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(54) Fastening device.

(57) A fastening device (10) for locating and fastening a unit such as a window (30, 31) or door (60) in an opening. The device typically includes a pair of upstanding tongues (14,16 114, 116), each with serrated tips (20,22). The device can be made integral with the frame of the window, during manufacture; and with such device fitted the window can be pushed into the opening where it is located, usefully with the aid of an accessory (58) pinned to the wall opening or reveal, without the need for drilling through the frame on-site. In an alternative embodiment the fastening device is integral with the structure defining the opening and the tips engage the unit.

In an alternative application, the device is integrally formed with a door jamb (52), and the door (60) is held in the closed position when the tongue tips enter slots i.e. recesses or apertures (57a, 57b) in an accessory plate secured to the door; the accessory plate has a longitudinal aperture through which a cam (63) projects, the cam being operated by a door handle (62) to lift the tongues out of the slots so that the door can be opened.

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This invention relates to a fastening device and is particularly, though not exclusively, concerned with a fastening device for locating and fastening an article in a structure defining an opening e.g. a window frame in an opening in a wall, or a door in a jamb.

The invention has particular application for the fitting of pre-assembled complete window units comprising a frame and fitted glazing. Thus multi-glazed windows are nowadays usually pre-assembled in a factory, in various sizes suited to customer needs. With factory made units it is easier to ensure the proper hermetic sealing, and it is often easier in a factory to make such units individually to a size to fit readily into a measured opening. It is then necessary to ensure that the window units remain located in the window opening.

Current methods of securing a window unit in place, such as passing several long bolts through the frame into the masonry surrounding the opening often result in distortion of the window unit, and often constrain the unit against proper thermal expansion and contraction. Furthermore, current fitting methods require considerable fitting time, adding appreciably to the cost; delay in securing in position a factory assembled pre-glazed window can cause problems to the fitting crew in windy conditions, since the unit may be blown or sucked out of the prepared opening before the window is properly secured and/or a fitter may be struck by a displaced window unit and/or may be cut by broken glass therefrom, and of course the problems arising from the currently accepted long fitting times are accentuated if several such units have to be fitted to a multi-storey buildingespecially if it is the heavier multi-glazed window units which are being manoeuvered. Even in good working conditions, locating and securing windows by the conventional methods requires considerable skill.

We are aware of the disclosure of Henry Hope & Sons B.P. 830,274 for a means of securing a metal window, in a metal sub-frame secured in a window opening. The sub-frame is slit, to provide in one embodiment a tongue piece "f" (Figs 1/2) which lies generally transverse to the window fitting direction, and parallel to the plane of the window frame; at one transverse end this tongue piece is bulged outwardly to form a catch. In the second embodiment (Fig.3/4) the sub-frame is again slit, to provide a tongue piece which lies generally parallel to the window fitting direction; the tongue piece has been pressed outwardly to form the required catch. Although both catches are formed from the sub-frame by slitting of the metal, it is suggested that these catches are "resilient", so that they can not only be deformed by the window frame during fitting but will thereafter move back, respectively parallel to the plane of the window frame and to the outwardly pressed position; this suggestion of resilience would be rejected as improbable with the metals used for window sub-frames at that date, and no disclosure of special and suitable metals is given. The requirement that the catch of the second embodiment is "non-resilient" to the outwardly pressed condition but "resilient" thereafter (therefrom and back thereto during window fitting) would also be rejected as impracticable for production sub-frames. Slitting a metal sub-frame to form a tongue, although widely used for fixing of static articles, would be considered as weakening the metal sub-frame and thus unsuitable for continued retention of an article subject to frequent (wind induced) dynamic removal forces of varying magnitude; such forces could furthermore subject the area around the slit to excessive and repeated hysteresis forces, perhaps leading to anticipated early failure. As with any arrangement relying on tongues, on a sub-frame to be fitted to a building prior to window fitting, the tongues can be damaged and/or deformed prior to window fitting, with either an insecure fitting or a replacement sub-frame being required, the need for the latter being perhaps observed only during fitting of a window several stories above ground in a high-rise building. Thus it is considered that the teaching of B.P. 830,274 would be rejected by workers in this art, and despite its age has not led to the applicant's knowledge to a production embodiment.

We are also aware of the disclosure of Herbert de Vries German Offenlegungschrift DE 3420626 for an "add-on" fastening device suitable for use with a window which opens about a pivot parallel to, but spaced from, one edge of the window frame within which the opening window is mounted. The window when open is not protected by the device against wind-induced forces; when closed, that edge of the opening window adjacent the pivot is to be held against withdrawal (and thus inadvertent window opening) by the device (rather than in other designs of window by the pivot). The fastening device does not mount the (fixed) window frame in an opening e.g. in a wall reveal; it does not secure the (opening) window against movement in the direction opposed to the initial fitting direction of the frame. The device is provided on one (side) frame member only, not on all (four) side frame members of a rectangular window frame. The device is designed to allow the opening window to move repeatedly transversly to the device tongue(s) during window opening and closing. The device is not formed integrally with the window, but is a separate component mounted between the window and window frame, and affixed to the window frame. The de Vries inner and outer window frames are shown as extruded (plastics) structures, giving continuity along the length of the components and dimensional accuracy, but utilise second (tongue) parts cut or punched out of the face of the fastening device. De Vries did not recognise the advantage of forming the fastening device integral with the outer periphery of the (outer) window frame for permanent frame retention in an opening, with a

reduced number of components, increased dimensional accuracy, reduced complexity and cost in fitting, and reducing "wasted" space in the window opening (a significant part of which is covered by the disclosed retention means for the outer frame). Nor did de Vries recognise that the inward stop for the window frame could advantageously be formed separately e.g. of top-hat form or by plates nailed to the reveal, each plate having an upstanding end part which when the plate 'is correctly positioned provides an inward abutment, secured to the reveal or window opening prior to fitting of the window unit into position.

Thus there is a long recognised need for a suitable means to secure the frame of a window unit in a newly built and/or into an existing window opening, which avoids undue distortion of the frame, which substantially reduces the time required for a unit to be located and secured, which reduces the skill required in order that a unit can be fitted by a wider range of available staff, and which when fitted allows the frame to expand and contract within the opening (i.e. with ambient temperature changes, with however the frame being securely retained in the opening), and which can avoid the need for on-site drilling of the structure which provides the window opening.

It is an object of our invention to partly or fully meet this long recognised need. Consequently, we propose to provide an improved fastening device for securing an article (such as a window unit) adjacent a surface (such as a surface of a structure defining a window opening) which includes a gripping member which can be resiliently deflected by the article during fitting and which can thereafter engage the article to inhibit subsequent removal.

Thus according to one feature of the invention we provide a fastening device for securing two members against relative movement in one selected direction characterised in combination by a first device part mounted upon and movable with one of the members and a second device part engageable with the other of the members, the second device part being resiliently deflectable towards said one of the members to permit relative movement between the members in a direction opposed to said one selected direction, the second device part being coupled to the first device part such that movement of the said one of the members in said selected direction can be resisted by the other of the said members, the said one of the members having a surface upon which the first device part is mounted, the said one of the members being a window component, the first device part being integral with the said window component, the said other of the members comprising a face of a window opening, the said surface facing outwardly of the opening and towards said face.

Preferably the second device part is a tongue tip, the tongue being formed integrally with the component (window frame) and angled thereto. Preferably the tongue tip is serrated; and in a typical embodiment used for installing pre-assembled and glazed window units, the fastening device will include a first tongue extending at a first angle from the frame, and a second tongue extending at a greater angle and to the same side of the frame, the tip of the second tongue having serrations which are more pointed than those of the tip of the first tongue, and able to grip against hard surfaces without appreciable slippage. Since some window frames have to be fitted into an existing reveal, the second tongue usefully has a first portion at the said greater angle to the plane of the plate and a second portion at a still greater angle, with the second portion including the tongue tip; in this embodiment, the tip (on the second tongue portion) may conveniently extend slightly further away from the plate than the tip of the first tongue, so that the second tongue can be the first to engage e.g. the masonry defining the reveal, and so that this engagement will be at an angle nearer to the perpendicular to the plate (and so usually to the masonry) than will be the engagement angle for the first tongue.

As a further feature, the first and second tongues are separated laterally by an intermediate portion of the first device part, so that if the window unit and the structure defining the opening are not exactly square one to the other, at least one of the tongues can engage the opening structure i.e. with the fastening device integral with the unit. Furthermore, to cater for the reveal or opening structure having a profiled non-uniform periphery, the first and second tongues are axially spaced one from the other so that at least one can engage the opening structure. We do however forsee that there may be applications wherein the tongues can be positioned fore and aft or side by side or where more than two tongues or gripping members are provided.

Although fastening devices as herein disclosed can be made integral with the structure forming the opening, prior to the insertion of a pre-assembled (ready-glazed) window unit, this is not the preferred arrangement since the fastening devices have to be secured e.g. in a window opening, individually on site. Thus I prefer the alternative arrangement wherein the fastening devices are integral with the window frame (with device formations on at least two sides thereof) i.e. preformed as part of the window frame - as when this is a plastics extrusion; for this preferred arrangement the tongue tips can locate arid fasten the respective window unit by engageing the respective surface(s) of the structure defining the opening. Because the tongues each provide a resilient mounting, the window frame is resiliently sprung within that structure defining the opening, so allowing a peripheral gap in which the frame can expand and contract e.g. with ambient temperature variations. The peripheral gap between the frame and e.g. the masonry can be filled and sealed with known propriet-

ary sealing products in the normal manner.

If the structure defining the opening is not immediately suitable for the location and fastening of a window unit, I am also proposing an accessory comprising transverse retaining slots (holes or depressions depending on the thickness of the accessory), the accessory being fixable to the structure at a position where it can be engaged by a tongue tip, in use. This accessory, conveniently a flat plate, can itself be modified so as to include a central (longitudinal) aperture running generally perpendicular to the transverse slots which in one embodiment stop short of the aperture to make this (modified) accessory better suited to other applications; thus, in use, the modified accessory can be affixed e.g. to a door jamb, whereby a tongue tip can hold closed a door, the door handle operating a cam which can project through through the (longitudinal) aperture to release the tongue tip(s), by engageing them or extensions thereof, to allow the door to be opened, whereby the fastening device of the present invention has an alternative application as a part of a lock.

The invention will now be described by way of example with reference to the accompanying drawings, in which:-

Fig.1 is a plan view of a fastening device in accordance with the my co-pending patent application;

Fig.2 is a view (not to scale) on the line II-II of Fig.1;

Fig. 3 is a view (not to scale) on the line III-III of Fig.1;

Fig.4 is a cross section through a window unit and a reveal, showing a single fastening device according to Figs.1-3 between the window unit and the reveal;

Fig.5 is an end view of an alternative fastening device in accordance with my co-pending application;

Fig.6 is a plan view of the fastening device shown in Fig.5;

Fig.7 is a partial cross section through a door frame and a door, and a fastening device in accordance with my co-pending application;

Fig.8 is of an accessory plate for use with the fastening device of Fig.7;

Fig.9-13 are views corresponding to Figs.4-8 but in accordance with the present invention.

In the drawings, similar parts carry similar numbers.

The fastening device 10 shown in Figs.1,2,3 and 4 is formed from 0.4mm thick hard rolled stainless steel, in this embodiment from a rectangular blank of 80mm x 35mm ; it comprises a flat plate section 12 and two gripping members 14 and 16 which extend generally upwardly (as seen in Fig.2) from the plate section 12, and to the same side thereof. Between the gripping members there is retained an intermediate portion 19, in the same plane as the flat plate section 12, and which in an alternative embodiment has a nailing hole i.e. of smaller diameter than screw holes 18. As more fully described below, the gripping members 14,16 have their engagement tips 15,17 axially (i.e. upwardly as seen in Fig.1) and laterally offset.

The gripping member 14 is in the form of a tongue, provided by a substantially planar strip punched from flat plate section 12 and which is angled at 60 degrees to the plane of plate section 12, and in this embodiment reaches at its tip 15 a height of 10mm above the plane of plate section 12.

The second gripping member 16 is also in the form of a tongue, provided by a strip angled from plate section 12, to a height at its tip 17 of 9mm above the plane of plate section 12. The gripping member 16 comprises two sections 16a and 16b. The first section 16a is at 45 degrees to the plane of plate section 12, and the second section 16b, which is integral with the first section 16a, is at 85 degrees to the plate section 12.

Two holes 18, aligned with gripping members 14 and 16, are formed through the plate 12; in use, fastening means such as a countersunk screw (or less preferably) a nail can be passed through each hole 18 to fix fastening device 10 to a surface, such as to surface 32 of a reveal 33 as seen in Fig.4. Thus in a particular application of the fastening device, a window unit 30, in this embodiment having a wooden frame 31, but in alternative embodiments having a frame of another known frame material such as UPVC or aluminium, is held in place in a structure (including in this embodiment reveal 33) which defines a window opening, by at least one fastening device 10 fixed by nails 35 through holes 18 to one surface 32 of the window opening. The fastening device may have a (smaller) nailing hole in the intermediate section 19 for preliminary fixing, and then holes 18 are likely to be used for retaining screws.

To fit a window unit into a window opening, fastening devices in accordance with the invention are fixed to each reveal around the window opening, and then the window unit 30 within frame 30 is offered up to the window opening and pushed into place up to and against plasterwork 34, with the gripping members 14 and 16 being deflected by the window frame 31. Any tendency for the window unit 30 to slide or be vacuum-drawn back out of the window opening either during fitting or subsequently is inhibited by the gripping members 14 and 16 which in this example both "bite" into the window frame 31.

If the window unit is to be fitted before the plasterwork is ready, I propose an alternative stop up to which the unit can be pushed. In one embodiment this is one or more components of top-hat shape and of synthetic resinous material, each pinned to the reveal to form a inward abutment. In another embodiment, this stop is formed by one or more plates nailed to the

reveal, each plate having an upstanding end part which when the plate is correctly positioned provides the inward abutment.

An alternative design of fastening device according to the disclosure of my co-pending patent application is shown in Figs. 5 and 6. The device 40 in this embodiment is moulded from nylon, and comprises a flat plate section 42 and first and second gripping members 43 and 44. The gripping members 43 and 44 have respective supports 43a and 44a, formed to minimise the deflection of the gripping members in use. The plate is provided with holes 46 whereby, in use, the device may be fixed to a surface by fastening means e.g. a screw passed therethrough. The device 40 is used in the same manner as that previously described for the device 10.

In an alternative application, fastening devices in accordance with the invention may be used as a latch, as more particularly shown in Figs.7 and 8. Thus Fig 7 shows a modified fastening device 50 fixed to a door frame 52 by screws 54. Each of the laterally and axially spaced gripping members 56a,56b has a lateral extension (not seen in Fig.7 but respectively extending towards the other gripping member). In the position shown in Fig.7 the door 60 is closed, and as seen in this view the plate 58 is fixed to the facing surface of door 60 i.e. that surface which faces fastening device 60; the gripping members 56 have at least their tips in engagement respectively in a pair of slots 57a, 57b one to either side of but not opening into aperture 59 in plate 58, and so acting to hold the door shut. To open the door 60, the handle 62 is manipulated by a user to rotate a cam 63 into and then through opening 59, the cam contacting the lateral extension(s) and deflecting the gripping members out of the slots 57a, 57b to allow the door to open about its hinge (not shown). In an alternative embodiment, the slots 57a, 57b open into aperture 59; instead of lateral extensions to the respective gripping members, the gripping members for this embodiment are themselves made wider so that they encroach into aperture 59, from which they can be lifted by cam 63 to allow the door 60 to be opened.

In the arrangements according to the invention and as shown in Figs. 9 - 13, the window frame 31 is of an extrudable material such as plastics (uPVC), as already commonly used for window frames. The fastening device is formed integrally with the window opening, and such arrangement is advantageous in that it permits accommodation to variations in the receiving surface (for example the outwardly facing surface of the window frame), though in a further embodiment I prefer to form the fastening device integral with the frame to engage a depression in or recessed part of the surface defining the opening. The arrangements can be used with a separate plate forming an inward abutment, limiting inward movement of the window frame.

In field trials, it has been found that fastening devices in accordance with the invention will fasten and hold a window unit in place in a window opening despite a loading of several tonnes on the window unit, such as may occur from the vacuum effect of a strong wind blowing substantially parallel to the glazing. Fastening devices according to the invention, if they are part of the window unit, allow a fully glazed window to be fitted in 5 minutes or less. With frame to masonry clearances due to thermally induced expansion/contraction of units rangeing from 1mm to 14mm on each side of the frame, the fastening devices did not release their locating and fastening loading.

Fastening devices in accordance with the invention are particularly advantageous in that, in use, they tend to centre the window in the window opening as the window is being fitted, and thereafter can hold the window securely in place without distorting the window frame. If non-continuous, usefully the fastening devices are positioned adjacent the corners of the window frame, or opposite transoms or mullions able to accept the (resilient) loading from the gripping members.

The use of a fastening device in accordance with this invention as a latch is particularly advantageous in that the fastening device is simple and robust, and does not require high accuracy fitting. This application also makes use of the unique features of the fastening device.

Claims

1. A fastening device for securing two members against relative movement in one selected direction, characterised in combination by a first device part (12) mounted upon and movable with one of the members (30, 33, 52, 60) and a second device part (15,17, 20, 22) engageable with the other of the members (30, 33, 52, 60), the second device part being resiliently deflectable towards said one of the members to permit relative movement between the members in a direction opposed to said one selected direction, the second device part being coupled (14, 16, 114, 116) to the first device part such that movement of the said one of the members in said selected direction can be resisted by the other of the said members, the said one of the members having a surface upon which the first device part is mounted, the said one of the members being a window component, the first device part being integral with the said window component, the said other of the members comprising a face of a window opening, the said surface facing outwardly of the opening and towards said face.

2. A fastening device according to Claim 1 charac-

terised in that one of the members is an extruded window frame and in that the second device parts are the tips of first and second tongues, the tongues being integral with the frame.

3. A fastening device according to Claim 2 characterised in that the first and second tongues are at different angles relative to the frame axis.

4. A fastening device according to Claim 2 characterised in that at least the tongues are of a plastics material.

5. A fastening device according to Claim 2 characterised in that in the tip of each tongue is serrated (20,22), the tip (20) of the said another of the tongues (16b) having serrations which are more pointed than those on the tip (22) of the first tongue (14).

6. A fastening device according to Claim 2 or Claim 3 characterised in that the second tongue (16) has the other of said second device parts (16b) at said different angle, said the other of said second parts (16b) being coupled to the window frame by a portion at a smaller angle than said different angle and a smaller angle than said first angle, and in that the fastening device can accommodate variations in the surface forming the reveal.

7. A fastening device according to any of claims 2 to 4 characterised in that the tongues are separated in said one selected direction.

8. An assembly comprising a structure (33) defining an opening and an article (30, 31) to be fastened in the structure defining the opening, the article having dimensions substantially equal to but smaller than those of the opening, in which the article is fastened in the opening by a plurality of fastening devices according to any of Claims 1 - 6, the article being restrained against removal from the opening principally by the said one of the second parts and being centered and supported in the opening principally by said other of the second parts.

9. A window assembly which includes a fastening device according to any of claims 1- 7 when made from a plastics material and having a resilient part used to locate a window unit in a window opening characterised by a window frame adapted to be fitted into the opening, the window frame having the resilient part integral therewith and which permits the window frame to be moved in one direction into the window opening and thereafter coacts with the opening to prevent the window frame from being withdrawn from the opening in the direction which is opposite to the first direction.

10. An assembly according to claim 8 or claim 9 characterised by a stop (34) against which the window unit can be pushed into place and further characterised in that the stop is formed by one or more plates secured to the reveal, each plate having an upstanding end part which when the plate is correctly positioned provides the inward abutment against further movement of the window frame in the said one direction.

11. An assembly according to any of Claims 8 to 10 characterised in that a single fastening device according to any of Claims 1 - 7 is fixed to a door jamb (52), and an accessory plate (58) is fixed to the facing surface (when the door is closed) of the door, the accessory plate being slotted (57a, 57b) with the slots being of a size to receive a tongue tip, the door including a handle (62) connected to a cam (63) positioned to project through a longitudinal aperture (59) in the accessory plate, the cam being so disposed that rotation of the handle can cause the cam to engage and resiliently deflect out of the slots a tongue received therein.

12. A method of fastening and locating an article in a structure defining an opening, the opening being slightly smaller than the article to provide a gap therebetween, which includes the steps of fixing at least one fastening device according to Claims 1 - 7 to one of the article and structure at a position so that the device in use is located in the gap.

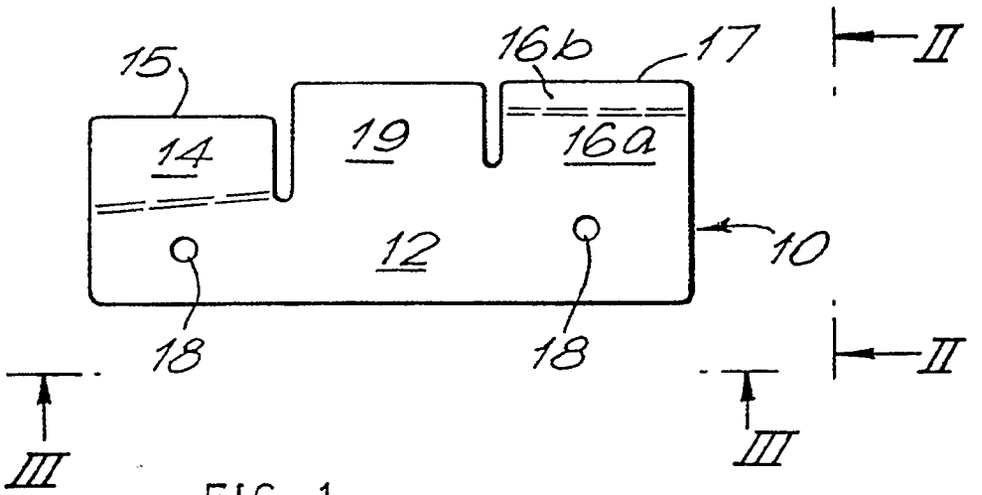


FIG 1

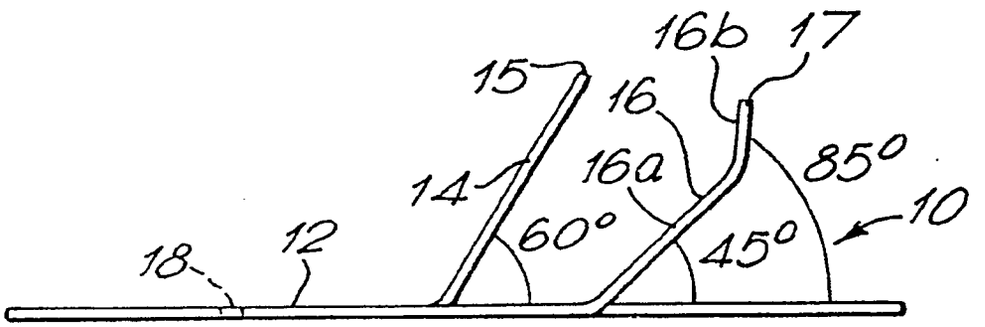


FIG 2

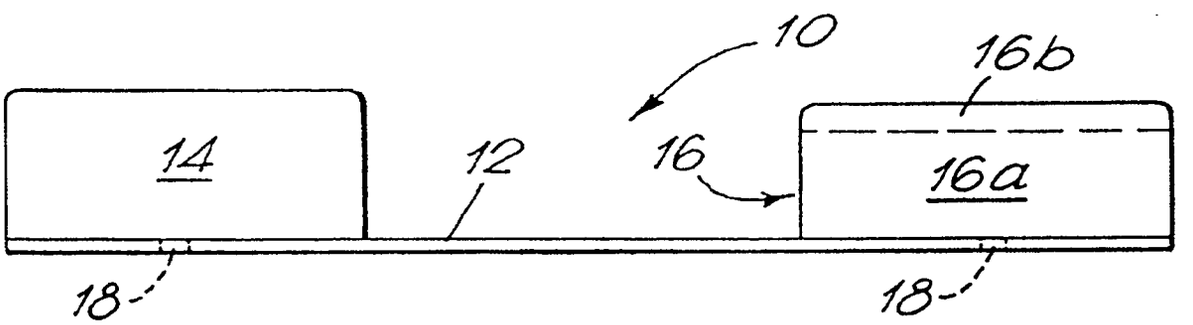


FIG 3

FIG 4

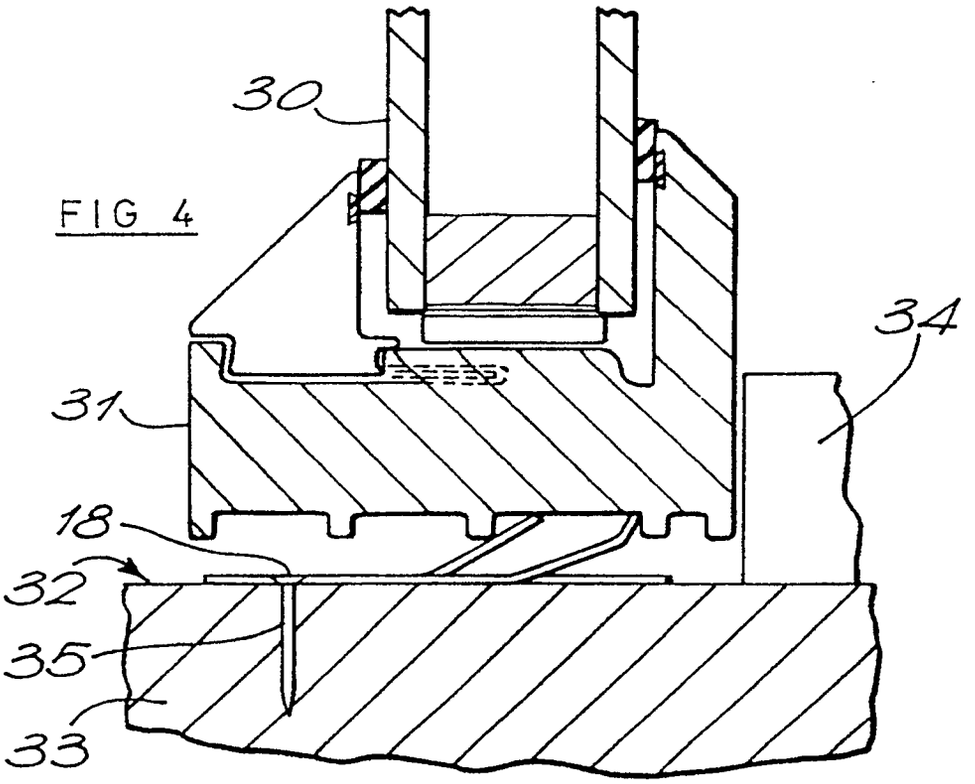


FIG 5

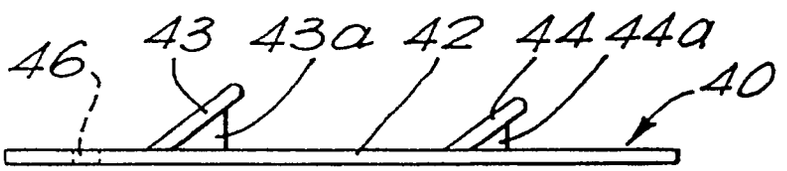
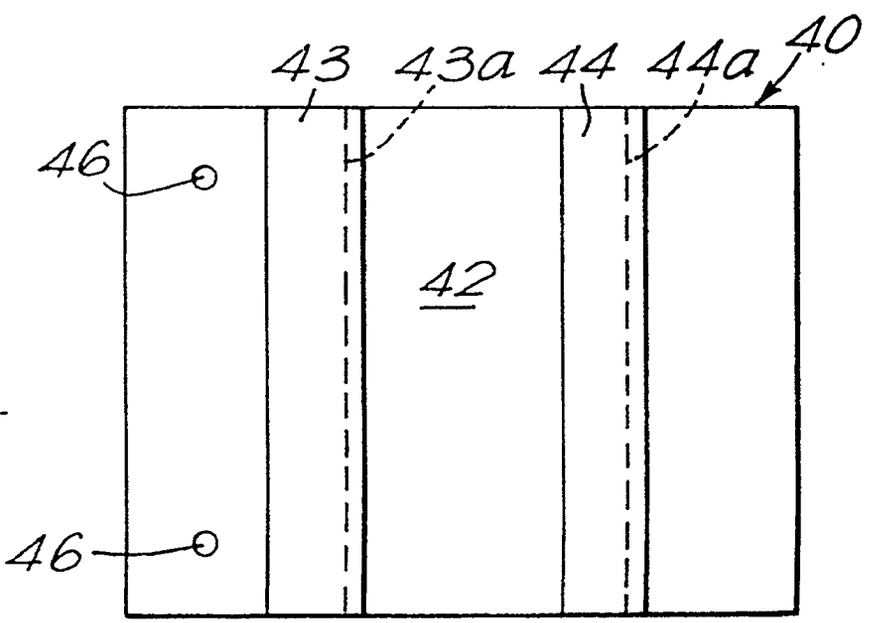


FIG 6



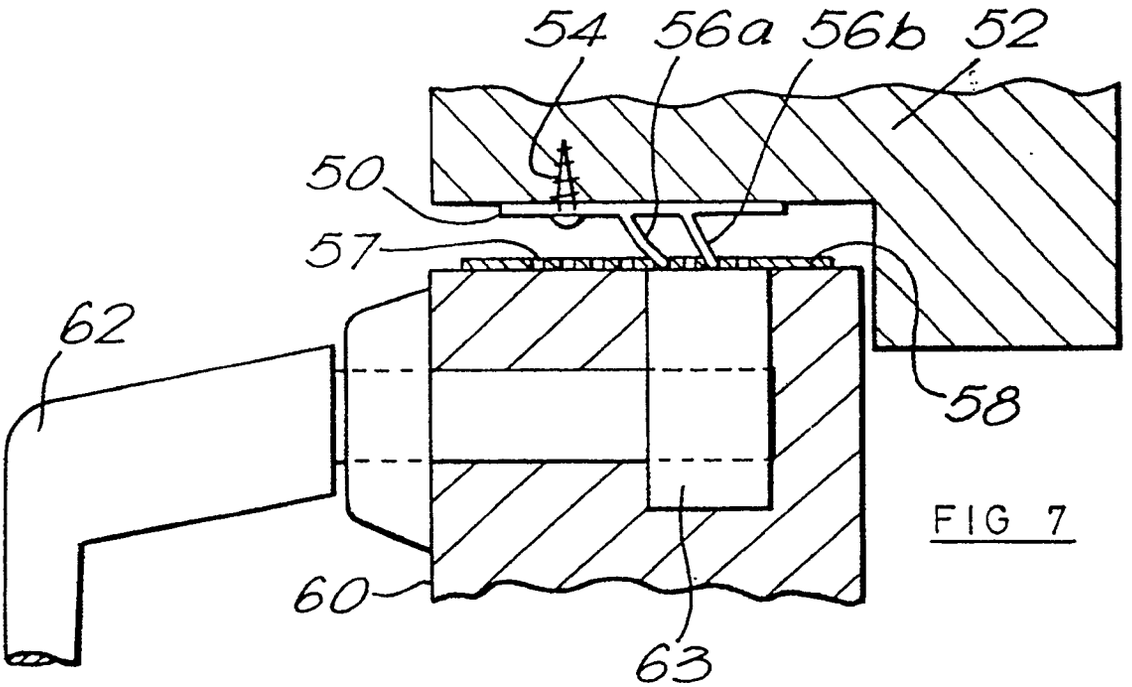


FIG 7

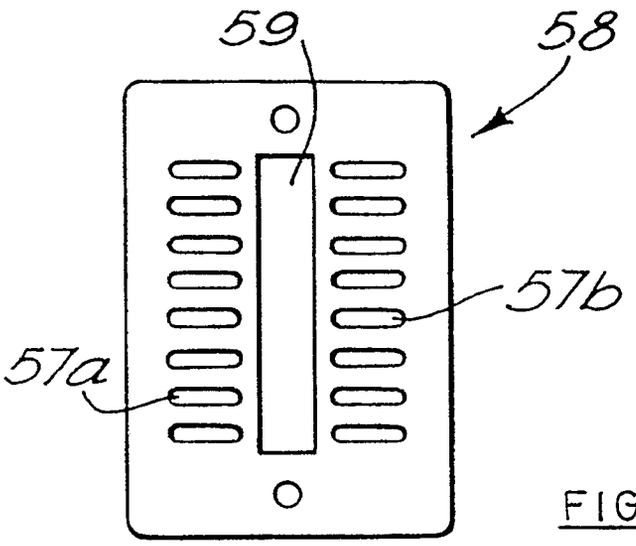
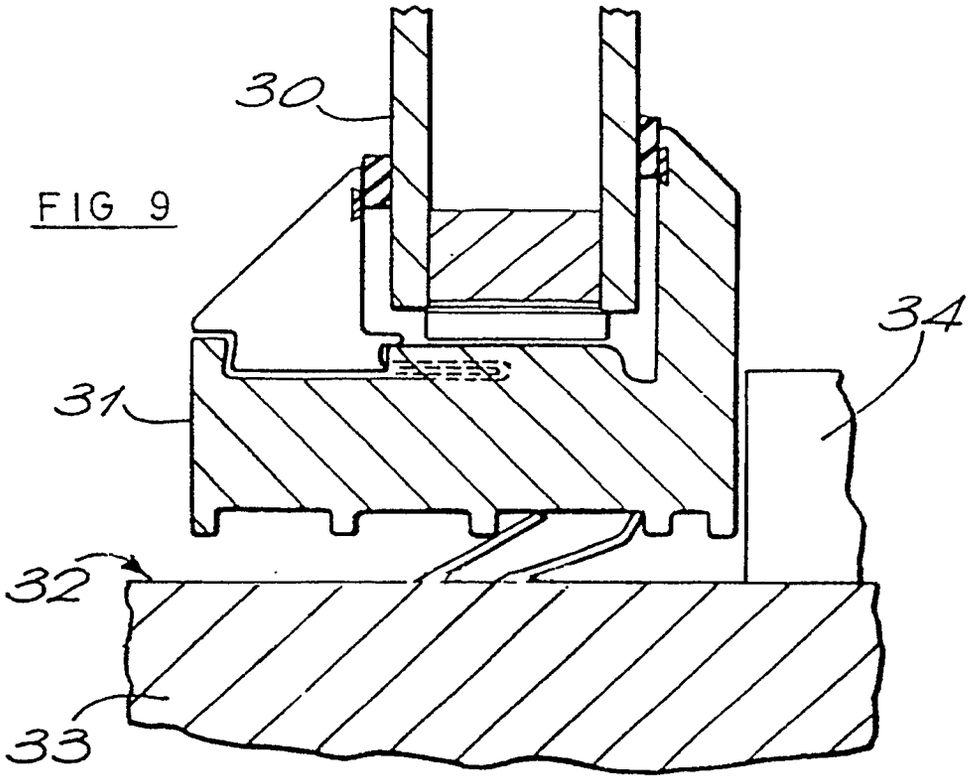


FIG 8

FIG 9



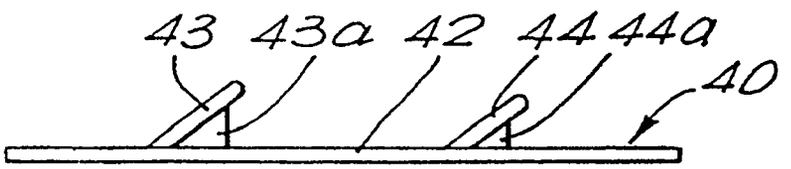


FIG 10

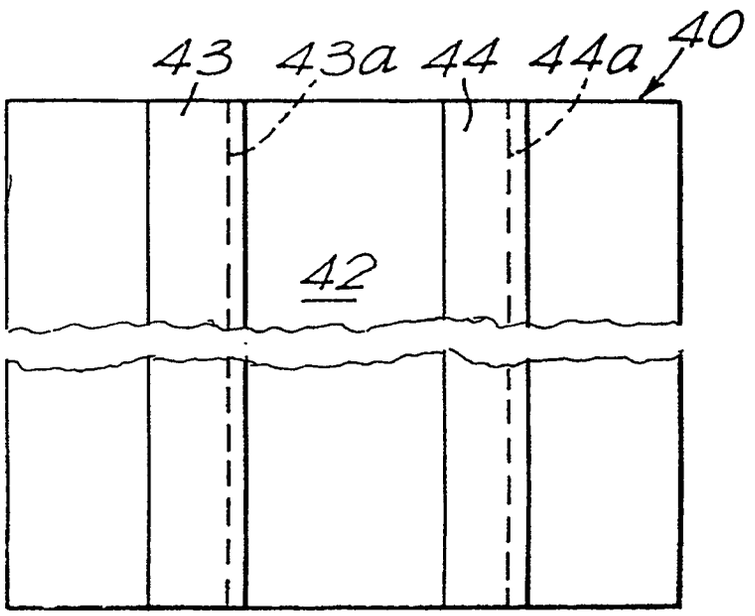


FIG 11

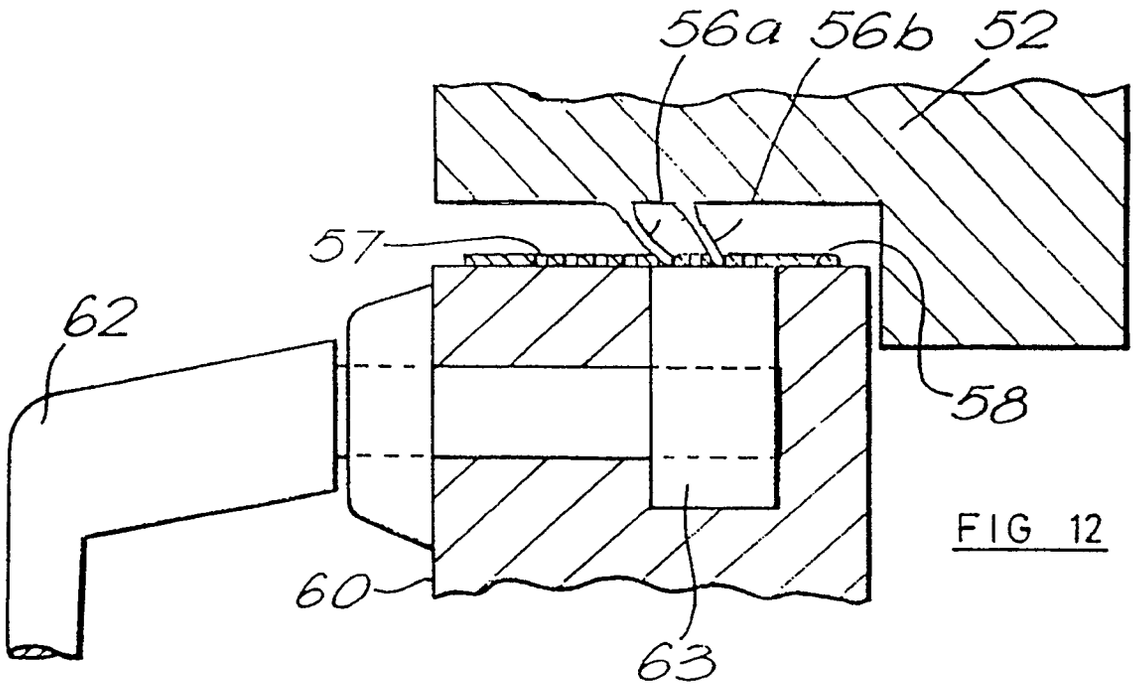


FIG 12

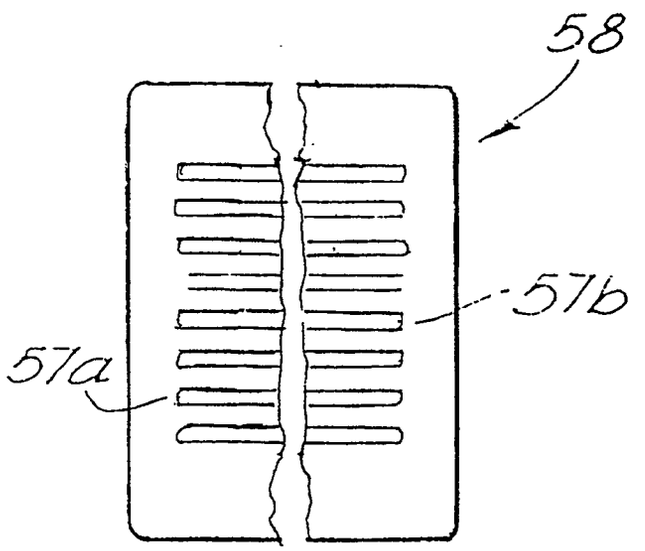


FIG 13