



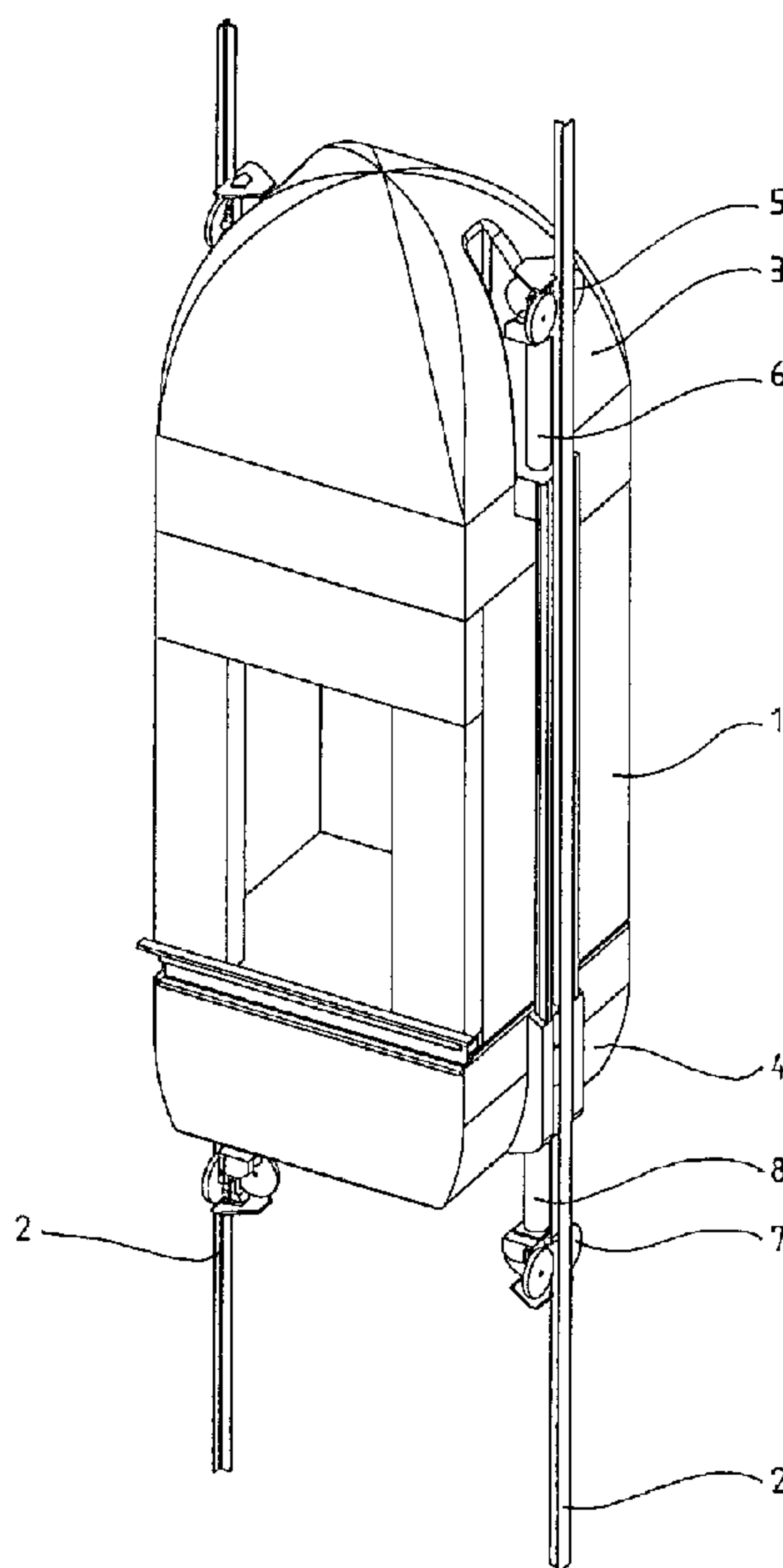
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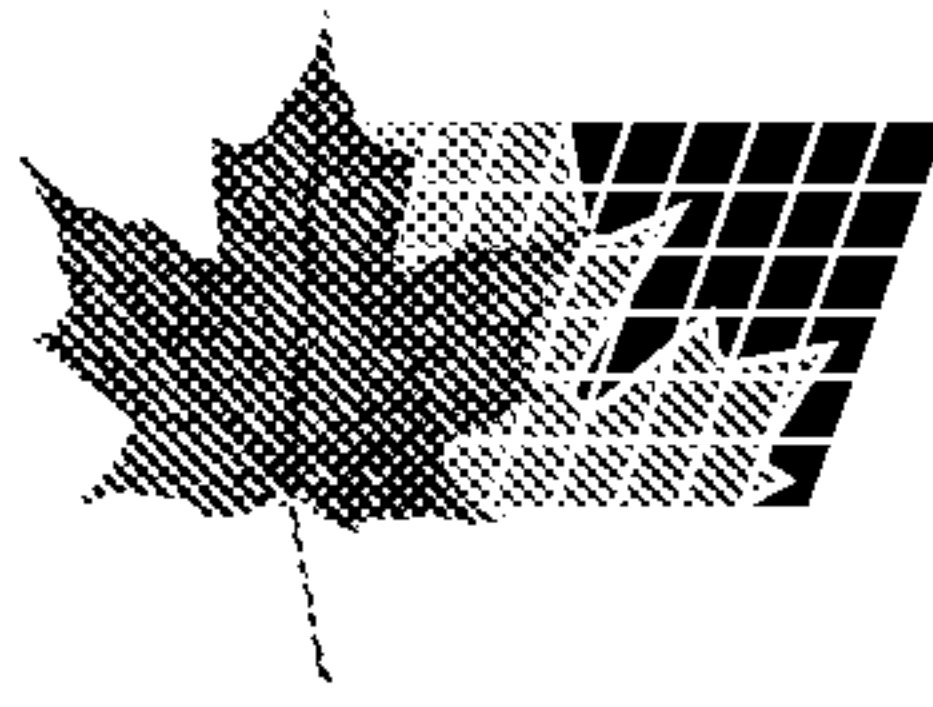
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(54) **DISPOSITIF POUR REDUIRE LE BRUIT AERODYNAMIQUE  
DANS LES CABINES D'ASCENSEUR SE DEPLACANT A  
GRANDE VITESSE**

(54) **DEVICE FOR REDUCING WIND NOISE IN FAST MOVING  
ELEVATOR CARS**



(57) The present invention relates to a device for reducing wind noise and vibration on fast moving elevator cars (1) consisting of externally mountable aerodynamic elements (3, 4) and a device to permit access to the car roof. The



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upper externally mounted element (3) with a shape similar to an ellipsoid is placed loosely on top of the elevator car (1) and held by direct mechanical means of a centering device. Recesses at the sides surround the guide roller supports (6). As a means of providing access to the car roof there is an integral lifting device which allows the upper extension element (3) to be lifted. The lower extension element (4) is constructed as a hollow body in the shape of a frame and has on its underside flaps which can be swiveled downward and which permit access to the equipment on the underside of the elevator car (1).

## Abstract

(IP1190)

The present invention relates to a device for reducing wind noise and vibration on fast moving elevator cars (1) consisting  
5 of externally mountable aerodynamic elements (3, 4) and a device to permit access to the car roof. The upper externally mounted element (3) with a shape similar to an ellipsoid is placed loosely on top of the elevator car (1) and held by direct mechanical means of a centering device. Recesses at the  
10 sides surround the guide roller supports (6). As a means of providing access to the car roof there is an integral lifting device which allows the upper extension element (3) to be lifted. The lower extension element (4) is constructed as a hollow body in the shape of a frame and has on its underside  
15 flaps which can be swiveled downward and which permit access to the equipment on the underside of the elevator car (1).

(Fig. 1)

Description: (IP1190)

The present invention relates to a device for reducing wind noise and vibration in elevator cars moving at high speed, consisting of at least one aerodynamic element mounted on the car, and a means of access on the car roof.

Wind noise and vibrations are caused by eddies in the air on and around the external contours of an elevator car when travelling at high speed in excess of about 4 m/sec. In terms of aerodynamics, the shape of an elevator car itself, with its various edges, projections, and flat end faces below and above, as determined by technical and functional requirements, is not an ideal shape for a vehicle.

15

To reduce the eddies in the air which cause noise and vibration, the body of the elevator car should have a shape along which the air displaced during travel can flow with as little eddying as possible. In principle, such a shape can be achieved by means of vertically projecting structures which are mounted on the upper and lower end faces of an elevator car.

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Various solutions are known in which the principle described above is used.

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In a technical article with the title "Vibration Analyses for Lifts", which appeared in "Elevator World" in March 1986, an elevator car is shown on page 62 which has domes with a streamlined shape on the upper and lower end faces of the elevator car. In addition, the outside walls are clad with sound-absorbing material. The sides of the domes on the entrance side of the car have flat surfaces which are parallel to the entrance side of the hoistway wall. The other three sides of the domes have surfaces which curve inward, the remaining horizontal surfaces of the upper and lower end faces of the car being correspondingly reduced in size.

30

35

When travelling at high speed, and with the external form of these streamlined domes as illustrated, a horizontally directed, dynamic component of force occurs which acts laterally on the guide rollers and can adversely affect travel comfort. This is because the streamlined shapes of the extensions above and below the car, when viewed from the side, have a surface parallel to the hoistway wall in the neighborhood of the entrance, but slope markedly on the other three sides. During travel, the dynamic pressure of the air acting on the rear of the elevator car gives rise to the lateral force mentioned above, which acts horizontally on the guides.

US 5,220,979 discloses a number of solutions for extensions and attachments to elevator cars with the objective of suppressing acceleration of the airflow in the neighborhood of the entrance. The common characteristic of all the solutions proposed is that at least one additional surface parallel to the entrance side of the hoistway wall is always created on the elevator car both above and below on the side of the entrance. As a simple solution, attachments having the shape of a monopitch roof with side plates (Figs 3A/B, 4A/B/C, 9) are proposed below and above the elevator car. Further solutions relate to apron elements which allow air to pass through (Fig. 5-8). Figs 10 and 11A show steps in the development of the solution according to Fig. 11B, the latter corresponding to a large extent to the illustration in "Elevator World" mentioned above. Three of the four sides which make up the hollow bodies mounted above and below are curved in one direction only. The joins between one side and its adjacent side are angular.

GB 2 280 662 discloses similar, but very high extensions and attachments which have simple curved surfaces with angular joins and flat surfaces parallel to the front hoistway wall. A special feature is that there are doors which can be opened to provide access to the upper and lower side of the car. The great height of the attachments makes longer runbys necessary

at the ends of the hoistway.

All the solutions discussed above display the effect of acting laterally on the guide elements. In addition, the angular joins  
5 in the hollow bodies of the extensions can have a disruptive effect on the airflow, and therefore still cause eddies in the air. Furthermore, many of the problems of practical handling are still not solved. In relation to access to the technical and other equipment of an elevator car, it is only in the last  
10 of the documents mentioned that a partial solution is known, but this is at the cost of an impractical height of the attached aerodynamic bodies.

For this reason, the purpose of the present invention is to  
15 create improved aerodynamic elements for mounting on elevator cars, which eliminate the shortcomings described and which are simple to handle.

The device according to the invention is characterized in that  
20 a first extension element, with an ellipsoid shape, for example, with curved external surfaces and spherically formed joins is provided as a dome which can be placed on the upper end of the elevator car.

25 To reduce the noise created when travelling downward, a second extension element with a favorable aerodynamic profile in the form of a frame-shaped hollow body with rounded external and internal surfaces can be mounted on the underside of the elevator car.

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Advantageous further developments and improvements are stated in the subclaims.

The upper extension element is equipped with a lifting device  
35 which can be operated manually and/or driven by a motor, by means of which, on the one hand, access is provided for maintenance work on the upper side of the car and, on the other

hand, the possibility of escape for passengers who may be trapped in the car is ensured.

5 The lifting device consists of a rope winch which can be operated from the open emergency trap door, or from the elevator hoistway through a hinged opening, for example, and a hoisting rope which is fastened to the tip of the upper extension element and which passes from there over a return pulley above the upper extension element, and over a return  
10 pulley inside the extension element, to the rope winch. If operation is by means of a motor, in the case of power failure the motor is supplied from an auxiliary source of electric current.

15 The upper extension element is placed over a centering device on the upper side of the car so as to give a direct mechanical connection, and is held reliably in the position in which it is placed by means of its own weight alone. The elimination of all fastening devices makes it easier to remove the extension  
20 element quickly by raising it immediately in the case of an emergency.

The centering device consists of a metal centering sheet on the element which is, for example, riveted to the edge of the  
25 element and which has a shaped edge, and a centering frame on the car which has a second shaped edge with the same shape as, and matching, the first shaped edge. When placed on top of each other, the two shaped edges form a secure direct mechanical connection between the elevator car and the element placed on  
30 it, there being in between the shaped edges an elastic layer which damps noise and vibration.

The upper mountable extension element also has on each side on which the guides are located a channel-shaped recess which  
35 surrounds the guide roller supports at a distance from them on all sides. To ensure a favorable pattern of air flow, the inside surfaces of the recesses are offset from the vertical at

a slight angle toward the center of the car, and the joins to the side surfaces are gently rounded.

At least one openable join makes it possible to install the upper extension element in at least two halves. If there is only one openable join it is preferably at right angles to the plane of the guides.

The lower extension element is constructed as a frame-shaped hollow body, and is fastened to the underside of the car by means of a shaped fastening edge.

Shaped channels surround the lower guide roller supports on both sides so as to avoid eddies in the air at high travel speeds. Adjoining the shaped channels are slightly projecting enclosures for the guiderails which serve the same purpose.

Three sides of the frame-shaped lower extension element are partially rounded toward the inside, so as to reduce the surface area of the underside of the elevator car, and thereby also the area it presents to the air, a flat front side of the lower extension element serving as an apron as required by regulations.

The underside of the lower extension element has a frame which is arched on the inside, and two flaps which can be opened by moving on hinges. These downward-hinging flaps permit access to the electrical and mechanical equipment on the underside of the car. Simple, manually operated locks hold the flaps in the closed position.

Openings in the edges of the flaps allow the compensating ropes and traveling cables to pass through, any remaining spaces being sealed with foam inserts.

35

The upper and lower extension elements are constructed of lightweight materials, preferably fiber-reinforced plastic, and

have a high degree of structural stability, being reinforced if necessary with internal ribs, so that no vibrations occur in the walls of the elements even at high travel speeds.

- 5 A more detailed description of the invention based on an exemplary embodiment follows below and is illustrated in the drawings. These show:

10 Fig. 1: A perspective view of a complete elevator car with the device according to the invention;

Fig. 2: A simplified three-dimensional illustration of the upper extension element;

15 Fig. 3: A cross section through the centering device between the upper extension element and the upper side of the elevator car;

20 Fig. 4: A lattice model of the upper extension element;

Fig. 5: A plan view from above of the upper extension element with contours;

25 Fig. 6: An illustration of the principle for the lifting device for the upper extension element (first variant);

Fig. 7: An illustration of the principle for the lifting device for the upper extension element (second variant);

30 Fig. 8: A three dimensional diagonal view from above of the lower extension element;

Fig. 9: A three dimensional diagonal view from below of the lower extension element; and

35

Fig. 10: A side view of the lower extension element.

In Fig. 1 an elevator car 1 is shown with the device according to the invention, which consists essentially of an upper extension element 3 positioned on the upper side of the elevator car 1, and a lower extension element 4 fastened on the underside of the elevator car 1. The elevator car 1 runs by means of upper and lower guide rollers 5 and 7 on guiderails 2. The guide rollers 5 and 7 are mounted on guide roller supports 6 and 8 at a vertical distance from the prismatic car body, and project vertically beyond the extension elements 3 and 4. In the interest of illustrating the extension elements 3 and 4 clearly, any car suspension ropes, compensating ropes, and traveling cables are omitted from Fig. 1. The extension elements 3 and 4 have parts projecting from their sides, and recesses, which partly surround the guide roller supports 6 and 8 and the guiderails 2.

Fig. 2 shows the upper extension element 3 viewed from the side of the guides, and having a channel-shaped recess 9. The free space which this creates around the guide roller support 6 permits air to flow in this zone largely without eddies at high travel speeds. Furthermore, the three inner flanks of the lateral recess 9 are shaped in such a way that the recess 9 becomes wider toward the top. An opening 31 at the apex of other upper extension element 3 allows suspension ropes for the elevator car 1 to pass through. For installing or removing the upper extension element 3 there is an openable join 30 which runs, for example, at right angles to the plane of the guides.

Fig. 3 shows in cross section the construction of the zone of the lower edge of the upper extension element 3 and the details of its connection to the elevator car 1. Fastened to the lower edge of the element wall 10, at the periphery of the upper extension element 3, is a stiffening and centering sheet 11 made of metal bent several times which in the horizontal direction terminates in an edge with a gable-roof shaped profile 12. On the upper side of the elevator car 1 there is a centering attachment 14 having the shape of a frame and made

from a bent section. The bent profile of the centering attachment 14 has a gable-roof shaped profile 15, which has the same shape as the profile edge 12 of the centering sheet 11 into which it fits perfectly. 13 indicates an elastic separating layer which is bonded, for example, onto the edge profile 15 of the centering frame 14. The elastic separating layer 13 serves to damp noise and vibration. It can be seen from Fig. 3 that the upper extension element 3 positioned on the centering frame 14 is mechanically held fast against lateral displacement, and that due to its own weight it also needs no additional fastening in the vertical direction. By simply lifting the extension element 3, the upper side of the elevator car becomes accessible.

Fig. 4 shows by means of a lattice model the three-dimensional, ellipsoid-like shape of the upper extension element 3. The rounded joints between the sides, and to the recesses 9, are particularly visible. It is only with these gently rounded joints between the various zones of the surface that the air current can flow past without eddies when traveling at high speed.

In a similar way, the plan view in Fig. 5 illustrates by means of contours the external shape of the upper extension element. The funnel-shaped widening of the recesses 9 toward the top can also be clearly seen.

Figs 6 and 7 illustrate for two different variants the principle of a device for lifting the upper extension element 3 to permit access to the upper side of the car, and for the possible evacuation of trapped passengers in the event of a breakdown. On the upper side of the elevator car 1 there is a manually operated rope winch 18 which can be operated from the open emergency trap door (not shown) or from the hoistway through a hinged opening (also not shown) as mentioned above. A hoisting rope 20 passes from the rope winch 18 around a return pulley 17 to a return pulley 16 which is fastened by means of a

rope clip to the suspension ropes 19 and then to the apex of the upper extension element 3, where it is fastened. The difference between the two variants is not one of principle, but relates only to the arrangement of the return pulley 17. In  
5 Fig. 6 the return pulley 17 is fastened to the upper extension element 3 itself, and in Fig. 7 the return pulley 17 is fastened to the suspension ropes 19 by means of a rope clip. By means of an appropriate transmission ratio for the rope winch 18, the strength required to raise the upper extension element  
10 3 is so low, that the lifting device can be operated by a person of average strength without particular difficulty. The gearbox of the rope winch 18 is, of course, constructed so as to be self locking.

15 Fig. 8 shows a three-dimensional diagonal view from below of the lower extension element 4, which is constructed as a frame-shaped hollow body. 23 indicates a shaped fastening edge by means of which the lower extension element is firmly fastened to the underside of the elevator car 1. On the entrance side of  
20 the elevator car, the lower extension element 4 has a flat surface 22 which serves as an apron as required by regulations. The external surface at the back 22, and the two surfaces at the sides, are rounded inward toward the bottom. Shaped channels 24 on the inside completely surround the lower guide  
25 roller supports, and projecting enclosures partly surround the guiderails 2.

Fig. 9 shows a three-dimensional view of the lower extension element viewed diagonally from below. Arched internal sides 26  
30 enclose a rectangular surface, which is closed by means of two flaps 27. The flaps 27, which are fastened in a pivoting manner by means of hinges 29, can be opened downward and permit access to the electrical and mechanical equipment on the underside of the car. Simple locking devices (not shown) hold the flaps 27  
35 reliably in the closed position while the elevator is in operation. An opening 28 in the front edge of the flap 27 allows the compensating ropes and the traveling cables to pass

through. The opening 28 is sealed, preferably by means of foam inserts, to prevent the inflow of air during travel.

5 Fig. 10 shows as a side view the true shape of the inwardly curving side surfaces 21 and the flat front surface 22 of the external surfaces of the lower extension element 4.

10 The material used for construction of the extension elements 3 and 4 here described is preferably fiber-reinforced plastic. A further possibility is to coat injection molded or otherwise shaped foam bodies with a laminate. For large numbers, the deep drawing method, or vacuum method, can be used with any raw material including metal.

15 In addition to relevant methods of calculation, a range of measurements of noise and vibration were used to determine the external shape of the extension elements 3 and 4, and in this respect the shape shown gives optimal results. However, this does not exclude the possibility that for specific  
20 installations the external shape shown can differ from the shape illustrated in the examples in individual areas of the surface.

25 A range of systems such as, for example, hydraulic, compressed air, spindle, chain, or gripping systems can be used for the lifting device for the upper extension element. The drive can also be provided by servomotors which are supplied by an auxiliary source of electric current in the case of a power failure.

30

Centering bolts and centering holes can also be used for the centering device for the upper extension element 3, these being located opposite each other on the extension element 3 and on the upper side of the elevator car 1.

## Claims

(IP1190)

1. Device to reduce wind noise and vibration in elevator cars (1) traveling at high speed, consisting of at least one aerodynamic element (3, 4) mounted on the car and a means of access on the car roof,  
5 characterized in that  
the device has an upper extension element (3) with a shape similar to an ellipsoid, preferably a lower extension  
10 element (4) in the shape of a frame, and a device for lifting the upper extension element (3).
2. Device according to Claim 1,  
characterized in that  
15 the lower edge of the upper extension element (3) and the upper edge of the elevator car (1) have matching and mechanically interlocking centering devices (11-15).
3. Device according to Claim 1,  
20 characterized in that  
the upper extension element (3) is loosely placed on the car roof.
4. Device according to Claim 1,  
25 characterized in that  
the lifting device consists essentially of a rope winch (18) with rope (20), and a deflection pulley and a return pulley (17, 16).
- 30 5. Device according to Claim 4,  
characterized in that the lifting device can be operated manually and/or motor driven.
6. Device according to Claim 1,  
35 characterized in that  
the upper extension element (3) has at least one openable join (30).

7. Device according to Claim 1,  
characterized in that  
the upper extension element (3) on the sides of the guides  
5 has channel-shaped recesses (9) which surround the guide  
roller supports (6) and the guiderails(2).
8. Device according to Claim 1,  
characterized in that  
10 the lower extension element (4) is constructed as a frame-  
shaped hollow body.
9. Device according to Claim 8,  
characterized in that  
15 the lower extension element (4) is closed by means of  
flaps (27) which can be swiveled downward and which permit  
access to the mechanical and electrical equipment on the  
underside of the elevator car (1).
- 20 10. Device according to Claim 7,  
characterized in that  
the lower extension element (4) has shaped channels (24)  
for the lower guide roller supports (8) and projecting  
enclosures (25) which partly surround the guiderails (2).

Fig. 1

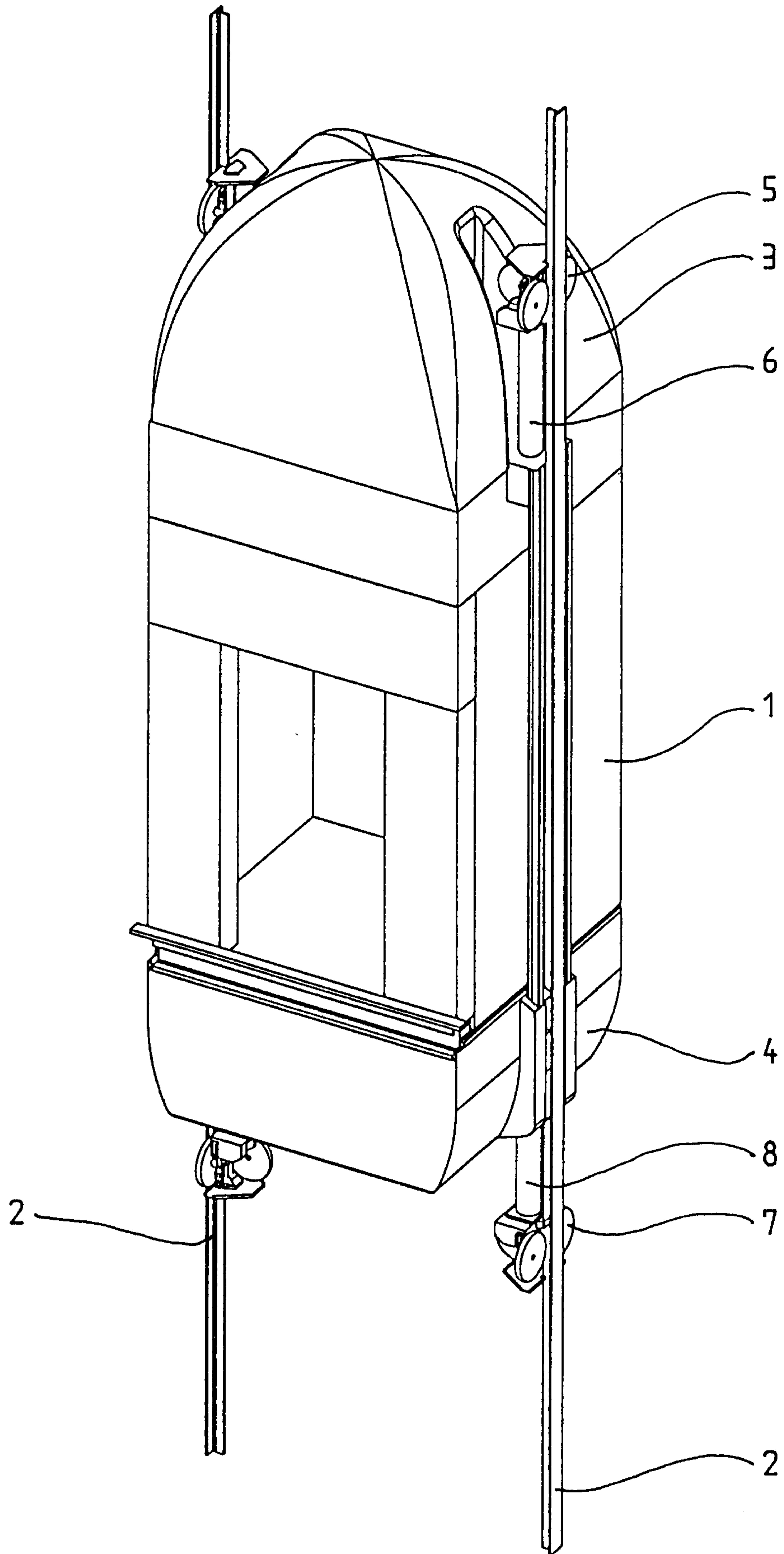


Fig. 2

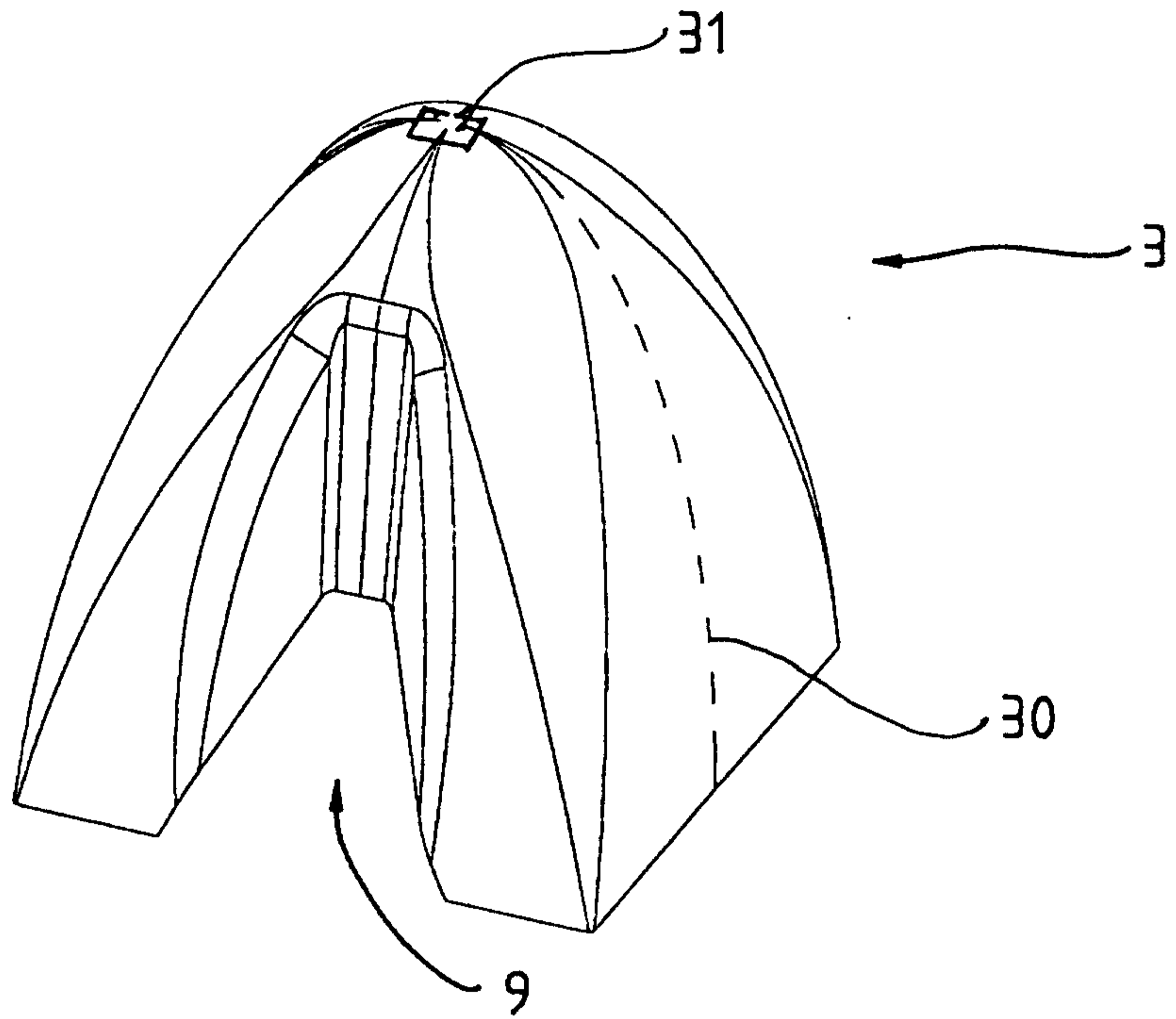


Fig. 3

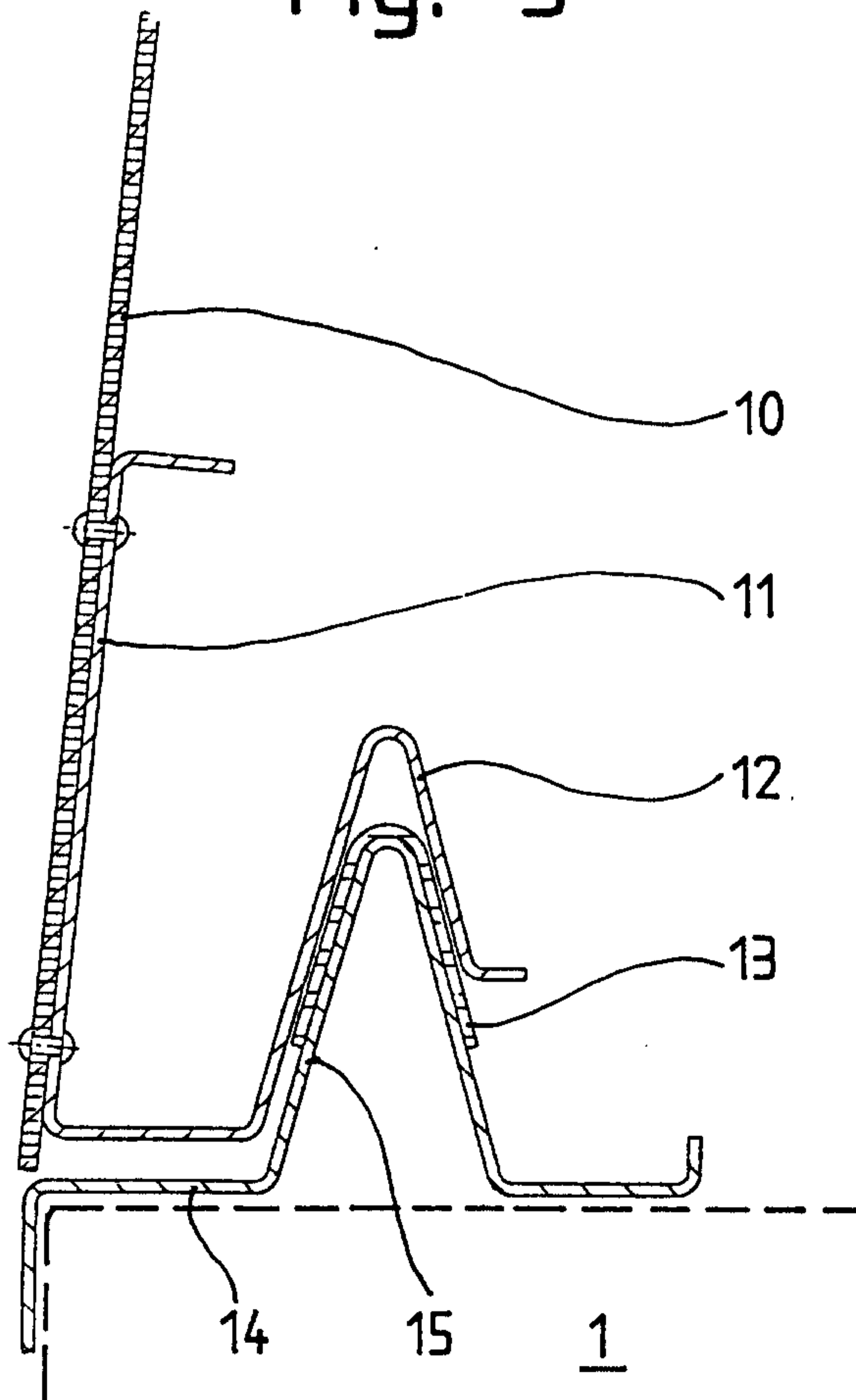


Fig. 4

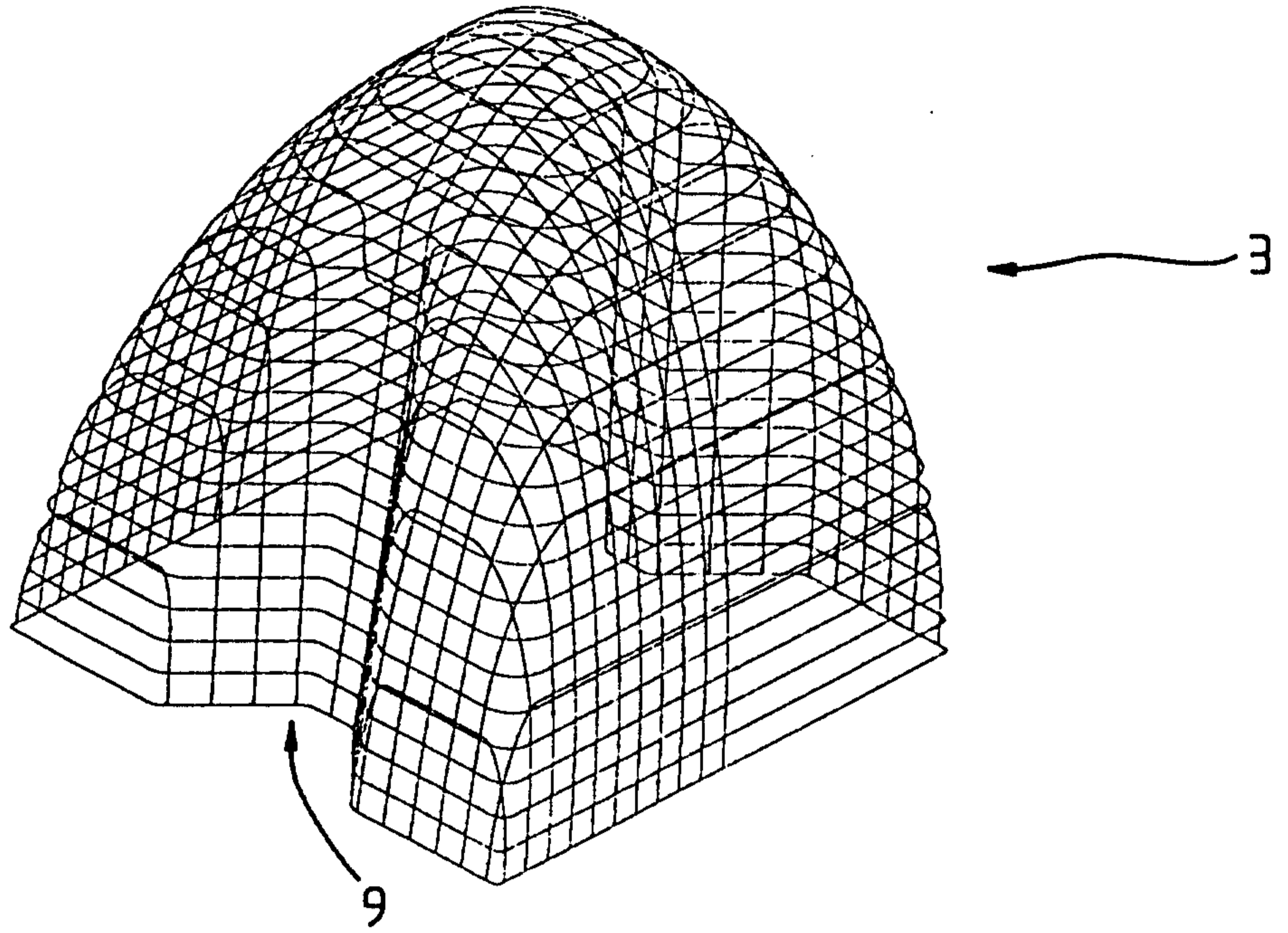


Fig. 5

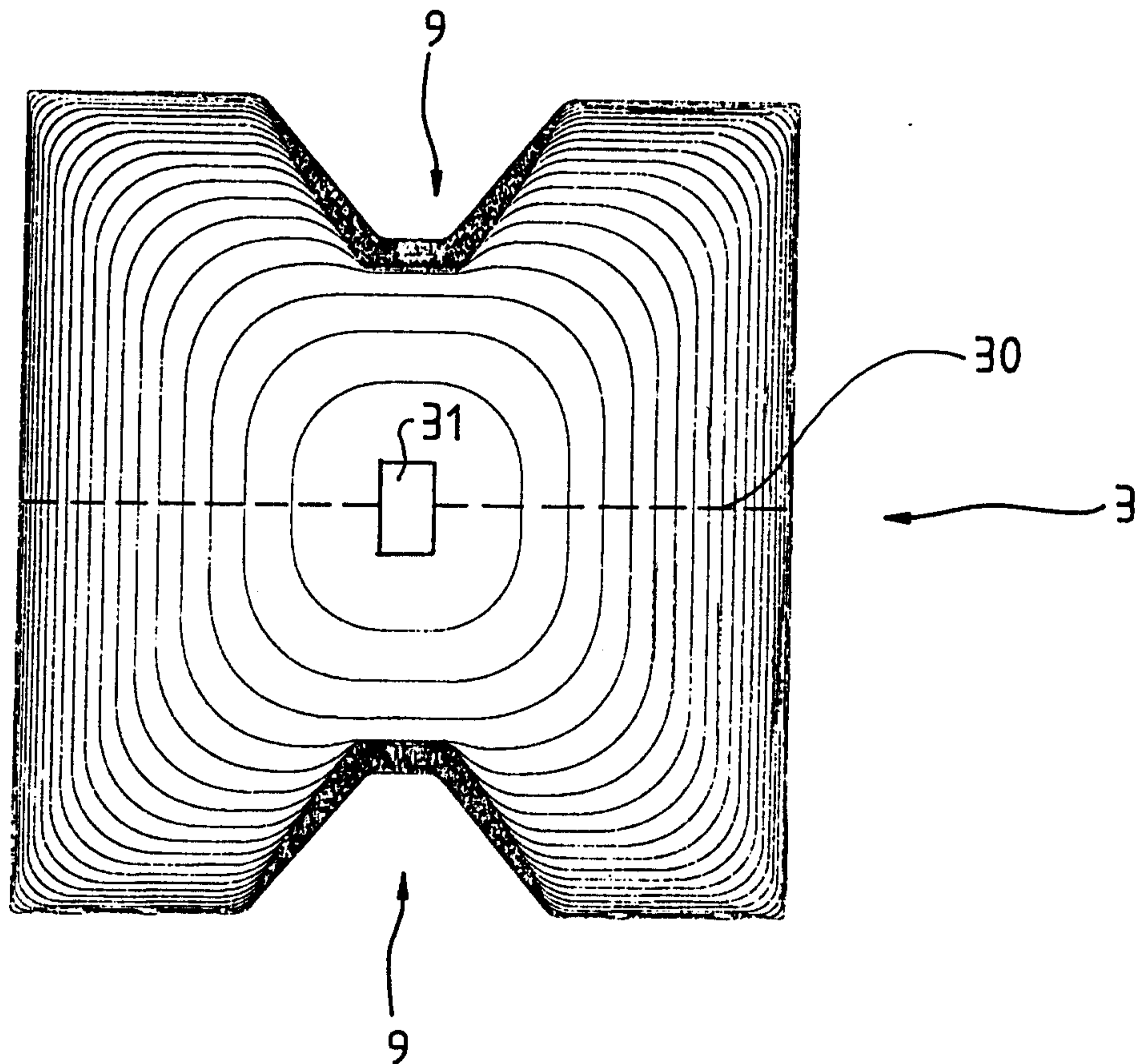


Fig. 6

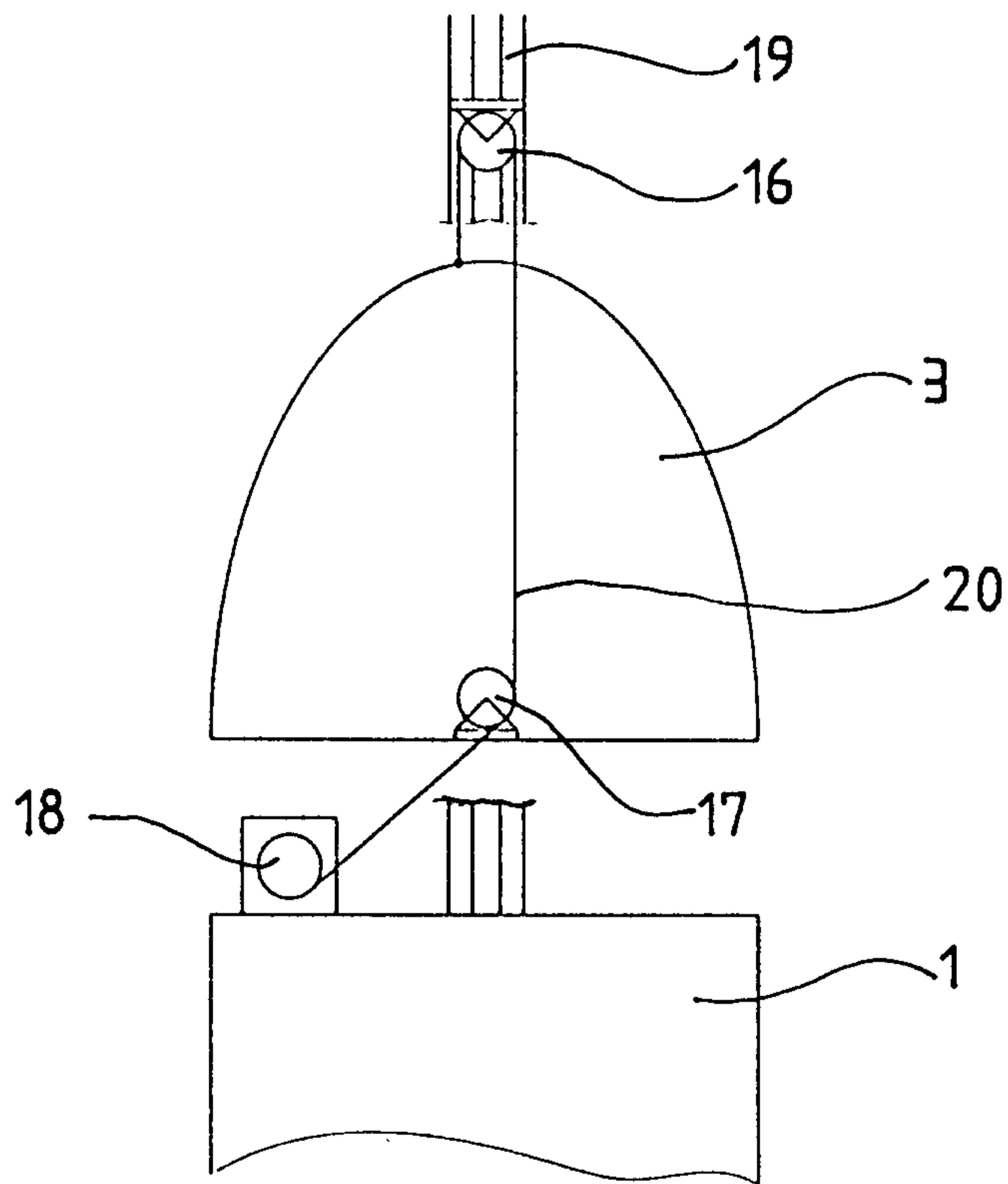


Fig. 7

