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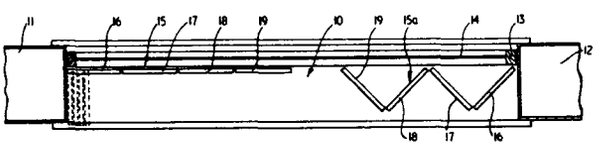
(54) Shutter and window provided with such a shutter.

(57) A shutter for a window is provided, the shutter comprising a plurality of panels (16–19) of thermal insulation material, the panels being hinged together such that in use they are movable between a closed, extended, position in which they lie in substantially the same plane to provide a thermal insulation screen and an open, collapsed, position in which they lie folded together.

The shutter provides thermal insulation characteristics which are significantly more effective than those of double-glazing but without many of the disadvantages of double-glazing.



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Shutter and window provided with such a shutter

The invention relates to shutters and more particularly to shutters for windows.

It is well known that a single pane of glass provides little or no thermal insulation, but the conventional method of providing additional insulation is to provide a double-glazed window, there being two sheets of glass with a layer of air trapped therebetween. However double-glazing has a number of disadvantages. Firstly, the arrangement is permanent and while it reduces heat loss when outside conditions are colder than the inside conditions, it also restricts the entry of heat when the outer conditions are hotter. Furthermore it is difficult to effectively double-glaze existing windows and it is usually necessary to fit completely new frames. A further disadvantage is that there is a risk of condensation between the two sheets of glass.

The invention aims to provide thermal insulation for windows, without the disadvantages associated with double-glazing.

The invention provides a shutter for a window, the shutter comprising a plurality of panels of thermal insulation material, the panels being hinged together such that in use they are movable between a closed, extended, position in which they lie substantially in the same plane to provide a thermal insulation screen and an open, collapsed, position in which they are folded together.

The panels may be hinged such that when moving between the open and closed positions they adopt a zig-zag or concertina configuration.

Each panel may comprise a pair of sheets between which a thermal insulation foam material is sandwiched. A polyisocyanurate foam may be used.

Each sheet may comprise a laminate such as Formica or Wareite. Alternatively each sheet may comprise or be finished in metal (e.g. steel) plastics, timber or fabric.

The sheets may be attached to opposite sides of a support frame, e.g. of timber.

Alternatively the sheets may comprise opposite sides of a hollow plastics extrusion which contains the thermal insulation foam.

Preferably each panel is connected to the or each adjacent panel by a continuous hinge so that there is no air gap between the panels. A continuous flexible plastics hinge may be used, for example constructed of polypropylene.

Preferably each shutter is provided with a hinge at the free edge of one of the panels for use in mounting the shutter in position adjacent to a window. The hinge is preferably a continuous hinge so that there is no air gap when the shutter is mounted. A continuous flexible plastics hinge may be used, for

example constructed of polypropylene.

The shutter may be provided in combination with sealing strips which, when the shutter is in use, are used to provide a seal along the two edges of the shutter which extend transversely of the hinges when the shutter is in the closed position.

The sealing strips may comprise flexible wiping seals of rubber, synthetic rubber or plastics.

Preferably two shutters are provided which, in use, can be mounted at opposite edges of a window and which, in the closed position, meet to provide a thermal insulation screen over substantially the entire area of the window.

Means may be provided to form a seal where the two shutters meet. For example a sealing strip may be provided on the shutter which provides a wiping seal on the other shutter when both shutters are closed. The sealing strip may comprise a flexible strip of rubber, synthetic rubber or plastics.

The invention includes a window fitted with one or more shutters as defined above.

By way of example, a specific embodiment of shutters according to the invention will now be described, with reference to the accompanying drawings, in which:-

Figure 1 is a sectional plan view of a pair of shutters according to an embodiment of the invention, installed adjacent to a window;

Figure 2 is a front elevation showing the two shutters in their closed position;

Figure 3 is a view showing the interior of one shutter;

Figure 4 is a section on line A-A of Figure 3;

Figure 5 is a view of part of Figure 1 in greater detail, illustrating the hinges of one of the panels;

Figure 6 is a full size cross-sectional view of one of the hinges;

Figure 7 is a full size cross-sectional view of an alternative form of hinge;

Figure 8 is a vertical cross-section through one of the closed shutters, illustrating the sealing strips at the top and bottom of the shutter;

Figure 9 is a horizontal cross-section through the closed shutters showing the sealing strip at the point where the two shutters meet; and

Figures 10 to 12 are cross-sections through component parts of alternative embodiments of shutter.

Figure 1 illustrates a conventional window comprising an opening 10 bounded by wall sections 11 and 12, the opening being closed by a window frame 13 glazed with a single pane of glass 14.

According to the invention the window shown in Figure 1 is provided with a pair of thermal insulation shutters 15 and 15a. Each shutter comprises four panels, 16 to 19. One edge of each of the panels 16 is hinged to an edge of the window frame 13 and the panels themselves are hinged together so that they are movable between a closed position namely that adopted by panel 15 in Figure 1, and an open

position illustrated in dotted lines at the left hand side of Figure 1, in which the panels neatly collapse on one another taking up a small amount of storage space in which they do not significantly obscure the window. As is illustrated by the position adopted by the shutter 15a, the panels collapse on one another in a zig-zag or concertina fashion.

When both panels are in the closed position as illustrated in Figure 2, they provide a continuous thermal insulation screen which extends over the window. This not only traps a layer of air between the shutters and the glass, thereby having a similar insulation effect to double-glazing, but the shutters themselves also constitute a considerable barrier to the passage of heat and so the overall insulation effect which is achieved is significantly greater than that achieved by double-glazing. Furthermore the shutters can be opened to allow the maximum amount of solar energy gain during daylight hours. In the closed position the shutters give maximual thermal insulation against heat loss during the hours of darkness or when the room is unused. The closed position may also be used in the summer to prevent over-heating and to ensure complete darkness in rooms if desired.

As shown in Figures 3 and 4, each panel is built on a timber frame comprising two uprights 20 and four evenly spaced cross-members 21. A sheet of laminate or other rigid material 22 is secured to each face of the frame and the gap between the sheets of material is filled with polyisocyanurate foam thermal insulation material 22a.

To provide effective trapping of a layer of air between the shutters and the glass 14, continuous hinges are used which do not provide any air gap between

panels or the joint with the window frame 13. Figure 5 illustrates a first continuous hinge 24 between panels 17 and 18, a second continuous hinge 25 between panels 16 and 17, and a third continuous hinge 26 between panel 16 and the window frame 13. There is of course a similar hinge between panels 18 and 19 and the same sort of hinges are utilised on the panels of shutter 15.

Figure 6 shows one of the hinges in detail, the hinge comprising a continuous strip of polypropylene with a reduced thickness portion 27 about which the hinge can flex repeatedly.

If desired a hinge of the type shown in Figure 7 can be utilised, having barbs 28 which are plugged into recesses in the panels to improve the connection of the hinge with the panels.

As shown in Figure 8, a first sealing strip 29 is secured along the upper edge of the window recess and a second sealing strip 30 is secured along the lower edge of the window recess. Each sealing strip has a flexible wiping seal member 31 projecting therefrom and when the two shutters are pushed into their closed positions the members 31 are deflected by the shutters and form a seal along the upper and lower edges of the shutters.

To complete the sealing of the cavity between the shutters and the glass, the free edge of the panel 19 of shutter 15a is provided with a channel member 32 which extends for the full height of the panel and contains a flexible wiping seal 33. The shutter 15 is closed first, and when the shutter 15a is closed the wiping seal 33 is deflected by the shutter 15 and presses resiliently against the shutter, sealing any gap between the two shutters.

The window shutters shown in the Figures provide an effective but inexpensive alternative to double-glazing or double windows. They can be readily manufactured to suit a whole range of window sizes and can be provided with a range of different insulation core thicknesses depending on the thermal insulation requirements of the user. For example there may be core thickness of 6 mm, 9 mm, 13 mm, 20 mm, or 25 mm.

It has been calculated that the shutters may provide savings of up to 82% of heat loss through single-glazing and 63% of the heat loss through double-glazing.

The fact that the use of the shutters enables a room to be heated in a shorter period, and the room thereafter takes longer to cool means that energy savings can be achieved of between 15% and 26%. It has been calculated that it would take approximately 5.63 hours to lose the same amount of heat through closed shutters according to the invention as single-glazing would lose in one hour and it would take approximately 2.91 hours to lose the same amount of heat as double-glazing would lose in one hour.

The polyisocyanurate foam used for the core has a heat transfer coefficient (k) of 0.0202 watts/metre ^{o}C. A low heat transfer coefficient is of course desirable, and the k value preferably lies in the range 0.017 to 0.025 watts/metre ^{o}C.

It has been calculated that the U values, which give a measure of heat loss, when using the shutters are considerably less than those when using conventional forms of glazing. Some examples of comparative heat losses and fuel costs are given below.

1. For single glazing with 6 mm glass (U = 5.6 watts/metre^2 ^oC).

External Temp. ^oC	Internal Temp. ^oC	Heat Loss.	Heating Cost Electric	Oil	Gas
0	20	13.45	37.26p	15.74p	9.67p
5	20	10.08	27.92p	11.79p	7.92p
10	20	6.72	18.61p	7.86p	5.28p
15	20	3.36	9.97p	3.93p	2.64p

2. For double glazing with two sheets of 6 mm glass bounding a 20 mm air space (U = 2.9 watts/metre^2 ^oC).

External Temp. ^oC	Internal Temp. ^oC	Heat Loss.	Heating Cost Electric	Oil	Gas
0	20	6.96	19.28p	8.14p	5.47p
5	20	5.22	14.46p	6.11p	4.10p
10	20	3.48	9.63p	4.07p	2.73p
15	20	1.74	4.82p	2.04p	1.36p

3. For shutters according to the invention with a 13 mm core, trapping a 20 mm layer of air against a 6 mm sheet of glass (U = 0.9 watts/metre^2 ^oC).

External Temp. ^oC	Internal Temp. ^oC	Heat Loss.	Heating Cost Electric	Oil	Gas
0	20	2.39	6.62p	2.79p	1.87p
5	20	1.79	4.95p	2.09p	1.41p
15	20	1.19	3.30p	1.39p	0.94p
20	20	0.60	1.66	0.70p	0.47p

The heat loss figures refer to the number of kilowatts loss in 12 hours through a window area of 10 square metres.

The fuel costs are based on domestic tariffs of 2.71p per kilowatt of electricity, 16.4p per Therm of

Natural Gas (1500 Therms per year) and 36p per gallon of oil and assumed efficiency of Electricity 98%, Gas 70% and Oil 65%.

All the U values were calculated in accordance with Building Research Establishment digest No.108 entitled "Standardised U values" dated August 1969, and were based on normal standard exposure. The double and single glazing U values are in accordance with Building Research Establishment digest No.140 entitled "Double glazing and double windows" dated April 1972.

The U value of windows fitted with the shutters according to the invention are comparable, when the shutters are closed, to the U value of the external wall and during winter cold zones around windows can be drastically reduced.

Depending on the thickness of the shutters, the location and exposure of the windows, the internal temperature and the type of fuel use for heating, the return by fuel savings on the capital expenditure on the shutters can vary considerably. Based on Building Research Establishment digest No.190 entitled "Heat loss from buildings" dated June 1976 it has been calculated that typical figures based on current prices might be: Electricity, capital recovered in 1.1 years; Oil, capital recovered in 2.5 years; and Gas, capital recovered in 3.7 years.

In addition to providing a thermal insulation screen, the shutters provide additional privacy and security against unwanted intrusion.

The invention is not restricted to the details of the foregoing embodiment.

Although the shutters shown are specifically designed for mounting on the inside of the glass, the shutters can if desired be made or covered with weather-resistant materials and be adapted for mounting externally.

The external surface of the shutters may be light in colour and/or reflective so that the shutters tend not to lose heat outwardly when they are used to retain heat within a building and also tend not to absorb heat from the outside when they are used to keep a building cool.

If desired the sealing strips 29 and 30 may be replaced by sealing strips mounted on the shutters themselves. This simplifies the installation of the shutters since there is no need to attach the sealing strips to the window recess. For example the upper and lower edge of each panel may be capped by an elongate member having the cross-section shown in Figure 10. Each capping member has a first channel 34 to receive the panel, and a second T-shaped channel 35. When the panels of a shutter have been hinged together the shutter is opened out so that the panels lie in the same plane. In this position the channels 35 of the respective capping members co-operate to define a first substantially continuous T-shaped channel extending along the upper edge of the shutter and a second substantially continuous T-shaped channel extending along the lower edge of the shutter. A length of flexible wiping sealing strip is then fed through each substantially continuous channel to extend along the full length of each channel, the strip having the cross-section shown in Figure 11. The foot 36 engages in the T-shaped channel, the blade 37 extending from the channel to provide a wiping seal to engage in use with a face of the window recess. Each strip is sufficiently flexible and resilient to permit the shutters to be folded into the open position, each strip taking up a zig-zag or concertina shape matching that of the open shutters, flexing and slight stretching of the strips occuring in the vicinity of the hinges.

Instead of manufacturing the panels as shown, the panels may be manufactured by extruding a hollow rectangular cross-section, with or without internal stiffening ribs or webs, cutting the extrusion into lengths equal to the desired length of the shutters, and filling the interior of each length of extrusion with thermal insulation foam. For example the lower edge of each extrusion can be capped, e.g. using an adhesively secured capping member as shown in Figure 10. Liquid foam creating material can then be inserted into the extrusion, and when the materials have foamed up to fit the extrusion, the upper edges can be capped by adhesively securing a further capping member. Hinges may be formed by extruding the plastics material such that there is a continuous tube at each longitudinal edge of the rectangular cross-section of the extrusion. Selected portions of the tubes can then be cut away such that when the panels are fitted together tubular portions of one panel register with tubular portions of an adjacent panel to form a substantially continuous tube along which a piano hinge type hinge pin can be passed to pivotally interconnect the panels.

Alternatively the extrusion may be formed such that each longitudinal edge is provided with a continuous groove with serrated walls to receive a hinge of the form shown in Figure 7.

It may be inconvenient to make a number of extrusions of differing cross-sectional dimensions to enable shutters to be manufactured to fit a variety of different windows, but the same effect can be achieved by making each shutter from an appropriate number of standard size panels and then making up any shortfall in dimensions with one smaller panel. This panel may be manufactured by cutting

one of the extrusions longitudinally to reduce its width and then capping the cut edge with a sealing capping member such as shown in Figure 10 or, if a seal is not required at that location, with a plain capping strip having the cross-section shown in Figure 12.

Another possibility which results from fitting the upper and lower sealing strips to the panels rather than to the window recess is that shutters can be made in standard sizes and the shutters can be arranged to close across window recesses of varying widths by varying the extent to which the shutters adopt a concertina or zig-zag position when closed. Indeed a shutter which is not in a planar position when closed may give a more pleasing visual effect.

Although the shutters are shown mounted on the opposite sides of a window, they may be mounted at the top and bottom of a window so that the hinges extend horizontally. Alternatively there may be a single shutter and the shutter may be attached to the top or bottom of a window.

Instead of being arranged to fold together in a concertina or zig-zag fashion, the panels making up a shutter may be arranged so that the shutter can be wound up into the collapsed position. The shutter may for example be windable around a storage drum or shaft. With such an arrangement it is preferred that the width of each panel is no wider than 5" to 6". If the panels are wider than this, then the rolled up shutter has an excessively large radius.

It is not essential to use four panels for each shutter, and any desired number of panels may be used, although it is preferred that an even number is used, for example 2, 4, 6, or 8 panels.

Although the use of polyisocyanurate foam is preferred, other thermal insulation material may be used, for example polyurethene foam, or foamed polystyrene.

Instead of being built on a timber frame, the panels may be built on a frame of plastics material or metal, or a combination of materials.

Instead of using wiping seals, compression seals may be used in which a strip of sealing material is compressed between two members to form the seal.

Claims:

1. A shutter for a window, characterised in that the shutter comprises a plurality of panels (16-19) of thermal insulation material, the panels being hinged together such that in use they are movable between a closed, extended, position in which they lie in substantially the same plane to provide a thermal insulation screen, and an open, collapsed, position in which they are folded together.

2. A shutter as claimed in Claim 1, in which the panels are hinged such that when moving between the open and closed positions they adopt a zig-zag or concertina configuration.

3. A shutter as claimed in Claim 1 or Claim 2, in which each panel comprises a pair of sheets (22) between which a thermal insulation foam (22a) is sandwiched.

4. A shutter as claimed in Claim 3, in which the foam is a polyisocyanurate foam.

5. A shutter as claimed in Claim 3 or Claim 4, in which each sheet comprises a laminate.

6. A shutter as claimed in any one of Claims 3 to 5, in which the sheets are attached to opposite sides of a support frame (20,21).

7. A shutter as claimed in any one of Claims 3 to 5, in which the sheets comprise opposite sides of a hollow plastics extrusion which contains the thermal insulation foam.

8. A shutter as claimed in any one of the preceding claims, in which each panel is connected to the or each adjacent panel by a continuous hinge (24,25) so that there is no air gap between the panels.

9. A shutter as claimed in Claim 8, in which a continuous flexible plastics hinge is used.

10. A shutter as claimed in any one of the preceding claims, provided with a hinge (26) at the free edge of one of the panels for use in mounting the shutter in position adjacent to a window.

11. A shutter as claimed in Claim 10, in which the hinge is a continuous hinge so that there is no air gap when the shutter is mounted.

12. A shutter as claimed in Claim 11, in which the hinge is a continuous flexible plastics hinge.

13. A shutter as claimed in any one of the preceding claims, in combination with sealing strips (29,30) which, when the shutter is in use, are used to provide a seal along the two edges of the shutter which extend transversely of the hinges when the shutter is in the closed position.

14. A shutter as claimed in claim 13, in which the sealing strips comprise flexible wiping seals of rubber, synthetic rubber, or plastics material.

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15. A shutter as claimed in any one of the preceding claims in combination with a second similar shutter such that the two shutters can, in use, be mounted at opposite edges of a window and which, in the closed position, meet to provide a thermal insulation screen over substantially the entire area of the window.

16. A shutter as claimed in Claim 15, in which means (32,33) are provided to form a seal where the two shutters meet.

17. A shutter as claimed in Claim 16, in which a sealing strip is provided on one shutter which provides a wiping seal on the other shutter when both shutters are closed.

18. A window when fitted with one or more shutters as claimed in any one of the preceding claims.

Fig.1.

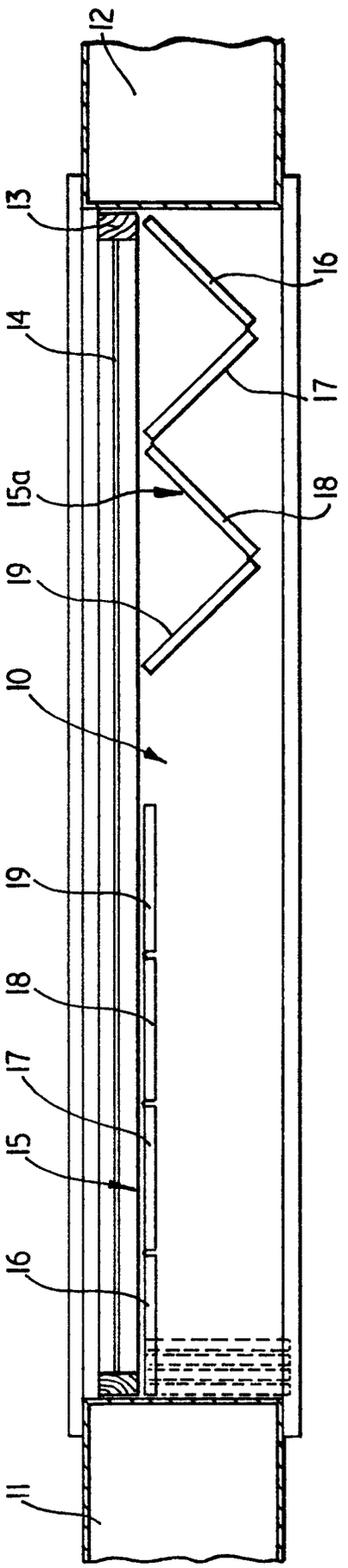


Fig.2.

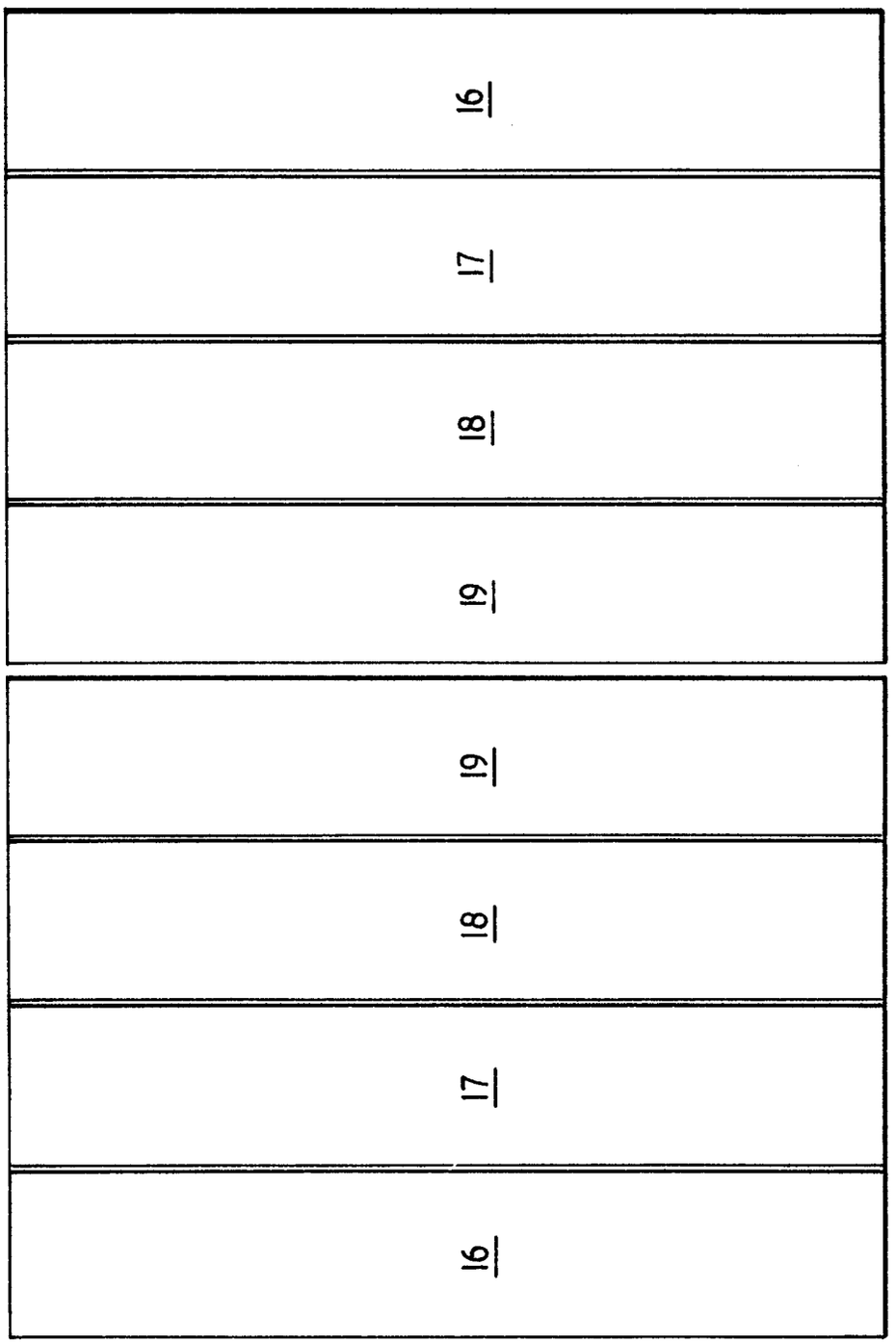


Fig.3.

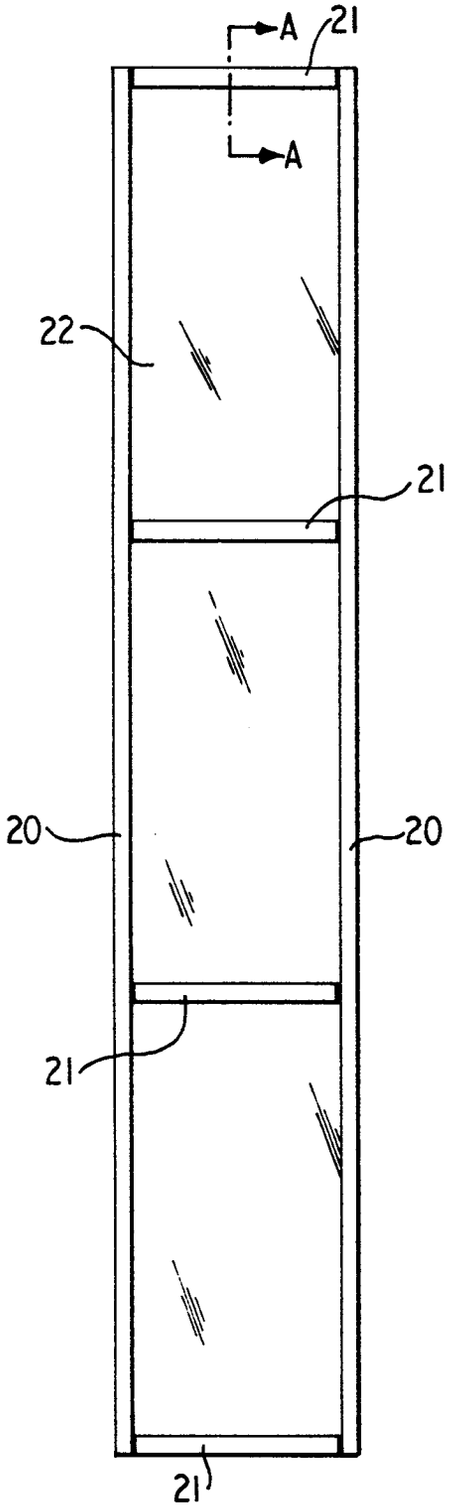
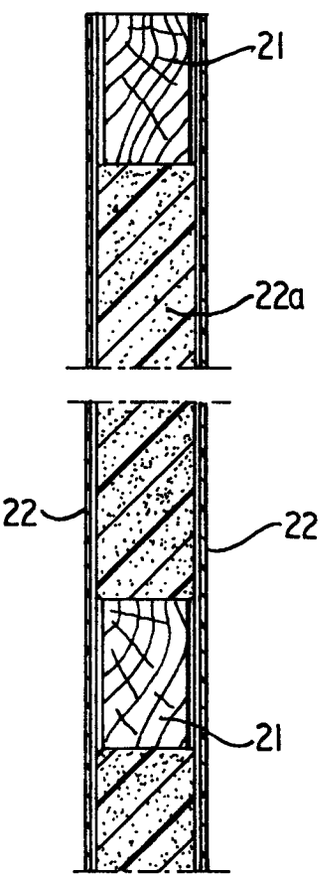


Fig.4.



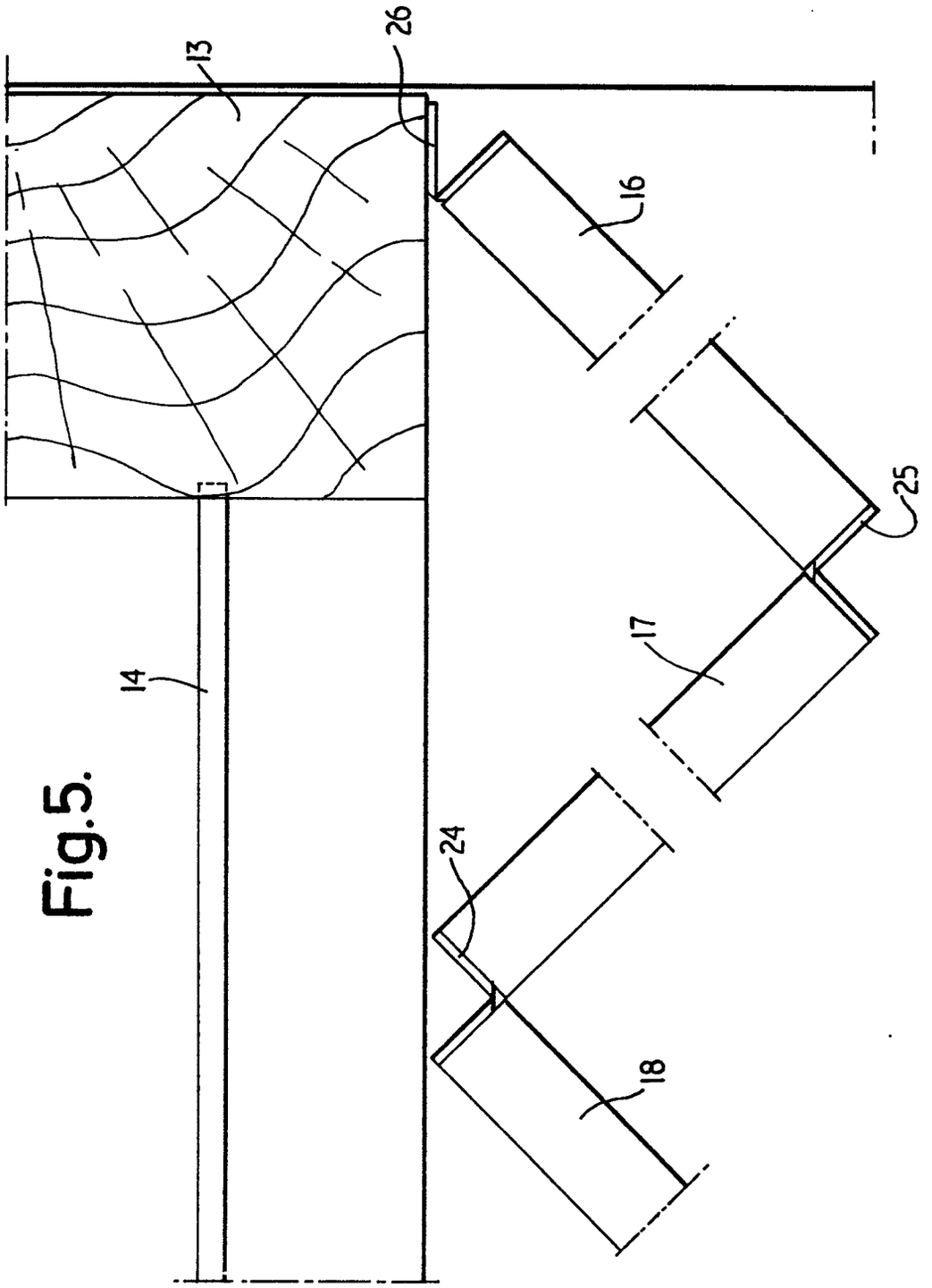


Fig.5.

Fig.6.

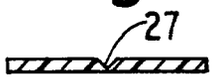
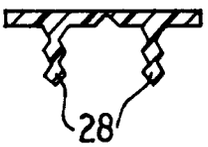


Fig.7.



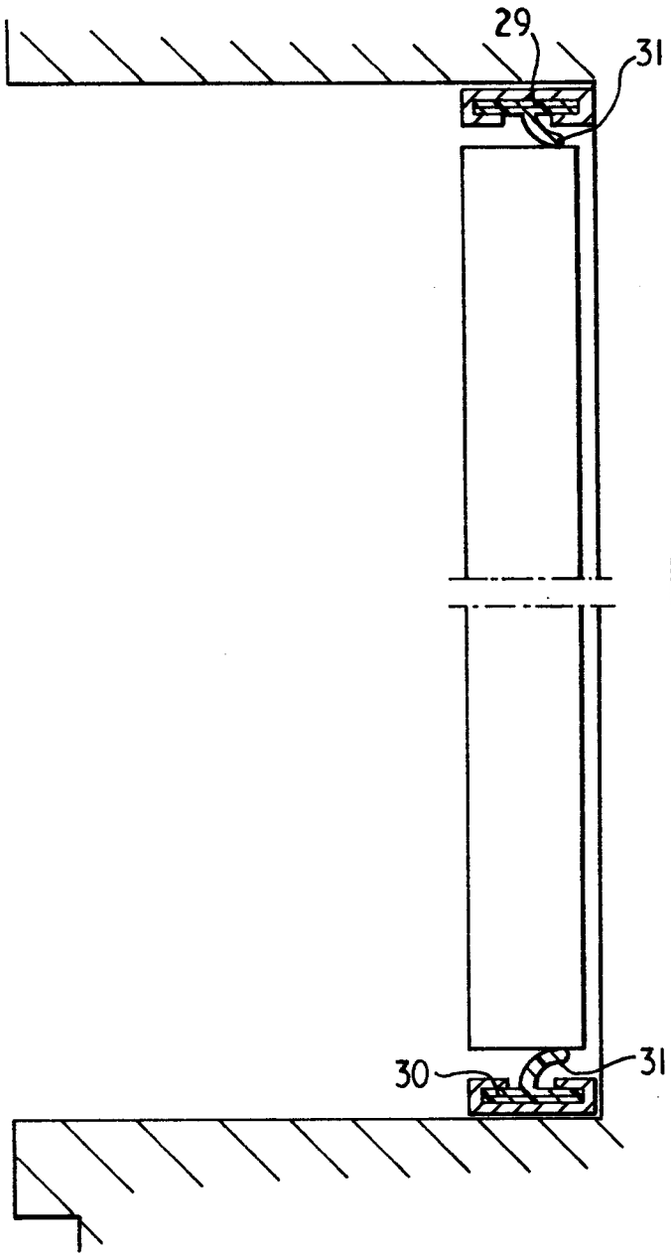


Fig.8.

Fig.9.

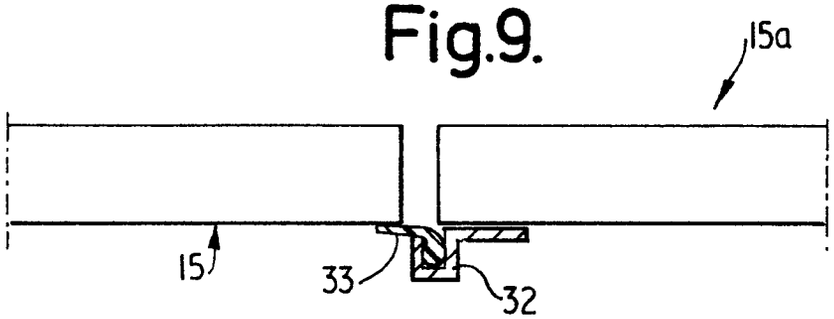


Fig.10.

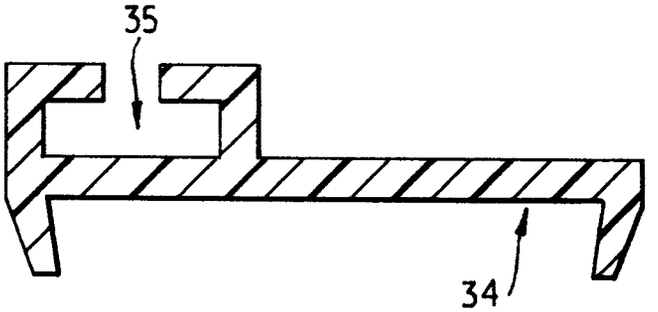


Fig.11.

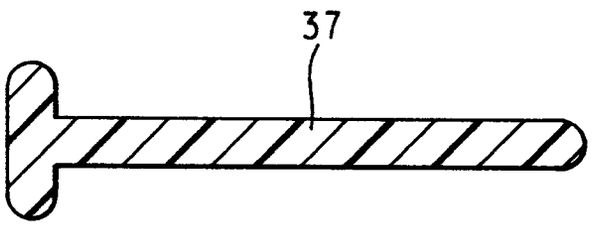
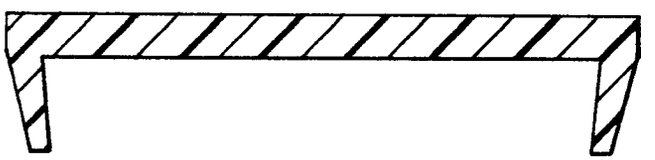


Fig.12.



European Patent Office

EUROPEAN SEARCH REPORT

0006349
Application number

EP 79 30 1133

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	GB - A - 920 828 (AILLAUD) * page 1, lines 60-84; page 2, lines 1-42; figures 1 to 4 *	1,2,7, 10,11, 15,18
	FR - A - 2 353 701 (ROCCAPLAST) * page 5, lines 22-37; page 6, lines 1-10; figures 1 to 5 *	1,2,8, 10,11, 15,18
	FR - A - 2 094 291 (BARBETTA & CASTELLI) * claims and figure 1 *	1,2,8, 9,11, 12
	FR - A - 2 180 459 (ALAZARD) * page 2, lines 6-13; figures 1 and 2 *	1,2,13
	FR - A - 2 315 587 (PALTZ) * page 1, lines 27-36; page 2, lines 1-8; figures 1 to 4 *	3,4,6
P	FR - A - 2 388 952 (LACAVE) * page 5, lines 16-40; page 6, lines 1-18; figures 1 to 7 *	1,2,7,

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

E 06 B 9/06

TECHNICAL FIELDS SEARCHED (Int.Cl.³)

E 06 B

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4-09-1979	VIJVERMAN

EPO Form 1503.1 06.78