

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

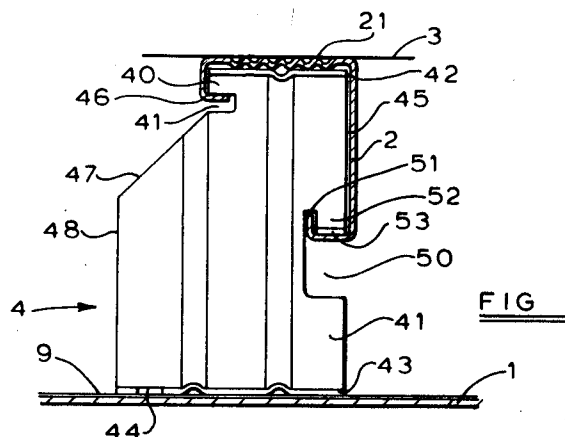
0 504 505 A1

(12)

EUROPEAN PATENT APPLICATION(21) Application number: **91302313.1**(51) Int. Cl.⁵: **E04D 3/36, E04F 13/08,
E04B 7/00**(22) Date of filing: **18.03.91**(43) Date of publication of application:
23.09.92 Bulletin 92/39(84) Designated Contracting States:
DE ES FR IT NL SE(71) Applicant: **ASH & LACY BUILDING PRODUCTS
LIMITED**
P.O. Box 58, Alma Street
Smethwick, Warley, West Midlands B66
2RP(GB)(72) Inventor: **Carey, Francis Bryan**
White Lodge, 85 Compton Road
Wolverhampton, West Midlands WV3
90H(GB)(74) Representative: **Attfield, Donald James et al**
BROOKES, MARTIN & WILSON Prudential
Buildings 5 St. Philip's Place
Birmingham B3 2AF(GB)(54) **Wall/roof assemblies.**

(57) A membrane (3) support/spacer-bracket assembly consists of a cold rolled angled cross-section metal support member (2) having a horizontal membrane support surface (21) to which the membrane (3) is secured by self tapping screws, a spacer bracket (4) of sheet metal having an upper portion in non-rotatable engagement with the support member (2) and a lower portion for attachment to a primary structure member (1). A first inwardly directed cup-shaped receiving member (55) is positioned at one end of the support member horizontal surface (21) and a second inwardly directed cup-shaped receiving member (56) is positioned at the end of the leg of the member (24) depending from the other end of the support surface. The bracket upper portion includes inwardly directed slots (49, 50) formed in opposed edges to define tongue portions (40, 52) for engagement in the support member receiving members (55, 56) whereby the bracket is locked into the support member. The bracket (4) further includes an angled anti-rotating element (53) formed at an edge portion to act between the inner side of the support member surface and a point in a receiving member spaced from the corresponding bracket tongue member engaging therein, whereby rotation of the

bracket within the support member is prevented. The support member horizontal surface (21) is preferably ribbed, the pitch of the ribs (27) being about 1.1 times the diameter of the self tapping screw thread, the thread engaging the support surface (21) at the base of a rib, the ribbing providing improved screw torque and pull out resistance for a given thickness of metal forming the support member.

**EP 0 504 505 A1**

The present invention relates to a wall or roof structure including a primary structural member carrying a membrane spaced therefrom and in particular with the means for supporting the membrane in the spaced apart relationship from the said structural member.

The refurbishment of roofs or walls of existing buildings, especially commercial buildings such as factories or warehouses etc., may be achieved by providing a supporting grid over the existing wall or roof and attaching a new outer weatherproof wall or roof membrane thereto. To achieve this purpose it is necessary to employ a support means between the existing primary structural members and the new roof or wall system.

British Patent No. 2148975 describes one form of a suitable support means in which a bracket element is located in a support member for the membrane by a twist and lock action. This system has the disadvantage, however, that in use the bracket may be caused to rotate and thereby become loose and allow relative movement in the assembly.

Accordingly the present invention provides a wall or roofing sub-structure comprising a membrane carried by a support member, said membrane and said support member being spaced apart from a primary wall or roof structural member, wherein said sub-structure includes a support member having an angled cross section defining a hollow interior and a bracket spacer element means having a first portion in locking engagement with said hollow interior of said support member and a second portion for securing to said primary structural member;

said bracket element being a sheet material having opposed edge portions, an upper face extending between said edge portions and including first and second slots formed in said edge portions and directed inwardly thereof, said slots and said top face defining first and second tongue portions;

said support member including a support head to which said membrane is secured and first and second receiving members in which said first and second tongue members of said bracket are received,

said first portion of said bracket further including an integral anti-rotating element acting between a said receiving member and an internal portion of said support member whereby rotation of the said bracket relative to said support member is prevented.

It is preferred that the upper face of the bracket member is in direct or indirect engagement with the underside of the support head. Indirect engagement will occur if an insulating pad is inserted between the upper face of the bracket and the support head of the support member.

We have found that, when a roof or wall membrane is secured to the head of the support of the bracket/support member assembly by self tapping screw means, the "pull out value" and "resistance to the rotation" of the screw is enhanced if the surface of the support member is ribbed by pressing the ribs into the surface of the member in the direction of screw travel. The improvement in "pull out" value and "resistance to rotation" vary with the difference in pitch and depth of the individual ribs and the thread size of the fixing screw. For maximum effect the screw lead hole should be formed in the bottom of a said rib. The pitch of the rib should not be more than twice the screw thread diameter, preferably not more than 1.5 times the screw thread diameter and most preferably not more than 1.1 times the diameter of the screw thread. In the context of the present invention the pitch of a rib is defined as the distance between the top portions of the two sloping sides of the rib. In order to prevent the distortion of the rib and for ease of drilling action the drill (or the drill end of the fixing screw) used to form the lead hole should preferably have a tip subtending an angle less than the angle between the two sides of a rib.

In one embodiment of the present invention the support member includes a leg element extending downwardly from one edge of said support head substantially normally thereof for the full length of said member; the first said receiving member is integral with the said head and formed at the opposite edge thereof and includes an inwardly directed lip portion to provide a substantially U-shaped member, said second receiving member is formed integrally with the said leg member and includes an upwardly directed portion to provide a second substantially U-shaped member, the axes of said U-shaped members being substantially at right angles;

said first slot in said bracket is formed parallel to the upper face thereof and spaced therefrom to provide said first tongue portion for engagement in said first U-shaped receiving member, and said second slot is formed in said opposite edge and includes an upwardly directed component to provide said second tongue member extending downwardly for engagement in said second U-shaped receiving member.

The anti-rotating element may be in the form of an abutment extending from the end of said second tongue member substantially parallel to said bracket second portion and engaging with the inwardly directed lip member of said first receiving member.

The anti-rotating element may also be formed by bending the top portion of the said first portion of said bracket to form an angled member the top edge of which forms the upper face of said first

portion, a lower edge portion of the said angled member engaging against the lip portion of said first U-shaped receiving member. Alternately it may comprise a first angled member, extending from the upper face of the bracket first portion at one edge thereof and having its free end engaging the lip portion of said first U-shaped receiving member at a point spaced from said first tongue member, and a second angled member extending from the opposite edge of the upper face of said bracket first portion at the other edge thereof and having its free end engaging the base of said second U-shaped receiving member at a point spaced from said second tongue member.

The anti-rotating element may further be formed by "winging back" a part of the edge portion of the bracket to provide an angled member as aforesaid.

Embodiments of the present invention will now be described with reference to the accompanying drawings in which:-

Figure 1 is a part sectional view through a first embodiment of a roof sub-structure of the present invention:

Figure 2 is a cross sectional representation of a support member used in Figure 1,

Figure 3 is a representation of the means of attaching the bracket of Figure 1 to the support member of Figure 2, and

Figure 4 is a representation in part cross section of means of securing a membrane to the support member of Figure 2.

Figure 5 is a part sectional view through a second substructure of the present invention;

Figure 6 is a side view of the embodiment of Figure 5 in the direction A;

Figure 7 is a view of a modified version of the embodiment of Figure 5;

Figure 8 is a view of Figure 7 in the direction B,

Figure 9 is a plan view of the upper portion of bracket 4 in the direction C-C of Figure 7,

Figure 10 is a part sectional view of a third embodiment of the invention,

Figure 11 is a side view of the embodiment of Figure 10 in the direction D,

Figure 12 is a part sectional view of a fourth embodiment of the invention, and

Figure 13 is a side view of the embodiment of Figure 12 in the direction E.

In the drawings the support member and the bracket are each formed from mild steel sheet,

Referring to Figures 1 - 4 of the drawings, Figure 1 illustrates a roof structure comprising a primary structural member 1, and a sub-structure including a support member 2 carrying a roof membrane 3 and a bracket member 4 spacing apart the said support member 2 from the primary structural member 1.

The support member 2, most clearly shown in Figure 2, comprises a support head 21 having a return lip 22 the end portion 23 of which is substantially parallel to support portion 21, to provide a first U-shaped receiving member 55. A downwardly extending leg 24 having a return lip 25, the end portion 26 of which is substantially parallel to leg 24, provides a second U-shaped receiving member 56. Ribs or corrugations 27 are formed lengthwise along the support member, the apices (pitch) being spaced apart by a distance approximately equal to the diameter of the shank 7 of the fixing screw 6 shown in Figure 4.

Spacer bracket 4 consists of a plate 41 having a corrugated face and including parallel elements 42 and 43 extending at right angles from the top and bottom end portions respectively of plate 41. The lower element 43 includes holes 44 whereby the bracket is secured to the primary structural member 1 by suitable fastening means (not shown). Plate 41 has a side member 45 extending between the top and bottom portions thereof and an opposite upper side 46 extending parallel to side 45 to meet a sloping shoulder 47 which meets lower side portion 48 parallel to side 45, whereby the upper portion of the plate is narrower than the lower portion. At the top of shoulder 47 in wall 46 a slot 49 is formed to define with element 42 a first tongue member 40, and to receive end portion 23 of lip return 22 of the support member 2. A slot 50 is formed in wall 45 from which a further slot 51 extends from the back thereof upwardly towards support face 42 and parallel to wall 45 to provide a second tongue member 52. An abutment element 53 extends at right angles from member 52 and is parallel to and in the same sense as element 42. Slot 51 is dimensioned to receive end portion 26 of return lip 25 of support member 2. The positioning and dimensioning of slots 49, 50 and 51 and the length of tongue members 40 and 52 are arranged such that when the bracket 4, primary structural member 1 and support member 2 are in the relative positions shown in Figure 1 and Figure 3B, tongue members 40 and 52 are engaged in mating relationship in U-shaped receiving members 55 and 56 respectively thereby securely locking the upper end of the bracket 4 within support member 2 and preventing rotation of the bracket.

The method of locating bracket 4 in support member 2 is shown by reference to Figure 3. Initially, with wall 45 of bracket 4 parallel to leg 24 of support member 2 and element 42 of bracket 4 loosely engaged in return lip 22 of support member 2 ("A"), bracket 4 is slidingly moved along support member 2 until it reaches its required position and is then brought into an upright position whereby element 42 engages the lower side of corrugations 27 of support head 21, end portion 23 of return lip

22 engages in slot 49 such that the lower edge of tongue 40 and the end portion 23 are in mating contact, element 53 and tongue 52 engage in receiving member 56, element 52 being in contact and return lip 25 thereby securely locating bracket 4 in support member 2, ("B"). Since element 53 is in the base of U-shaped receiving member 56 and in contact with end 25, rotation of bracket 4 relative to support member 2 is not possible.

As previously mentioned bracket 4 is then secured to the support primary structural member 1 by a fastening means, such as a nut and bolt arrangement passing through hole 44 and a corresponding hole formed in member 1. A roofing membrane 3 is secured to support head 21 of member 2 by means of a self tapping screw 6 and washer 8, the screw passing through membrane 3 into a suitably sized hole drilled in support head 21, as illustrated in Figure 4.

Ribbing 27 in support head 21 assists in securely locking the bracket 4 in support member 2, reduces thermal transfer between the membrane and the support member and provides additional stiffening of the section for load bearing. The presence of the ribbing has a further important advantage in that if the pitch of the ribs is as defined above, then improved engagement of the screw, i.e. improved pull out value and resistance to rotation of the screw is obtained.

In this context the expression "support member" includes angle section, channel section and Z-section members, purlins and other forms of beams used to support roof or wall membranes.

The embodiments of Figures 5-9 are the variations of the embodiment of Figures 1-3 and like parts are referenced with like indicia.

In Figures 5 and 6 lip 23 of member 2 has its extreme end portion 23a folded back to provide additional strength and ribs 64 are spaced at 10mm centres, the rib pitch being 6mm to receive self tapping screws having a 5.5mm thread and 4.5mm shank.

Bracket 4 has its uppermost portion folded backwards to provide an outwardly and downwardly angled member 57 the edge 58 of which (forming part of tongue 40) engaging against portion 23a of lip 23 to securely lock the bracket against rotation in member 2. Bracket 4 is pressed such that the lower portion 43, extending outwardly at substantially right angles from the body of the bracket is shaped to provide outwardly sloping side portions 60 and 61 which contain fixing holes 62 and 63 to receive self tapping screws 64. The angle of the sloping side portions 60 and 61 facilitate the application of the fixing means 64 and improves the location of the bracket.

In Figures 7 - 9 bracket 4 is similar to bracket 4 of Figures 5 and 6 except that the upper face 42

is formed with a recess 67 to define shoulders 68 and 69 that engage directly against the lower surface of member 2, ribs 64 contacting the upper surface of recess 67. Additionally a first angled member 65 extends outwardly and downwardly from the top shoulder 68 such that the lower edge portion 70 is in engagement with portion 23a of lip 23 at a point spaced from tongue 40. A second angled member 66 extends from the top of shoulder 69 such that the lower edge 71 is in engagement with lip 25 of receiving member 56 at a point spaced from tongue 52. The presence of members 65 and 66 secures the bracket 4 against rotation within member 2 and assist in supporting bracket 4 in its perpendicular relation to member 2. Members 65 and 66 may be conveniently formed by "winging" back the edge portions of the bracket.

In the embodiment of Figures 10 and 11 support member 100 is in the form of a C-section channel having inwardly directed jaws 101 and 102 and a longitudinally ribbed upper surface 105 to which a membrane (not shown) may be secured, for example by self tapping screws. Spacer bracket 110 is pressed from sheet steel and is provided with T-shaped upper portion defined by head 111 and inwardly directed slots 113 and 114 to provide tongue portions 122 and 123. Shoulders 111a and 111b of head 111 engage jaws 101 and 102 of member 100 and upper face 112 engages the lower portion of ribs 105a extending longitudinally of member 100.

Bracket 110 is pressed to provide a lower portion 115 extending at right angles thereto and having outwardly sloping edge portions 116 and 117 containing fixing holes 119 and 120 through which fixing means 121 may pass to secure the bracket to a roof purlin 118.

Head 111 includes an outwardly and downwardly extending portion 125, formed by bending over the upper portion of head 111, the edge 126 of which engages jaws 101 and 102 of support 100 at a point spaced from shoulders 111a and 111b to lock the bracket 111 against rotation in support 100.

In an alternative form, tongue portions 123 and 124 may be "winged back" to provide two members engaging jaws 101 and 102 respectively in place of member 125.

The Figures 12 and 13 embodiment is a variation of that of Figures 10 and 11 and like parts are identified by like indicia. The support member 200 is again in the form of a C-section channel having side portions 201 and 202 and inwardly directed jaws 203 and 204. Sides 201 and 202 provided with opposed outwardly directed cups 210 and 211, the upper and lower sides of which are defined by jaws 203, 204 and shoulders 212, 213. Head portion 130 of bracket 110 is dimensioned

such that the tongue portions 131, 132 engage in channels 210 and 211, the upper face 133 being spaced from ribs 105a to define a gap 134 which may be filled with insulating material. Head portion 130 includes, extending from upper face 133, an outwardly and downwardly extending member 140 the edge 141 of which engages against jaws 203 and 204 of support 200 at a point spaced from shoulders 111a, 111b thereby preventing rotation of bracket 110 relative to support 200.

Although the ribbing in the illustration has been shown as being formed lengthwise of the support member it could be formed transversely or diagonally to the length of the member or in a cross-hatch formation with equal effect.

Figure 1 of the drawings also shows the presence of a liner membrane 9 positioned between the primary structural member 1 and the bracket 4. If such a membrane is used then a cavity is created between membranes 3 and 9 which may, if desired, be filled with an insulating material. The membrane 9 may comprise the original roofing or wall cladding of the building.

The invention may, of course, be applied to the installation of roofs or walls in new buildings and although it has been described with reference to the positioning of an outer membrane on a primary structural member of a building, it could, of course, also be applied to supporting an inner wall membrane.

Claims

1. A wall or roofing sub-structure comprises a membrane (3) carried by a support member (2, 100, 200) said membrane (3) and said support member being spaced apart from a primary wall or roof structural member (1), wherein said sub-structure includes a support member (2, 100, 200) having an angled cross section defining a hollow interior and a bracket spacer element (4, 110) means having a first portion (111, 130) in locking engagement with said hollow interior of said support member and a second portion (43, 115) for securing to said primary structural member (1);

said bracket element (4, 110) being formed of a sheet material having opposed edge portions (45, 46); and an upper face (42, 112, 133) extending between said edge portions, said edge portions including first and second slots (49, 50; 113, 114), directed inwardly thereof, said slots and said upper face and/or said edge portions defining first and second tongue portions (40, 52; 122, 123; 131, 132);

said support member (2, 100, 200) having a support head (21, 112, 133) to which said

membrane (2) is secured and first and second receiving members (55, 56; 210, 211) in which said first and second tongue members (40, 52; 123; 131, 132) of said bracket (4, 110) are received.

said first portion of said bracket further including an integral anti-rotating element (53, 57, 65, 66, 125, 140) acting between a said receiving member (55, 56; 210, 211) and an internal portion of said support member whereby rotation of the said bracket (4, 110) relative to said support member (2, 100, 200) is prevented.

2. An assembly according to claim 1 wherein said upper face (42, 112, 137) of said bracket (4, 110) is in direct or indirect engagement with the support head (21, 112, 133) of the said support member (2, 100, 200).

3. A structure according to claim 1 or claim 2 wherein the support member (2, 100, 200) includes a leg element (24) extending downwardly from one edge of said support head (21) substantially normally thereof for the full length of said member; the first said receiving member (55) being located at the opposite edge of said support head (21), is integral with the said head and including an inwardly directed lip (23) portion substantially parallel to the support head (21) to define a substantially U-shaped receiving member (55), said second receiving member (56) being located at the end of said leg element (24) and includes an upwardly directed portion (26) to provide a second substantially U-shaped receiving member (56), the axes of said U-shaped receiving members (55, 56) being substantially at right angles,

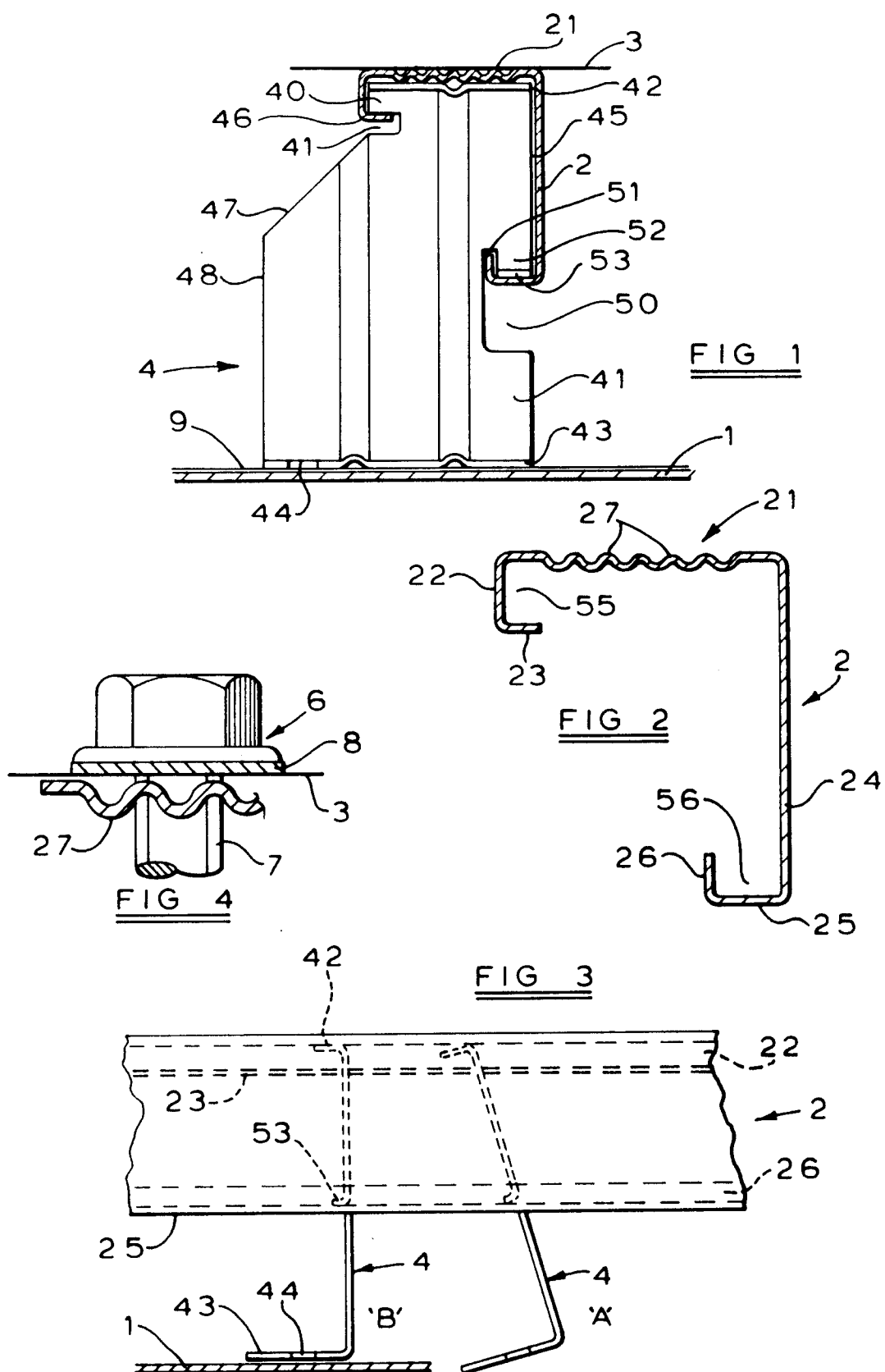
said first slot (49) in said bracket (4) being substantially parallel to the upper face (21) thereof and spaced therefrom to provide said first tongue portion (40) for engagement in said first U-shaped receiving member (55), and said second slot (50) including an upwardly directed component (51) substantially parallel to the edge (45) to provide a second tongue member (52) extending downwardly for engagement in said second U-shaped receiving member (56).

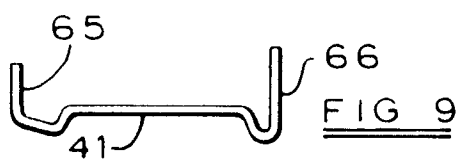
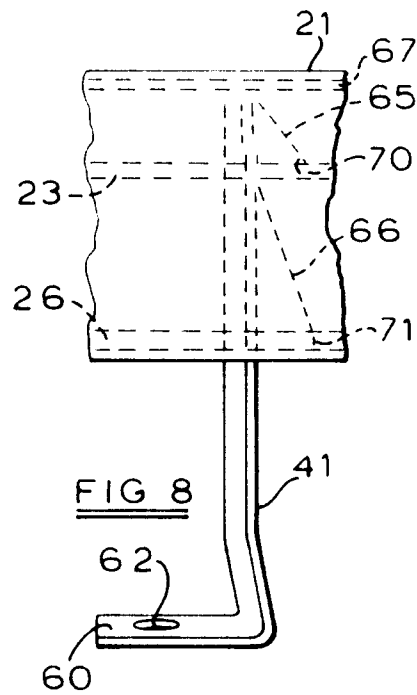
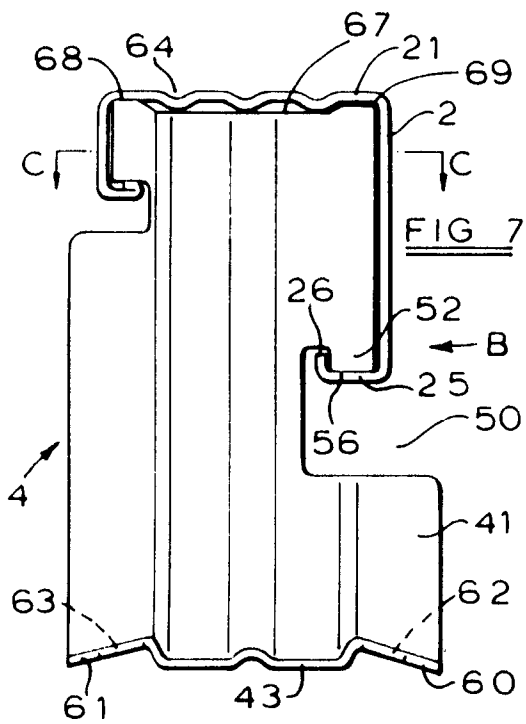
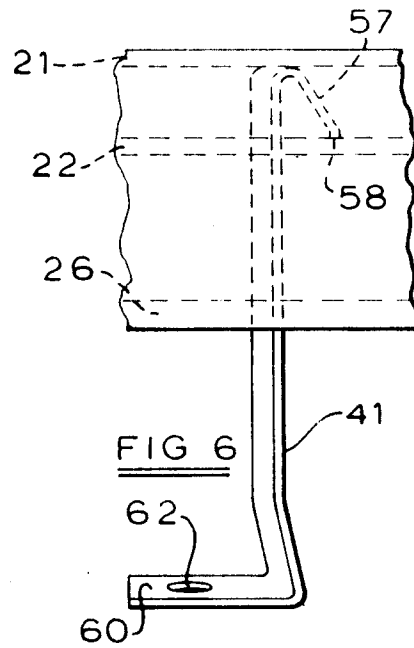
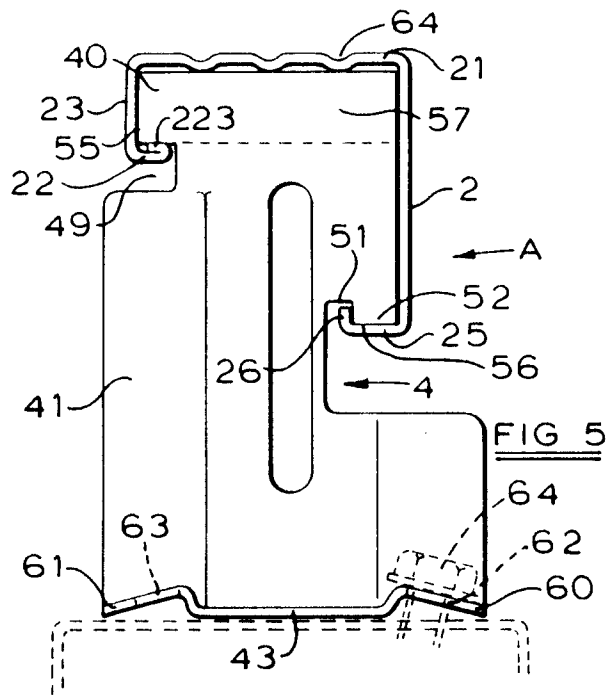
4. A structure according to claim 3 wherein said anti-rotating element comprises an abutment (53) extending from the end of said second tongue member (52) substantially parallel to said bracket second portion (43) and engaging with the inwardly directed lip member (25) of said first receiving member (55).

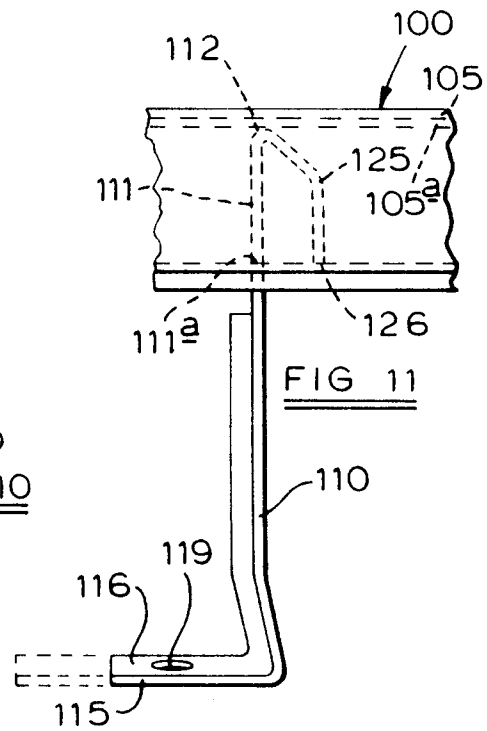
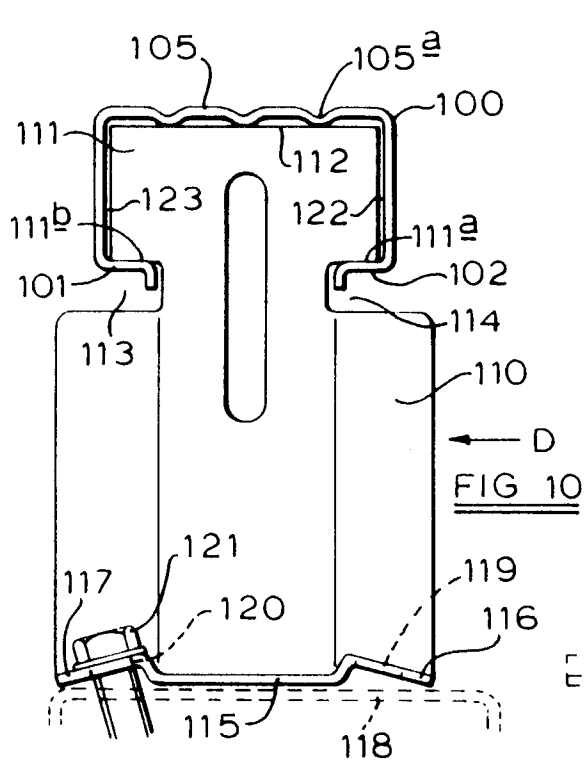
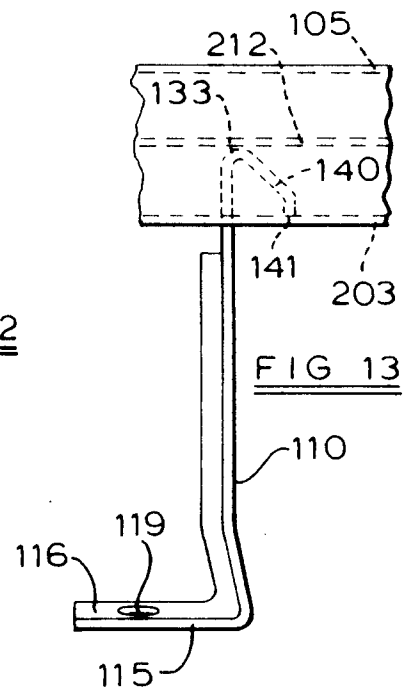
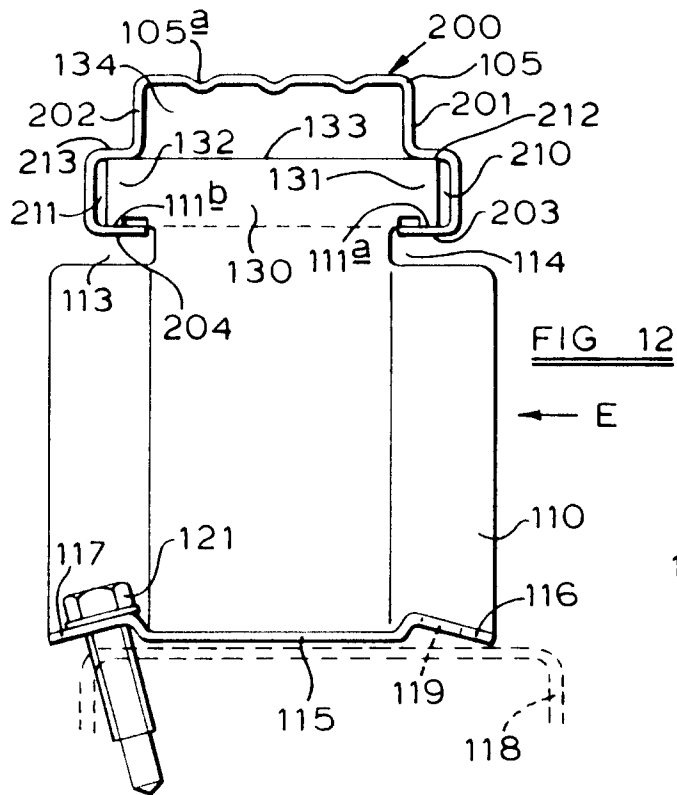
5. A substructure according to claim 3 wherein said anti-rotation element comprises an angled member (57) extending from the top (42) and having a lower edge portion (58) of the said angled member engaging against the lip portion (23) of said first U-shaped receiving member (55). 5
6. A substructure according to claim 3 wherein said anti-rotation element comprises a first angled member (65) extending from the upper face (42) of the bracket first portion at one edge thereof and having its free end (70) engaging the lip portion (23) of said first U-shaped receiving member (55) at a point spaced from said first tongue member (40), and a second angled member (66) extending from the opposite edge of the upper face (42) of said bracket first portion at the opposite edge thereof and having its free end (71) engaging the base (25) of said second U-shaped receiving cup (52) at a point spaced from said second tongue member (52). 10
15
20
7. A sub-structure according to claims 1 or 2 wherein said first and second inwardly directed slots (113, 114) are formed along a line parallel to said upper face (112, 133) and spaced therefrom to provide outwardly extending first and second tongue members (131, 132); 25
30
said support member (100) comprising an open channel with inwardly directed lip members (101, 102) said first and second receiving members being defined by said support head (112) and said inwardly directed lip members (101, 102). 35
8. A sub-structure according to claim 7 wherein said anti-rotation element comprises an angled member (125) or members the lower edge (126), or edges engaging against said lip portions (101, 102) of said first and second U-shaped receiving members at points spaced from the first and second tongue members (122, 123). 40
45
9. A sub-structure assembly according to claims 7 or 8 wherein the upper face (112) of said first portion of said bracket (110) directly or indirectly engages the lower surface of said support head (105). 50
10. A sub-structure assembly according to claim 1 or claim 2 wherein said first and second inwardly directed slots (113, 114) are formed along a line parallel to said upper face (133) of said bracket (110) first portion to provide first and second tongue members (131, 132), 55

said support member (200) comprises a channel section member provided with outwardly directed U-shaped receiving cups (210, 211) formed at the ends of the channel arms (201, 202) extending from said support head (105), the ends of said arms extending inwardly to form first and second lips (203, 204) defining the lower edges of said first and second receiving cups (210, 211).

11. A sub-structure assembly according to any one of the preceeding claims wherein the support member (2, 100, 200) support head (21, 105) is ribbed, the pitch of the said ribs (27, 64, 105) being less than twice the diameter of the thread of a screw thread fixing means used to secure the membrane (3) thereto.
12. A sub-structure assembly according to claim 11 wherein the pitch of the ribs (27, 64, 105a) is less than 1.5 times the diameter of the said thread.
13. A substructure according to claim 12 wherein the pitch of the rib (27, 64, 105a) is not greater than 1.1 times the diameter of the screw thread.









European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 2313

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y, D A	GB-A-2 148 975 (CAREY) * the whole document * ---	1, 2, 7, 9 3	E04D3/36 E04F13/08 E04B7/00
Y A	FR-A-1 312 360 (ARNAU) * page 2, column 1, paragraph 2; figures 6, 7 * -----	1, 2, 7, 9 4, 8	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E04D E04B E04F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11 NOVEMBER 1991	Examiner HENDRICKX X.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document F : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application I : document cited for other reasons & : member of the same patent family, corresponding document			