(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 050 517**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **81304916.0**

(51) Int. Cl.³: **E 06 B 5/16**

(22) Date of filing: **20.10.81**

(30) Priority: **20.10.80 GB 8033772**
04.12.80 GB 8038921

(43) Date of publication of application: **28.04.82**
Bulletin 82/17

(84) Designated Contracting States: **AT BE CH DE FR GB IT LI LU NL SE**

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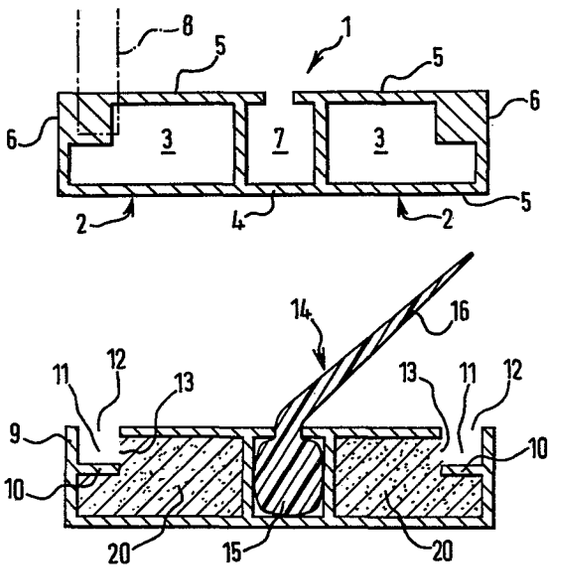
(54) Intumescent seals.

(57) There is provided a seal for sealing a pivotally mounted door against draughts, smoke and fire, the device comprising an elongate holder (1), defining at least two channels (7 and 3) each having an opening, a first of the channels (7) retaining a resilient element (15) having a blade (16) protruding from the opening of the channel and for acting as a draught and smoke seal, the second channel (3) containing intumescent material (20), the intumescent material expanding through the opening (12) of the second channel for forming a fire seal when subjected to high temperature, the blade being at an acute angle to a face (5) of the holder in which the opening of the second channel is provided, the second channel being provided with a baffle (10) extending within the channel and defining a strait (11) intermediate the opening of the channel and an interior chamber (20) of the holder.

There is further provided a method of making an intumescent seal comprising: providing a tubular holder (1) having a longitudinal bore or interior chamber (3) defined by a thickened longitudinally extending portion (6) of the holder contiguous with a relatively thin wall (5) of the holder; filling the bore of the holder with solid intumescent material (20); and thereafter removing a longitudinally extending part of said thickened portion (as by a saw cut (8)) thereby to leave part of said thickened portion as a baffle (10) within the holder, the space left by said removed part forming a strait (11) having an opening (12) to the exterior of the holder and an opening (13) to the bore of the holder.



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Intumescent Seals

The present invention relates to intumescent seals. In particular the present invention relates to improved intumescent seals and to a method of making tamper-resistant intumescent seals.

Known intumescent seals comprise an elongate holder containing intumescent material, the holder being provided with an opening or series of openings along its length. Such seals are fitted arround doors or window openings, usually in the door or window frame. In the event of a fire, the intumescent material, when exposed to elevated temperature intumesces, that is it swells considerably and exudes through the opening or openings in the holder to seal any gap between the door or the window and the frame thereby preventing, or at least hindering, passage of smoke, flame and fumes past the door or window. This not only serves to retard spread of the fire but also assists in protecting people on the side of the door or window remote from the fire from the smoke and fumes produced by the fire.

Certain known seals for sealing doors (or other closure members) against draughts, smoke and fire comprise an elongate metal holder defining at least two channels each having an opening. A first of the channels retains a resilient element which has a blade protruding through the opening of the channel. The other channel or channels (herein referred to as the "second channel or channels") contain intumescent material.

The sealing device is rebated into either the door frame or an edge of the door. When the door is closed the blade acts as a draught and smoke seal and the intumescent material, when subjected to high temperature as under fire conditions, expands through the opening of the second channel or channels to form a fire seal.

Known sealing devices as described above include the sealing devices shown in Figure 6 of British Patent No.1529054 and Figure 3 of British Patent No.1529733, both granted to Dixon

International Limited, and Figures 1 and 2 of British Patent Application No.17806/77 also in the name of Dixon International Limited.

In the known sealing devices the blade of the resilient member is at right angles to the face of the holder having the opening or openings for the intumescent material. This has led to disadvantages. In particular the sealing devices have proved unsuitable for single action doors, especially single action duble doors.

The present invention aims to provide on improved intumescent seal for sealing doors, particularly single action doors, against draughts, smoke and fire.

Furthermore, a problem associated with intumescent seals, especially when used in places frequented by children, such as schools, is that intumescent material is commonly removed from the holders by tamperers using pointed instruments as probes pushed into the holders through the openings.

To overcome this problem, it has been proposed to provide a baffle within the holder, the baffle restricting access to the intumescent material by a probe pushed into the holder through the opening. Our British patent no.1529733 describes such intumescent seals. As disclosed in that patent, the intumescent seals comprise an elongate holder having an opening to the exterior of the holder, a baffle within the holder defining an interior chamber and a strait within the holder providing communication between the interior chamber and the opening. The interior chamber of the holder contains at least a major part of intumescent material in the holder. The intumescent material within the interior chamber can intumesce through the strait and out of the holder through the opening but the baffle restricts access to the interior chamber by a probe pushed through the opening by a tamperer.

A disadvantage of intumescent seals as described above, in which a baffle is present in the holder, is that it has not hitherto provided possible to manufacture such seals in an economic manner. This is because the holders, as articles of indefinite length and uniform cross section, have to be made by extrusion but the dies used are necessarily complex and will not stand up to the required pressures.

The present invention aims at overcoming or mitigating the disadvantage described above.

In accordance with a first aspect of the present invention, there is provided a seal for sealing a pivotally mounted door against draughts, smoke and fire, the device comprising an elongate holder defining two channels each having an opening, a first of the channels retaining a resilient element having a blade protruding from the opening of the channel and for acting as a draught and smoke seal, the second channel containing intumescent material, the intumescent material expanding through the opening of the second channel for forming a fire seal when subjected to high temperature, the blade being at an acute angle to a face of the holder in which the opening of the second channel is provided.

In accordance with a second aspect of the invention, there is provided, in combination, a door frame, a door pivotally mounted relative to the door frame, and a sealing device comprising an elongate holder defining two channels each having an opening, a first of the channels retaining a resilient element having a blade protruding from the opening of the channel, the second channel containing intumescent material, the sealing device being affixed to one of the door and the door frame, wherein when the door is in a closed position the blade engages with the other of the door and the door frame to act as a draught and smoke seal and the intumescent material on being subjected to high temperature intumesces through the opening of the second channel to form a fire seal between the door and the door frame.

There may be two channels in the holder having respective openings and each containing intumescent material, the resilient member preferably being disposed between the two channels.

Preferably said acute angle is in the range 30 to 60°.

When the sealing device is installed on a single action door or a door frame for such a door, the free edge of the blade should be the trailing edge of the blade in relation to the relative movement of the door and door frame during closure of the door.

In accordance with a further aspect of the present invention, there is provided a method of making an intumescent seal comprising: providing a tubular holder having a longitudinal bore or interior chamber defined by a thickened longitudinally extending portion of the holder contiguous with a relatively thin wall of the holder; filling the bore of the holder with solid intumescent material; and thereafter removing a longitudinally extending part of said thickened portion thereby to leave part of said thickened portion as a baffle within the holder, the space left by said removed part forming a strait having a longitudinally extending opening to the exterior of the holder and a longitudinally extending opening to the bore of the holder.

The bore of the holder may be filled with the intumescent material by first filling the bore with a slurry or paste of a composition which subsequently hardens to form the intumescent material.

Preferably the removal of said part of the thickened portion leaves two webs, one of which constitutes the baffle and the other preferably being at the exterior of the holder. To this end, the thickened portion is preferably at a corner of the holder and is preferably square or rectangular in cross section.

The removal of said part of the thickened portion is conveniently effected by means of a saw or other cutting tool and leaves the opening from the strait into the bore of the holder defined between a free edge of the relatively thin wall portion and a free edge of the baffle.

The invention is further described below by way of example with reference to the accompanying drawings, in which:

Figure 1 is a cross section of a first sealing device according to the invention;

Figure 2A is a perspective view of a door and a door stile, the door being equipped with the first sealing device.

Figure 2B is similar to Figure 2A but with fire conditions on one side of the door; and

Figure 3 is a section of a second sealing device according to the invention.

Figure 4A is a cross section of a holder before filling with the intumescent material;

Figure 4B is a cross section of an intumescent seal made from the holder of Figure 1A;

Figures 5A to 9A ("A" figures only) are cross sections of holders prior to filling with intumescent material; and

Figures 6B to 9B ("B" figures only) are cross sections of intumescent seals made respectively from the holders of Figures 6A and 9B.

The sealing device shown in Figure 1 comprises an elongate holder 1 defining a first channel 2 and a second channel 3.

The channels 2 and 3 have respective openings 4 and 5. The first channel 2 retains a resilient member 6 having a blade 6' protruding from the channel 2 through the opening 4. The second channel 3 contains intumescent material 7. The openings 5 and 6 are provided in a face 8 of the holder 1 and the blade 6' is at an angle of 45° to the face 8.

The holder 1 is formed with a baffle 15 extending within the channel 3. The baffle 15 is co-extensive with the opening 5 and defines a strait 19 intermediate the opening 5 and an interior chamber 20 of the holder. The chann el 3 thus consists of the strait 19 and the chamber 20, the strait containing a minor proportion of the intumescent material 7 and the chamber containing a major proportion of the intumescent material.

As shown in Figure 2A, the sealing device may be installed in a groove 10 along one side edge of a door 11. When closed the door 11 engages a stile 12 of a door frame. (The top crosspiece of the door frame is not shown in Figures 2A and 2B.) The door 11 is a single action door opening in the direction indicated by arrow A and the free edge of the blade 6' is the trailing edge of the blade when the door is closed.

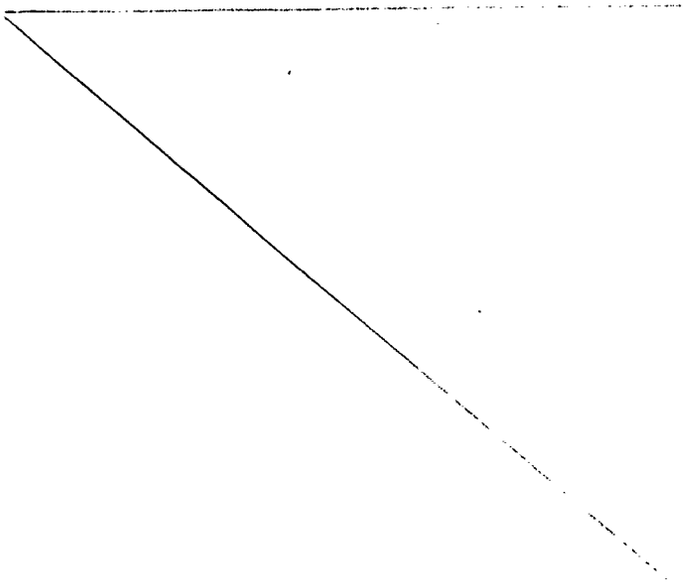
Figure 2A shows the door closed under normal conditions, the blade 6' bearing against the stile 12 and acting as a draught seal. In the event of a fire the blade 6' at least initially continues to bear against the stile 12 and acts as a smoke seal.

The baffle 15 protects the intumescent material 7 in the chamber 20 against a probe which may be pushed through the opening 5 by a tamperer.

As shown in Figure 2B when the fire reaches the holder, the intumescent material in the holder 1 intumesces through the opening 5 in the holder and fills, at 14, any gap between the stile 12 and the adjacent edge of the door 11 thereby acting as a fire seal. If the fire is on the same side of the holder as the opening 5, the intumesced material at 14 serves to protect the blade 6' against the heat of the fire.

The holder 1 is made of material of high thermal conductivity e.g. aluminium. The resilient member is conveniently made of Neoprene.

The seal shown in Figure 3 is similar to that shown in Figure 1 except that it has two channels 3 having respective openings 5 and each containing intumescent material 7. The channel 2 retaining the resilient member 6 is disposed between the



two channels 3.

In the event of a fire, on either side of the holder 1 the blade 6' is protected from the heat of the fire by material which has intumesced through the opening 5 nearer the fire.

Although in the foregoing description particular reference has been made to a single action single door, the seals are equally applicable to double action single doors, single action double doors and double action double doors.

The seals described above with reference to Figures 1 to 3 may be made by a method such as described below.

Referring to Figure 4A, a rigid holder 1 is elongate and of uniform cross section and comprises two tubular portions 2, each having a longitudinal bore or interior chamber 3 and being interconnected by a web 4. Each tubular portion 2 comprises relatively thin walls 5 and a contiguous relatively thick portion 6 at a corner of the holder, the portion 6 being of square cross section. A channel 7 is defined by facing walls of the two tubular portions 2 and the connecting web 4.

In making an intumescent seal, the bores 2 are filled with a composition in the form of a slurry which is allowed or caused to harden to form a solid coherent mass of intumescent material 20. Then a longitudinal saw cut bounded by dot-dash line 8 is made into each portion 6 to remove a part thereof. The saw cut breaks into the bore 3 but leaves a web 9 (see Figure 1B) at the exterior of the holder and a web 10 within the holder. There is thus formed a strait 11 having an opening 12 to the exterior of the holder and an opening 13 to the longitudinal bore 3 of the holder.

The web 10 constitutes a baffle, which, as can be seen from Figure 1B, restricts access to the bore or interior chamber 3 of the holder by a probe pushed through the opening 12 by a tamperer.

A resilient draught and smoke sealing element 14 may be fitted to the seal. The sealing element 14 has a foot portion 15 which is located in the channel 7 and a blade 16 which extends away from the channel.

The intumescent material in either of the tubular portions 2 can protect the sealing element from heat in the event of a fire. It is to be understood that it is not essential to provide the sealing element 14.

Figures 5A to 9A show other shapes of holders and Figures 5B to 9B show intumescent seals made therefrom.

In the holder of Figures 5A and 5B the channel 7 faces in the opposite direction to the openings 12 in the intumescent seal, and the tubular portions are interconnected by a relatively thick portion 4'. The seal can be fixed to a structure such as a door by fasteners (e.g. nails) passed through the portion 4' and the channel 7 into the structure.

The holder of Figures 6A and 6B has only one tubular portion 2 and hence only one interior chamber 3. Ideally in use the opening 12 is disposed between the source of fire and the sealing element 13.

The holder of Figures 7A and 7B has an inverted T-shaped channel 7 to receive a correspondingly shaped base of a draught and smoke sealing element.

The holder of Figures 8A and 8B has only a single tubular portion 2 and the channel 7 faces in the opposite direction to the opening 12 in the seal. In alignment with the channel 7 is a shallow V-shaped channel 16 in portion 4" of the holder. The seal can be fixed to a structure such as a door by fasteners

(e.g.nails) passed through the portion 4" and the channel 7 into the structure, heads of the fasteners being sunk into the channel 16.

In the holder of Figures 9A and 9B, the tubular portions have a common wall or web 5', there being no interconnecting web 4.

The holders described above and as shown in the "A" figures may be made by extrusion of aluminium, aluminium alloy or plastics material. Such plastics material preferably has inclusions of material of high thermal conductivity.

It will be appreciated that the seals described above and which comprise a resilient draught and smoke sealing element, may be used with such element omitted simply as an intumescent fire seal.

CLAIMS

1. A seal for sealing a pivotally mounted closure member against draughts, smoke and fire, comprising an elongate holder defining two channels each having an opening, a first of the channels retaining a resilient element having a blade protruding from the opening of the channel and for acting as a draught and smoke seal, the second channel containing intumescent material, the intumescent material expanding through the opening of the second channel for forming a fire seal when subjected to high temperature, the blade being at an acute angle to a face of the holder in which the opening of the second channel is provided, the second channel being provided with a baffle extending within the channel and defining a strait intermediate the opening of the channel and an interior chamber of the channel.

2. A seal according to Claim 1, wherein there are two channels in the holder having respective openings each containing intumescent material, the resilient member being disposed between the two channels.

3. A seal according to Claim 1 or 2, wherein said acute angle is in the range 30 to 60°.

4. In combination, a fixed structure, a closure member pivotally mounted relative to the fixed structure, and a seal comprising an elongate holder defining two channels each having an opening, a first of the channels retaining a resilient element having a blade protruding from the opening of the channel, the second channel containing intumescent material, the seal being affixed to one of the closure member

and the fixed structure, wherein the closure member is in a closed position the blade engages with the other of the closure member and the fixed structure to act as a draught and smoke seal and the intumescent material on being subjected to high temperature intumesces through the opening of the second channel to form a fire seal between the closure member and the fixed structure, the second channel being provided with a baffle extending within the channel and defining a strait intermediate the opening of the channel and an interior chamber of the channel.

5. A combination according to Claim 4, wherein there are two channels in the holder having respective openings each containing intumescent material, the resilient member being disposed between the two channels.

6. A combination according to Claim 4 or 5, wherein said acute angle is in the range 30 to 60°.

7. A method of making an intumescent seal comprising: providing a tubular holder having a longitudinal bore or interior chamber defined by a thickened longitudinally extending portion of the holder contiguous with a relatively thin wall of the holder; filling the bore of the holder with solid intumescent material; and thereafter removing a longitudinally extending part of said thickened portion thereby to leave part of said thickened portion as a baffle within the holder, the space left by said removed part forming a strait having a longitudinally extending opening to the exterior of the holder and a longitudinally extending opening to the bore of the holder.

8. A method according to claim 7, wherein the bore of the holder is filled with intumescent material by first filling the bore with a slurry or paste of a composition which subsequently hardens to form the intumescent material.

9. A method according to claim 7 or 8, wherein the removal of said part of the thickened portion leave two webs, one of which constitutes the baffle.

10. A method according to claim 9, wherein the other web is at the exterior of the holder.

11. A method according to claim 10, wherein the thickened portion is at the corner of the holder.

12. A method according to claim 11, wherein the thickened portion is square or rectangular in cross section.

13. A method according to any of claims 7 to 12, wherein the removal of said part of the thickened portion is effected by means of a cutting tool and leaves the opening from the strait into the bore of the holder defined between a free edge of the relatively thin wall portion and a free edge of the baffle.

14. A seal according to any of claims 1 to 3, when made by a method according to any of claims 1 to 7.

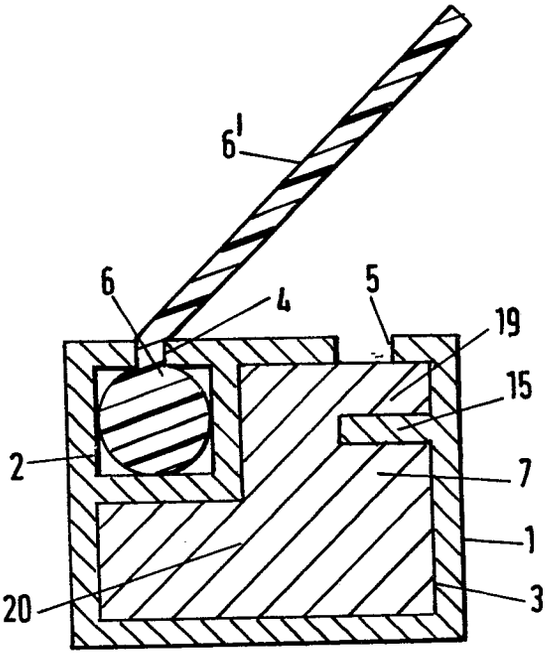


FIG. 1.

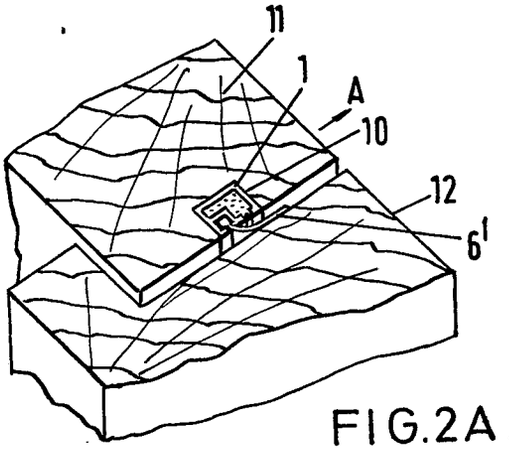


FIG.2A.

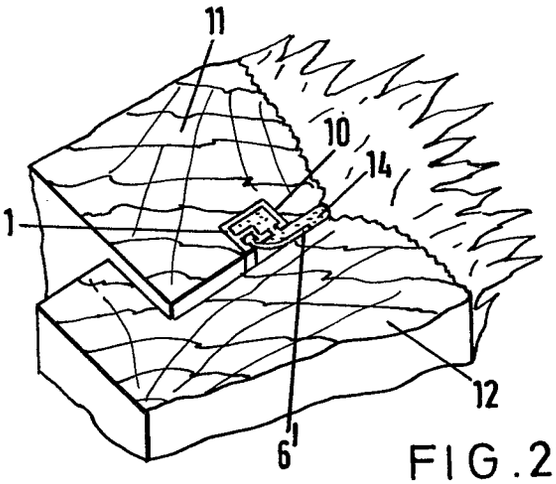
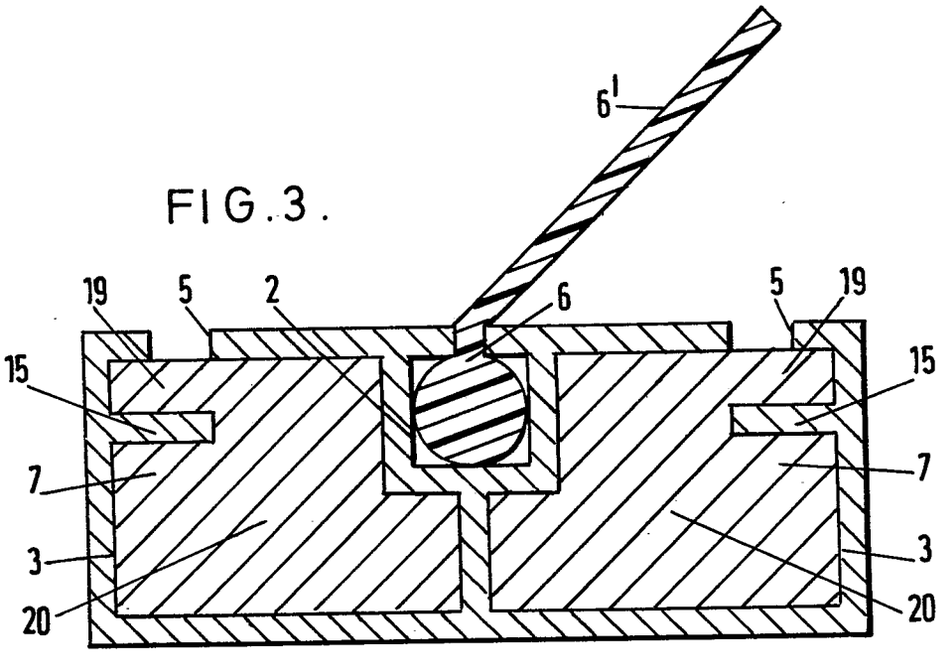


FIG.2B.

FIG.3.



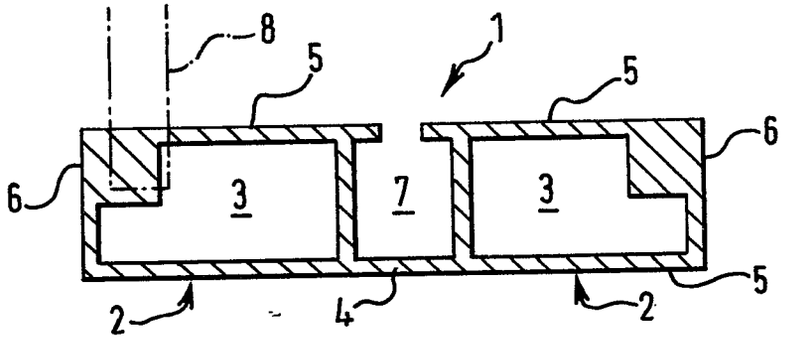


FIG.4A.

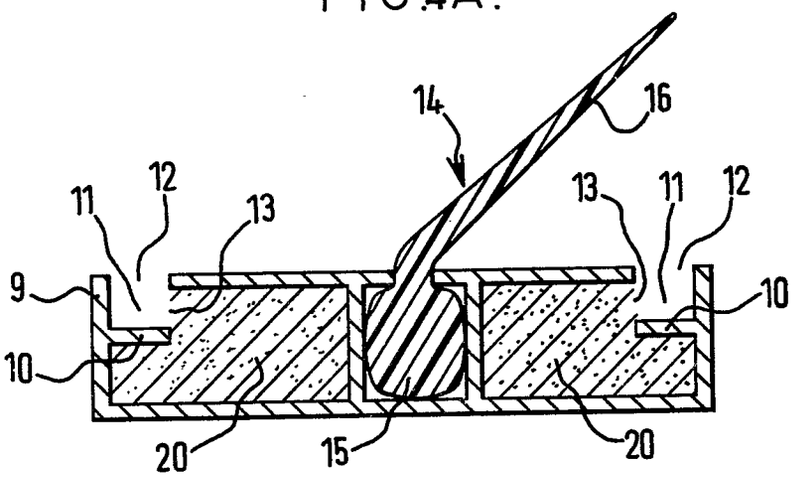


FIG.4B.

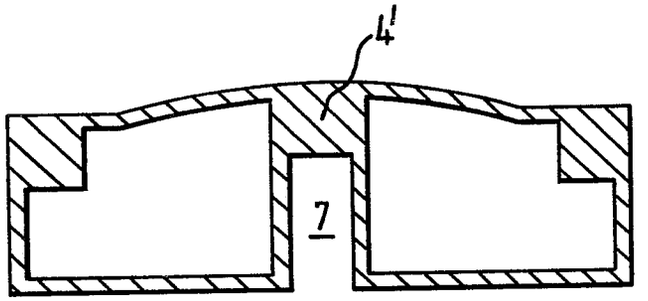


FIG.5A.

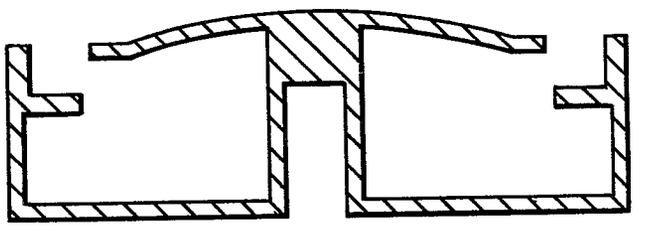


FIG.5B.

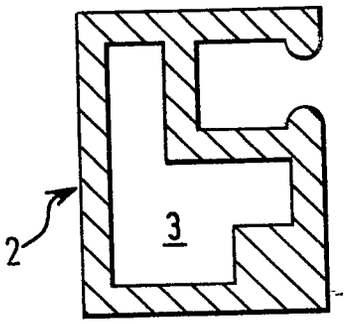


FIG.6A.

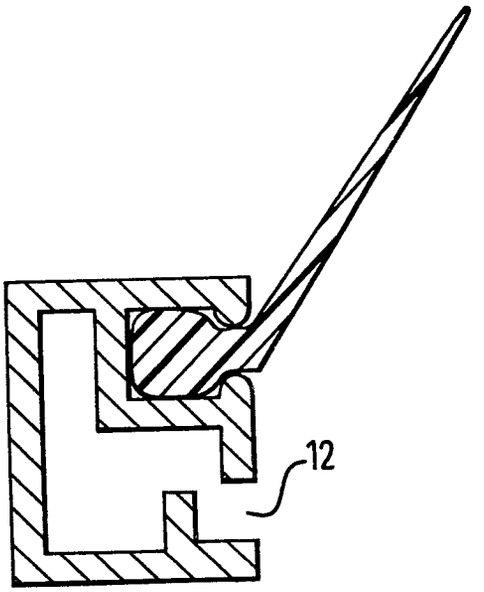


FIG.6B.

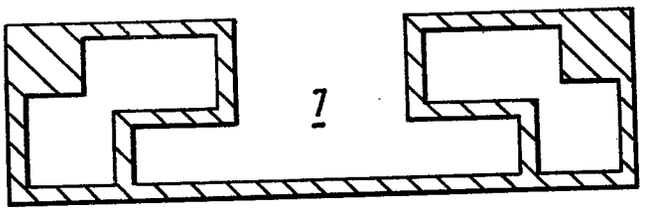
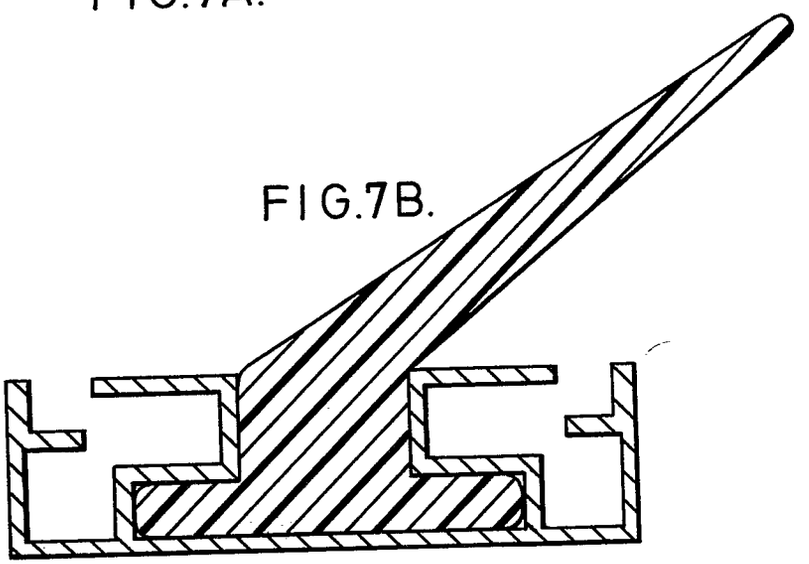


FIG.7A.

FIG.7B.



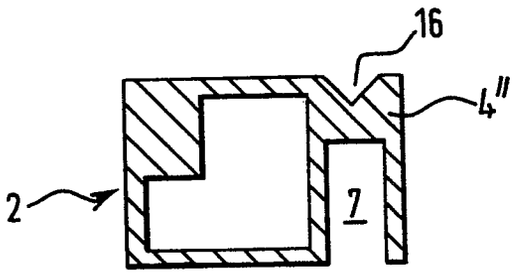


FIG.8A.

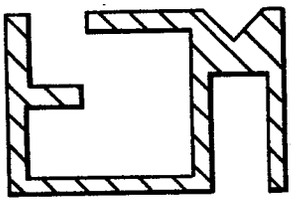


FIG.8B.

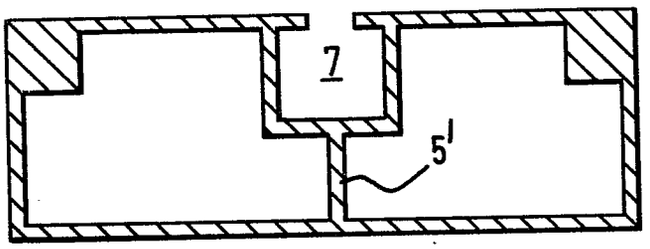


FIG.9A.

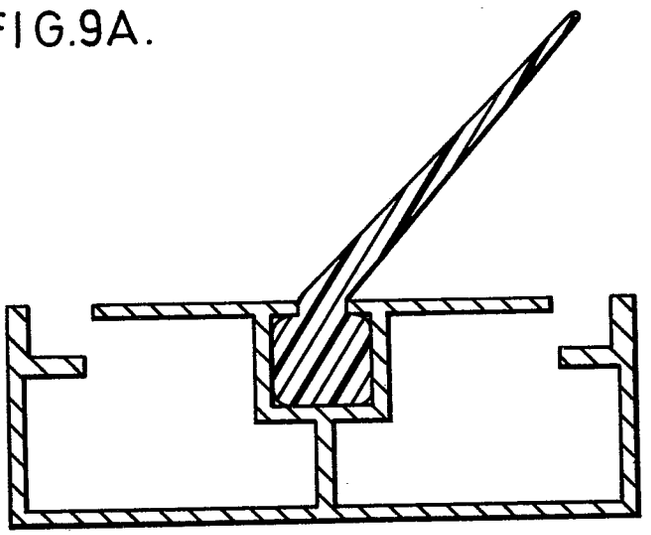


FIG.9B.

European Patent Office

EUROPEAN SEARCH REPORT

Application number
0050517
EP 81 30 4916

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	FR - A - 2 391 347 (INDUSTRIE- en HANDELSONDERNEMING ELTON) * page 2, lines 18-40; page 3,; figures 1-3 *	1,2,4, 5
	FR - A - 2 335 134 (INDUSTRIE- en HANDELSONDERNEMING ELTON) * page 5, lines 2-40; page 6; figures 1-4 *	1,2,4, 5
	FR - A - 2 348 330 (DIXON INT.) * Page 2, lines 22-40; pages 3-6; figures 1 and 2 *	1,4,7, 8,13

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
E 06 B 5/16

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)
E 06 B

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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D: document cited in the application
L: document cited for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18.01.1982	VIJVERMAN

EPO Form 1503.1 06.78