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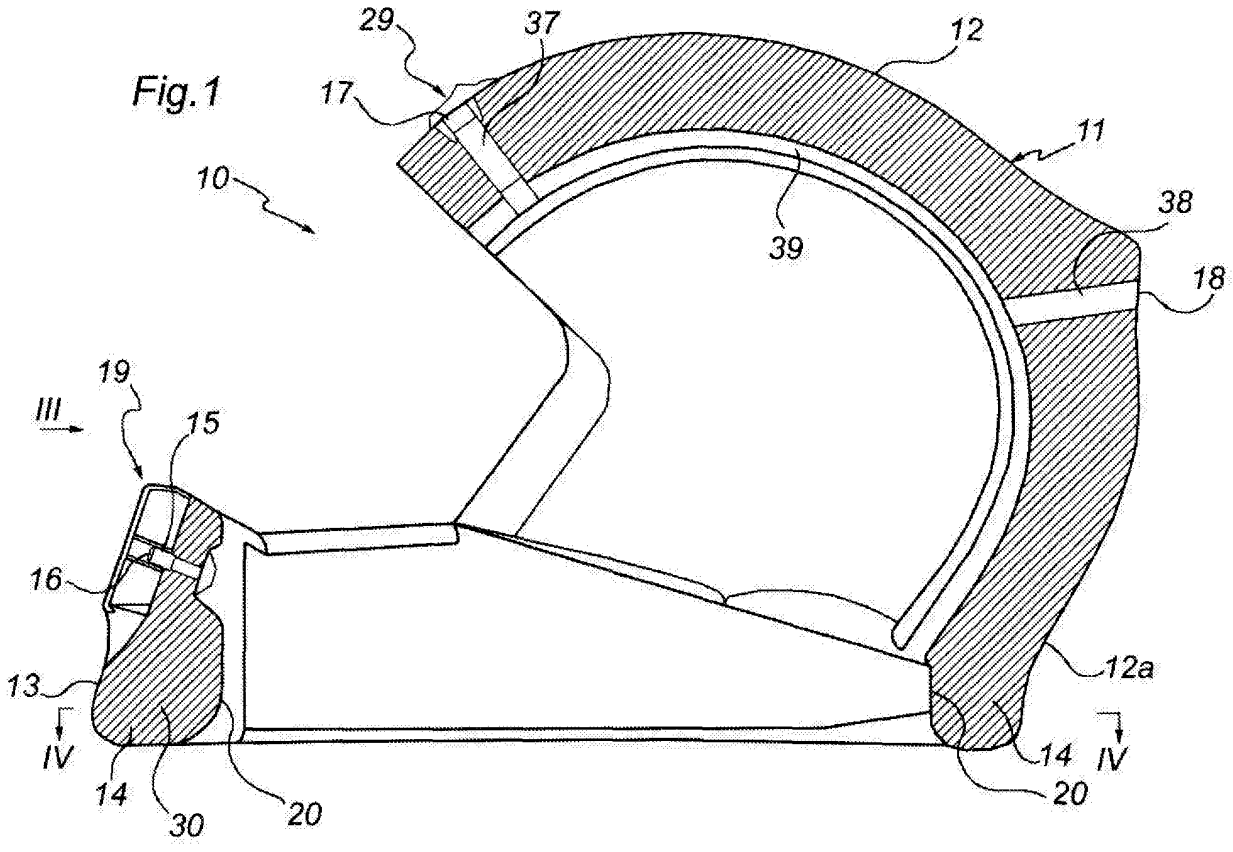
(54) Full-face helmet and method of manufacturing same

(57) A full-face helmet comprises an outer shell (11) which forms a bubble (12) with a base portion (12a) and a chin protector (13). A layer of expanded polystyrene (30) covers the inner surface of the bubble and fills an annular gap (14) bounded on the outside by the chin protector (13) and by the base (12a) of the bubble, and on the inside by an annular band (20) located within and at a distance from the base portion (12a) of the bubble and from the chin protector (13). The polystyrene layer (30) firmly connects the inner band (20) to the outer shell (11).

Fig.1



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Description

[0001] The present invention relates to a full-face helmet suitable for motorcyclists, skiers and people engaged in various activities requiring a protective helmet. The invention also relates to a method of manufacturing this full-face helmet.

[0002] Known full-face helmets comprise an outer shell (usually polycarbonate or glass fibre or Kevlar) which forms the bubble and the chin protector, while on the inner surface of the shell is spot-bonded a layer of expanded polystyrene which covers the inner surface of the bubble.

[0003] It is an object of the invention to provide a full-face helmet capable of offering better protection against impact, especially but not exclusively against frontal impacts to the chin protector.

[0004] It is another object of the invention to provide a full-face helmet that weighs less than the conventional full-face helmets mentioned above. It is another object of the invention to improve on the attachment of the straps which fasten under the user's chin to make the helmet fast.

[0005] These and other objects and advantages which will be seen more clearly below, are achieved, according to the present invention, with a full-face helmet, and a method of manufacturing it, as defined in the appended claims.

[0006] A preferred but not restrictive embodiment of the invention will now be described, referring to the attached drawings, in which:

- Figure 1 is a side view in vertical section of a helmet according to the invention;
- Figure 2 is a view in section on II-II as marked in Figure 1;
- Figure 3 is a front view of the helmet in the direction of arrow III as marked in Figure 1;
- Figure 4 is a view in horizontal section on IV-IV as marked in Figure 1; and
- Figure 5 is an enlarged view of a detail from Figure 2.

[0007] Referring initially to Figure 1, a full-face helmet according to the present invention is marked 10 as a whole. The helmet 10 comprises an outer shell 11 which forms a bubble 12 with a lower or base portion 12a and a chin protector 13, an annular band or strip 20 located within and at a distance from the base portion 12a of the bubble and from the chin protector 13, and a layer 30 of expanded polystyrene injected onto the inner surface of the bubble or into the intermediate annular gap or space 14 (Figure 4) which is bounded on the inside by the annular band 20 and on the outside by the base portion 12a of the bubble and by the chin protector 13.

[0008] In the present description and in the claims which follow, terms and expressions such as "radial", "inner", "outer", "upper" and "lower" should be interpreted with reference to the centre of the helmet and to the position of the helmet when worn on the head of a user.

[0009] The principal steps in making the helmet 10 are as follows.

[0010] Starting from a generally flat sheet of polycarbonate (or glass fibre or Kevlar), the outer shell 11 as shown in the drawings is obtained by thermoforming or moulding. A number of holes are preferably formed in the shell 11:

- a front hole 15 in the chin protector, which will later take a plug 16 for attaching a flow deflector 19 for channelling the air over the outer surface of the visor (not shown);
- a hole 17 in the front-upper region of the bubble to create an air intake for internal ventilation of the helmet, as described in more detail below;
- an air outlet hole 18 in the rear region of the bubble; and
- two opposite side holes 21, 22 (Figure 2) for insertion of respective tubular pieces 24 belonging to two attachment devices 23 for the helmet fastening straps 25, 26; these attachment devices will be described in detail below.

[0011] Thermoforming or injection moulding is used to form the annular band 20, which is in the form of a closed, preferably continuous loop extending vertically to a limited height and following the (roughly oval) shape in plan view of the base of the helmet, and more precisely of the chin protector and the base of the bubble. As shown in Figure 1, the height of the front part of the annular band 20 is preferably comparable with that of the chin protector 13. However, the annular bar 20 has radial dimensions significantly smaller than those of the outer shell 11, in such a way as to delimit with the latter the annular gap 14.

[0012] The outer shell 11 and the inner band 20 are then placed in a mould (not shown) for the injection moulding of expanded polystyrene. In the mould the band 20 is positioned within and at a radial distance from the base of the shell 11, as shown in Figures 1 and 4, to define the annular gap 14.

[0013] The inner band 20 has a pair of opposite holes 27, 28 close to its upper edge. These holes are formed alongside the holes 21, 22 of the outer shell and in such a way as to be substantially aligned with the latter. There are thus two radially aligned holes on each of the two opposite sides of the helmet. Into each of these pairs of aligned holes there is inserted, before the polystyrene is injected, one of the two attachment devices 23 for the straps 25, 26.

[0014] Also before the polystyrene is injected, a valve 29 is fitted in the air inlet hole 17 in the outer shell 11 so that the incoming air flow can be adjusted.

[0015] The polystyrene is then injected to form the layer 30 of expanded polystyrene, which covers the inner surface of the bubble 12 and fills the annular gap 14, making intimate contact with the inner band 20, with the base portion 12a of the bubble, and with the chin protector

13. In this way the layer 30, the inner band and the outer shell 11 are firmly held together as a single body.

[0016] In the event of a frontal impact to the chin protector, as indicated by the arrow A in Figure 4, the inner band, being connected to the outer shell, cooperates with the chin protector 13 to withstand the impact and diffuse and dissipate the impact energy to the other parts of the helmet.

[0017] It is important to note that the helmet according to the invention exhibits better performance in impact absorption not only on the chin protector. Tests conducted by the Applicant demonstrate that, because of the connection between the outer shell and the polystyrene layer on the inside of the bubble, excellent results are also obtained in tests of impacts from above and against the sides of the bubble. The results of these tests have made it possible to reduce the thickness of the outer shell to approximately 1 mm (as against a thickness of 2 - 4 mm for the shells of conventional helmets). It has also been possible to use a less dense polystyrene than in conventional helmets, replacing a density of 80 - 90 kg/m^3 to approximately 70 kg/m^3. The result has been to produce a helmet weighing approximately 0.750 kg that offers greater safety and is far lighter than conventional helmets, which weigh on average about 1.250 kg. As will be appreciated, reducing the weight usually militates against safety.

[0018] Another important advantage provided by the present invention has to do with the improved attachment of the straps. As illustrated in Figure 5, the attachment devices 23 are embedded in the polystyrene when the latter is injected. Each of these devices comprises a tubular distance piece 24 that extends from the outer shell to the inner band, and that is rigidly fixed to or formed integrally with an attachment piece 31 having an extended surface, in this case for example in the form of a wheel with an outer ring 32 connected to the tubular piece 24 by spokes or radial ribs 33. An expansion pin 35 is inserted into the tubular distance piece 24 from the inside, and sealed on the outside by a plug 36. Reference number 37 is a washer interposed between the tubular distance piece 24 and the enlarged part of the expansion pin 35, while 38 is a stirrup to which the strap 26 is connected.

[0019] Two factors contribute to the improved attachment compared with the conventional fixing system (which usually uses a rivet to fix the strap to the outer shell): the embedding of the attachment device 23 in the polystyrene, and the distance apart of the two points of bearing contact between the fixing device and the holes 21, 28, and 22, 27 formed in the outer shell and in the inner band. When a strap is pulled, the two holes formed in both the outer shell and in the inner band act as two spaced-apart points of reaction which give rise to an opposing torque that efficiently resists the shear stress transmitted by the strap to the attachment device.

[0020] In the same polystyrene-injection step, two through holes 37, 38 (Figure 1) are formed in the layer 30 which extend from the respective holes 17, 18 in the outer shell to the inner surface of the layer 30 which covers the inside of the bubble, and a series of separate, essentially parallel grooves 39 are formed to carry the air from the admission hole 17 to the outlet hole 18. As illustrated in Figure 3, the grooves 39 are distributed over the inner surface of the polystyrene layer 30 to create a diffuse internal ventilation to prevent the stagnation of hot air and so increase the user's comfort.

[0021] It will be understood that the invention is not limited to the embodiment described and illustrated herein, which is to be considered as an illustrative embodiment of the helmet. Rather, the invention is capable of modifications to shapes, dimensions and arrangements of parts, constructional details and materials employed. For example, the attachment piece may differ in shape from the wheel shape illustrated in the figures (it may for example be shaped like a plate or like a solid disc).

Claims

1. A method of manufacturing a full-face helmet, comprising the following steps:

   a1) providing an outer shell (11) forming a bubble (12) with a base portion (12a) and a chin protector (13);
   a2) providing an annular band (20) having a peripheral surface with radial dimensions significantly smaller than those of the base portion (12a) of the bubble and of the chin protector (13) of the outer shell (11);
   b) placing the outer shell (11) and the inner band (20) in an expanded-polystyrene injection-moulding machine, positioning the inner band (20) within and at a radial distance from the base of the shell (11), so as to define an annular gap (14) bounded on the inside by the annular band (20) and on the outside by the base portion (12a) of the bubble and of the chin protector (13) of the shell (11);
   c) injecting expanded polystyrene onto the inner surface of the bubble (12) and into the annular gap (14) so as to produce a layer of expanded polystyrene (30) which

      - fills the annular gap (14), making intimate contact with the inner band (20), with the base portion (12a) of the bubble and with the chin protector (13) so as to connect the band (20) firmly to the shell (11), and
      - covers and makes intimate contact with the inner surface of the cranial part.

2. The method of Claim 1, **characterized in that** said step c) is preceded by the step of inserting between the outer shell (11) and the inner band (20),

in opposite lateral positions, two devices (23) for attaching respective helmet fastening straps (25, 26), and **in that**
following the said injection step c), the attachment devices (23) remain embedded in the polystyrene layer (30).

3. The method of Claim 2, **characterized in that** said step a1) includes the step of forming, on each of the two opposite sides of the bubble (12), a respective hole (21, 22) for mounting the attachment devices (23).

4. The method of Claim 1, **characterized in that** said step a1) includes the step of also forming
an air admission hole (17) in the front-upper region of the bubble (12) and
an air outlet hole (18) in the rear region of the bubble.

5. The method of Claim 4, **characterized in that** said injection step c) includes the steps of
forming in the layer (30) two passages (37, 38) that extend from the respective air admission and outlet holes (17, 18) of the bubble (12) to the inner surface of the layer (30) covering the inside of the bubble, and
forming in the layer (30) a plurality of ventilation grooves (39) distributed over the inner surface of the polystyrene layer (30) to convey the air from the admission passage (37) to the outlet passage (38).

6. A full-face helmet produced in accordance with any one of the preceding claims.

7. A full-face helmet of the type comprising
an outer shell (11) that forms a bubble (12) with a base portion (12a) and a chin protector (13), and
an expanded-polystyrene layer on the inner surface of the bubble;
characterized in that
the helmet also includes an annular band (20) located within and at a distance from the base portion (12a) of the bubble and from the chin protector (13) and
in that the expanded-polystyrene layer (30) makes intimate contact with the inner surface of the bubble and at least partly fills a gap (14) bounded on the inside by the annular band (20) and on the outside by the base portion (12a) of the bubble and by the chin bar (13), in such a way as to make intimate contact with the inner band (20), with the base portion (12a) of the bubble and with the chin protector (13), so as to connect the band (20) firmly to the shell (11).

8. The helmet of Claim 7, **characterized in that** the gap (14) is an annular gap that runs around the inner periphery of the base of the outer shell (11) and is completely filled with expanded polystyrene (30) formed by injection.

9. The helmet of Claim 7, **characterized in that** it includes a pair of devices (23) for the attachment of fastening straps (25, 26) embedded in the polystyrene layer (30) on the two opposite sides of the helmet.

10. The helmet of Claim 9, **characterized in that** each attachment device (23) comprises:

- a tubular distance piece (24) extending from the outer shell (11) to the inner band (20), and
- an attachment piece (31) having, embedded in the polystyrene, an extended surface area, rigidly fixed to or formed integrally with the tubular piece (24).

11. The helmet of Claim 10, **characterized in that** each attachment piece (31) is in the form of a disc, wheel or plate and is oriented approximately at right angles to the tubular piece (24).

12. The helmet of Claim 10, **characterized in that** in each tubular element (24) there is housed a fixing means (35) capable of rigidly connecting the inner band (20) to the outer shell (11).

13. The helmet of Claim 10, **characterized in that** the said fixing means (35) is an expansion pin.

Fig.1

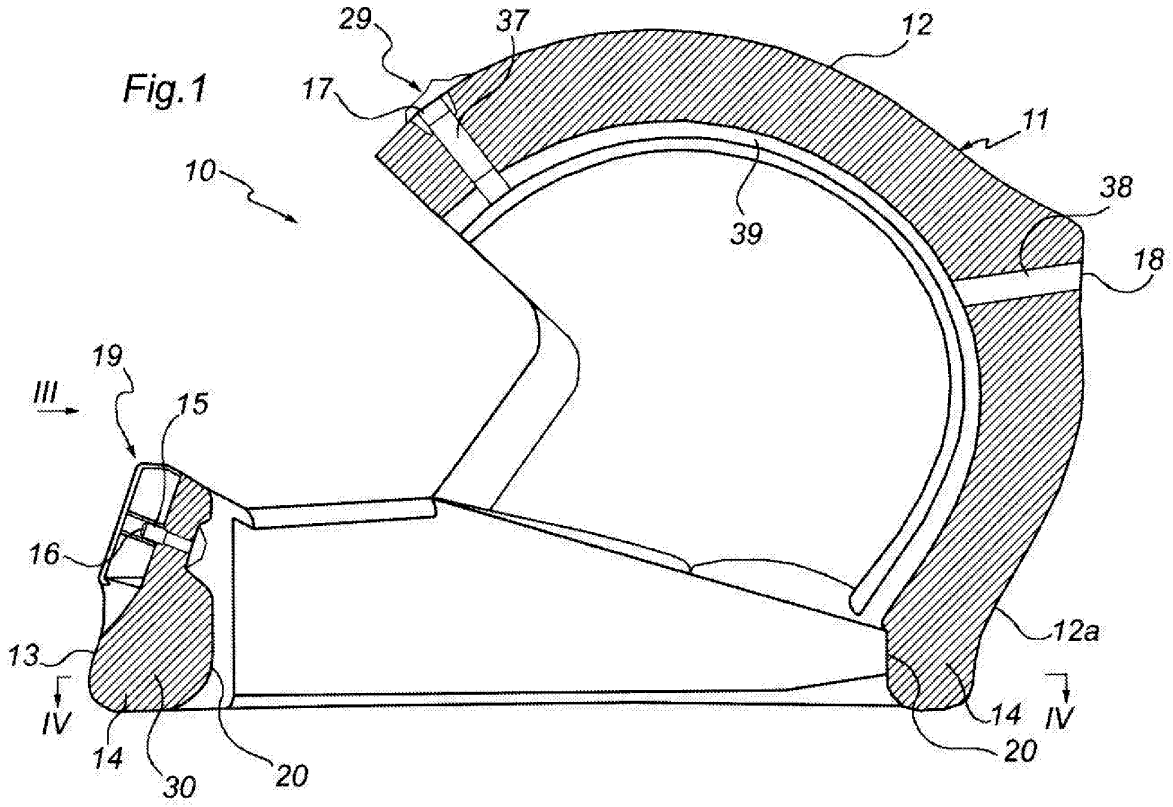
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Fig.2

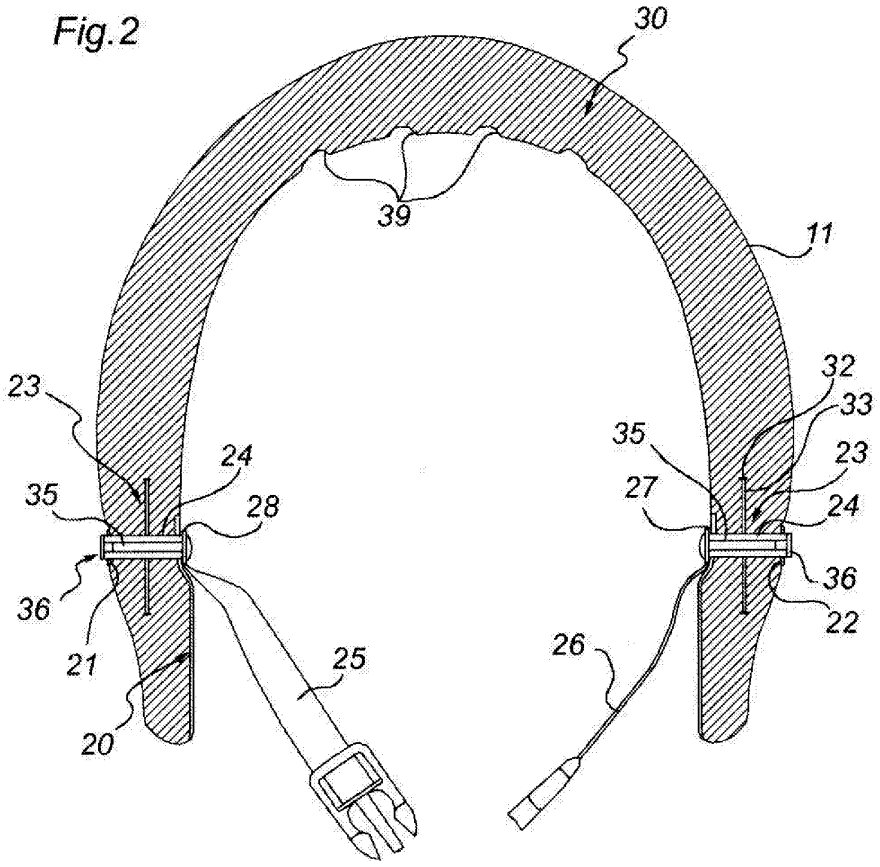
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Fig.3

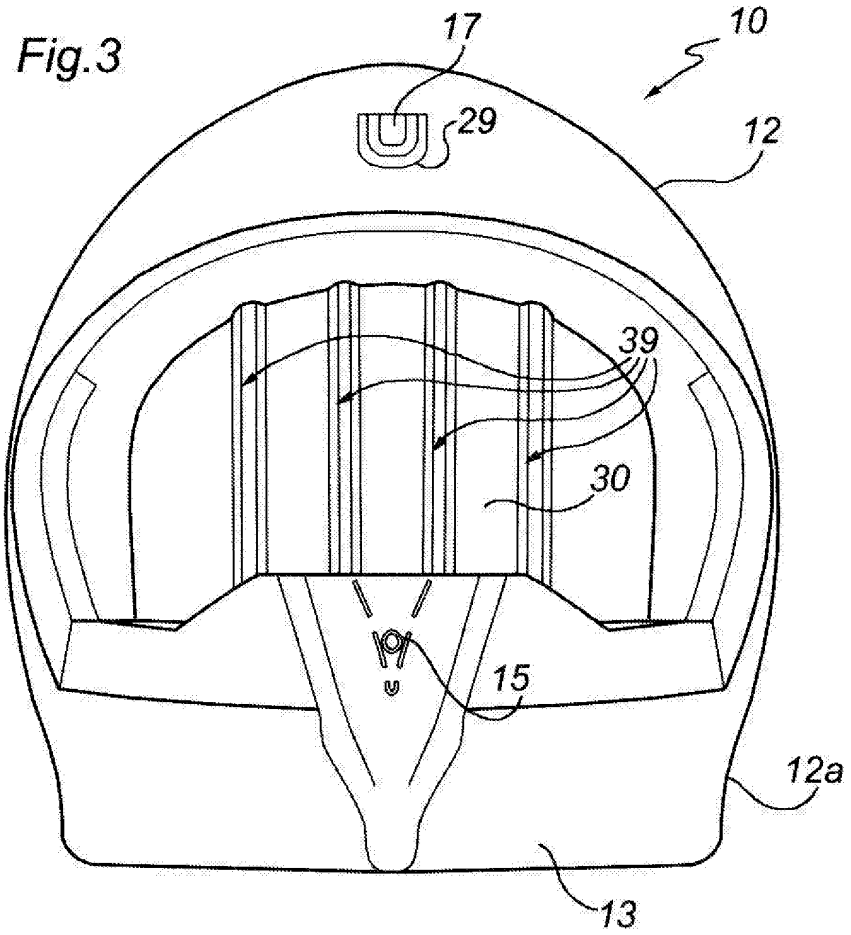


Fig.4

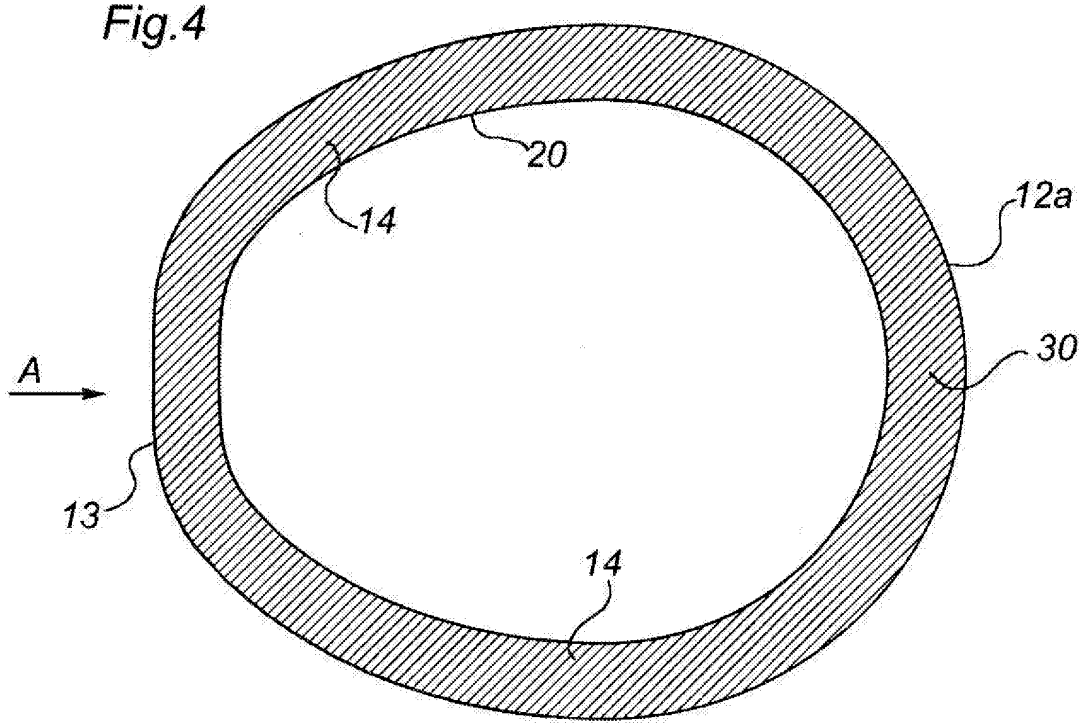
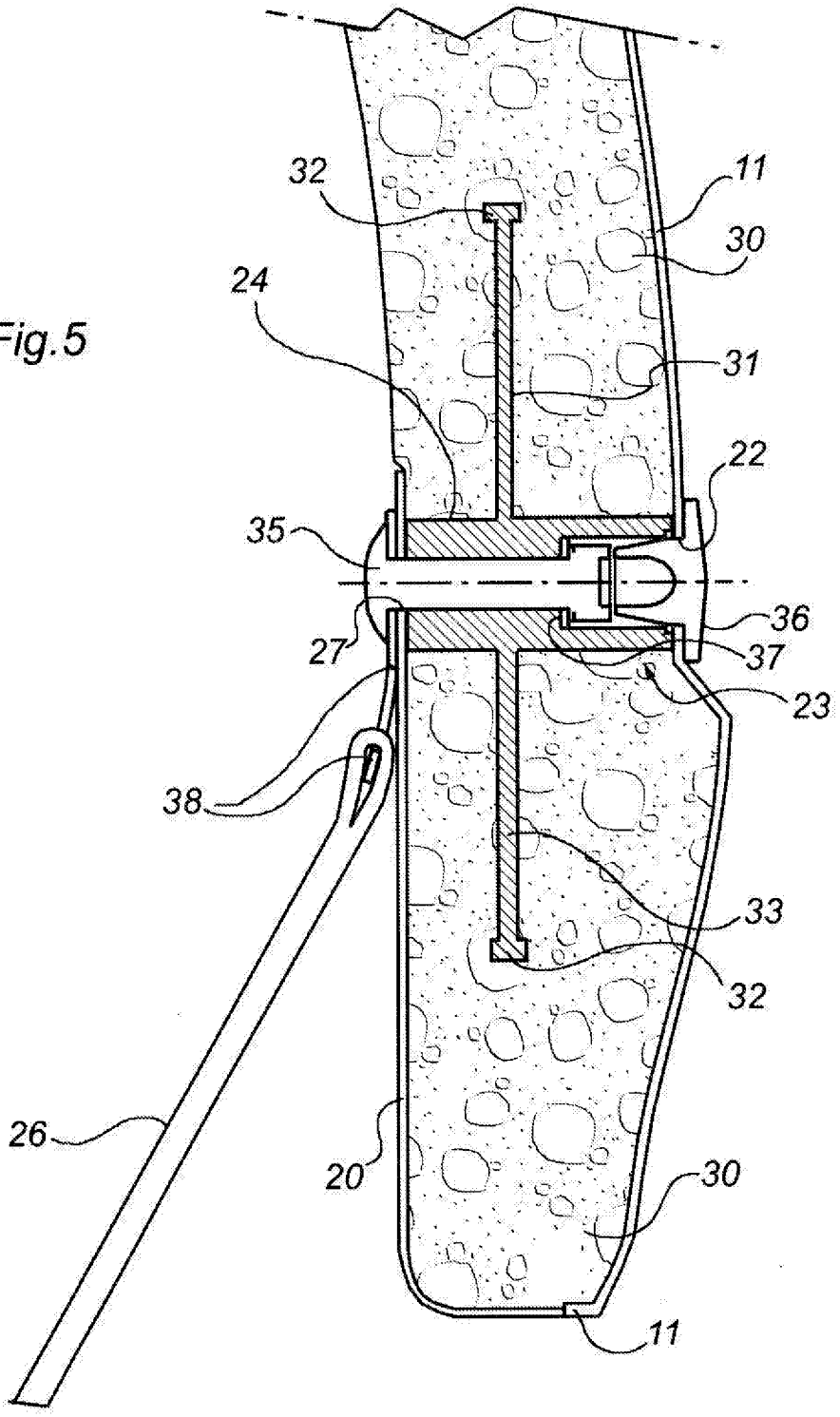


Fig.5



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EUROPEAN SEARCH REPORT

Application Number
EP 05 10 7246

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 December 2005	Hannam, M

CATEGORY OF CITED DOCUMENTS

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