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(71) Applicant: **Metsec PLC**
Oldbury, West Midlands B69 4HE (GB)

(72) Inventor: **Burns, Roy J.**
Rugeley, Staffordshire, WS15 4RS (GB)

(74) Representative:
Carpenter, David et al
MARKS & CLERK,
Alpha Tower,
Suffolk Street Queensway
Birmingham B1 1TT (GB)

(54) Structural systems

(57) A bar and bracket assembly for a roof or wall construction, wherein the bar (11) is in the form of a re-entrant channel-section having integral flanges (15, 16) extending inwardly from each side wall (13, 14) of the channel, and the or each bracket (21) has cut-outs (29) in its opposite edges respectively to receive said flanges (15, 16), the assembly being characterised in that said flanges (15, 16) are bent, adjacent their inner edges, to define integral webs (17, 18) extending generally parallel to one another in a direction away from the base wall (12) of the channel, said cut-outs (29) in the or each bracket (21) being dimensioned to accommodate said webs (17, 18).

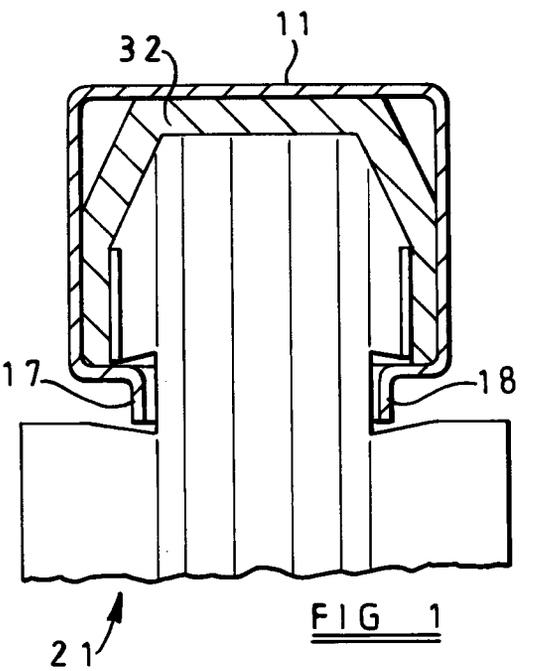

FIG 1

EP 0 882 852 A2

Description

Background of the Invention

This invention relates to a bar and bracket assembly for use in a wall or roof construction for a building, particularly, but not exclusively, a steel framed building.

Prior Art

It is known to secure roof and/or wall cladding sheets to channel-section supporting bars which extend transverse to roof purlins or wall cross-members and are secured thereto through the intermediary of a plurality of brackets spaced along the length of the supporting bar. The brackets provide an air gap (usually filled with insulation) between the outer cladding, and a roof or wall membrane supported directly on the roof purlins or wall cross-members. Such arrangements find use particularly where a new roof or wall cladding is to be put in place over an existing roof or wall cladding, the existing roof or wall cladding constituting the aforesaid membrane. It is also known for the supporting bar to be in the form of a re-entrant channel, the two side walls of the channel terminating in inwardly directed flanges partially closing the open face of the channel. British Patent No 2148975 shows such a construction and also discloses that the elongate brackets are engaged with the supporting bar by introducing a head end of the bracket into the open face of the channel, and then rotating the bracket relative to the channel about an axis extending longitudinally of the bracket to engage the flanges of the re-entrant channel in cut-outs at opposite sides respectively of the width of the bracket.

In use wind loading on the cladding can tend to lift the cladding away from the building structure thus tending to pull the supporting bar off the brackets. It is found that constructions of the kind disclosed in British Patent No 2148975, while readily accommodating wind loading pressing the cladding towards the building structure, are frequently deficient when subjected to wind loading attempting to lift a cladding away from the building structure. In order to accommodate this deficiency it is often necessary to either increase the gauge of the material used to form the channel member, or to utilise more brackets, more closely spaced, or both. It is an object of the present invention to provide a bar and bracket arrangement where the aforementioned problems are minimised.

Summary of the Invention

In accordance with the present invention there is provided a bar and bracket assembly for a roof or wall construction, wherein the bar is in the form of a re-entrant channel-section having integral flanges extending inwardly from each side wall of the channel, the or each bracket has cut-outs in its opposite edges respectively to receive said flanges, and, said flanges are bent, adjacent their inner edges, to define integral webs extending generally parallel to one another in a direction away from the base wall of the channel, said cut-outs in the or each bracket being dimensioned to accommodate said webs.

Preferably said cut-outs of each bracket divide each bracket into a head region which is received within the respective channel-section bar in use, and a body region which spaces the bar from the structural member to which the bracket is secured in use, said head being fitted with a synthetic resin cap providing a thermal break between the material of the bar and the material of the bracket. Preferably the head and its cap are so dimensioned in relation to the channel-section of the bar that there is interference between the cap and the interior of the bar when the bracket is rotated about a longitudinal axis to lock the bracket into the bar, said interference preventing rotation of the bracket relative to the bar beyond the locked position, and resisting return rotation.

Preferably said flanges of said bar extend at right angles to the length of the bracket in use, and the wall of each cut-out of the bracket which lies adjacent the inner surface of the flange is inclined so that the bracket makes contact with each flange adjacent the root of the flange.

Preferably the width of each cut-out in the bracket is such that any deflection of the flanges which occurs if an attempt is made to withdraw the bracket from the bar brings the free edge of the web of each flange into abutting engagement with the wall of the cut-out.

Preferably each bracket is formed from strip material and is corrugated longitudinally to provide strengthening formations.

Conveniently opposite side walls and/or the base wall of the channel-section bar have longitudinally extending regions with have been deformed to improve their stress loading characteristics.

Brief Description of the Drawings

One example of the invention is illustrated in the accompanying drawing, wherein:-

Figure 1 is a diagrammatic cross-sectional view of a bar and bracket assembly,

Figure 2 is a transverse cross-sectional view of the channel-section bar of the assembly of Figure 1,

Figure 3 is a front elevational view, partly in section, of part of a bracket of the assembly of Figure 1,

Figure 4 is a front elevational view of the bracket of Figure 3 with its cap removed,

Figures 5, 6 and 7 are cross-sectional views on the

lines 5-5, 6-6 and 7-7 respectively in Figure 4, and

Figure 8 is a transverse cross-sectional view of the cap illustrated in Figure 3, taken along the line 8-8 in Figure 3.

Detailed Description of the Preferred Embodiment

Referring to the drawings, the bar 11 of the bar and bracket assembly is an elongate channel-section member formed from cold-rolled mild-steel strip and comprises a base wall 12, and first and second opposite, parallel side walls 13, 14 extending at right angles to the base wall 12, each of the side walls 13, 14 terminating, at its end remote from the base wall 12, in an integral, inturned flange 15, 16, the flanges 15, 16 partially closing the open wall of the channel-section. The flanges 15, 16 extend parallel to the base wall 12 and at its inner end each of the flanges terminates in an integral, outwardly extending web 17, 18 the webs 17, 18 lying parallel to one another and parallel to the side walls 13, 14. The transverse cross-section of the bar 11 is illustrated in Figure 2, and it will be recognised that this cross-section is consistent throughout the whole of the length of the bar 11.

In order to improve the stress capability of the bar, that is to say the load at which the structural failure of the bar in a direction transverse to its length, occurs, by comparison with a bar formed from plane strip, the base 12 and/or the side walls 13, 14 are formed with regions extending throughout the length of the bar, and terminating short of the longitudinal edges of the base 12 and/or side walls 13, 14 which have been deformed in the manner described in our co-pending International Patent Application No PCT/GB96/01365 the whole disclosure of which is imported herein by this reference. It is to be understood however that other forms of rigidising deformation of such regions of the base and/or side walls could be utilised to improve the stress characteristics of the bar if desired.

Each bar is intended to be utilised with a plurality of identical brackets one of which is illustrated at 21 in the drawings. Each bracket 21 is formed from a length of plane mild-steel strip which has been pressed or stamped to provide the transverse cross-section illustrated in Figure 7 throughout its length. As is apparent from Figure 7 each bracket has a pair of planar marginal regions 22 at opposite lateral edges, the planes of the regions 22 being inclined with respect to one another at an included angle of around 160°. The longitudinally extending central region of the bracket is of M-shaped cross-section comprising first and second parallel, longitudinally extending ribs 23 defining between them a generally V-shaped groove 24 along the centre-line of the bracket. The height of the ribs 23 is such that the free longitudinal edges of the regions 22 and the tops of the ribs 23 are co-planar.

Each bracket is formed with a head region 25 at one end and a foot region 26 at the opposite end. Within the foot region 26 an end portion of the strip is bent to form a foot 27 lying at right angles to the length of the bracket and having the inclined marginal regions 22 extending downwardly as illustrated in Figure 4, so that the free edges of the regions 22 of the foot, together with the tops of the ribs 23 define co-planar seating points when the foot is secured to a planar member such as a purlin in use. The regions 22 of the foot are formed, midway along the length of the foot, with apertures for receiving fixing screws for securing the bracket to a purlin, cross-member or the like. Moreover, between the foot 27 and the main, leg portion of the bracket there is an inclined heel region 28 extending at an obtuse angle to the remainder of the length of the bracket and thus at an acute angle to the foot 27. The effect of the heel region 28 is to move the fixing holes in the foot 27 as close as possible to the line of the remainder of the bracket and to minimise offset loadings in the assembly in use.

In the head region 25 of the bracket the cold-rolled strip is slotted transversely to provide respective cut-outs 29 in the opposite marginal regions 22. The cut-outs 29 extend across almost the full width of the regions 22 terminating adjacent the commencement of the ribs 23, the cut-outs being of re-entrant dove-tail form adjacent the ribs 23. In the head region 25, and commencing at the free end, the regions 22 are cut-off obliquely, and the remaining portions of the regions 22 are bent at right angles, along longitudinally extending lines, to define first and second arms 31 at right angles to the plane in which the free edges of the regions 22 and the tops of the ribs 23 are co-planar.

A moulded synthetic resin cap 32 (Figure 8) of generally H-shaped transverse cross-section is engaged over the head region 25 of each bracket, each cap 32 having an internal recess shaped to receive the ribs 23 and arms 31 of the bracket. It can be seen from Figure 8 that the lower outer corner 33a of one limb of the H-section cap, and the upper outer corner 34a of the opposite limb of the cap are cut away at 45° to the length of their respective limbs to facilitate rotation of the cap within the channel-section of a bar in use. Moreover, the minimum width of each cut-out 29 (measured in the direction of the length of the bracket) is slightly greater than the width of each web 17 of the respective bar 11.

In use a bracket, equipped with a cap 32 is assembled with its respective bar in the following manner. The bracket 31 is orientated relative to the bar 11 such that the width of the bracket is parallel to the length of the bar and the head region 25 of the bracket, carrying the respective cap 32 is introduced between the webs 17, 18 of the bar and is inserted until the free end of the cap 32 abuts the inner face of the base wall 12 of the bar 11. Thereafter the bracket is rotated about its longitudinal centre line relative to the bar 11 so that the flanges 15, 16 with their integral webs 17, 18 enter the cut-outs 29 beneath the cap 32, and the outer faces of the opposite

limbs of the H-section cap 32 abut the inner surface of the side walls 13, 14 of the bar 11. The dimensions of the cap 32 within the bar 11 are such that the cap 32 binds against the inner surfaces of the side walls 13, 14 during such rotation, the cut away corners 33a, 34a of the cap 32, distortion of the cap 32, and slight outward flexure of the side walls 13, 14 facilitating rotation of the brackets to the point at which its plane is transverse to the length of the bar. Rotation beyond this point is resisted, it being noted that the opposite corners of the H-section cap have not been cut away so as to constitute abutments resisting rotation of the bracket and cap beyond the 'locked' position in which the opposite faces 33, 34 of the cap abut the inner faces of the side walls 13, 14.

In use the foot 27 of each bracket will be secured by screws extending through the regions 22 of the foot, at right angles to the regions 22 and thus extending obliquely into, for example, the purlin or cross-member of the structure to which the bar and bracket assembly is to be secured. It will be recognised that prior to affixing the securing screws through the foot 27, the bracket, already assembled to the respective bar 11 as described above, can, if necessary be slid longitudinally of the bar to adjust the position of the bracket. Subsequently, cladding sheets will be secured by self-tapping screws to the base wall 12 of the bar 11 and it will be recognised that in use wind loading attempting to force the cladding towards the purlin or cross-member to which the brackets are secured will be accepted by abutment of the inner surface of the base wall 12 of the bar 11 with the cap 32, and the loading will be transmitted through the length of the bracket to the purlin or cross-member. The weakest point of the bracket is of course the neck defined by the cut-outs 29 between the main region and the head region of the bracket. However, it will be noted that the ribs 23 extend continuously through the neck region and so maintain the stiffening and/or strengthening of the bracket in this region thus resisting buckling of the bracket under the imposition of such loading.

It should be recognised also that wind loading can impose loads tending to lift the cladding away from the purlin or cross-member and such loads are resisted by the screws securing the cladding to the bar 11, the screws securing the brackets to the purlin or cross-member, and the flanges 17, 18 located in the cut-outs 29 of the bracket. The dove-tail nature of the cut-outs 29 is of importance in relation to such loading. It will be recognised that the primary point of contact between the head region 25 of each bracket and its respective bar 11, is the lower surfaces of the arms 31 which of course extend longitudinally of the bar 11, and engage, in line contact, with the inner surfaces of the flanges 15, 16 adjacent their point of connection with the side walls 13, 14 respectively. Thus, firstly, because loading is applied to the flanges 15, 16 adjacent their points of connection with the side walls 13, 14 there is little tendency for flexure of the flanges 15, 16 as a result of such loading. Secondly, such flexure as occurs is resisted by the strengthening effect provided by the continuous webs 17, 18 at the free ends of the flanges 15, 16, and by abutment of the free edges of the webs 17, 18 with the opposite edges of the cut-outs 29. Thus there is a physical locking action which minimises flexure of the flanges 15, 16 and so resisting the tendency for the head region 25 to be pulled out of the channel-section bar. The resistance to bending in the neck of each bracket as mentioned above is of importance because such "pull-out" loads are applied by way of the arms 31 and are thus applied offset from the length of the bracket.

The screw connections of the cladding to the bar and the brackets to the purlin or cross-member are designed to accommodate predetermined maximum wind loadings. However, the introduction of self-tapping screws into the deformed region of the base wall 12 is beneficial in this respect as it is found to improve the pull-out resistance of the screw, by comparison with an equivalent screw engaged with plane mild-steel strip of the same gauge.

It will be recognised that where appropriate the brackets and/or the bars 11 can be formed from galvanised mild-steel, or can be formed by mild-steel which is subsequently treated with paint or other anti-corrosion coatings.

It is anticipated that for given operating conditions and bracket spacing the arrangement described above can utilise thinner gauge material in the bar construction than is needed in known arrangements.

Claims

1. A bar and bracket assembly for a roof or wall construction, wherein the bar (11) is in the form of a re-entrant channel-section having integral flanges (15, 16) extending inwardly from each side wall (13, 14) of the channel, and the or each bracket (21) has cut-outs (29) in its opposite edges respectively to receive said flanges (15, 16), the assembly being characterised in that said flanges (15, 16) are bent, adjacent their inner edges, to define integral webs (17, 18) extending generally parallel to one another in a direction away from the base wall (12) of the channel, said cut-outs (29) in the or each bracket (21) being dimensioned to accommodate said webs (17, 18).

2. An assembly as claimed in claim 1 characterised in that said cut-outs (29) of each bracket (21) divide each bracket into a head region (25) which is received within the respective channel-section bar (11) in use, and a body region (26) which spaces the bar from the structural member to which the bracket is secured in use, said head region being fitted with a synthetic resin cap (32) providing a

thermal break between the material of the bar (11) and the material of the bracket (21).

3. An assembly as claimed in claim 2 characterised in that the head region (25) and its cap (32) are so dimensioned in relation to the channel-section of the bar that there is interference between the cap and the interior of the bar when the bracket is rotated about a longitudinal axis to lock the bracket into the bar, said interference preventing rotation of the bracket relative to the bar beyond the locked position, and resisting return rotation.

4. An assembly as claimed in any one of the preceding claims characterised in that said flanges (15 ,16) of said bar extend at right angles to the length of the bracket in use, and the wall of each cut-out (29) of the bracket which lies adjacent the inner surface of the flange is inclined so that the bracket makes contact with each flange adjacent the root of the flange.

5. An assembly as claimed in any one of the preceding claims characterised in that the width of each cut-out (29) in the bracket is such that any deflection of the flanges (15, 16) which occurs if an attempt is made to withdraw the bracket from the bar brings the free edge of the web (17, 18) of each flange into abutting engagement with the wall of the cut-out.

6. An assembly as claimed in any one of the preceding claims characterised in that each bracket is formed from strip material and is corrugated longitudinally to provide strengthening formations.

7. An assembly as claimed in any one of the preceding claims characterised in that opposite side walls and/or the base wall of the channel-section bar have longitudinally extending regions with have been deformed to improve their stress loading characteristics.

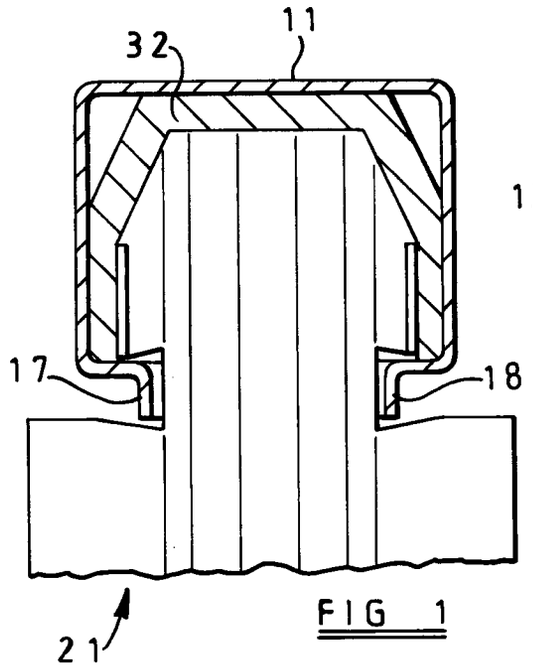

FIG 1

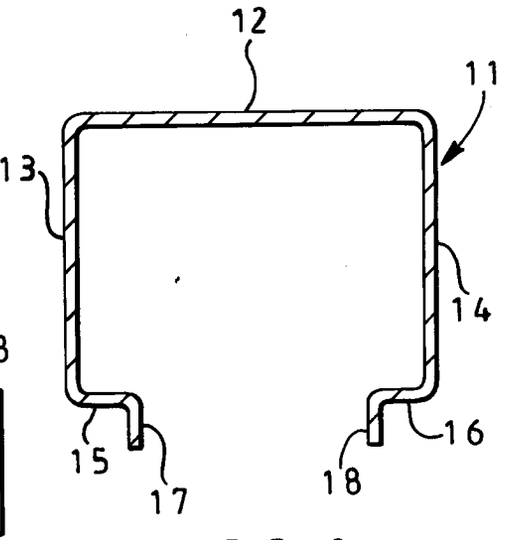

FIG 2

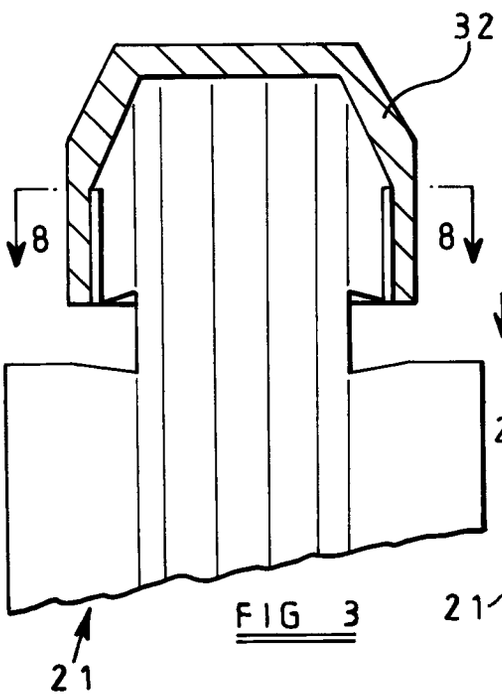

FIG 3

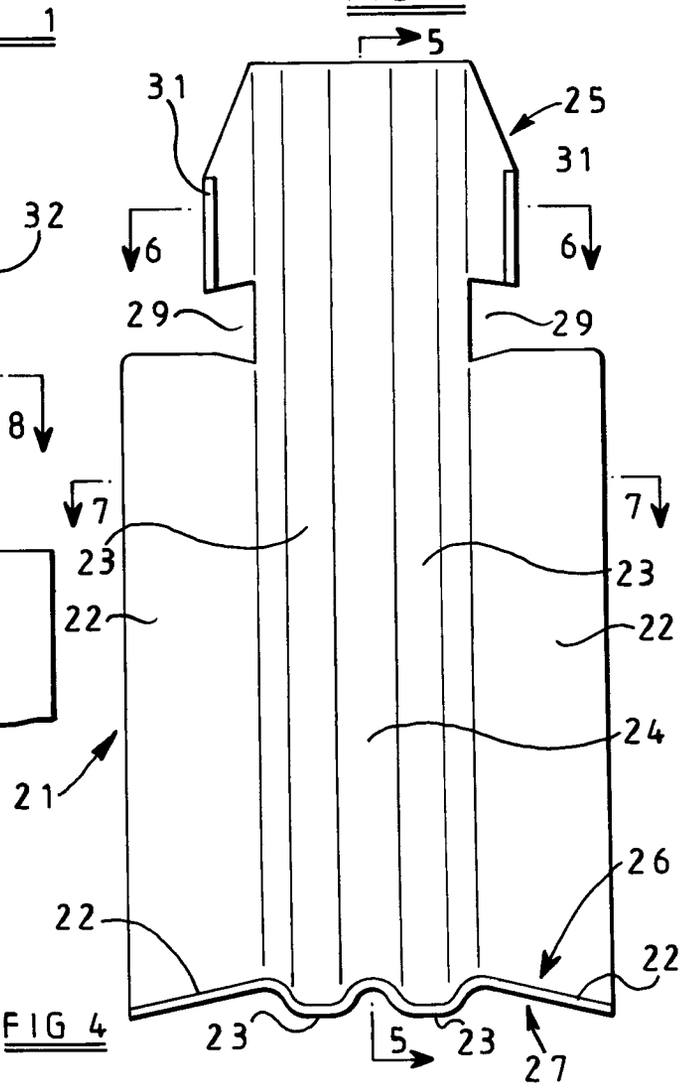

FIG 4

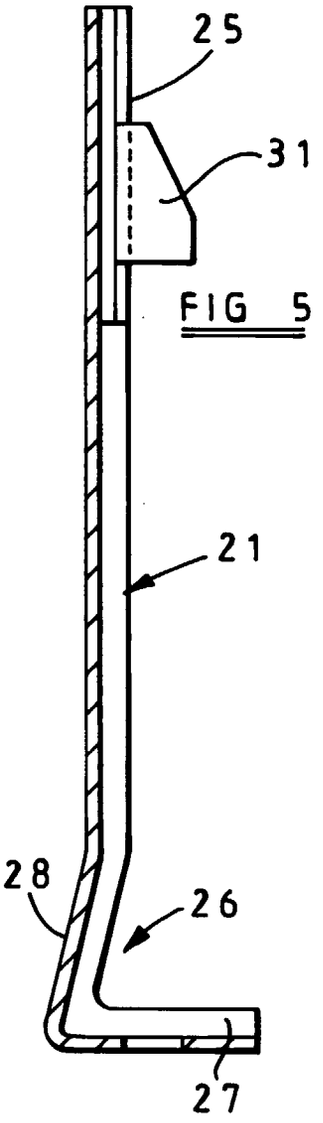

FIG 5

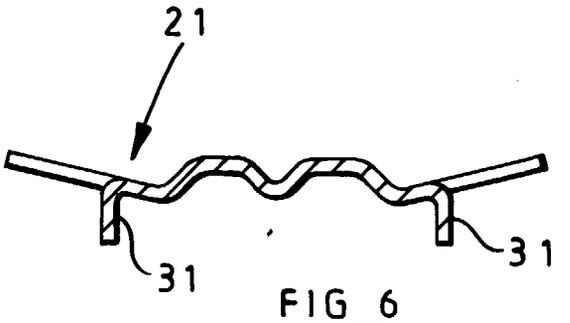

FIG 6

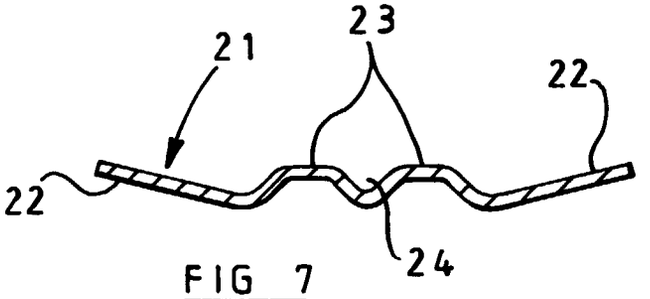

FIG 7

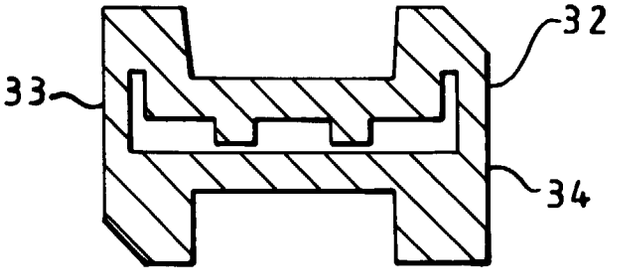

FIG 8