig 1 is a perspective view of a sheet covering of one embodiment of the invention;

Fig 2 shows an end profile of the sheet covering of Fig 1;

30 Fig 3 is a perspective view of part of a roof formed using the sheet covering of Fig 1;

Fig 4 is an end view of a roof showing used of a sheet covering of Fig 1 together with a ridge cap and fascia strip;

Fig 5 is a perspective view of a further embodiment of a sheet covering in accordance with the invention;

5 Fig 6 is a partial perspective view showing an external wall formed with the use of the sheet covering of Fig 5;

Fig 7 shows an end profile of a wall formed with the use of the sheet covering of Fig 5.

#### Description of Preferred Embodiments

10 The sheet covering shown in Fig 1 is a metal roofing sheet 10 having a central panel section 20 and opposite marginal edge portions generally indicated at 13 and 26.

The roofing sheet 10 preferably has a protective paint or other coating such as galvanising or that known as "Colorbond" (trade mark of BHP Steel (JLA) Pty  
15 Ltd). Steel and aluminium are the usual materials from which roofing sheets are formed although sheets formed of synthetic plastics material, fiberglass and other like sheet materials may be used in the performance of the present invention.

An upstanding rib 12 extends along the marginal edge 13 while a downwardly extending flange 24 extends along the opposite marginal edge 26.  
20 The rib 12 is formed of a first wall 9 extending upwardly from the marginal edge 13 of the panel section 20 and a second wall 8 which forms a sidewall of a trough 28. The upper ends of the walls 8 and 9 are engaged and inwardly and downwardly directed to form a flange 18. The inwardly and downwardly extending flange 18 which defines with the inner sidewall 9 of the rib 12 a  
25 receptor channel 15.

The flange 24 has an inwardly directed hook formation 21 which, in use, is adapted to interengage with the receptor channel 15. The flanges 18 and 24 are substantially parallel and extend along the full length of the roofing sheet panel 20.

30 Outwardly of the rib 12, the roofing sheet 10 is formed with a trough 28 defined by a wall of the rib 12 and an upstanding, outer supporting wall 30. The floor of the trough is formed by a strip 32 while an upper edge of the supporting

- 6 -

wall 30 is provided with a support surface 34 projecting outwardly from the wall 30. The supporting wall 30 and support surface 34 are adapted to provide support for a roofing sheet engaged with the receptor and extending back over the trough 28, as hereinafter described.

5           Fasteners 40, which may be nails, screws or the like, are used to fasten the metal roofing sheet 10 to a rafter, chord of a truss or other roof structural member. In use of the metal roofing sheet 10 of this embodiment of the invention, the rib 12, flanges 18 and 24 and trough 28 extend across the slope of the roof. The slope of the roof is determined so that, for a given height of rib 12 and support wall 30 and width of panel section 20, the panel section 20 is able to shed water.

10           Referring to Fig 3, a roof 36 is illustrated formed of a plurality of roofing sheets 10 together with a fascia panel 48 and a ridge capping 42. The fascia panel 48 is fastened to rafters 38 by appropriate fasteners (not shown), the fascia panel 48 having a rib 12 and flange 18 similar to those as described with reference to the roofing sheet 10 of Fig 1. The fascia panel 48 is also provided with a trough having an outer supporting wall 30 which is similar to that of the roofing sheet panel described with reference to Fig 1. The floor 32 of the trough 28 of the fascia panel 48 is secured to the rafters 38 by fasteners 40. A first roofing sheet 10 is then engaged with the flange 18 so that the hook formation 21 engages within the receptor channel 15 defined by the flange 18 and wall 9. The panel 20 of the roofing sheet 10 extends up the roof line, a lower surface thereof engaging with the support surface 34 to provide strength and stability to the roofing sheet 10. With the hook formation 21 firmly engaged with the receptor channel 15 of the fascia panel 48, the trough base 32 of the roofing sheet 10 is engaged with the rafters 38 and further fasteners 40 are used to secure that trough 28 to the rafters 38.

20           In Fig 3, a second roofing sheet 10 is then engaged with the flange 18 and receptor channel 15 of the first roofing sheet 10. The second roofing sheet 10 extends further up the roof line and the base 32 of the trough 28 of the second roofing sheet 10 is secured to the rafters 38 by further fasteners 40. In this way, a roof may be laid along roof rafters for any suitable distance, each subsequent

- 7 -

roofing sheet 10 overlying the previous sheet and interlocking thereto, each sheet being secured by appropriate fasteners through the base 32 of the receptive troughs.

Because the engagement of the hook member 21 within the respective receptor channels 15 is a positive, interlocking engagement, the possibility of disengagement is substantially reduced if not eliminated. The support wall 30 and support surface 34 provide substantial strength to the structure of the rib 12 so that, during erection and other maintenance, a person's weight is easily able to be supported on the rib 12 and support wall 30.

10 As shown in Fig 3, at the upper end of the roof sheeting run, a ridge cap 42 is provided having inwardly turned end flanges which are able to snap fit over the flange 18 to thereby secure the ridge cap in position without fasteners.

The structure illustrated in Fig 4 is similar to that as described with reference to Fig 3 except that only one metal roofing sheet 10 is illustrated.

15 Referring to Figs 5 to 7, the sheet illustrated is designed particularly as wall cladding and has a profile so that, in use, the cladding has a pleasing aesthetic appearance on the wall of a building structure. The sheet is similar to that shown in Fig 1, having a panel 20 with an upstanding rib 12 and a downwardly extending flange 24 terminating in a hook formation 21.

20 The panel of this embodiment has a first planar section and a connecting region 51 extending to a base region 50 from which the rib 12 extends. The connecting region 51 extends at a suitable angle to the main panel 20 to provide a desired appearance when the panels 10 are assembled on the wall of a building structure.

25 A further difference between the panels of this embodiment and that of Fig 1 is that the support wall 30 extending upwardly from the channel base 32 is of a substantially reduced height and is used to provide structural strength to the trough base 32 to minimise bending or distortion thereof in use.

30 In use of the wall sheet 10 as cladding, such as illustrated in Figs 6 and 7, a lower starting strip 54 is used providing a receptor underneath the flange 18 to receive the first hook formation 21 of a first wall panel 10. With the first wall

- 8 -

panel 10 in position, fasteners 40 are used to engage through the channel base 32 into a wall stud 56. A second wall panel 10 is then interlocked behind the flange 18 and further fasteners used to fasten the subsequent trough floors 32 to the studs 56. Each of the wall panels 10 overlap the preceding sheet 10 thereby hiding the fasteners 40 and protecting those fasteners against weather. The fasteners securing the uppermost sheet 10 in position are concealed with use of a corner flashing 58 that is secured to a frame structure to maintain the upper sheet 10 in position. The corner flashing 58 also has a flange 24 which hooks around the flange 18 of the uppermost sheet 10 to assist in maintaining the corner flashing in position. The overlapping engagement of the wall sheets is clearly shown in Fig 7.

It will be appreciated that the flange 18 is formed from a double folded section of material forming the roofing sheet 10 to thereby provide a double wall thickness in the area where stress is applied to the sheet 10. If desired, the hook formation 21 may also be formed of a double wall thickness of material, as may the flange 24, to thereby provide increased strength and security to the roofing structure.

**Claims:**

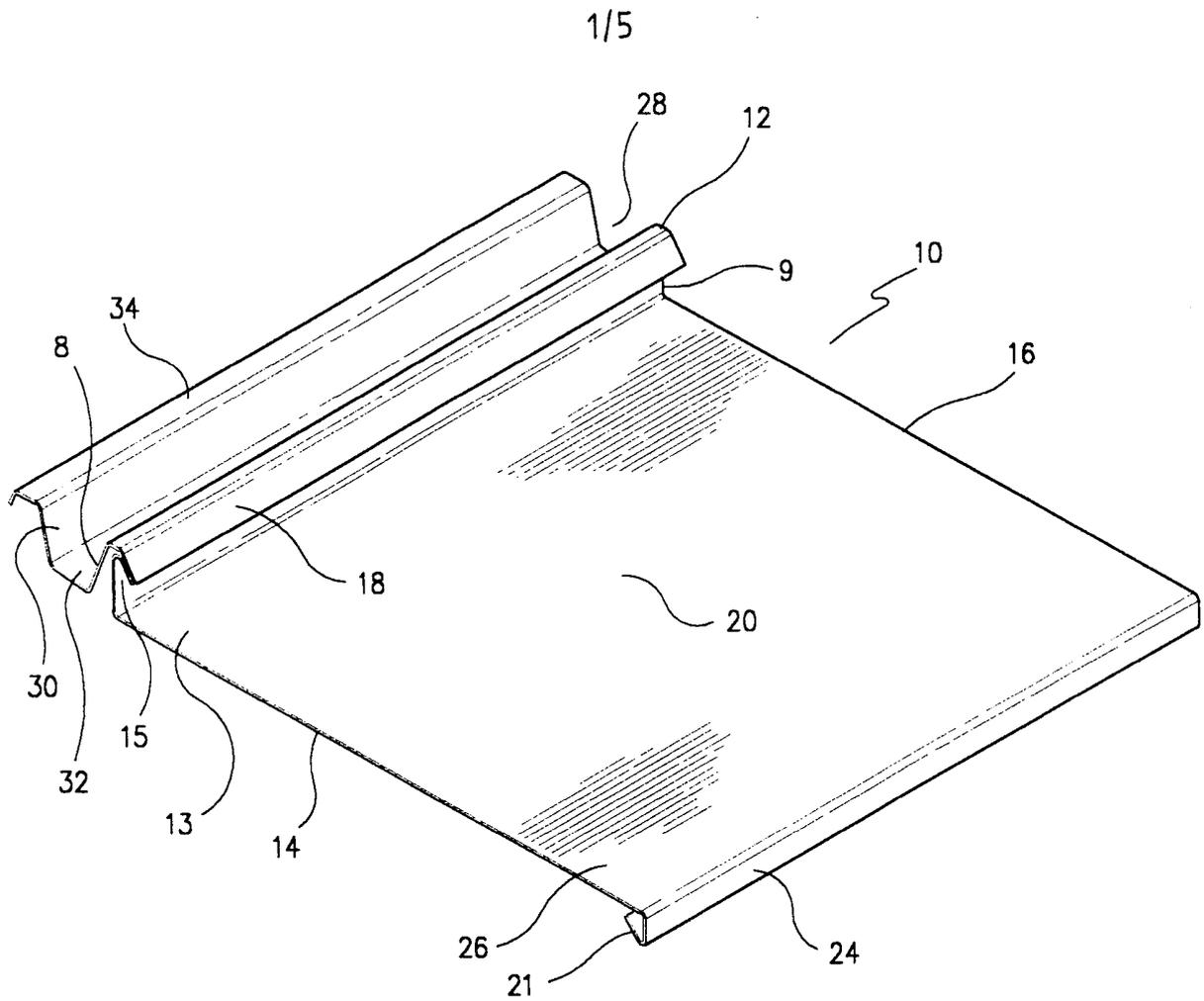
1. A roof or wall sheeting comprising an elongated panel section having an upstanding rib extending along and adjacent one longitudinal marginal edge, said rib terminating in an inwardly and downwardly extending flange directed towards  
5 the panel section and defining with the rib a receptor channel, the marginal edge outwardly of the rib being formed with an outer wall section defining a trough, the opposite marginal edge of the panel section having a downwardly and inwardly extending securing flange adapted to engage and interlock with the receptor of an adjacent similar sheet.
- 10 2. A roof or wall sheeting according to claim 1 wherein the trough includes a base through which the sheeting is fastened to a support.
3. A roof or wall sheeting according to claim 1 or claim 2 wherein the outer wall section has an outwardly extending support surface.
4. A roof or wall sheeting according to any one of the preceding claims  
15 wherein said rib, flange and outer wall section are formed of the sheet material of the sheeting.
5. A roof or wall sheeting according to any one of the preceding claims wherein said panel section is substantially planar.
6. A roof or wall sheeting according to any one of the preceding claims  
20 wherein said rib is formed of a first wall extending from the panel section and a second wall extending upwardly from the trough, the upper ends of said walls being engaged and extending inwardly and downwardly to form said flange.
7. A roof or wall sheeting according to claims 1 to 4 wherein said panel

- 10 -

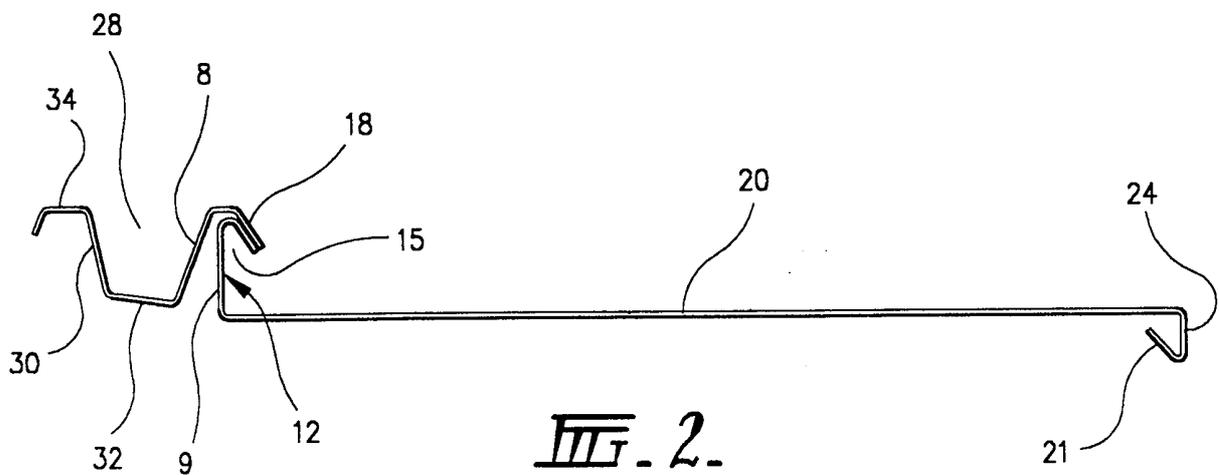
section includes an inclined section extending from the panel to a base of the rib whereby panel sections of interconnected sheets are substantially co-planar.

8. A roof or wall cladding system comprising a plurality of sheeting components according to any one of the preceding claims interconnected with  
5 each other so that the securing flange of respective sheeting engages and interlocks with receptor channels of adjacent sheeting, and fasteners engage the troughs of each sheeting with a support.

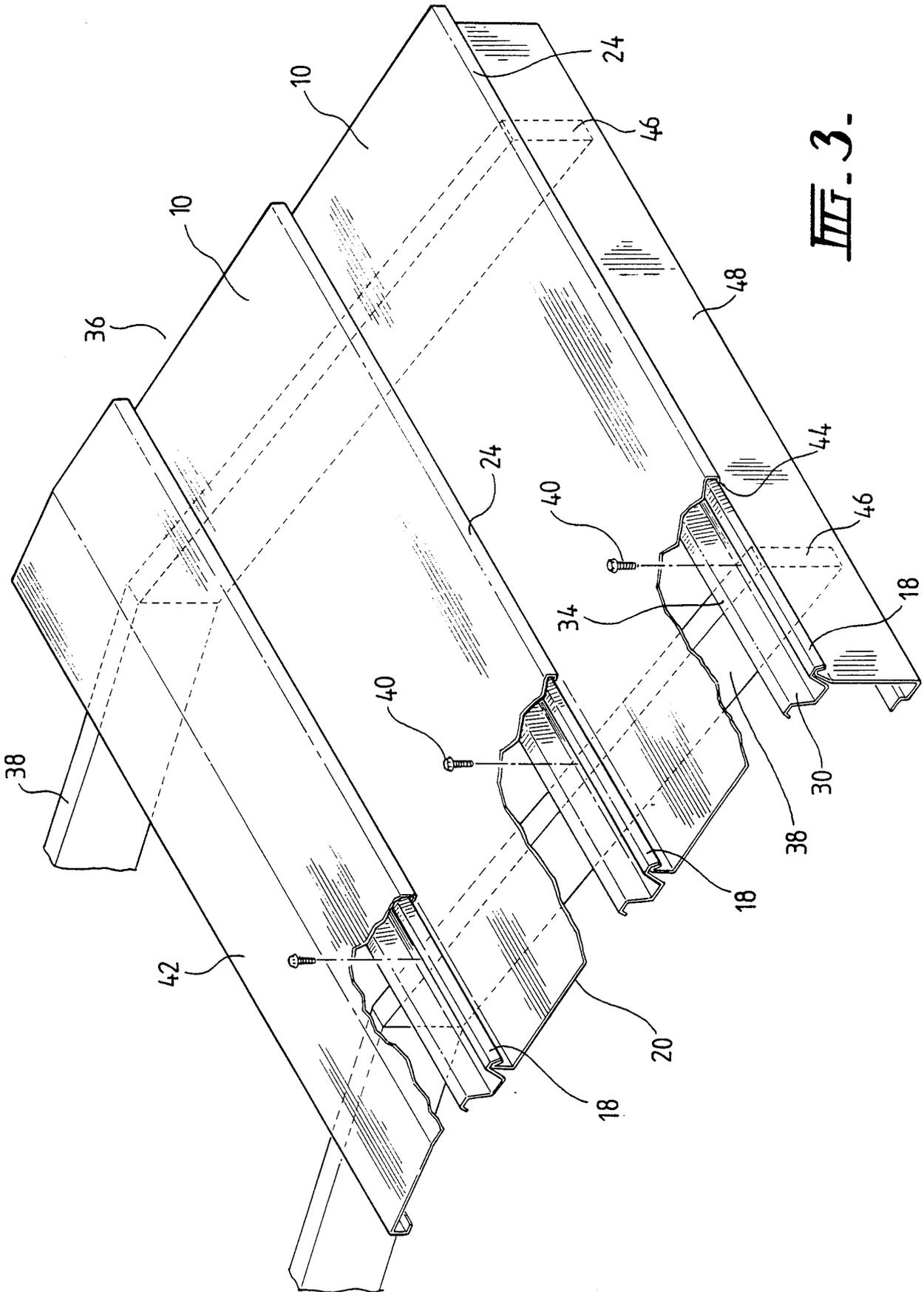
9. A roof or wall sheeting substantially as hereinbefore described with reference to the accompanying drawings.



**FIG. 1.**

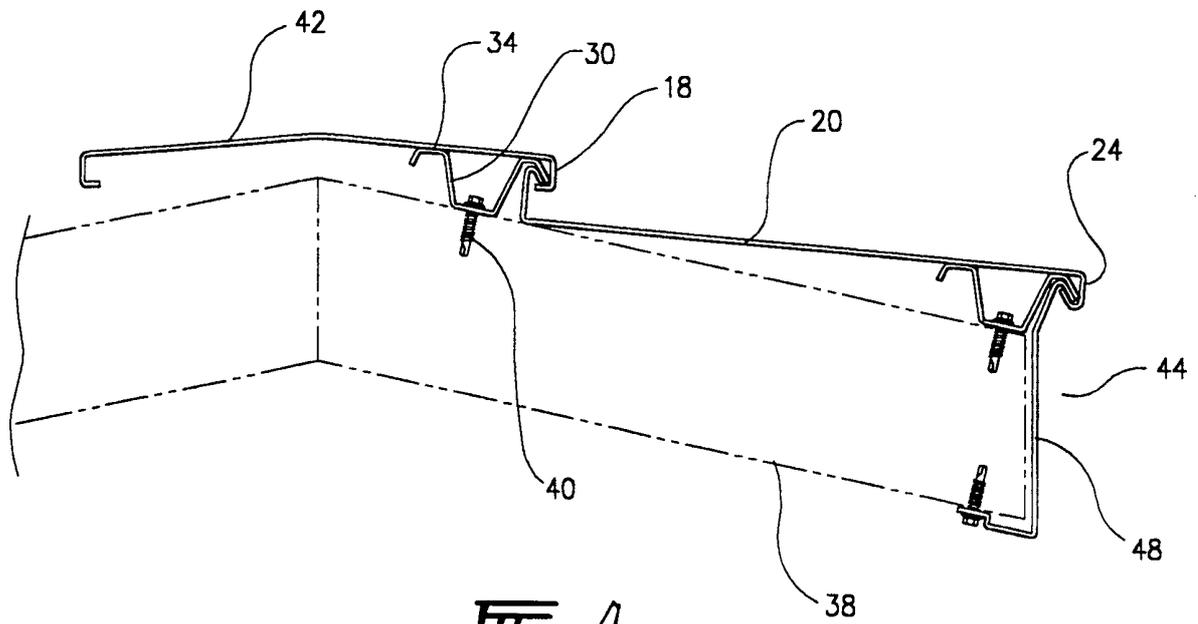


**FIG. 2.**

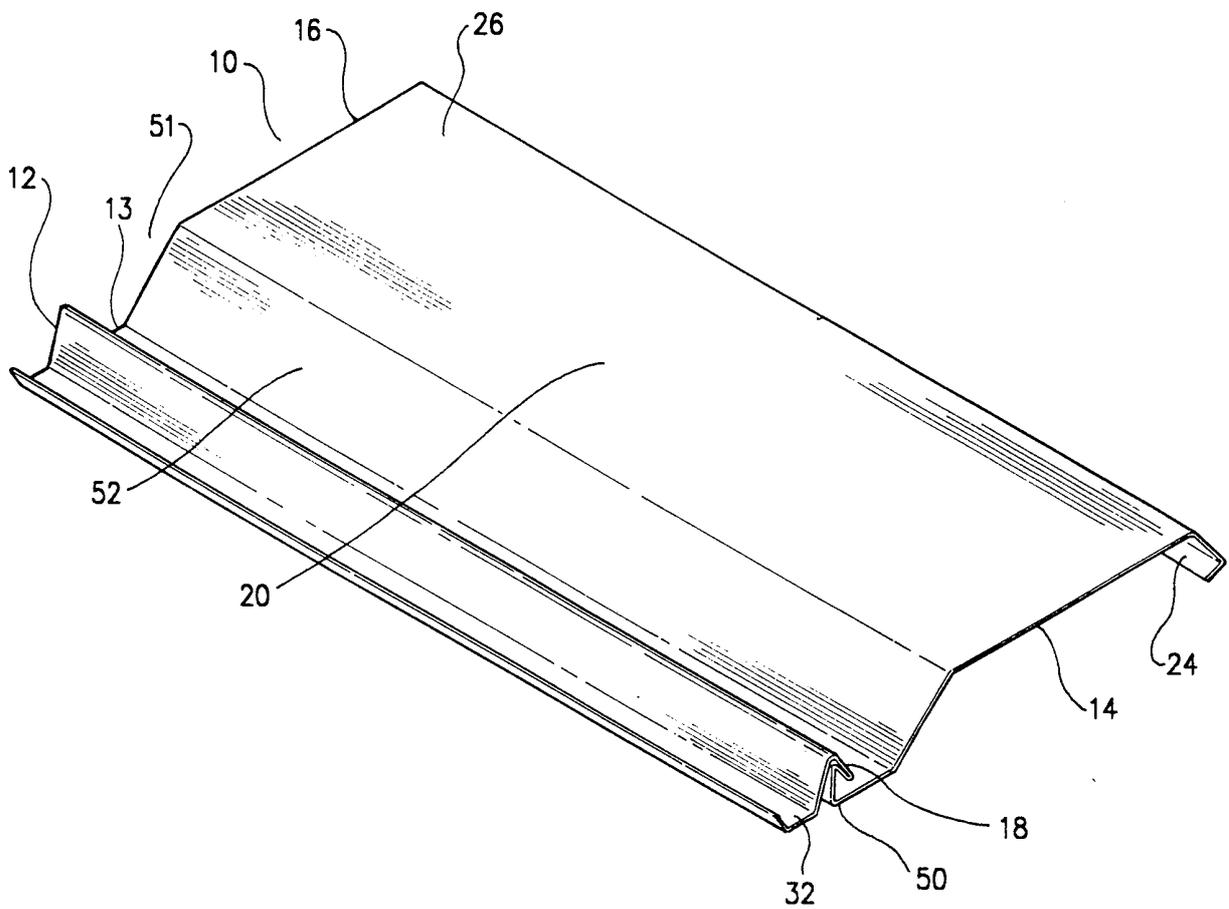


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3/5



**FIG. 4.**



**FIG. 5.**

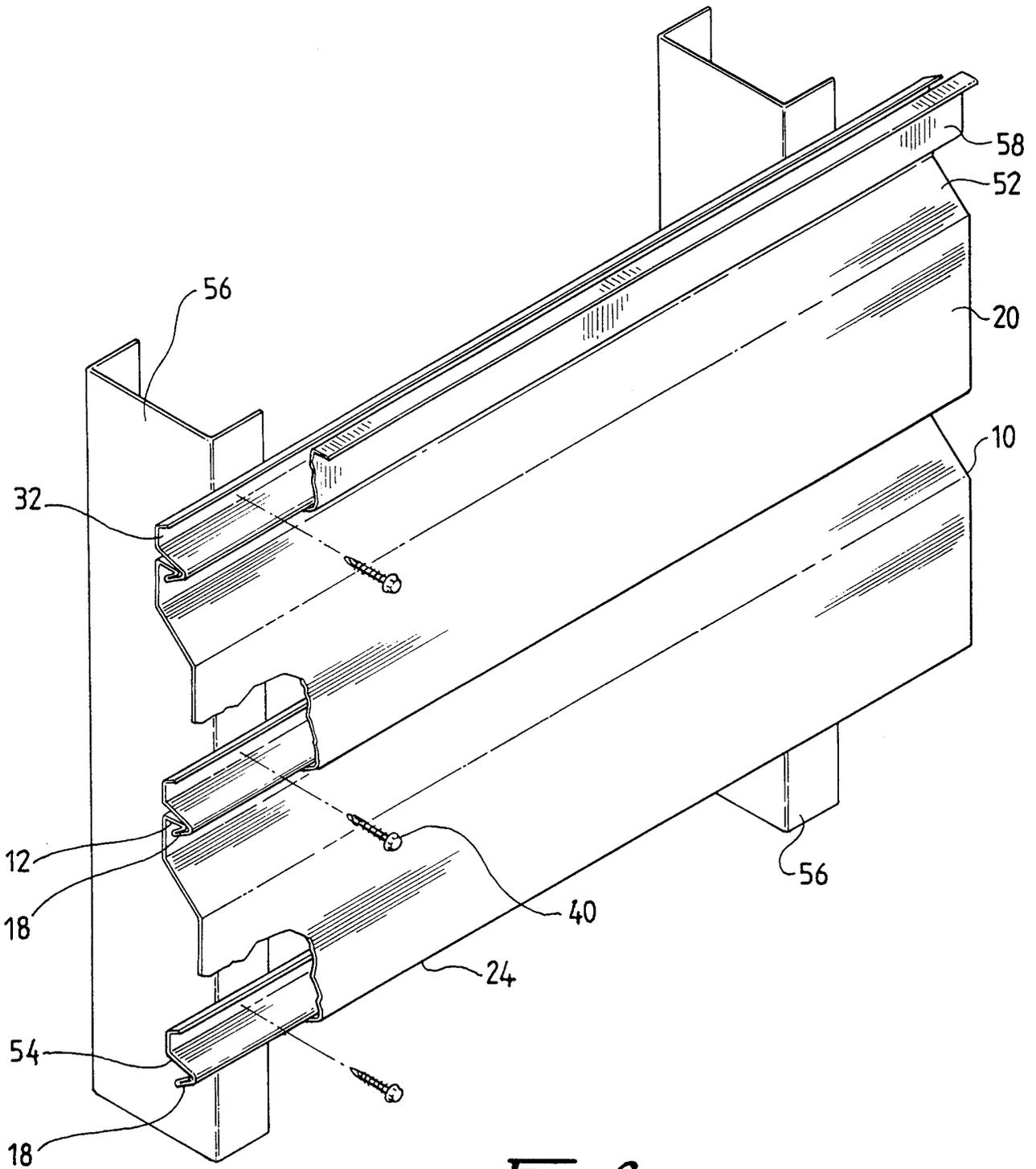


FIG. 6.

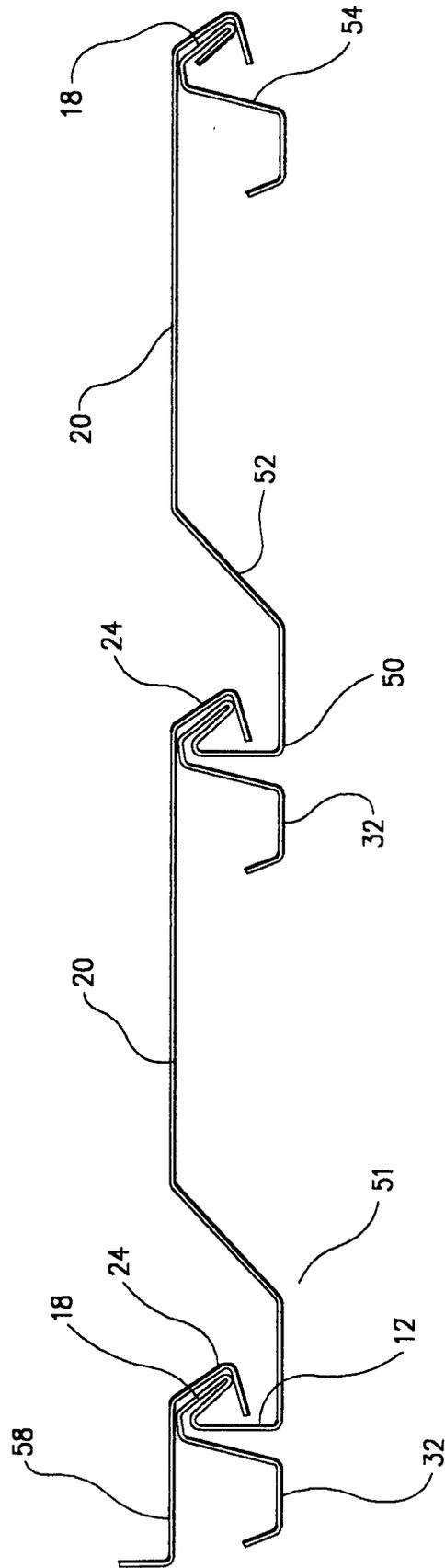
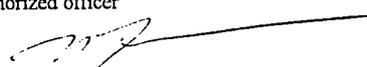


FIG. 7.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 99/00889

<b>A. CLASSIFICATION OF SUBJECT MATTER</b>		
Int Cl <sup>6</sup> : E04D 3/363, 3/362 E04F 13/12 E04C 2/32		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols) E04D E04B E04F E04C F16S		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU IPC : E04D 3/363, 3/362, 3/365, 3/30 E04F 13/12 E04C 2/32		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPAT JAPIO : sheet panel board overlap overlie overlay roof wall channel furrow trough interlock connect engage		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2245618 A (EUROCLAD (SOUTH WALES) LIMITED) 8 January 1992 Figures 2, 3 and 4	1-8
X	AU 80470/94 (657083) B (WU) 23 February 1995 Figures 1 and 3	1-8
A	AU 44402/72 A (ROOFTILERS (VIC.) PTY LTD) 17 January 1974	
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C		<input checked="" type="checkbox"/> See patent family annex
* Special categories of cited documents:		
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"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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"P"	document published prior to the international filing date but later than the priority date claimed	
Date of the actual completion of the international search 29 November 1999	Date of mailing of the international search report 24 DEC 1999	
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer  <b>MATTHEW FORWARD</b> Telephone No.: (02) 6283 2606	

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/AU 99/00889

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96/11312 A (RAZOR ENTERPRISES, INC.) 18 April 1996	
A	AU 58306/96 A (STRAMIT CORPORATION LIMITED) 16 January 1997	

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/AU 99/00889**Box 1 Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.: 9  
because they relate to subject matter not required to be searched by this Authority, namely:  
The claim does not comply with Rule 6.2(a) of the PCT, because it relies upon references to the description and drawings.
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

**Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest.  
 No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/AU 99/00889**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
GB	2245618	AU	81951/91	WO	92/01129		
AU	80470/94	CA	2128760	GB	2291660	US	5507126
AU	44402/72	GB	1402422				
WO	96/11312	CA	2176214	EP	786039	US	5535567
END OF ANNEX							