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

(11) EP 2 826 941 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
21.01.2015 Bulletin 2015/04

(51) Int Cl.:
E06B 9/00 *(2006.01)*

(21) Application number: **14173346.9**

(22) Date of filing: **20.06.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **20.06.2013 GB 201311003**

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(54) Flood barrier arrangement

(57) The present invention relates to an improved barrier arrangement to inhibit fluid passing through a structural opening. The barrier arrangement comprises a main frame structure which is expandable in a first direction to engage the barrier arrangement with a structural opening and the arrangement further comprises a frame expansion element which is moveable relative to the main frame structure between a contracted and an expanded configuration to enable expansion of the barrier arrangement in a second direction to further engage the barrier arrangement in a second direction with a structural opening. In the expanded configuration a separation opening is defined between the main frame structure and the frame expansion element and as such a projection is provided which is arranged to substantially occlude the separation opening, wherein the frame expansion element, projection and main frame structure each comprise outwardly facing abutment surfaces facing the first direction and being coplanar in the expanded configuration.

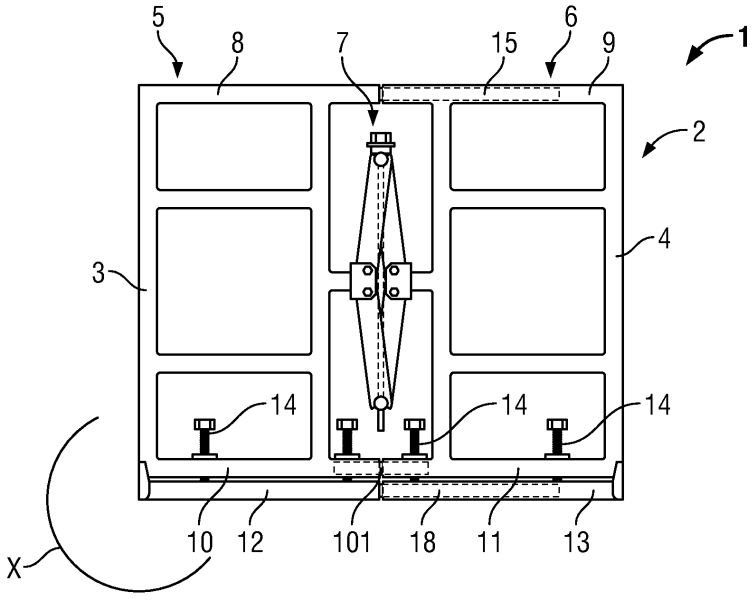

FIG. 1

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Description

[0001] The present invention relates to a barrier arrangement and more particularly to a barrier arranged to inhibit fluid passing through a structural opening.

[0002] Barriers for preventing fluid ingress through building structures are well-known for example for inhibiting water flooding of buildings through window or door openings. Reference is made to EP0978624 which discloses an arrangement comprising a frame expandable in two mutually perpendicular directions, with a waterproof covering thereon. This arrangement is effectively expanded in a structural opening such as a door or window to prevent water ingress. A limitation associated with this arrangement is, however, apparent in that as the lower frame member 12 is expanded effectively drawing it away from frame members 10, 11, a potential leak path is opened between the end of frame member 12 or 18 in the transverse axis, and the intersection of the peripheral edges of frame members 3 and 10.

[0003] An improved barrier arrangement has now been devised.

[0004] A barrier arrangement for a structural opening comprising a main frame structure expandable in a first direction to engage the barrier arrangement with a structural opening, the barrier arrangement further comprising a frame expansion element moveable relative to the main frame structure between a contracted and an expanded configuration to enable expansion of the barrier arrangement in a second direction to further engage the barrier arrangement with a structural opening, such that in the expanded configuration a separation opening is defined between the main frame structure and the frame expansion element, one of the frame expansion element or main frame structure comprising a projection projecting therefrom arranged to substantially occlude the separation opening, wherein the frame expansion element, projection and main frame structure each comprise outwardly facing abutment surfaces facing the first direction and being coplanar in the expanded configuration.

[0005] The presently claimed invention provides a significant benefit over prior art arrangements as it has been determined that under certain pressures there is the possibility of leakage occurring through the barrier arrangement and thus through the opening in the building structure. By occluding the separation opening defined between the main frame structure and the frame element through the provision of a projection as defined extending from the main frame structure or the frame expansion element, the possibility of leakage occurring is significantly reduced and the pressure the barrier arrangement is able to withstand is increased.

[0006] The separation opening in the expanded configuration may be defined as being provided between an end of the frame expansion element the end surface forming the frame expansion element abutment surface the frame expansion element effectively forming an outer peripheral edge of the barrier arrangement. The three abutment surfaces engage with the structural opening, with a cover membrane beneficially seating therebetween.

[0007] It will be appreciated that the projection extends towards the other of the main frame structure or the frame expansion element dependent on whether the projection is formed on with the main frame structure or the frame expansion element. In the specific embodiments described with reference to the accompanying drawings it will be appreciated that the projection has been shown extending from the frame expansion element, but could equally extend from the main frame structure.

[0008] Benefits associated with the present invention are significant. Typical prior art arrangements for enabling expansion of a frame into an opening utilise telescopic members which are effective for changing or adjusting the length or width of a frame. A problem with such telescopic arrangements is there is always a step between the termination of the outer member and the extension therefrom of the inner member. When attempting to prevent water ingress into a building through a door or window for example any weak point in the barrier arrangement will result in water ingress. As the pressure is increased the water flow will also be increased. Accordingly, the provision of the claimed outwardly facing abutment surfaces in the first direction wherein the abutment surfaces of the frame expansion element, projection and main frame structure are coplanar means that the possibility of water ingress is effectively removed.

[0009] A further benefit of the present invention is during assembly. Barrier arrangements to prevent water ingress must be easy to assemble as there is often little warning of potential flooding. As such utilising the claimed invention reduces significantly the possibility of the apparatus jamming during installation. Utilising typical telescopic members for expanding a barrier arrangement, in particular adjacent at corners, results in difficulty as the frame expansion element in prior art arrangements is typically expanded using more than one expansion bolt. These are unlikely to be actuated concurrently meaning that the frame expansion element becomes misaligned. As such this misalignment causes associated tilting of an inner telescopic member relative to the outer telescopic member causing jamming and often incorrect and ineffective installation.

[0010] The first direction and the second direction beneficially are substantially mutually perpendicular. Window frames and door frames are typically square or rectangular meaning that it is beneficial that the first direction and second direction in which the barrier arrangement expands are substantially mutually perpendicular.

[0011] The frame expansion element is beneficially elongate having a longitudinal axis and the separation opening may be defined between an end of the frame expansion element and a corner of the main frame structure in an axis substantially transverse to the longitudinal axis of the frame expansion element.

[0012] The barrier arrangement has a peripheral edge

and the separation opening is therefore defined in the peripheral edge when the barrier arrangement is in an expanded configuration. The frame expansion element therefore defines part of the peripheral edge of the barrier arrangement, and comprises a peripheral longitudinal edge. Typically, the frame expansion element and peripheral longitudinal edge thereof seats at the bottom edge of an opening.

[0013] The projection beneficially projects substantially perpendicular to the longitudinal axis of the frame expansion element. The projection is beneficially fixedly secured to the frame element, but may alternatively project from a main frame member of the main frame structure.

[0014] The abutment surface of the main frame structure or the frame expansion element is preferably configured to accommodate a portion of the projection. It is beneficial that the main frame structure or frame expansion element and abutment surfaces thereof accommodate a portion of the projection in both the expanded and contracted configuration meaning effectively there is an overlap of the projetion and recess to prevent deformation of the projetion by the water pressure. This removes interruptions associated with telescopic members for example and improves relative movement during assembly.

[0015] A substantially planar peripheral edge is therefore defined by the abutment surfaces of the main frame structure and the projection in the expanded configuration, and preferably in the contracted configuration.

[0016] A recess is preferably provided in the abutment surface of the main frame structure or frame expanding element for receipt of the projection. As the recess is also outwardly facing the projection can deform during assembly.

[0017] The projection is beneficially arranged to move linearly and parallel to the longitudinal axis of the main frame structure.

[0018] The frame expansion element is beneficially positioned substantially parallel to a main frame member of the main frame structure, in both the contracted and expanded configuration. During operation when the barrier arrangement is positioned in a structural opening it is beneficial that the main frame structure is expanded sideways to engage with the structural opening. The frame expansion element is then subsequently expanded parallel to the main frame member of the main frame structure to secure and seal the bottom edge of the opening.

[0019] The main frame structure beneficially further comprises a second main frame member projecting substantially parallel to the longitudinal axis of the frame element. The projection beneficially overlaps an end of the second main frame member in both the contracted and the expanded configuration. This ensures that the possibility of water ingress through the separation opening is minimised.

[0020] The projection beneficially comprises a finger and the main frame structure beneficially includes a receiving portion for receipt of the finger. In the transverse axis of the abutment surface of the main frame structure there is beneficially an abutment surface defined by the finger intermediate the abutment surface of the main frame structure. This provides a benefit in that transversely across the peripheral edge there is always an abutment surface in engagement with the structural opening meaning that leakage possibility is minimised.

[0021] A cover membrane is beneficially disposed across the main frame structure and the frame element. The cover membrane is beneficially liquid impermeable and is stretchable to accommodate expansion of the barrier arrangement in the first and second directions. This cover membrane seats around the peripheral edge of the barrier arrangement to engage directly with the structural opening providing a positive seal.

[0022] The present invention will be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a schematic side view of a barrier arrangement according to an exemplary embodiment of the present invention in a collapsed configuration.

Figure 2 is a schematic side view of the barrier arrangement of Figure 1 in an expanded configuration.

Figure 3 is a schematic side view of a corner of the barrier arrangement identified by 'X' in Figure 2 that has been enlarged for clarity purposes.

Figure 4 is a schematic end view of the enlarged view of Figure 3 from the direction indicated by letter 'A' in Figure 3. This is in the contracted configuration.

Figure 5 is a schematic end view in the same direction as indicated in Figure 4 but in the expanded configuration.

Figure 6 is a schematic underside plan view of the longitudinal extending portion of a frame expansion element for use in an exemplary embodiment of the present invention.

[0023] Referring to the Figures, the barrier arrangement (generally designated 1) comprises a main frame structure made up of a metallic box section frame 2 comprising two frame halves 5,6 which are moveable away from, or toward, one another in accordance with operation of an actuation mechanism 7. Each frame half 5,6 comprises a respective side frame member 3,4 connected to respective uppermost frame members 8,9 and lower frame members 10,11. A bracing element 101 may be positioned extending between the ends of the lower frame members 10,11, such that in the contracted configuration the bracing element 101 is substantially received in the lower frame members 10,11. The bracing element is preferably secured to the lower frame member

11 and is provided internal of the lower frame member 11. The opposing distal end is moveable in relation to lower frame member 10 and is located therein to provide a bracing effect for providing increased rigidity to the frame. The distal end 103 of the bracing element 101 is beneficially forked such that movement of the bracing element 101 is not impeded by the bolt 14.

[0024] Each lower frame member 10,11 carries a frame expansion element which may be termed a bottom rung made up of rungs 12,13 which is secured to the underside of the respective lower frame element 10,11 but moveable away from or towards the respective frame element 10,11 by means of operation of bolts 14 threadably received in respective threaded nuts secured to frame element 10,11. Upper frame element 8 and lower rung 12 each carry a respective projecting limb 15,18 which is telescopically received within the interior of the adjacent respective upper member 9 and lower rung 13. Limbs 15,18 are friction fitting within the hollow channel section of upper element 9 and lower rung 13 respectively in order to enhance the rigidity of the frame is maintained when in the expanded configuration. Projecting limb 18 will be described in more detail with respect to Figure 6.

[0025] The actuation mechanism 7 is operable from the rear side of the apparatus and comprises a pivotal linkage mechanism including pivoting arms 19,20,21,22 and a threaded actuation rod 23 which is actuatable by a nut 24 provided at an end thereof.

[0026] Turning nut 24 causes the threaded rod 23 to rotate about its axis and the lowermost ends of arms 22, 21 to be drawn toward the nut 24 in order to expand the frame 1. Conversely, in order to retract the frame to a collapsed configuration, the nut 24 is rotated in the opposite sense causing the lowermost ends of arms 21, 22 to move away from nut 24 due to the threaded connection with threaded rod 23.

[0027] The obverse face of the frame is covered by a flexible (expandable) rubber sheet 25 envelope which is stretched across the frame and provided in the form of a partial envelope having peripheral edges 26 which overlap the frame, thereby securing the sheeting in position. In the Figures the cover membrane extending across the frame is not shown for the purpose of clarity of explanation of the operation of the barrier frame. The outermost edges of the cover membrane which may be in the form of a rubber sheet envelope are preformed to have a portion which abuts the frame members and frame element, and portions which stand proud of the respective frame element. By this means, edge portions of the rubber sheet envelope are arranged to collapse/flatten against the respective frame element when the frame is expanded into abutment with the walls of the structural opening across which the barrier is positioned. This provides an efficient seal with the relevant wall. The rubber sheet enveloping the frame terminates in a free edge portion which extends around the frame permitting access to the rear of the frame (and for example the actuating mechanism 7).

[0028] Referring to Figures 3, 4 and 5 the magnified area identified by letter 'X' in Figures 1 and 2 is shown in detail. Figure 3 is front view of this magnified area and shows the main frame structure, and in particular the side frame member 3 thereof and frame element 10 extending substantially perpendicular to the side frame member 3. For clarity, Figure 3 shows the barrier arrangement in the expanded configuration and clearly identifies where the separation opening 31 is occluded by the peripheral edge comprising an outer facing abutment surface of the projection 30. Thus, in the expanded configuration the projection, along with the frame expansion element 12 and side frame member 3 form a coplanar peripheral edge abutment surface of the barrier arrangement that engages the structural opening. Referring to Figure 5 which shows the peripheral edge of the projection 30 and in particular the portion 32 of the projection that covers the separation opening defined in the side view between the frame member 10 and the frame element 12, the importance of the projection 30 occluding the separation opening can be understood in the expanded configuration. The opening defined in the front view between the lower frame member 10 and frame element 12 is covered by the cover membrane and for water to pass through this separation gap the force would need to overcome the strength of the cover membrane and effectively tear the cover membrane. However, the peripheral edge is protected via the projection 30. In prior art arrangements there is a tendency for the cover membrane to be pushed inwardly due to either a separation gap that is unprotected or a telescopic side frame member 3 having a non-coplanar abutment surface. A gap is therefore typically exposed between the cover membrane and the structural opening thus allowing ingress of water.

[0029] Referring to Figure 4, the projection is secured to the frame element 12. The projection 30 may be integrally formed with the frame element 12 or may be secured thereto as shown, for example, in Figure 3. The projection extends upwardly from the frame element 12 and includes a male portion 34 received within a correspondingly shaped recess portion 36 in the side frame member 3. The recessed portion 36 may comprise a cut-out area of minimal depth having a contact surface 36a across which the rearward face of the male portion 34 is arranged to slide. The depth of the recess portion 36 is beneficially less than 5mm. The distance that the male portion 34 moves between the expanded and contracted configuration is beneficially less than 10mm and even more beneficially approximately 7mm meaning that in the expanded configuration as represented in Figure 5 there is a small area defined between the tip of the male portion 34 and the lower most point of the recess portion 36 which is beneficial as the possibility of leakage in this area due to an opening between the peripheral edges is minimised. By providing a shoulder on opposing sides of the recess portion as identified by reference numerals 38, positive contact between this peripheral edge surface of the side frame member 3 and the structural opening is preserved. A further recessed portion 40 is not visible,

however, the leakage possibility is minimised as no gap is present due to the positioning of the lower frame member 10. In addition the male portion 34 maintains a substantially planar surface to the peripheral edge of the side frame member 3 and frame element 12 with a minimised recess portion 40 provided on opposing sides of the male portion 34. As movement of the projection 30 is minimised and limited to approximately 7mm a positive seal around the peripheral lower edge of the frame expansion element 12 is achieved. The separation opening in the peripheral edge of the barrier arrangement between the lower frame member 10 and frame expansion element 12 is therefore protected via the projection 30.

[0030] Referring now to Figures 6a and b a bottom plan view of the frame expansion element is presented. It will be appreciated that the main structure frame portions 5, 6 are expanded to move away from each other in order to secure the barrier arrangement in the opening. As such it will further be appreciated that the frame expansion element 12 must also be expandable. This has traditionally been achieved with a telescopic portion such as a limb 18 as presented, for example, in Figure 1. It has been realised by the applicant, however, that the provision of such a limb provides a possibility for a leak path to be presented due to the limb 18 being received within one or both of the rungs 12, 13. When the rungs 12, 13 are expanded there will inherently be abutment surfaces between the rungs 12, 13 and the structural opening and the limb 18 and the structural opening that are not coplanar. This therefore presents a leak path. Referring to Figures 6a and b there is presented a frame expansion element comprising rungs 12, 13 in the expanded and contracted configurations respectively. A benefit of this configuration is that the rung 12 has an extension portion 80 coplanar with the abutment surface of the rung 12. This extension portion 80 also forms an abutment portion of the barrier arrangement and thus engages with the structural opening. The rung 13 is moveable and slidably engageable with an inner telescopic element 82 also fixedly projecting from the rung 12. A channel 84 is cut into the surface of the rung 13 along which the extension portion 80 is unable to slide. It will therefore be appreciated that a substantially coplanar abutment surface is provided by the frame expansion element through the surfaces provided by the rung 12, extension portion 80 and rung 13. The potential leak path that would have been defined by the separation between the rungs 12, 13 has been removed due to the provision of the elongate extension portion 80 provided in the channel 84.

[0031] In use, the arrangement including the rubber sheet in position stretched across the frame 1 is positioned in its collapsed configuration in position in the structural opening to be barred. The actuation mechanism 7 is then operated to cause the frame 1 to expand such that frame portions 5, 6 move away from one another until the side frame members (covered by the peripheral sealed portion of sheet) engage respective side walls of the structural opening. The nut 24 may, for example, be actuated by a preset torque wrench such that the frame is not over tightened in the opening. When in position with the barrier engaging the side walls of the structural opening, bolts 14 are operated to force rungs 12, 13 downwardly into engagement with the base portion of the structural opening in order to achieve an efficient seal therewith. When expanding the frame by operation of actuation mechanism 7 and bolts 14, the rubber sheet stretches with the frame.

[0032] The barrier arrangement of the invention provides a number of advantages. For example the arrangement is easily assembled on site and may be assembled whilst flooding is occurring.

[0033] Additional barriers may be positioned in side by side relationship either horizontally or vertically and expanded in order to increase the area covered by the barrier.

[0034] The barrier arrangement is particularly useful for restricting flood damage through structural openings such as doors and windows.

[0035] The present invention has been described by way of example only and it will be appreciated by the skilled addressee that modifications and variations may be made without departing from the scope of protection afforded by the appended claims.

Claims

1. A barrier arrangement for a structural opening comprising a main frame structure expandable in a first direction to engage the barrier arrangement with a structural opening, the barrier arrangement further comprising a frame expansion element moveable relative to the main frame structure between a contracted and an expanded configuration to enable expansion of the barrier arrangement in a second direction to further engage the barrier arrangement with a structural opening, such that in the expanded configuration a separation opening is defined between the main frame structure and the frame expansion element, one of the frame expansion element or main frame structure comprising a projection projecting therefrom arranged to substantially occlude the separation opening, wherein the frame expansion element, projection and main frame structure each comprise outwardly facing abutment surfaces facing the first direction and being coplanar in the expanded configuration.

2. A barrier arrangement according to claim 1 wherein the outwardly facing abutment surfaces of the frame expanding element, projection and main frame are coplanar in the contracted configuration.

3. A barrier arrangement according to claim 1, wherein the separation opening is defined between an end of the abutment surface of the frame expanding el-

ement and the abutment surface of the main frame structure.

4. A barrier arrangement according to any preceding claim, wherein the first direction and the second direction are substantially mutually perpendicular.

5. A barrier arrangement according to any preceding claim, wherein the frame expansion element is elongate having a longitudinal axis and the separation opening is defined between an end of the frame expansion element and a corner of the main frame structure in an axis substantially transverse to the longitudinal axis of the frame expansion element.

6. A barrier arrangement according to any preceding claim, wherein the projection projects substantially perpendicular to the longitudinal axis of the frame expansion element.

7. A barrier arrangement according to any preceding claim, wherein the abutment surface of the main frame structure or the frame expansion element is configured to accommodate a portion of the projection.

8. A barrier arrangement according to claim 7, wherein the abutment surface of the main frame element or the frame expanding element comprises a recess for receipt of a portion of the projection.

9. A barrier arrangement according to any preceding claim wherein the protrusion bridges across the entire separation gap in the expanded configuration.

10. A barrier arrangement according to any preceding claim wherein the frame expansion element is positioned substantially parallel to a frame member of the main frame structure, in both the contracted and expanded configuration.

11. A barrier arrangement according to any of claim 10, wherein the frame member projects substantially parallel to the longitudinal axis of the frame expansion element.

12. A barrier arrangement according to claim 11, wherein the projection overlaps an end of the main frame member in both the contracted and expanded configuration.

13. A barrier arrangement according to any preceding claim comprising a cover membrane disposed across the main frame structure and the frame element.

Fig 1

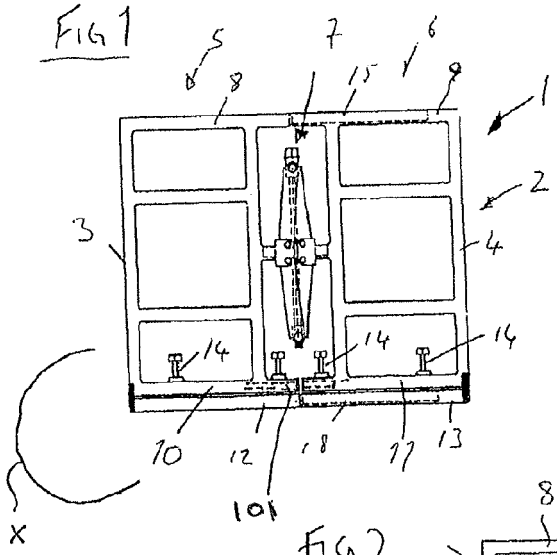
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Fig 2

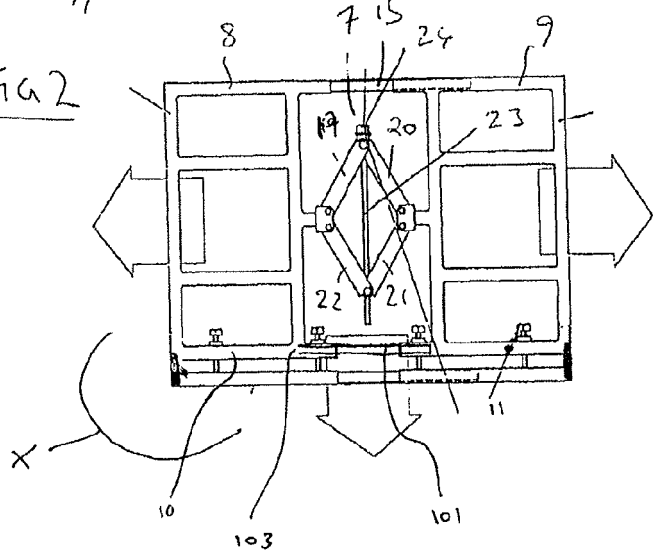
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FIGURE 4

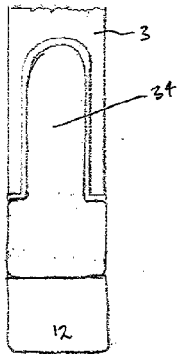


FIGURE 5

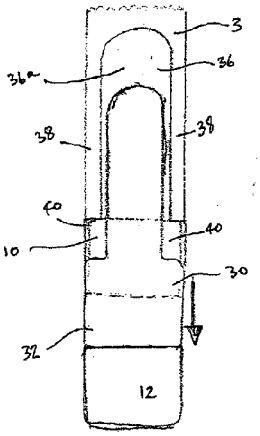


FIGURE 3

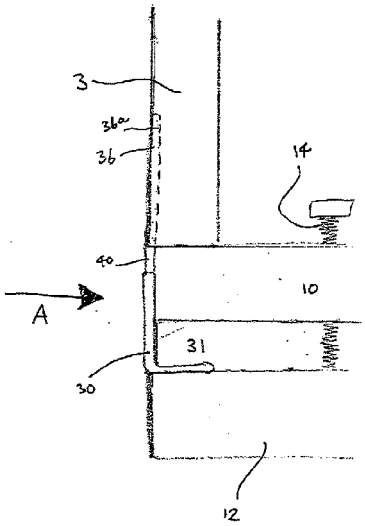
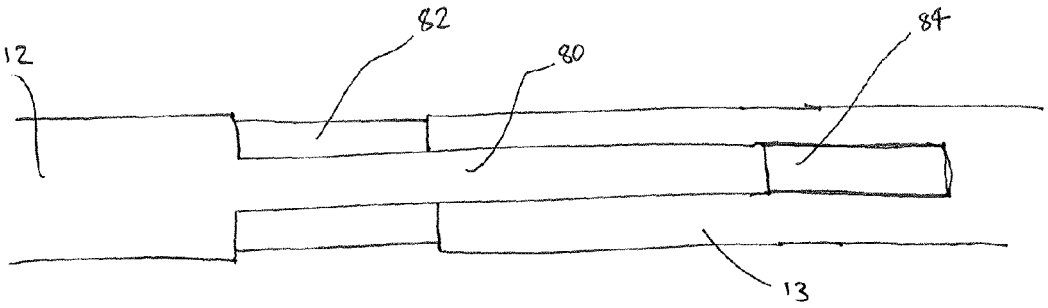
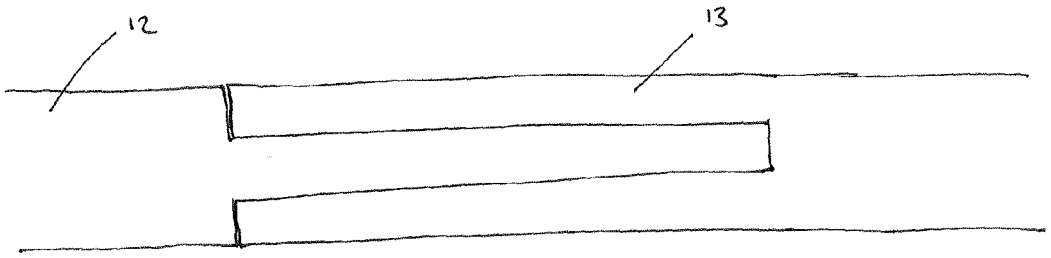


FIGURE 6

(a)



(b)



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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