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(11) **EP 1 245 252 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**02.10.2002 Bulletin 2002/40**

(51) Int Cl.7: **A63B 23/04, A63B 23/08**

(21) Application number: **02252342.7**

(22) Date of filing: **28.03.2002**

(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE TR**  
Designated Extension States:  
**AL LT LV MK RO SI**

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(30) Priority: **30.03.2001 GB 0108123**

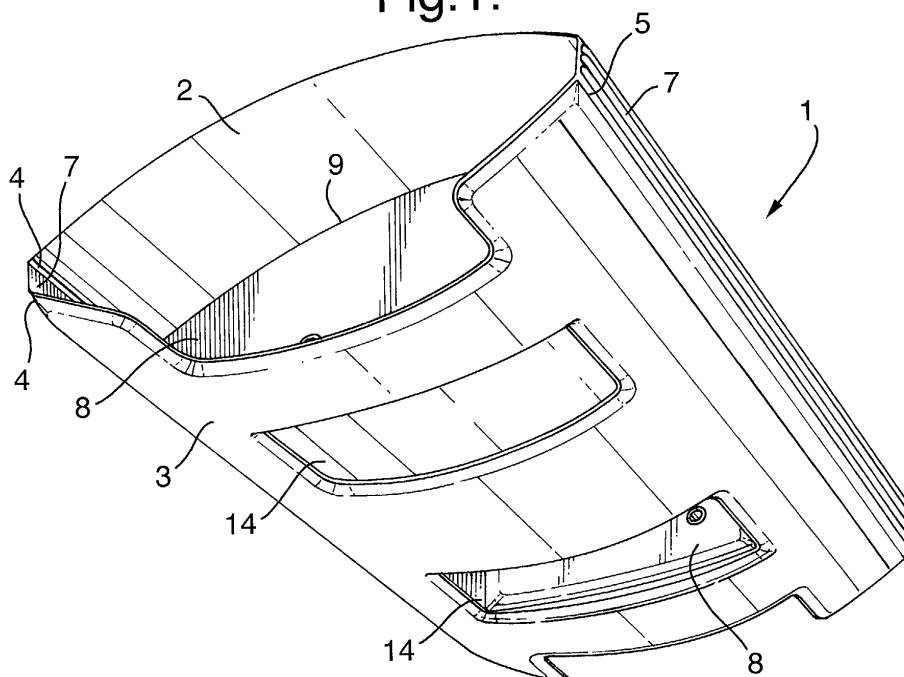
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(54) **Device for reducing the risk of deep vein thrombosis (DVT)**

(57) A lower leg exercise device (1) has an upper panel (2) and a lower panel (3) which are hingedly attached together along opposing longitudinal sides. A pair of elliptical forming panels (8) are hingedly attached to the lower panel (3) and are each foldable between a first position in which they lie substantially flat against the lower panel, whereby the upper panel may be collapsed flat against the lower panel for compact storage, and a second position in which they engage between

the first and second panels in an upstanding manner so as to maintain the panels in spaced apart relationship. In said second position, the loading applied by the convexly curved upper and lower edges of the forming panels (8) to the upper and lower panels (2, 3) results in said panels each adopting a convexly curved shape. In use, the device is placed on the floor in its erect configuration, the user placing their feet on the upper panel and rocking the device back and forth on the curved lower panel.

**Fig.1.**



**EP 1 245 252 A2**

## Description

**[0001]** The present invention relates to devices for facilitating exercise of the lower leg, calf-muscle, ankle, foot, and toe in order to help to reduce the risks of deep vein thrombosis, for example during long commercial airline flights.

**[0002]** Deep Vein Thrombosis (DVT) is a medical problem which is related to lack of exercise of certain vital muscles in the legs which aid pumping blood back up the body from the feet and the lower legs to the heart, and can be associated with periods of prolonged stasis or inactivity, for example as a result of immobility after medical treatment, during long car journeys and also when travelling on long-haul flights, during which passengers typically remain seated for long periods of time, when the muscles of the lower legs and feet are not worked. This can lead blood to pool in the lower legs, which, in some cases, can result in blood clots forming, and this, in turn, carries the danger of one of the clots breaking off and travelling through the body to the lungs where it can cause a Pulmonary Embolism - a potentially fatal condition. Exercise of the lower leg has been shown medically to reduce the risk of DVT. To reduce the risk of DVT to airline passengers, then, it now being recommended that, whilst on-board, passengers should ensure that regular exercise of the lower legs and feet is undertaken to help improve circulation, the most obvious form of which is to walk up and down the aisles at regular intervals. However, it is generally undesirable to have large numbers of people moving around an aircraft during flight since it can lead to further safety risks to the passengers, for example as a result of unexpected turbulence, and also causes disruption to the cabin crew trying to carry out their duties as a result of inevitable congestion of the aisles.

**[0003]** A number of devices have, therefore, been proposed for enabling exercise of the lower legs and feet to be carried out whilst the user is stationary. However, these known devices typically suffer the disadvantages of bulk, weight, and complexity of manufacture and operation. Some devices also need to be inflated prior to use and then deflated after use for storage. Furthermore, these known devices often require considerable space for operation and the need for specialised knowledge or qualified guidance for effective operation.

**[0004]** Once such known device is disclosed in US-A-4159111 and comprises a treadle apparatus including a base with a pair of foot pedals pivotally mounted thereon which are operated by the user through a stepping motion of the feet. This device has the drawback, however, that it is bulky and hence difficult both to store and also to use within a confined area such as in the passenger seating area of an aircraft.

**[0005]** Another device is known which has a pair of foot pedals pivotally mounted on a base with a rocking arm extending therebetween so as to constrain the pedals to move in opposite directions in a stepping motion.

Furthermore, the rocking arm is removable and the base foldable so as to enable the device to be collapsed for compact storage. However, this device is again bulky when in its erect configuration, making it difficult to use effectively within the confines of an aircraft cabin, and is also very difficult to erect and collapse.

**[0006]** An object of the present invention is, therefore, to provide an effective device which permits individual exercise of the lower leg and feet within a restricted area. It is also an object to provide a device which requires minimal storage space when in its collapsed state.

**[0007]** According to the present invention, there is provided an exercise device which is free standing and foldable with at least a convex lower, and preferably also a convex upper surface. More particularly, the present invention provides a lower leg exercise device comprising a first and a second panel which are hingedly connected together along one pair of opposing edges, and at least one forming panel which is movable between a first position in which said first and second panels lie substantially flat against each other, and a second position in which at least one of said first and second panels adopts a convexly curved shape.

**[0008]** A lower leg exercise device in accordance with the invention has the advantage that it provides a simple and effective means for exercising the lower legs and feet within a confined space which is light weight, enabling a rocking motion to be executed which has been found to provide effective exercise for the lower leg, calf-muscle, ankle, foot and toes for reducing the risk of DVT, and can easily be folded flat for compact storage and carriage in a bag or in the pocket of a seat. It is also quick and easy to erect for use and is cheap and simple to manufacture.

**[0009]** Preferably, the or each forming panel takes the form of a hinged internal shaping former which is placed between the upper and lower surfaces, which, in the second position, applies a load to the first and second panels which deforms at least one thereof into a convexly curved shaped, which deformed panel then provides a rocking surface for executing the design exercise. In particular, the device advantageously includes a pair of longitudinally spaced forming panels which are realised as rib members that, in the second position, engage between inner surfaces of the first and second panels substantially perpendicularly thereto so as to maintain said panels in spaced apart relationship. This arrangement has the advantage that a particularly effective support system for the erect device is produced. Furthermore, the forming panels are preferably pivotally connected to one of the first and second panels by means of a suitable hinge system and are pivotally moveable about said hinge between said first and second positions. This has the advantage of producing a self contained device which is particularly compact and to which all the necessary parts are permanently fastened, thereby eliminating the risk of essential components becoming lost.

**[0010]** The connection between the forming panels and the main panels may be particularly effectively achieved by providing integrally formed actuating flaps and associated access openings in the first panel. Each said actuating flap then has attached thereto one of the forming panels and is pivotally moveable about a hinge line between a first position in which it engages in its associated opening and the attached forming panel lies substantially flat against the inner surface of first panel and a second position in which it extends towards the inner surface of the second panel, the attached forming panel engaging said second panel and retaining the device in its erect configuration. In this way, the access openings enable the forming panels easily to be moved manually from the first to the second positions and the open ends of the device then facilitate the return movement to the collapsed configuration when the exercise is completed.

**[0011]** In an alternative arrangement, a forming panel may be pivotally attached to the end edges of one or possibly both of the first and second panels for engagement, in their second positions, in the open ends of the device, which arrangement is particularly cheap and simple to manufacture.

**[0012]** The forming panels may be shaped with at least one convexly curving edge which engages with said at least one first or second panel and distorts it into a convexly curved shape. In the preferred embodiment, the forming panels may be elliptically shaped resulting in both the first and second panels adopted a convexly curving shape. This has the advantage that in addition to the floor engagement surface being curved for enabling rocking motion to be executed, the foot engagement surface is also curved, which has been found to further increase the effectiveness of the exercises.

**[0013]** Correct assembly of the device from the collapsed configuration may be further simplified by provision of stops on the inner surface of one of the first and second panels which prevent the forming panels being pivotally moved beyond the correct second positions.

**[0014]** The device may be constructed from a variety of different materials including, but not limited to plastic, card, corrugated card or plastic or the like. It is also advantageous for the material to be non-slip or have reduced slip properties so as to prevent sliding movement between the device and the operating surface and also between the device and the operator's feet. Alternatively, a reduced or non-slip finish could be applied to the outer surfaces of the first and second panels.

**[0015]** In order that the invention may be well understood, there will now be described some embodiments thereof, given by way of example, reference being made to the accompanying drawings, in which:

Figure 1 is a bottom perspective view of a device according to the invention in an erect configuration;

Figure 2 is a top perspective view of the device of

Figure 1 in an erect configuration showing the forming panels in phantom;

Figure 3 is a side view of the device of Figure 1 in its erect configuration;

Figure 4 is an end view of the device of Figure 1 in its erect configuration;

Figure 5 is a bottom view of the device of Figure 1 in its erect configuration;

Figure 6 is a side view of the device of Figure 1 in a collapsed configuration;

Figure 7 is a bottom view of the device of Figure 1 in its collapsed configuration;

Figure 8 is an end view of the device of Figure 1 in a collapsed configuration;

Figure 9 is a perspective view of a second embodiment of a device according to the invention in a semi-erect configuration;

Figure 10 is a top view of the embodiment of Figure 9 in a collapsed configuration;

Figure 11 is a side view of the embodiment of Figure 9 in a collapsed configuration; and

Figures 12 to 14 are top, side and end views, respectively, of the second embodiment in an erect configuration.

**[0016]** Referring first to Figure 1, there is shown a lower leg exercise device 1 which comprises an upper panel 2 and a lower panel 3 joined together along opposing longitudinal edges 4, 5 by means of hinges 7, which, in the illustrated embodiment, take the form of flexible webs of material. These webs may be integrally formed with the upper and/or lower panels or may be separately attached thereto. In Figure 1, the device is illustrated in an erect position in which a pair of forming panels 8 are engaged transversely between the upper and lower panels 2, 3 and at opposite ends of the device so as to maintain the panels 2, 3 in spaced apart relationship. As can best be seen in Figure 2, the forming panels 8 are elliptical in shape and take the form of ribs which engage with an upper curved edge 9 against the upper panel 2 and a lower curved edge 10 against the lower panel 3 so that said upper and lower panels 2, 3 are urged into a convex shape, the hinges 7 allowing the panels 2, 3 to move apart to form the device into an elliptical cross-section as shown in Figure 4.

**[0017]** As can be seen more clearly in Figure 3, the forming panels 8 are, themselves, pivotally connected to the lower panel 3 by means of hinged operating pan-

els 12. In particular, the operating panels 12 are integrally formed with the lower panel 3, and, by means of a fold line 13, are each foldable between a first position in which they are substantially co-planar with the lower panel 3, engaging in access openings 14 formed therein, and a second position in which they extend substantially perpendicularly from the lower panel 3 towards the upper panel 2, each said operating panel 12 having attached to it one of said forming panels 8. In this way, when the operating panels are in their first positions folded into the access openings 14 in the lower panel 3, the forming panels lie substantially flat with the lower panel 3 as shown in Figure 7, wherein the upper panel 2 lies against the lower panel 3 with the forming panels 8 positioned therebetween and the device is collapsed for compact storage.

**[0018]** In order to erect the device for operation, the operating panels 12 are manually pressed from the first position towards the upper panel using access opening 14 formed in the lower panel 3. This results in their pivoting about fold lines 13 towards their second positions shown in Figure 2, during which movement the upper and lower panels 2, 3 are urged apart into convexly curved shapes, resulting in the device assuming an elliptical shape shown in Figures 1 and 2.

**[0019]** Retaining stops 15 are provided on the inner surface of the upper panel which prevent the forming panels being moved beyond their perpendicular positions.

**[0020]** Once so erected, the device is positioned with the lower panel 3 on any working surface. The operator then places the feet on the curved upper surface of the upper panel 2 and exercises by using the toes and heels to rock the device back and forth.

**[0021]** Upon completion of exercises, the device is returned to its flat configuration by the operator inserting their fingers through the open ends of the device and manually pivotally moving the forming panels 8 away from the retaining stops 15 and back into flat engagement with the lower panel 3.

**[0022]** It will, of course, be understood that although the described embodiment includes two forming panels which are spaced longitudinally along the device, preferably at positions which coincide with the points at which the feet of the operator will be applied to the upper panel 2 so as to ensure that maximum support is provided for the loading which will be applied by the operator to the upper surface during use, it is also possible to use just a single former located centrally of the device in order to maintain the device in the necessary shape for operation. The or each forming panel may also be connected to the upper panel instead of the lower panel. Furthermore, instead of being located part way along the device as in the device illustrated in Figures 1 to 8, the forming panels may instead be pivotally attached to the end edges of the upper and/or lower panels.

**[0023]** In particular, in an alternative embodiment illustrated in Figures 9 to 14, the device 101 includes four

forming panels 108 attached to each end of the upper panel 102 and the lower panel 103 along fold lines 104. In order to erect the device according to this embodiment for operation, the longitudinal sides 105, 106 of the device are pressed towards each other, which, due to the flexibility of the upper and lower panels, causes said panels to bow convexly away from each and hence the device 101 to adopt an elliptical shape. The forming panels 108 carried on each end of the device are then folded along the now convexly curved fold lines 104 into the elliptical mouth at each end of the device so as to overlap each other, each said panel extending across the whole of the open mouth of the device, whereupon the device will be held in the erect configuration. Secondary flaps 109, as shown in Figures 10 - 14, may also be provided on the forming panels 108 to assist in fixing them in place, although other methods may also be used such as locating studs or grooves. Due to the fact that, in the erect configuration, the hinge lines connecting the forming panels to the upper and lower panels 102, 103 will be curved, each panel will, when folded into the device, adopt a concavely curved shape, making them difficult to grasp in order to withdraw them from the ends of the device when collapsing it. For this reason, cut-out portions 110 are provided on the forming panels to facilitate their removal from the ends of the device 101. It will, of course, be understood that the cut-out portions may be replaced by other means for facilitating withdrawal of the panels such as tags for the like. For example, actuating tags may be provided on the forming panels so as to facilitate their movement between the first and second positions by the operator.

**[0024]** Of course, it will be understood that the hinged forming panels of the above described embodiments may be replaced by panels which are detachable from the device and simply inserted into the device and removed therefrom through the mouth formed at each end by the spaced apart transverse edges of the upper and lower panels.

**[0025]** In another embodiment of the invention which is not illustrated, the transversely extending rib type forming panels are replaced by a single forming panel which is located midway between the hinged edges of the upper and lower panels and which extends longitudinally along the device so as to engage the upper and lower panels along their longitudinal centre lines only, the rigidity of the material of the upper and lower panels then resulting in said panels adopting convexly curving shapes. The forming panel in this case may again be pivotally attached, by means of a suitable hinge, to the upper or lower panel or may instead be formed as a separate component which is inserted through the end of the device in a flat orientation and then rotated through 90 degrees so as to urge the longitudinal centre lines of the upper and lower panels apart.

**Claims**

1. A lower leg exercise device (1) comprising a first (2) and a second panel (3) which are hingedly connected together along one pair of opposing edges (4,5), and at least one forming panel (8) which is movable between a first position in which said first and second panels (2,3) lie substantially flat against each other, and a second position in which at least one of said first (2) and second (3) panels adopts a convexly curved shape. 5
2. A lower leg exercise device according to claim 1, wherein the or each forming panel (8) is a rib member which, in said second position, engages between said first (2) and second (3) panels substantially perpendicularly thereto so as to maintain said panels in spaced apart relationship. 10
3. A lower leg exercise device according to claim 1 or claim 2, wherein the or each forming panel (8) is pivotally connected to one of said first (2) and second (3) panels for pivotal movement between said first position, in which it lies substantially coplanar with said one of said first (2) and second (3) panels, and said second position in which it projects substantially perpendicularly between said first and second panels (2, 3). 15
4. A lower leg exercise device according to claim 3, wherein at least one of said first and second panels (2, 3) includes at least one integrally formed actuating flap (12) which is connected to its associated panel (2, 3) along a hinge line (13) and which is foldable about said hinge line (13) between a first position in which it engages in a complimentary shaped access opening (14) formed in its associated panel (2;3), and a second position in which it extends substantially vertically between said first and second panels (23), a forming panel (8) being attached to the or each actuating flap (12). 20
5. A lower leg exercise device according to claim 3, wherein the or each forming panel (8) is hingedly attached to an end edge of one of the first (2) and second (3) panels. 25
6. A lower leg exercise device according to claim 5, wherein at least one forming panel (8) is provided on each end of the device (1). 30
7. A lower leg exercise device according to any of the preceding claims, wherein the or each forming panel (8) includes at least one convexly curved edge (9, 10), which, in said second position, engages against one of said first and second panels (2, 3) so as to deform said one panel (2,3) into a convexly curved shape. 35
8. A lower leg exercise device according to claim 7, wherein the or each forming panel (8) is elliptical in shape such that, in said second position, both said first and second panels (2, 3) are deformed into a convexly curved shape. 40
9. A lower leg exercise device according to any of the preceding claims, wherein stop means (15) are provided on at least one of said first and second panels (2,3) for facilitating positioning of the or each forming panel (8) in said second position. 45
10. A lower leg exercise device according to any of the preceding claims, wherein said first and second panels (2,3) are hingedly connected along said one pair of opposing edges (4,5) by, in each case, a web of flexible material (7). 50
11. A lower leg exercise device according to claim 10, wherein the flexibility of said hinge material (7) is greater than the flexibility of said first and second panels (2,3). 55
12. A lower leg exercise device according to any of the preceding claims, including a pair of forming panels (8) which are spaced longitudinally along the device (1).
13. A lower leg exercise device according to any of the preceding claims, wherein when the or each forming panel (8) is in its first position, the first and second panels (2,3) are collapsible substantially flat against each other for compact storage.

Fig.1.

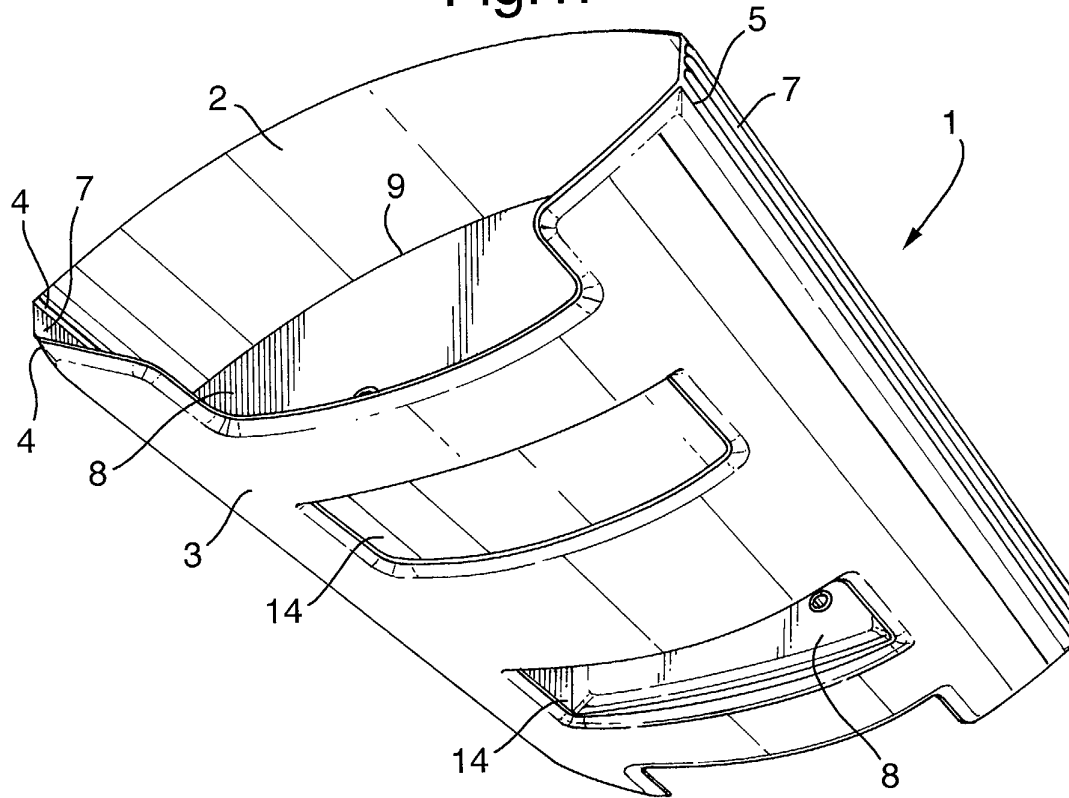
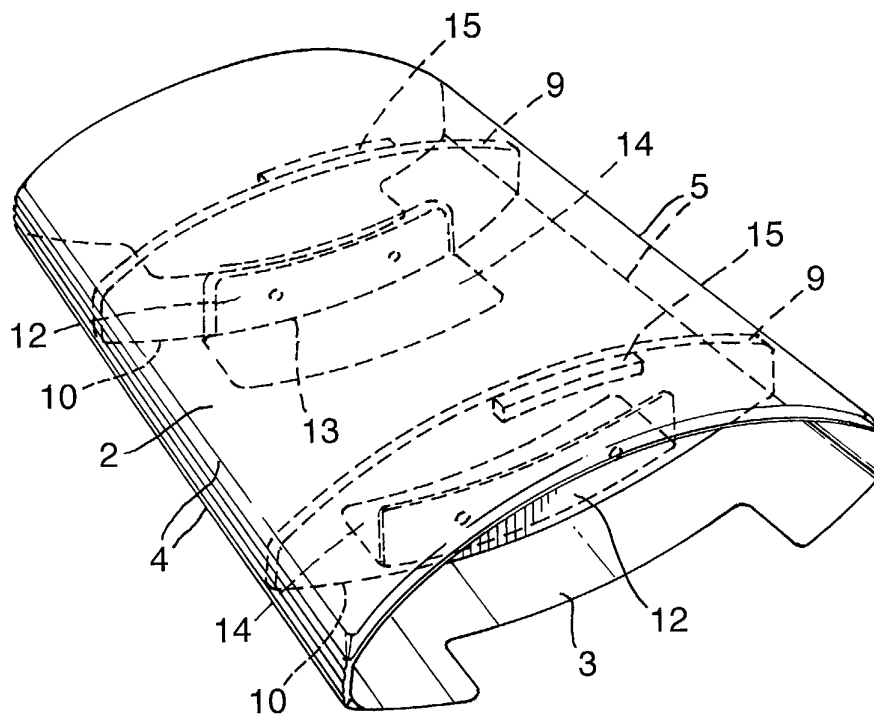


Fig.2.



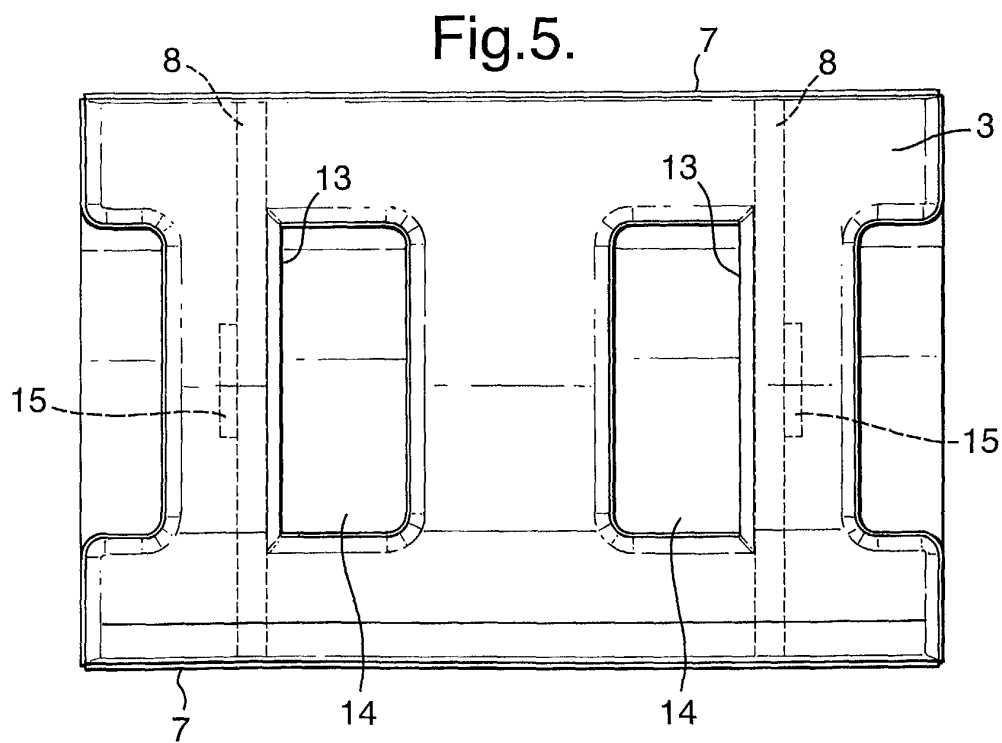
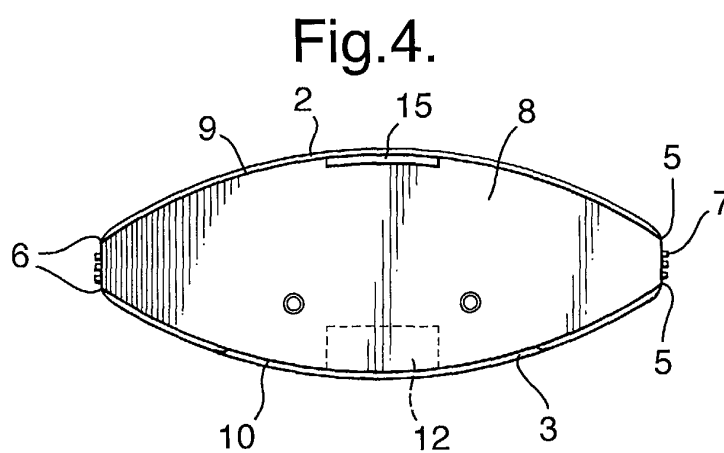
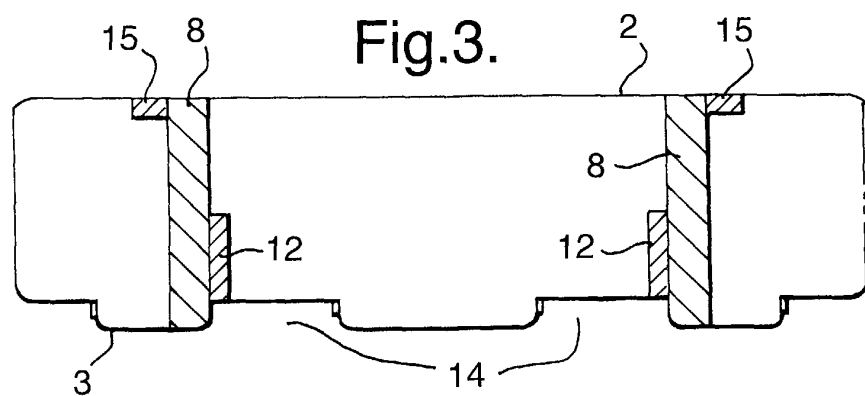


Fig.6.

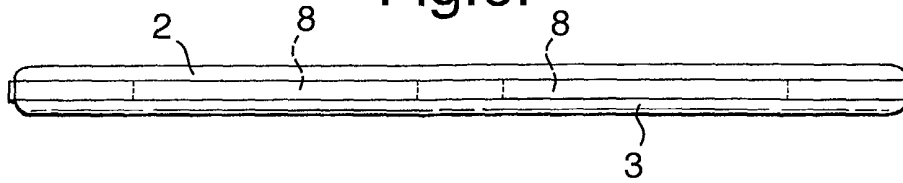


Fig.7.

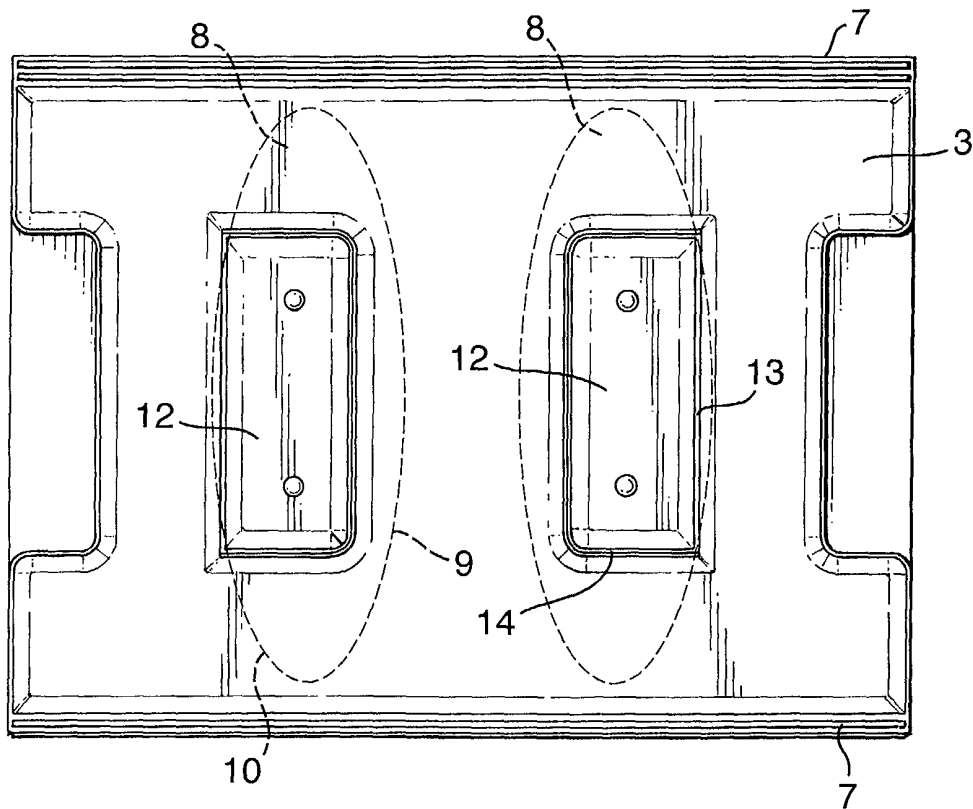


Fig.8.

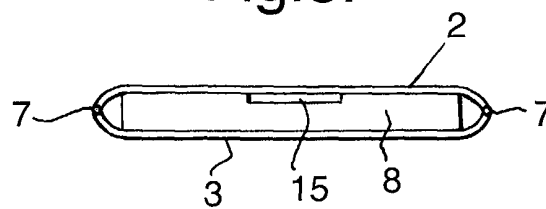




Fig.9.

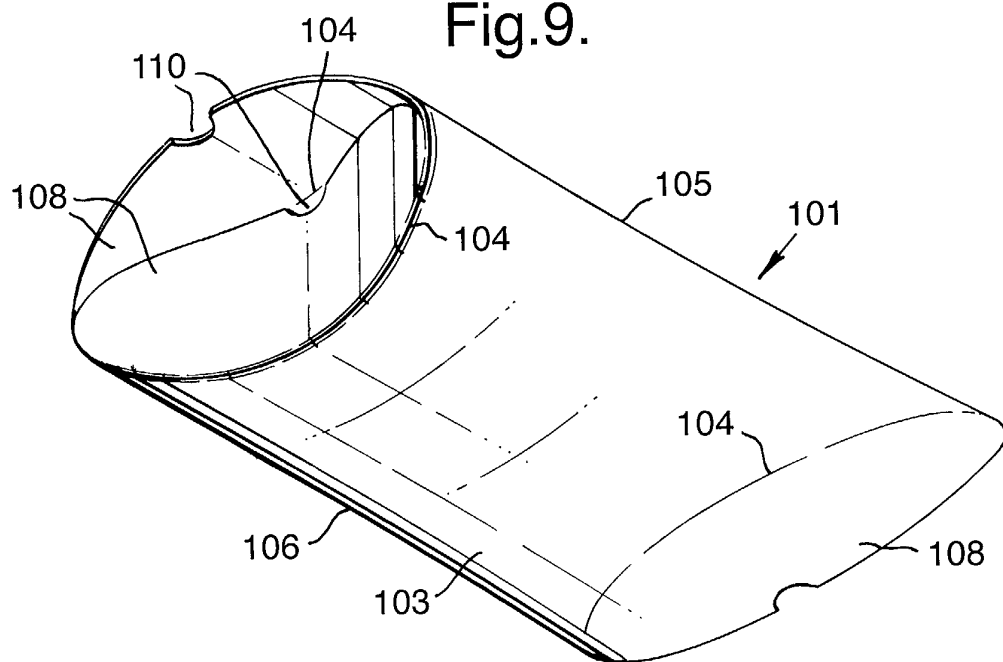


Fig.10.

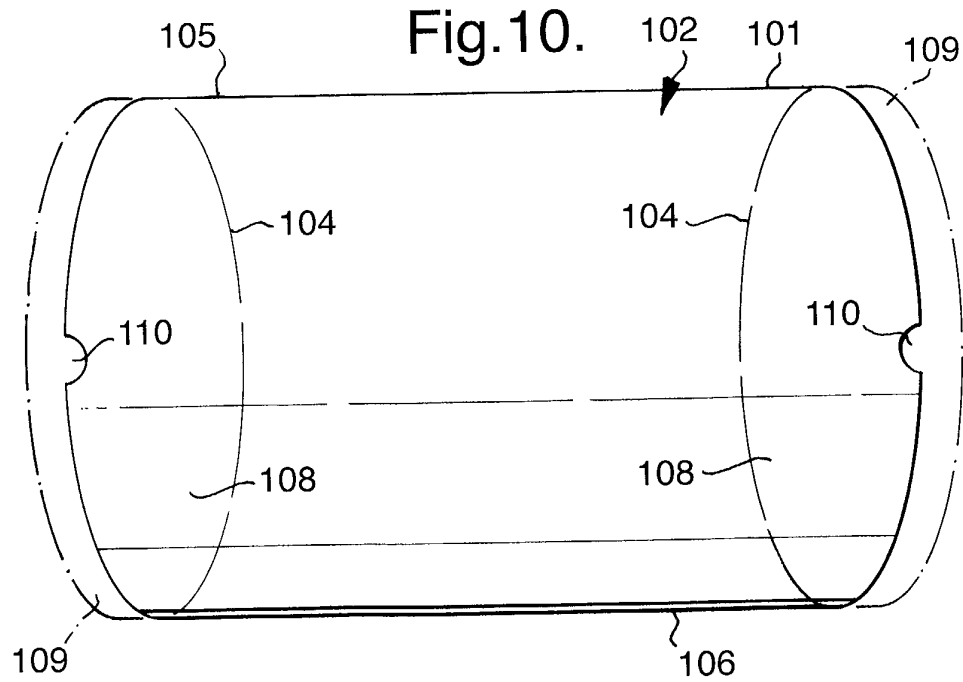


Fig.11.



Fig.12.

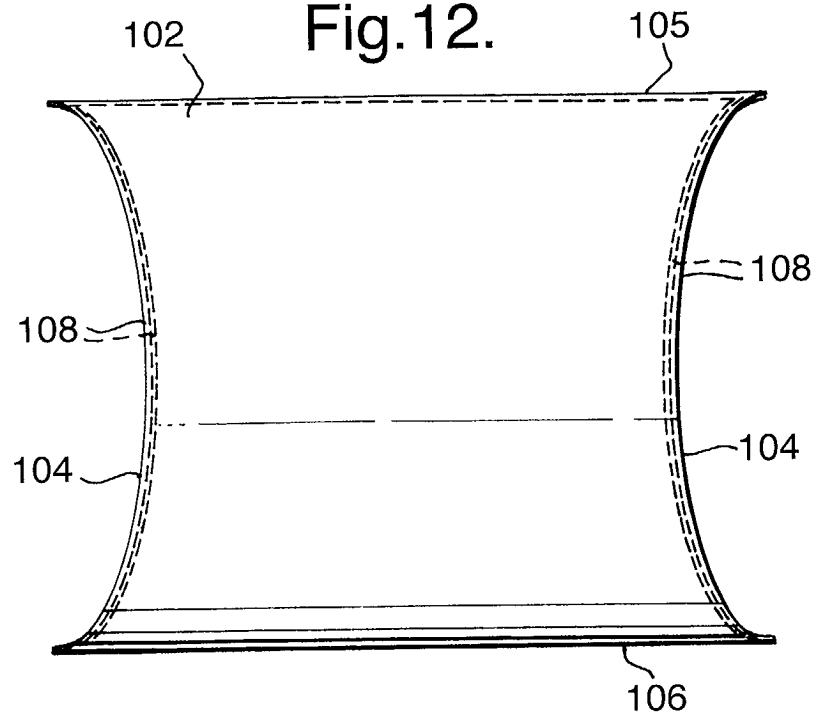


Fig.13.

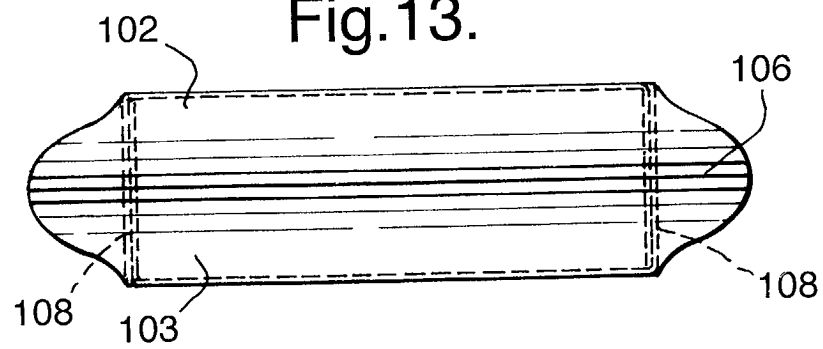


Fig.14.

