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(54) **Shock absorber for fixed structures, in particular for producing road safety barriers**

(57) A shock absorber (4; 24; 24a; 24b; 24c; 24d) for fixed structures, in particular for producing road safety barriers (1; 26; 26b; 26c; 26d); the absorber having a rear shoulder (7; 32; 32b) resting against a fixed struc-

ture (2; 27; 54), a shock-exposed front surface (34), and at least one body (9; 30; 30a; 30b; 30d) made of foam material and interposed between the rear shoulder (7; 32; 32b) and the front surface (34) along an axis (B; B') crosswise, in use, to the fixed structure (2; 27; 54).

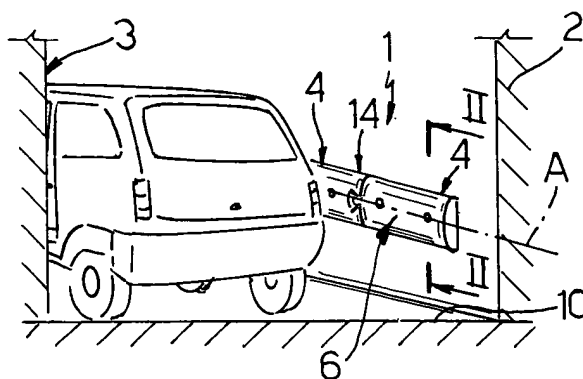
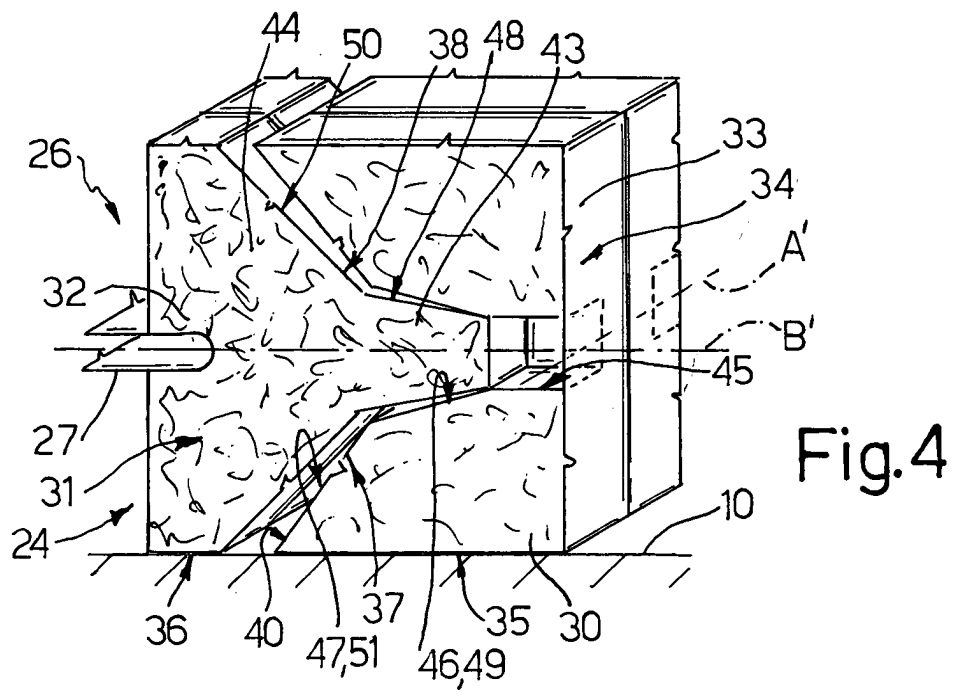


Fig.1



Description

[0001] The present invention relates to a shock absorber for fixed structures, in particular for producing car-park and, especially, road safety barriers.

[0002] To mark the lateral boundaries and prevent vehicles running off the road, safety barriers commonly known as guard-rails and made of shock-deformable sheet steel are employed; and, to safeguard against collision when parking, rails of thermoplastic material are fitted to the boundary walls of parking areas.

[0003] The above known solutions are unsatisfactory by providing for only a limited degree of shock absorption.

[0004] Moreover, sheet metal guard-rails tend to damage the vehicle body, even in the event of only minor collision.

[0005] It is an object of the present invention to provide a shock absorber for fixed structures, in particular for producing road safety barriers, designed to provide a straightforward, low-cost solution to the above drawbacks.

[0006] According to the present invention, there is provided a shock absorber for fixed structures, in particular for producing road safety barriers; the absorber comprising a rear shoulder resting against a said fixed structure, and a shock-exposed front surface; and being characterized by comprising at least one first body made of foam material and interposed between said front surface and said rear shoulder along an axis crosswise, in use, to said fixed structure.

[0007] A non-limiting embodiment of the invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a first preferred embodiment of the shock absorber for fixed structures, in particular for producing road safety barriers, according to the present invention;

Figure 2 shows a larger-scale section along line II-II in Figure 1;

Figure 3 shows a larger-scale, exploded rear view in perspective of a variation of the Figure 1 shock absorber;

Figure 4 shows a sectioned view in perspective of a second preferred embodiment of the shock absorber for fixed structures according to the present invention;

Figures 5 to 8 show variations of the Figure 4 shock absorber.

[0008] In Figures 1 and 2, number 1 indicates as a whole a safety barrier or bumper rail fitted to a vertical wall 2 bounding a vehicle parking area 3. Rail 1 comprises a number of modular shock absorbers 4, each having a front surface 6 exposed to shock by the vehicle, and a rear surface 7 resting against wall 2.

[0009] Each absorber 4 comprises a body 9 inter-

posed between surfaces 6 and 7, along an axis B perpendicular to wall 2, and which is made of relatively soft foam material, preferably a flexible or semirigid polyurethane foam, e.g. of the type known by the trade name "Bayfil" (registered trademark), or polypropylene foam. Polypropylene bodies are molded from beads expandable in presence of steam, the pressure of which imparts the required density, and therefore hardness, to the bodies during molding.

[0010] Body 9 is fixed to wall 2, at a given height off the floor or ground 10, by means of a number plugs 11 (Figure 2), comprises weight-reducing cavities 12, and is enclosed partly in a sheet cover 13, which defines surface 6 to enhance the appearance of rail 1, is preferably made of fabric or plastic material, and is fixed, e.g. glued or co-molded, to body 9. Absorbers 4 are aligned in a horizontal direction A perpendicular to axis B, and are connected to one another by a locating and retaining device 14 comprising a dovetail male portion and a dovetail female portion, which are formed in one piece with each body 9, at lateral ends of body 9 in direction A, and which slide into an adjacent female/male portion.

[0011] In the Figure 3 variation, device 14 comprises a pin 15, and a seat 16 engaged by pin 15 in direction A, and surface 7 is fixed to wall 2 by adhesive material 18 inside grooves formed along surface 7.

[0012] In variations not shown, surface 7 is fixed to wall 2 by two-sided adhesive tape, permanent magnets (if wall 2 comprises ferromagnetic material), or suction cups.

[0013] The Figure 4 embodiment relates to an absorber 24, which is placed on ground 10 and adjacent to other absorbers 24 in a horizontal direction A' to form, as a whole, a safety barrier 26 resting against a rear structure 27. Structure 27 is fixed to ground 10 in known manner not shown, and in particular forms part of a guard-rail extending along a road.

[0014] Absorber 24 comprises a front block 30 and a rear block 31, which are made of foam material, as described for body 9, and are coaxial along a horizontal axis B' perpendicular to structure 27 and to direction A'. Block 31 comprises a hollow rear portion 32 resting axially against structure 27 and engaged by structure 27 to hold block 31 on ground 10; and block 30 has a cover 33 similar to cover 13 and defining a shock-exposed flat front surface 34 perpendicular to axis B'.

[0015] Blocks 30, 31 have respective bases 35, 36 resting on ground 10, and are connected coaxially by a programmed-deformation device 37, which comprises a substantially truncated-cone-shaped axial projection 38 formed in one piece with block 31, and a substantially truncated-cone-shaped axial seat 40 formed in block 30 and engaged by projection 38.

[0016] Projection 38 and seat 40 taper axially towards surface 34, so as to force projection 38 into seat 40 and gradually vary deformation of absorber 24 during collision. In the example shown, projection 38 comprises an axial end portion 43, and an axial connecting portion 44

for connection to the rest of block 31; and seat 40 comprises an empty axial end portion 45 closed by cover 33, an intermediate axial portion 46 engaged by portion 43, and an axial inlet portion 47 engaged by portion 44. Portions 43, 46 are bounded by respective lateral surfaces 48, 49 converging axially towards surface 34 up to a mutual contact region; and portions 44, 47 are bounded by respective lateral surfaces 50, 51, which are spaced apart, converge axially towards surface 34, and form, with axis B', acute angles greater than those formed by surfaces 48 and 49 respectively, so as to obtain a sharp change in the deformability of device 37 as block 30 moves axially forward in the event of collision with surface 34.

[0017] During collision, in fact, portion 43 is forced axially inside seat 40, tends to penetrate portion 45, and is therefore deformed gradually to absorb the shock to a greater extent than would a single block of foam material. As contact between surfaces 50, 51 begins, portion 44 also tends to wedge inside seat 40 and so increase the resistance to forward axial movement of block 30, and deformation of device 37 continues until surfaces 50, 51 eventually contact completely.

[0018] The deformability of the absorber can be programmed by appropriately varying the angles of incidence of surfaces 48, 49, 50, 51 with respect to each other and to axis B', or by making the blocks of different, progressive density, and therefore of different, progressive deformability and absorption. For example, there may be provided a block of roughly 60 kg/m³ density against a fixed structure, a shock-exposed block of roughly 25 kg/m³ density, and an intermediate block (not shown) of roughly 40 kg/m³ density.

[0019] Figures 5 to 8 show respective variations of absorber 24, the component parts of which are indicated, where possible, using the same reference numbers as in Figure 4.

[0020] Figure 5 shows an exploded view in perspective of an absorber 24a, wherein front surface 34 is convex and perpendicular to base 35, so as to act as a traffic divider.

[0021] Absorber 24a is defined by a number of identical, modular blocks of foam material, and, in particular, comprises two blocks 30a, 30b, which differ from blocks 30, 31 by each comprising both projection 38 and seat 40 (shown partly), which are formed on opposite axial sides of block 30a, 30b and taper axially away from surface 34. Cover 33 is also replaced by a cover 33a comprising an outer sheet 52 similar to cover 13, and a very soft layer 53, which is interposed between sheet 52 and block 30a, is fixed, e.g. glued or co-molded, to block 30a and sheet 52, and is made of more deformable, lower-density foam material than block 30a.

[0022] Cover 33a is preferably applied to block 30a at installation.

[0023] Figure 6 shows a plan view of a barrier 26b, wherein each absorber 24b is defined by a front block 30b, an intermediate block 31b, and a rear block 32b

resting against a wall 54 as opposed to structure 27. Blocks 30b, 31b, 32b are made of foam material and connected to one another by device 37 described above; and absorbers 24b are connected to one another in direction A' by a locating and retaining device 55 comprising a male portion 57 and a female portion 58, which are complementary with each other and formed in one piece with, and at opposite lateral ends of, each block 30b in direction A'. Portions 57, 58 are bounded by respective cylindrical surfaces defining respective articulated joints about hinge axes 61 perpendicular to axis B' and direction A', and are each fitted in sliding manner to a respective adjacent portion 58, 57 to orient absorbers 24b with respect to one another and so adapt barrier 26b to curved paths or directions A'.

[0024] Figure 7 shows a partly sectioned view in perspective of a barrier 26c defined by absorbers 24c, which differ from absorbers 24b by axes 61 being parallel to axis B' to adapt barrier 26c to variations in the slope of ground 10, and by being fitted on surfaces 34 with reflector plates 62. Moreover, device 37 comprises four rods 63 (only two shown), which are also made of foam material similar to those described above, are located about projection 38 and seat 40 (not shown), and each slide, parallel to axis B', through both blocks 30, 31 to keep blocks 30, 31 in fixed relative positions cross-wise to axis B'.

[0025] Figure 8 shows a view in perspective of a barrier 26d defined by absorbers 24d spaced apart in direction A' and each comprising a number of modular blocks 30d similar to blocks 30a, 30b. Device 55 is replaced by a retaining device 65 comprising two flexible cables 66, which are made, for example, of steel, nylon, or hemp, and extend through the front blocks of absorbers 24d in direction A' and on opposite vertical sides of seats 40 to hold absorbers 24d together.

[0026] A number of T-section members 68 are also provided parallel to axis B', and which are fixed to ground 10, e.g. by plugs, on opposite lateral sides of each absorber 24b to retain blocks 30d in direction A' and guide blocks 30d axially towards a rear structure surface (not shown) during collision.

[0027] Absorbers 4, 24, 24a, 24b, 24c, 24d therefore comprise at least one body or block associated with shock-exposed surface 34, and which has a high degree of deformability and absorption by being made of foam material.

[0028] Moreover, device 37 holds together a number of preferably modular blocks of foam material, and provides for progressive deformation of absorber 24, 24a, 24b, 24c, 24d during collision.

[0029] The absorbers described and illustrated are also extremely easy to mold, and those made of "Bayfil" can be at least partly made at installation.

[0030] Clearly, changes may be made to absorbers 4, 24, 24a, 24b, 24c, 24d as described herein without, however, departing from the scope of the present invention.

[0031] In particular, the blocks of foam material of the

absorbers may be made of foam material other than those indicated by way of example.

[0032] The safety barrier may even be defined by only one absorber, the characteristics described of absorbers 4, 24, 24a, 24b, 24c, 24d may be combined, and/or members 68 may be replaced by other lateral retaining and axial guide devices. Moreover, posters and/or serigraphs containing information, e.g. advertising, may be applied to surface 34, and/or vertical retaining means may be provided to hold the blocks of absorbers 24a, 24b, 24c, 24d on ground 10, while still enabling axial slide towards a rear fixed structure.

[0033] Finally, in addition to roads and motorways, the safety barriers described and illustrated may also be used on sports tracks, such as car racing and ski tracks.

Claims

1. A shock absorber (4; 24; 24a; 24b; 24c; 24d) for fixed structures, in particular for producing road safety barriers (1; 26; 26b; 26c; 26d); the absorber comprising a rear shoulder (7; 32; 32b) resting against a said fixed structure (2; 27; 54), and a shock-exposed front surface (34); and being **characterized by** comprising at least one first body (9; 30; 30a; 30b; 30d) made of foam material and interposed between said front surface (34) and said rear shoulder (7; 32; 32b) along an axis (B; B') cross-wise, in use, to said fixed structure (2; 27; 54).
2. An absorber as claimed in Claim 1, **characterized in that** said foam material is polypropylene foam.
3. An absorber as claimed in Claim 1, **characterized in that** said foam material is polyurethane foam.
4. An absorber as claimed in any one of the foregoing Claims, **characterized by** comprising connecting means (14; 55; 65) located on opposite lateral sides of said first body (9; 30b; 30d) in a longitudinal direction (A; A') perpendicular to said axis (B; B'), to connect said first body (9; 30b; 30d) to adjacent absorbers (4; 24b; 24c; 24d).
5. An absorber as claimed in Claim 4, **characterized in that** said connecting means (14; 55) comprise a male portion (15; 57) and a female portion (16; 58) formed in one piece with said first body (9; 30b).
6. An absorber as claimed in Claim 5, **characterized in that** each said male (57) and female (58) portion defines an articulated joint which fits to an adjacent female/male portion (58) (57) so as to be movable about a relative hinge axis (61) perpendicular to said longitudinal direction (A').
7. An absorber as claimed in Claim 4, **characterized in that** said connecting means (65) comprise at least one flexible cable (66) extending through said first body (30d).
8. An absorber as claimed in any one of the foregoing Claims, **characterized in that** said first body (30; 30a; 30b; 30d) rests on a floor (10); retaining means (68) being provided to retain said first body (30; 30a; 30b; 30d) in a fixed position on said floor (10) in a direction (A') perpendicular to said axis (B').
9. An absorber as claimed in any one of the foregoing Claims, **characterized by** comprising a cover (13; 33; 33a) connected integrally to said first body (9; 30; 30a) and defining said front surface (34).
10. An absorber as claimed in Claim 9, **characterized in that** said cover (13; 33; 33a) comprises a sheet material (13; 33; 52) enclosing said first body (9; 30; 30a).
11. an absorber as claimed in Claim 9 or 10, **characterized in that** said cover (33a) comprises a layer (53) which is more deformable than said first body (30a).
12. An absorber as claimed in any one of the foregoing Claims, **characterized by** also comprising at least one second body (31; 31a; 31b; 30d) made of foam material and interposed between said first body (30; 30a; 30b; 30d) and said rear shoulder (7; 32; 32b); deformable means (37) being provided to connect said first (30; 30a; 30b; 30d) and second (31; 31a, 31b; 30d) coaxially with each other.
13. An absorber as claimed in Claim 12, **characterized in that** said deformable means (37) comprise a projecting portion (38) formed parallel to said axis (B') and in one piece with one of said first (30; 30a, 30b; 30d) and said second (31; 31a; 31b; 30d) body; and a seat (40) formed parallel to said axis (B') in the other of said first (30; 30a; 30b; 30d) and said second (31; 31a, 31b; 30d) body and engaged by said projecting portion (38).
14. An absorber as claimed in Claim 13, **characterized in that** at least one of said seat (40) and said projecting portion (38) tapers axially.
15. An absorber as claimed in Claim 14, **characterized in that** said projecting portion (38) and said seat (40) are defined by respective lateral surfaces (48, 50)(49, 51) converging axially with each other.
16. An absorber as claimed in Claim 15, **characterized in that** at least one of said lateral surfaces (48, 50) (49, 51) comprises a first (48)(49) and a second (50) (51) surface forming different angles with respect to

said axis (B').

17. An absorber as claimed in any one of Claims 13 to 16, **characterized in that** each said first (30a) and second (31a) body comprises a said seat (40) and a said projecting portion (38) formed on opposite axial sides of the body (30a)(30b). 5
18. An absorber as claimed in any one of Claims 12 to 17, **characterized in that** said deformable means (37) comprise deformable retaining means (63) for retaining said first (30) and said second (31) body in fixed relative positions crosswise to said axis (B'). 10
19. An absorber as claimed in Claim 18, **characterized in that** said deformable retaining means comprise at least one rod (63) made of foam material and extending through said first (30) and said second (31) body. 15
20. An absorber as claimed in any one of Claims 12 to 19, **characterized in that** said bodies are of different deformability. 20
21. An absorber as claimed in any one of the foregoing Claims, **characterized by** comprising visual indicator means (62) fitted to said front surface (34). 25
22. An absorber as claimed in any one of the foregoing Claims, **characterized by** comprising fastening means (11; 18) for fixing said rear shoulder (7) integrally to said fixed structure (2). 30

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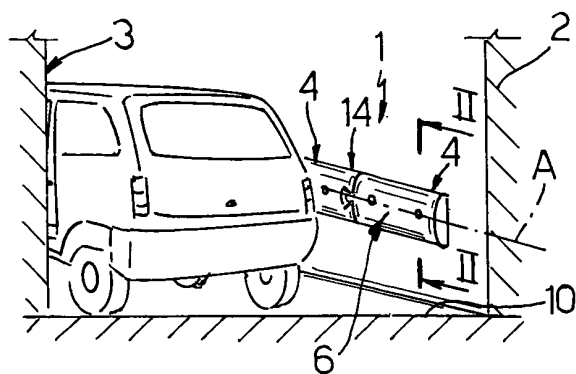


Fig.1

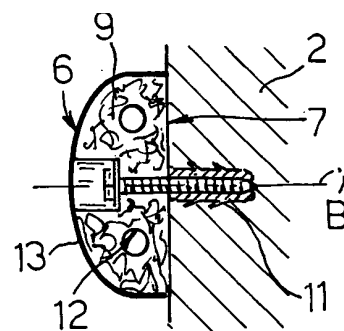


Fig.2

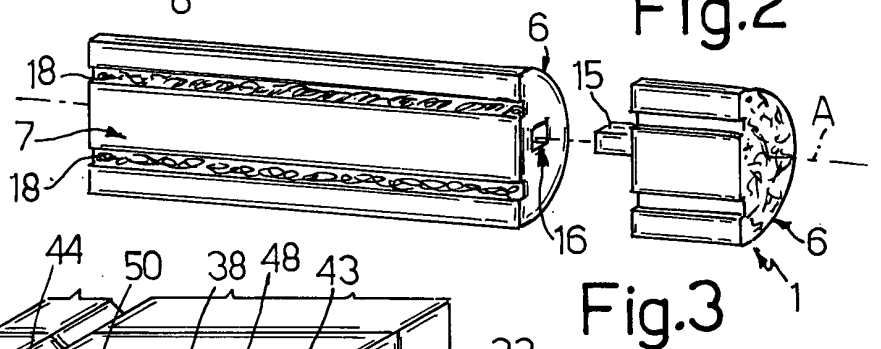


Fig.3

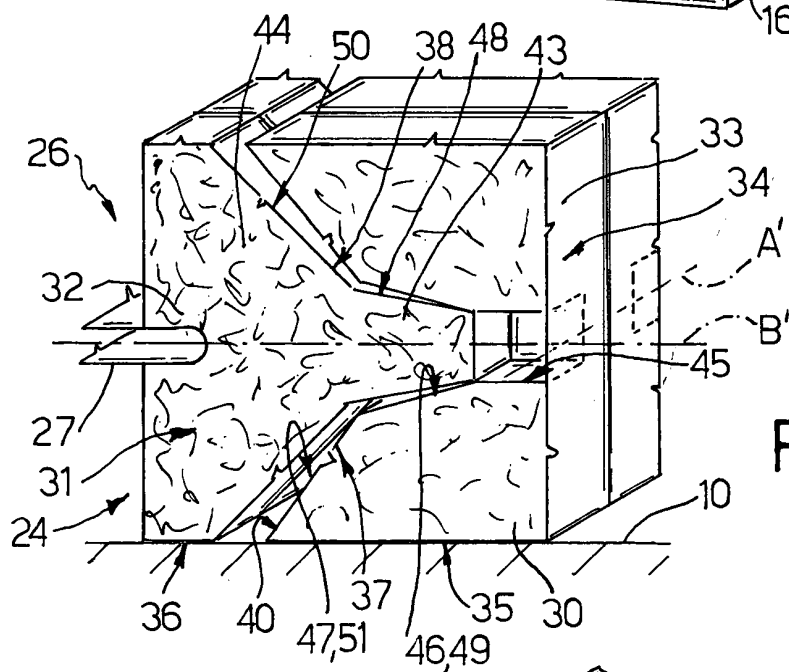


Fig.4

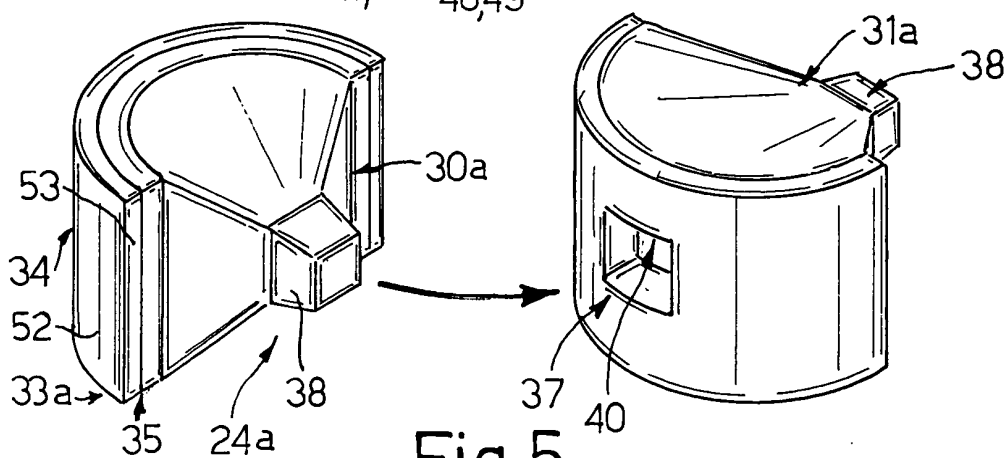
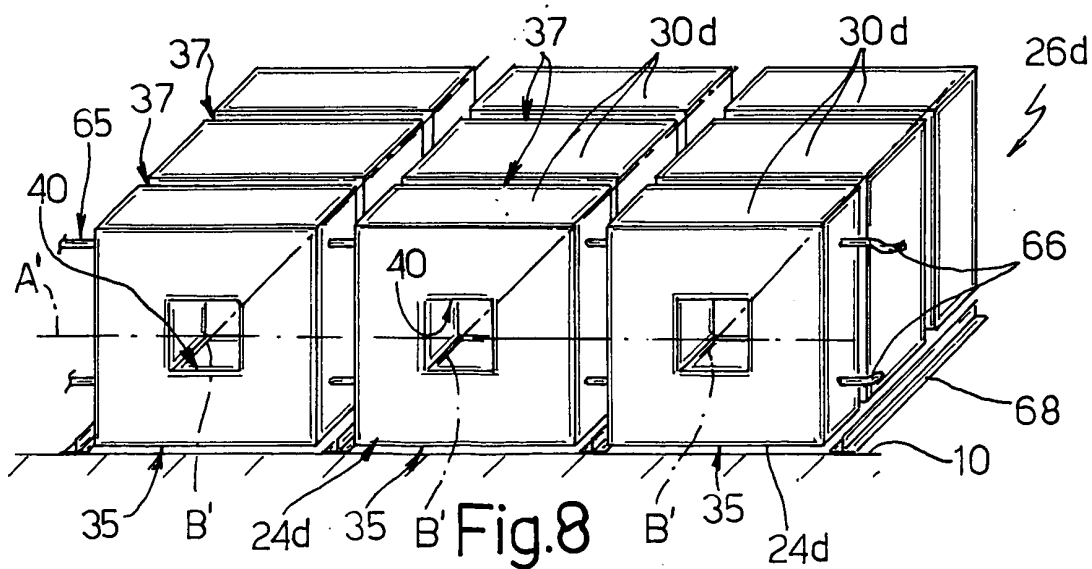
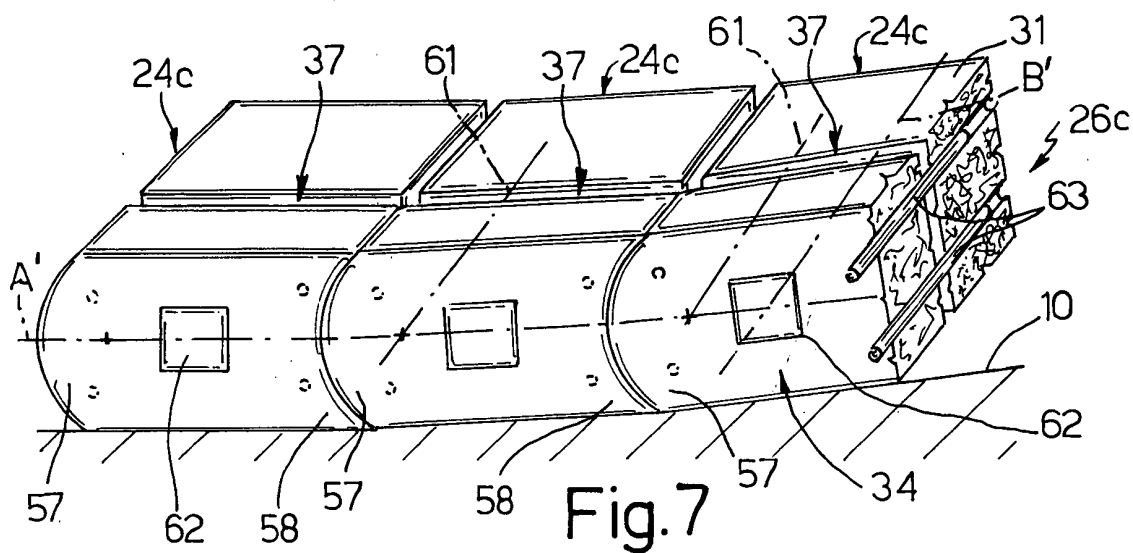
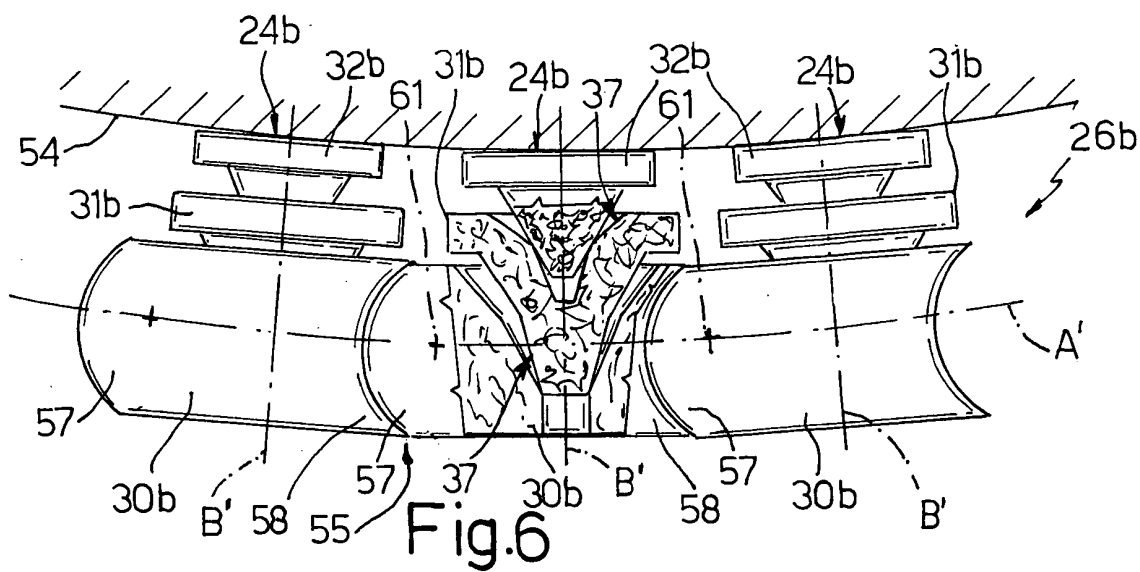


Fig.5





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EUROPEAN SEARCH REPORT

Application Number
EP 03 00 5117

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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 12 June 2003	Examiner Mysliwetz, W
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