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(71) Applicant: **Wilson, Anthony**
29 Grove Road
Weston-super-Mare Avon(GB)

(72) Inventor: **Wilson, Anthony**
29 Grove Road
Weston-super-Mare Avon(GB)

(74) Representative: **Stuart, Ian Alexander et al,**
MEWBURN ELLIS & CO. 2/3 Cursitor Street
London EC4A 1BQ(GB)

(54) Elongate building element.

(57) An element (110), e.g. for a window frame has a load-bearing member (12) (e.g. of aluminium) which provides a flange (20); and a cladding member (14) of thin-walled, flexible plastics whose flexibility allows it to snap-engage with the flange (20) (by means of formations (22;40) and (32,34;48,50) to define a channel (16). This channel (16) has a filling (18) which resists flexing of the cladding member (14). The filling (18) is preferably a solid foam produced by expansion of a composition (400) within the cavity (16), the cladding member being supported during the expansion to prevent distortion. Thus the members (12,14) may be partially (22;40) engaged and receive the foam composition (400) within the cladding member (14), then pass through a gap (409) between the conveyors (408,410) which squeeze the assembly to effect the snap-engagement and to provide the support.

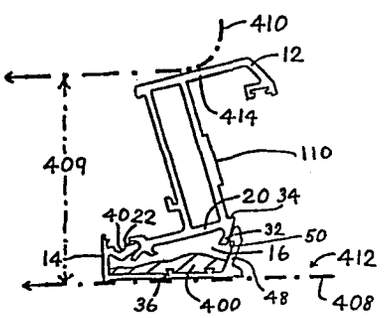

Fig 9

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ELONGATE BUILDING ELEMENT

The present invention relates to an elongate building element, and particularly to such an element which provides thermal insulation and is intended for use as a structural member of a window or door assembly.

A known type of building element is an assembly of two or more elongate members arranged to define an elongate cavity which is filled with a plastics foam material. For example, GB 2082234B discloses an elongate building element formed from an aluminium member and a plastics member. Each of these members has connecting means by which they are loosely engageable to define a cavity. This is filled with plastics foam, which expands so that it contacts all of the connecting means and locks the members together. The aluminium member provides the main mechanical strength of the element. The plastics member also needs to be quite robust and is therefore made from relatively thick-walled plastics. This makes it quite expensive to produce and also rather bulky. The thickness of the plastics walls means that they undergo significant thermal expansion and contraction. This tends to lead to delamination of the foam, which may lead to problems, particularly since the construction relies on the foam to clamp the members together.

According to the present invention there is provided an elongate building element comprising at least one

elongate load-bearing member (preferably an aluminium extrusion), and at least one elongate thin-walled plastics member, the members having complementary formations such that they are engageable together to define a cavity; and there being a filling material within the cavity.

Preferably the members are positively engageable to define a said cavity, suitably being snap-engageable together. The filling material serves as a packing, to resist deformation of the thin-walled plastics member(s).

Preferably the chamber is defined by a single load-bearing member and a single plastics member. The members may be engageable after resilient deformation of the (or at least one) plastics member, which may remain resiliently stressed in the engaged state. The complementary formations may include a tongue on one member engageable in a groove of the other, the members then being mutually pivotable to snap-engage detent means to define the cavity. The plastics member may be sufficiently flexible to allow different longitudinal regions to be in different stages of engagement.

In another aspect the invention provides a method of producing such an elongate building element which includes mutually engaging the load-bearing and plastics members, and providing a settable fluent material in the cavity and causing or allowing it to set. Preferably the material expands on setting. Preferably the plastics element is supported so as not to be deformed by the material. The

members may be engaged by bringing them laterally adjacent one another and deforming the plastics member. They may be engaged gradually along their lengths, the plastics member being twisted (during the operation) to permit this. Thus successive regions of the members may be engaged and the cavity may be filled as it is formed via a filling nozzle which moves relative to the members so as to be at or adjacent the region where engagement is occurring. Alternatively, the settable material may be passed into the fully-formed cavity. Although an expandable material such as a plastics foam is preferred, other types of composition could be used.

In a third aspect the invention provides apparatus for use in manufacturing a building element of the above type.

In a further aspect the invention provides a window or door assembly whereof at least the frame comprises building elements according to the first embodiment.

Some embodiments of the invention will now be described in greater detail with reference to the accompanying drawings in which:

Fig. 1 is a partial view of a transverse section through a window frame element which is a building element embodying the present invention;

Figs. 2 and 3 are views on a smaller scale showing the production of an element embodying the invention;

Figs. 4 and 5 are views showing further embodiments;

Fig. 6 is a schematic plan view of apparatus for use

in manufacturing building elements;

Fig. 7 is a schematic vertical section on line VII-VII in Fig. 6; and

Figs. 8 and 9 are views showing a building element being produced by means of the apparatus of Figs. 6 and 7.

The window frame element 10 shown in Fig. 1 consists of: a main member 12 of extruded aluminium; a cladding member 14 of thin plastics material (e.g. PVC), the two members 12,14 defining a cavity 16; and a solidified foam material 18 (e.g. polyurethane) which fills the cavity 16.

The main member 12 provides the mechanical strength of the element 10, and has a form dictated by its intended use. (Three examples are described later with reference to Figs. 3-5. Although in each of these the member 12 incorporates a box section, this is not essential.) At one side the member 12 has a flange 20 which defines one side of the cavity 16. This flange 20 has at one edge a formation defining a groove 22 having a rounded base 24, an angled wall 26 on the cavity side, and an upright wall 28 on the other side. A further angled wall portion 30 extends into the cavity 16 at an obtuse angle to the wall 26 and adjacent to it. The flange's other edge has a formation with an angled edge 32 providing a detent surface 34 facing away from the cavity.

The cladding member 14 is generally channel shaped, having a base 36 and two edge portions 38,48. The upper edge portion 38 (as drawn) has a downwardly projecting flange 40. The outer portion of this has an angled portion

42 for overlying the wall 26, terminating in a rounded bead 44 which fits snugly within the base 24 of the groove 22. There is a gap 46 between the portion 42 and the upright wall 28 of the groove, so that the member 14 can pivot clockwise relative to the main member 12.

The lower edge portion 48 is angled to correspond to the angled edge 32 of the main member 12, and terminates with a protrusion providing a detent surface 50 complementary to surface 36, and a ramp surface 52 parallel to the portion 48. The base 36 of the cladding member may have dovetail (or other) formations 54 which, like the wall portion 30 of the main member, serve to key to the foam material 18.

Figs. 2 and 3 show how a frame element 110 (including the structure of Fig. 1) may be assembled. First the groove 22 of the main member is offered up to flange 40 of the cladding member 14, angled so that the lower edge portions (32,34;48,50) do not clash. The main member 12 is then pivoted anti-clockwise about the bead 44 of the flange 40. The angled edge 32 slides over the ramp surface 52, and the plastics member 14 flexes and allows the detent surfaces 34,50 to snap into engagement. The members 12,14 are then locked together in a fixed configuration, urged by the resilience of member 14, with pairs of complementary angled surfaces (26,42 and 32,48) lying flush.

The cladding member 14 is then supported over at least a part of its external surface (preferably including at

least most of the outer face of the base 36) and a polyurethane foam composition is injected into the cavity 16. A preferred composition expands somewhat on setting, which occurs in about 15 seconds. Were the cladding member 14 not supported, it would be much distorted by the expanding foam, and might even break free from the main member 12. Once the foam has set, the support is no longer required, the element 10 having a stable shape. However, the inherent slight resilience of the foam 18 and the flexibility of the plastics member 14 give it a certain compressibility. This means that in the installation of such elements 10, quite high tolerances can be accepted.

If the upper region (referring to the orientation shown in Fig. 1) is handled violently (as may happen during installation of glass) there is a risk that the upper portion of the plastics member 14 will be bent away from the main member 12, the foam 18 being damaged in the process. To prevent this an extension 26' of the angled wall 26 may be provided as shown in phantom in Fig. 1. This extends partially along the flange 40 of the cladding member 14, to reinforce it sufficiently to inhibit such accidental bending away, without interfering with the process of assembling the element 10 (described later). The connection of the members 12,14 by the complementary formations (22,40 and 32,34,48,50) is reinforced by the keying of the foam 18 to the wall portion 30 and the dovetails 54.

The cladding member 14 is suitably made of extruded

PVC, with a general wall thickness of about 1mm. This is very cheap and easy to produce. Thus it is economically feasible to produce a wide range of different extrusions 14 with different surface finishes, so that an element based on a standard aluminium member 12 can be given a desired appearance.

The thin plastics cladding undergoes negligible thermal expansion in the thickness direction, and so delamination is most unlikely. It is further inhibited by the keying. In any case it should not be a serious problem, since the element does not rely on the foam to hold it together.

The flexibility of the member 14 allows it to be connected to the main member 12 as described. Indeed, this connection can be effected gradually along its length by twisting it torsionally, and "zipping it up" along its length, possibly injecting foam as the "zipping" progresses (supporting the element in the region of injection and setting). Since neither mode requires the members to be longitudinally displaced, it is practicable to handle considerable lengths, or even to combine extrusions continuously as they are formed.

Figs. 2 and 3 show a lower sill element 110 which has cladding 14 on the interior side. Fig. 5 shows a similar element 310 with exterior cladding. Fig. 4 shows a similar element 210 with both interior and exterior cladding. This can give very good insulation, and also enable the appear-

ance of both faces of the window assembly to be as desired. Such double cladding was impracticable with prior art cladding techniques using thick plastics members, because of the excessive thickness and expense.

A convenient method and apparatus for making building elements embodying the invention will now be described with reference to Figs. 6 to 9.

The exemplified element is generally as shown in Figs. 1 to 3, comprising a cladding member 14 of thin plastics material shaped to define a channel; and a main member 12 having a flange 20 which is snap-engaged with the cladding member 14 thus roofing the channel to form an elongate cavity 16 which is filled with an expanded plastics foam material 18.

The foam material 18 is produced from a known type of formulation. Components are mixed to form a fluent material which, after an induction time that depends on the temperature, expands as a foam which rapidly sets hard.

The illustrated method uses the fluent mixture at a temperature such that substantial foaming will not occur for a period of seconds (e.g. 2 to 30 seconds); this is passed into the channel of a length of cladding member 14. The main member 12 is then fully engaged, and the assembly is supported at least over the base 36 while the mixture foams and sets.

Prior to injection of the fluent mixture 400, the main member 12 may be partially engaged as shown in Fig. 8, the

flange 40 engaging the groove 22, but the members 12,14 being spaced apart at the opposite side to allow access for a feed nozzle 401 of a supply head 402. As shown in Fig. 6 there may be a feed conveyor 404 on which the members 12,14 are thus located to be carried past the supply head 402 to an engagement station 406 at which the members 12,14 are fully engaged and held while the mixture foams. This station may comprise a pair of conveyors 408,410 mounted one on top of the other with a gap 409 between them of height similar to the final dimension of the building element perpendicular to the base 36. (The gap may be uniform, or narrow somewhat in the conveying direction). The lower conveyor 408 projects beyond the upper one (410), and this projecting portion 412 is in line with the feed conveyor 404. The conveying direction of this pair of conveyors 408, 410 is at an angle (here 90%) to that of the feed conveyor 404. Thus the length of engagegd members 12,14, containing the mixture 400, is deposited by the feed conveyor 404 on the projecting portion 410, by which it is carried into and through the gap 409. (The feed conveyor 404 could carry just the cladding member 14 past the supply head 402. The metal member 12 could then be added at the engagement station 406.) As shown in Fig. 9, the members 12,14 are then braced between the pair of conveyors 408,410 with the result that the members are forced into full engagement, and supported on opposed bases 36,414 until they emerge from the gap. During the passage through the gap the mixture 400

expands, filling the cavity 16, and exerting a pressure which would deform the cladding member 14 (and perhaps detach it) were it not braced against a conveyor 408.

In order to allow the building element to be produced in substantial lengths, the feed conveyor 404 is preferably at least 5 metres long, and the conveyors 408,410 of the engagement station are at least 5 metres wide. Their lengths, and rate of movement, are adapted to the foaming and setting time of the mixture 400. Of course, other pressing means could be used.

The foam head 402 may heat the mixture before dispensing it (though this may not be necessary since the foaming process is exothermic). Since the mixture is passed into the channel of the plastics member 14, it tends to keep its heat (whereas if dispensed into aluminium, heat is conducted away, so that the mixture requires heating or other activation after being dispensed. Of course, this could still be supplied).

The depth of the finished element (between the bases 36, 414) is accurately determined by the conveyor gap 410, so this dimension is much more reliable than with conventionally produced elements. The gap may be variable.

CLAIMS:

1. An elongate building element (10;110;210;310) comprising at least two elongate members (12,14) connected to define a cavity (16) containing filling material (18), characterised in that at least one said member (14) comprises thin-walled plastics material such that it is flexible and that the filling material (18) acts as a packing to resist flexing thereof.

2. A building element (10;110;210;310) according to claim 1 wherein the elongate members (12,14) have complementary formations (22;40 and 32,34;48,50) by which they are snap-engaged to define the cavity (16).

3. A building element (10;110;210;310) according to claim 2 having two said elongate members (12,14) whereof one (14) provides a trough 1 and the other (12) provides a portion (20) which closes the trough to define the cavity; the complementary formations comprising a tongue (40) pivotally received in a groove (22) at one side of the trough and closing portion; and opposed detent surfaces (34,50) at the other side so that the members (12,14) are engageable by engaging the tongue (40) in the groove (22) and pivoting with flexing of the flexible member (14) until snap-engagement occurs to urge the detent surfaces (34,50) together.

4. A method of producing an elongate building element (10;110;210;310) which comprises at least two elongate members (12,14), connected to define a cavity (16) containing filling material (18); characterised in that at least

one of the members (14) is flexible; and wherein a fluent composition (400) is provided in the cavity (16) and caused or allowed to set so as to resist flexing of the flexible member (18).

5. A method according to claim 4 wherein the elongate members (12,14) are snap-engaged to define the cavity 16 by bringing them together in a laterally adjacent relationship and engaging them with flexing of at least part of the flexible member (18).

6. A method according to claim 4 or claim 5 wherein the filling material (18) derives from a composition (400) which expands and sets within the cavity (16); and wherein the flexible member (18) is supported against deformation during said expanding and setting.

7. A method according to claim 6 wherein the flexible member (14) provides a trough and the other member (12) is of metal and provides a portion (20) which closes the trough to define the cavity; and wherein the filling material is passed into the trough which is subsequently closed with the other member (12).

8. A method according to claim 6 or 7 including the step of subjecting an assembly of the members (12,14) and the composition (400) to pressure from opposed pressing means (408,410) to bring the members (12,14) into engagement to define the cavity (16) and to provide said support for the flexible member (14).

9. A method according to claim 8 wherein the pressing

means comprise a pair of mutually spaced conveyors (408,410) defining an elongate gap (409) between them; and wherein said assembly is fed through this gap (409); the speed of the conveyors being adapted to the expanding and setting time of the composition (400).

10. Apparatus for manufacturing an elongate building element (10;110;210;310) according to any of claims 1 to 3 and wherein the filling material (18) is derived by the expansion and setting within the cavity (16) of a fluent composition (400); the apparatus comprising a dispenser (402) for the fluent composition (400); a feed conveyor (404) for conveying a length of at least one member (12,14) past the dispenser (402) for it to receive composition (400); and an engagement station (406) arranged to receive the member(s) bearing the composition and, if necessary after addition of missing member(s), to grip them for a predetermined time and conform them to a predetermined dimension.

11. Apparatus according to claim 10 wherein the engagement station (406) comprises a pair of conveyors (408,410) located one above the other with a gap between them, the pair of conveyors (408,410) running transversely to the feed conveyor (404).

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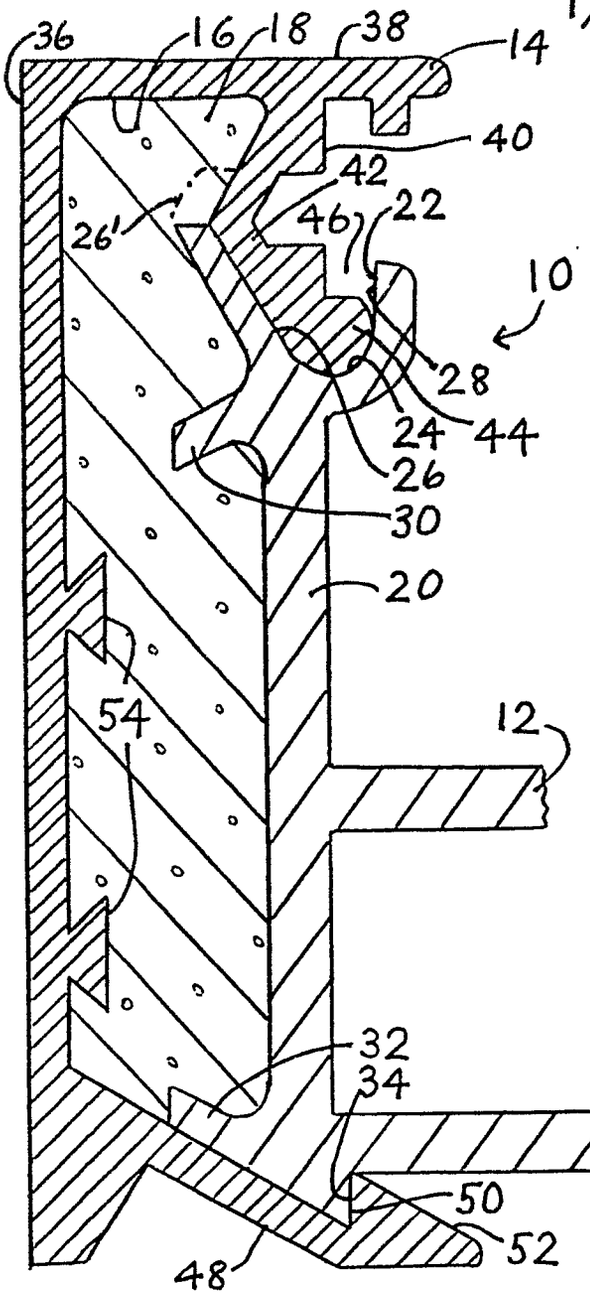


Fig 1

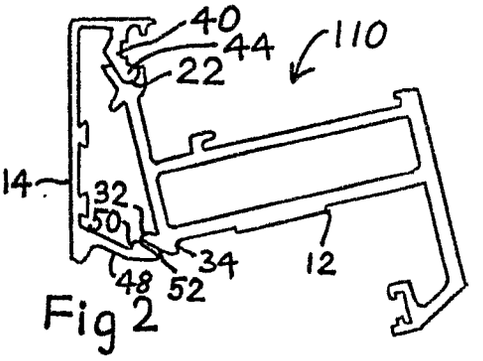


Fig 2

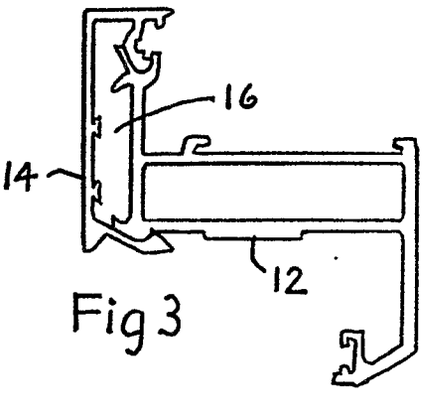


Fig 3

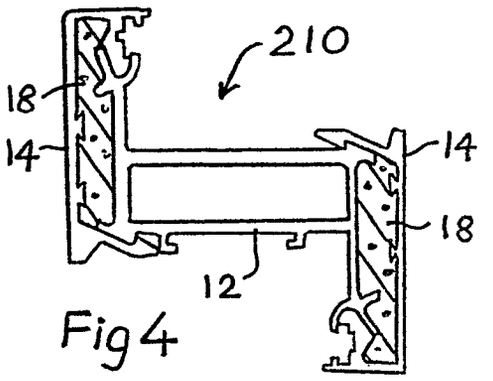
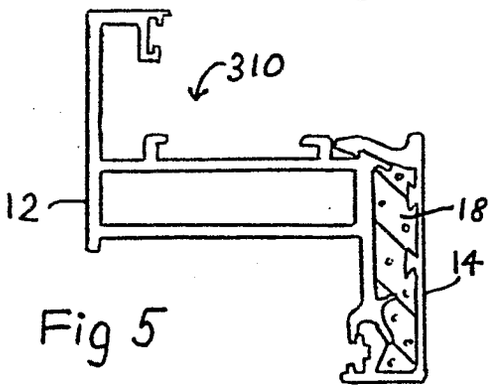


Fig 4



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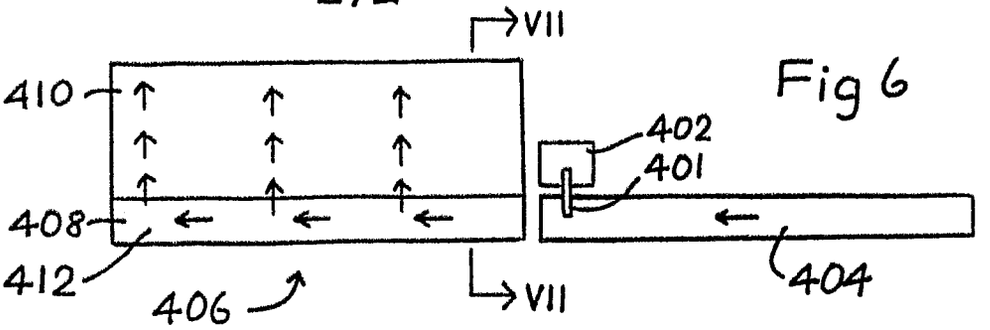

Fig 6

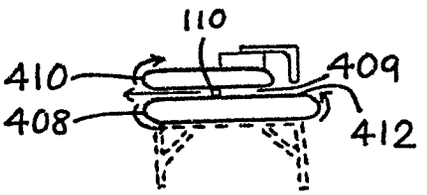

Fig 7

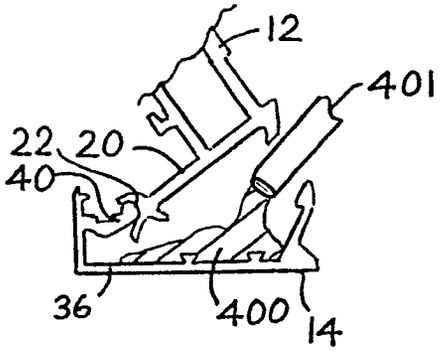

Fig 8

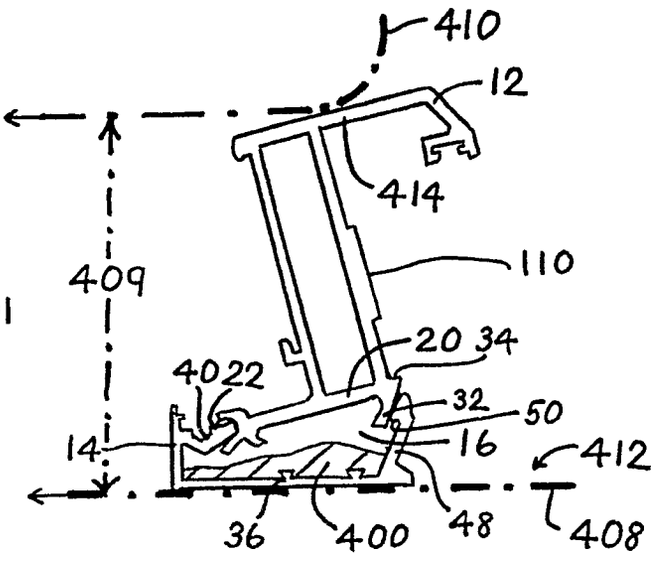

Fig 9