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(71) Applicant: **Olo, Olavi**
Tuiskutie 3 A
SF-00940 Helsinki (FI)

(72) Inventor: **Jernberg, Jari Paul Johannes**
Kontulankaari 14 B 17
SF-00940 Helsinki (FI)

Tiittala, Paavo Matti Antero
Haukiverkko 11 A
SF-02170 Espoo (FI)

(74) Representative: **Barlow, Roy James et al**
J.A.KEMP & CO. 14, South Square Gray's Inn
London WC1R 5EU (GB)

(54) A glass door and hinge structure.

(57) The invention relates to a glass door intended for use in refrigeration and freezing spaces, comprising two or more panes (2, 3), of which the outermost pane (2), facing away from the refrigeration and freezing space, is heated by means of an electrically conductive layer (4) on the inside of the pane, there being installed between the panes an intermediate trim (5), and which panes are at their edges surrounded by a plastic U-profile strip (6), and a light-metal frame (1) to which there is attached a tightening strip (7) which is of hard plastic and which, together with the light-metal profile (1), forms a U-shaped inner surface against which the U-profile strip (6) bears.

The invention also relates to a hinge structure specifically for a door intended for use in refrigeration and freezing spaces.

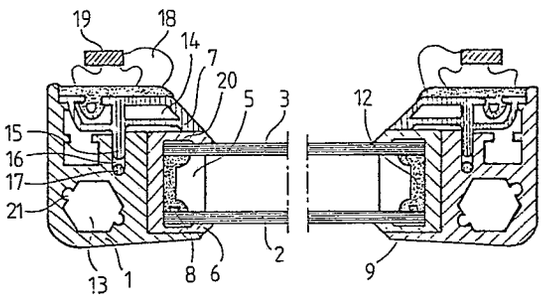

Fig. 2

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Description

A glass door and a hinge structure

The present invention relates to a glass door intended for use in refrigeration and freezing spaces and to a hinge structure specifically suitable for such a glass door.

Grocery stores have shifted increasingly towards the use of refrigeration and freezing cabinets having glass doors. Thus the client can see the products in the cabinet through the glass door and, having decided which product in the cabinet he wishes to buy, the client opens the door, takes the product out of the cabinet, and closes the door.

Such previously known glass doors currently in use usually comprise an aluminum U-profile frame in which there are two or three panes of glass, at least the outermost pane, facing away from the freezing and refrigeration space, and the innermost pane, facing towards the refrigeration and freezing space, are of tempered glass which well withstands ordinary mechanical stresses. An intermediate trim or seal is fitted between the panes.

In order that no frost should form on the outermost pane, facing away from the freezing and refrigeration space, in previously known glass doors this outermost pane is heated. This is accomplished by forming inside the outermost pane an electrically conductive layer, such as a layer of tin oxide or a layer of tin oxide, silver and tin oxide. Electrodes, e.g. silver electrodes, are formed on top of this electrically conductive layer by the so-called silk screen method, and these electrodes are connected to the mains voltage. The electrodes are usually located in the upper part and the lower part of the pane in such a manner that they can be seen through the door. This detracts from the outer appearance of the glass door, but it is a considerably greater disadvantage that, if the pane is broken when, for example, struck by a shopping cart, there is a risk that the client, or some other person, who directly or through the mediation of the metal shopping cart touches the electrode will receive an electric shock.

In previously known heated glass doors the electric wires are often attached to the electrodes by soldering, in which case the joint is not very good and the electric wire may even become detached; furthermore, the electric contact in such a joint is not always very good.

It is also previously known to attach a resistance wire or resistance wires to the inner surface of the aluminum profile frame, for example by means of fasteners or a fastening compound, in order that moisture should not condense on the frame.

Since the glass door is exposed to very great temperature differences, variations of pressure in the space between the glass panes are also very great. This imposes high demands on the sealing between the panes and also on sealing between the frame and the panes, the last-mentioned being also significant in terms of the required heating energy and thereby the consumption of electricity. The space between the panes is in general filled with a shield gas, usually argon or krypton gas, and if this gas discharges, for example owing to poor gas-tightness, it has a deteriorating effect on the electrically conductive layer, and thereby also on the useful life of the glass door.

Glass doors having two or three, or even four, panes of glass (the typical thickness of one pane is approximately 3-4 mm) are very heavy compared with conventional doors, and this imposes special demands on the hinge structure of the door. In known heated glass doors the changing of the handedness of the door is cumbersome and sometimes also impossible to implement, for example, owing to the fact that the electric wires which are led out of the frame structure of the door via the upper hinge, in connection with the changing of the handedness of the door, come to the place of the lower hinge, from where they cannot be drawn to the upper hinge without dismantling the entire door.

It is the object of the present invention to provide a glass door which is intended for use in refrigeration and freezing spaces, which has a simple construction, by means of which the disadvantages and deficiencies of previously known glass doors are avoided, and which has a long useful life.

It is a further object of the invention to provide a flexible hinge for a door specifically intended for use in refrigeration and freezing spaces, a hinge which withstands even great loads and enables the handedness of the door to be changed in a simple manner.

The main characteristics of the invention are given in the accompanying claims.

The invention is described below in greater detail in the form of preferred embodiments and with reference to the accompanying drawings, in which

Figure 1 depicts a front view of a glass door according to the invention,

Figure 2 depicts, on an enlarged scale, a horizontal cross section along line II-II in Figure 1,

Figure 3A depicts, on an enlarged scale, a horizontal section of a detail of Figure 1,

Figure 3B depicts a vertical cross section along line 3-3 in Figure 3A,

Figure 4 depicts a vertical cross section of a hinge struc ture according to the invention, installed in a glass door according to the invention,

Figure 5 depicts a plan view of a detail of Figure 4, and

Figure 6 depicts an exploded view of the hinge structure according to Figure 4.

Figure 1 depicts a front view of a glass door according to the invention, equipped with a lower hinge 10 and an upper hinge 11. The frame of the glass door is indicated by reference numeral 1.

Figure 2 depicts a horizontal cross section of the glass door, showing the structure of the frame profile and the installation of the panes 2 and 3 in it.

The glass door according to the invention comprises an outermost pane 2, facing away from the

refrigeration and freezing space, and an innermost pane 3, facing towards the refrigeration and freezing space. Both panes are of tempered glass and are attached, for example by means of a butyl tape, to a hollow intermediate trim 5, which is preferably of hard PVC plastic. This intermediate trim may be filled with a drying agent.

The outermost pane 2 is made heatable by coating the inner surface of the pane with an electrically conductive layer 4, which may be, for example, tin oxide or a triple layer of tin oxide, silver and tin oxide. In the left-side and right-side parts of the pane, close to the end parts of the pane, this electrically conductive layer 4 is connected to electrodes 8 and 9, which are connected to the mains voltage. As can be seen in Figure 2, electrodes 8 and 9 are located in the space 12 between the intermediate trim 5 and the end parts of the panes, and thus in a situation of breakage of the panes there is no danger of a client or some other person receiving an electric shock from the electrodes, which remain hidden.

The electrodes 8 and 9 can be formed on top of the electrically conductive layer 4, for example, by the silk screen method by using silver paste. The tempering of the glass can be carried out either before or after the silk screening.

The edges of the panes 2 and 3 are surrounded by a U-profile strip 6, which is preferably of soft PVC plastic. The space 12 between the intermediate trim 5 and the U-profile strip 6 is preferably filled with an insulating filler compound such as a two-component filler. There must be shield gas, e.g. argon or krypton gas, between the panes 2 and 3. The U-profile strip 6 considerably improves the gas-tightness as the pressure varies inside and outside the panes 2 and 3, and at the same time it serves as an electric insulator. The U-profile strip 6 can be designed so that air gaps 20 are formed between the U-profile strip 6 and the panes 2 and 3, the air gaps improving the thermal insulation properties of the structure.

The aluminum frame profile 1 constitutes the front part and the side part of the frame structure, and it has a hexagonal throughgoing aperture 13 for the hinge structure. In the aperture 13 there are additionally grooves 21 for the turning spring of the hinge structure. To the frame profile 1 there is attached a tightening strip 7, which constitutes the rear part of the frame structure and is preferably of hard PVC plastic. This tightening strip 7 is in direct contact with the cold air in the refrigeration and freezing space, and its thermal insulation properties are excellent compared with, for example, those of aluminum. To further improve the insulation properties of the tightening strip 7, air ducts 14 have additionally been formed in it. The tightening strip 7 has a protrusion 15, and the aluminum profile 1 has respectively a groove 16 for receiving this protrusion. The tightening strip 7 can be attached to the aluminum profile 1 by means of screws (not shown in the figure), which are screwed into the groove 16 mentioned above.

At the bottom of the groove 16 in the aluminum frame profile there is fitted a resistance wire 17. This resistance wire 17 is located close to the geometric center point of the aluminum profile, and so the heat is distributed evenly to the outer surfaces of the aluminum profile 1 and prevents condensation of moisture on these outer surfaces.

The tightening strip 7, together with the aluminum frame profile 1, forms a U-shaped inner surface against which the U-profile strip bears.

In addition, a bellows seal 18 having a magnet 19 for keeping the glass door tightly and firmly closed is attached to the tightening strip 7.

Figure 3A shows, on an enlarged scale, a horizontal cross section of the lower left-hand corner of the pane 2 shown in Figure 1. Figures 3A and 3B show schematically how the electrode 8 is connected to a copper wire 22, which for its part is connected in a conventional manner, for example by means of a clamp, to an electric wire (not shown in the figures). In the electrically conductive surface 4 of the pane 2 there is formed, for example, by means of a diamond disk, a groove 23, in which the copper wire 22 is installed. Thereafter, the silk screening is carried out by using silver paste, which also fills the groove 23. Finally, tempering is carried out, whereby the silver paste is glazed onto the glass surface. In this manner a very good electrical conductivity is achieved and the copper wire 22 remains firmly attached to the groove 23.

The fastening method depicted in Figures 3A and 3B above can also be implemented by replacing the copper wire with a copper stud which is embedded in a specific depression in the glass surface.

The fastening methods described above also provide the advantage that, if the glass for some reason breaks, the fracturing will occur at the groove 23 or depression made in the glass surface, in which case the electrode will also be broken at this point, thereby breaking off the electric contact with the electrically conductive layer 4 of the pane 2.

Figure 4 depicts the hinge structure according to the invention, installed in a door. The hinge structure comprises a lower hinge 10 and an upper hinge 11. Figure 5 depicts a plan view of the structure of the lower hinge, and Figure 6 is an exploded view of the hinge structure according to the invention.

As described above, the frame profile 1 of the glass door according to the invention has a hexagonal, throughgoing aperture 13, which additionally has grooves 21 for the hook-like end part 35 of the pin-like turning spring 34. A hexagonal lower hinge piece 24 and a hexagonal upper hinge piece 25 are fitted in this hexagonal aperture 13. These hinge pieces 24, 25 turn with the door.

The lower hinge piece 24 pivots in a support piece 26, which is attached to the door frame structure or some other supporting structure, such as the floor. The hinge piece 24 has a cylindrical hole 28 into which a plastic sleeve 33 is fitted. In the plastic sleeve 33, for its part, there is fitted the cylindrical part 31 of the means 30 for tightening the turning spring 34, the part 31 forming the hinge pin. The actual tightening means 30 is made up of a spiral gear 32 (a curved globoid gear). The lower end of the turning spring 34 is flattened and pushed into a hole 46 in the tightening means 30, the lower part of the hole being slot-like, the lower end of the turning

spring 34 moving only along with the spiral gear 32.

The spiral gear 32 is installed in a bore 38 in the supporting piece 26. The supporting piece 26 has additionally a bore 42 for a cylindrical tightening screw 43 (Figure 5), the thread of which mates with the teeth of the spiral gear. By means of the tightening screw 43 it is possible to tighten and slacken the turning spring 34.

The supporting piece 26 has additionally a second bore 39, which is taken into use if the handedness of the door is changed.

A depression 40 is formed in the upper surface of the supporting piece 26, and the hinge piece 24 has a protruding limiting part 36, which operates in this depression. The form of the limiting part 36 defines the turning angle of the door, the angle being preferably approximately 100°.

A locking lever 44 which can be turned about a vertical axis is fitted in the depression 40 of the supporting part 26. The limiting part 36 has a notch 45. When the door is open, the locking lever 44 can be turned so that its end comes into the notch 45, whereupon the door remains open, for example, during the filling of the refrigeration or freezing cabinet. The door is closed by turning the locking lever 44 out of the notch 45, whereupon the door is closed automatically by the force of the spring.

The upper hinge piece 25 pivots in the upper supporting piece 27, which is attached to the frame structure of the door or some other supporting structure. The upper hinge piece 25 also has a protruding limiting part 37, which operates in a depression 41 made in the supporting piece 27. The hinge piece 25 has a cylindrical hole 29 through which the electric wiring of the above-mentioned electrodes and of the resistance wire are drawn and taken out through the supporting piece 27.

The hinge structure according to the invention enables the handedness of the door to be changed in a simple manner. In this case the procedure is as follows: the electric wires drawn via the upper hinge 11 are detached from the attachment points outside the door structure, and the supporting pieces 26 and 27 are detached. The lower hinge structure (parts 26, 30, 33, 24 and 34) are drawn out of the aperture 13, whereupon the hook 35 grips the electric wires, whereupon they can be pulled out at the lower hinge. Next, the upper hinge structure (parts 27 and 25) is drawn out through the aperture 13. Then the door is turned 180° and the hinge structures are put in place, and finally the supporting pieces 26 and 27 are attached in place. In connection with the changing of the handedness of the door, also the tightening screw 43 is transferred from the bore 42 to the bore 39.

Only a few preferred embodiments of the invention are described above, and it is clear that they can be varied within the patent claims.

Claims

1. A glass door intended for use in refrigeration and freezing spaces, the door comprising a frame (1) and two or more panes (2, 3), of which the outermost pane (2), facing away from the refrigeration and freezing space, is heated by means of an electrically conductive layer (4) inside the pane, the layer being in contact with electrodes (8, 9) which, for their part, are connected to a source of voltage, and between which panes (2, 3) there is fitted an intermediate trim or intermediate trims (5), **characterized** in that along their edges the panes (2, 3) of glass are surrounded by a plastic U-profile strip (6) and that the frame is made up of a light-metal profile (1) which constitutes the front part and the side part of the frame, and that to the light-metal profile (1) there is attached a tightening strip (7) of hard plastic which together with the light-metal profile (1) forms a U-shaped inner surface against which the U-profile strip (6) bears.

2. A glass door according to Claim 1, **characterized** in that the electrodes (8, 9) are connected to the electric wires through the mediation of copper wires (22) or copper studs, which in the area of the electrodes are embedded in grooves (23) or depressions in the pane surface (4).

3. A glass door according to Claim 1 or 2, **characterized** in that the intermediate trim (5) is fitted at a distance from the end parts of the panes (2, 3) and that the electrodes (8, 9) are attached to the pane (2) at a point which is between the intermediate trim (5) and the end part of the pane (2).

4. A glass door according to any of the above claims, **characterized** in that the space (12) between the intermediate trim (5) and the U-profile strip (6) is filled with a sealing compound.

5. A glass door according to any of the above claims, **characterized** in that the frame profile (1) is heated by means with a resistance wire (17) or resistance wires installed in the profile.

6. A glass door according to any of the above claims, **characterized** in that there are air gaps (20) between the U-profile strip (6) and the panes (2, 3).

7. A glass door according to any of the. above claims, **characterized** in that there is an air duct (14) in the tightening strip (7).

8. A glass door according to any of the above claims, **characterized** in that the frame profile (1) has in its hinge-side part a vertical through-going aperture (13) for the hinge structure and electric wires.

9. A hinge structure for a door, specifically for a distribution door intended for use in refrigeration and freezing spaces, comprising a lower hinge (10) and an upper hinge (11), **characterized** in that the hinge structure comprises lower support means (26) and upper support means (27), which are attached to the door frame structure or to some other supporting structure, as well as a lower hinge piece (24) and an upper hinge piece (25), which turn along

with the door and are installed in vertical apertures (13) in the lower part and the upper part of the door frame structure (1) and are pivoted in the said support means (26, 27), and a turning spring (34) for closing the door automatically.

10. A hinge structure according to Claim 9, **characterized** in that at least one hinge piece (24) has a throughgoing hole (28) and that the turning spring (34) is fitted through the said hole (28) in such a way that its one end (35) is installed in an aperture (13, 21) in the frame structure and turns along with the door and its other end is attached to the turning spring tightening means (30), which is installed in a bore (38) in the supporting means (26).

11. A hinge structure according to Claim 10, **characterized** in that the tightening means (30) is made up of a spiral gear (32) and that the turning spring (34) can be tightened by means of a cylindrical tightening screw (43), which is installed in a horizontal bore (39, 42) in the supporting means (26) and the thread of which mates with the teeth of the spiral gear (32).

12. A hinge structure according to Claim 11, **characterized** in that the spiral gear (32) has a cylindrical part (31) which is parallel to the axis of the gear, extends into a hole (28) in the hinge piece (26) and forms the hinge pin.

13. A hinge structure according to any of Claims 9-12, **characterized** in that there is a depression (40, 41) in the door-side part of the supporting means (26, 27) and that the hinge piece (24, 25) has a protruding limiting part (36, 37) which operates in this depression and defines the turning angle of the door.

14. A hinge structure according to Claim 13, **characterized** in that in the depression (40) in the supporting means (26) there is installed a locking lever (44) which can be turned, and that in the limiting part (36) there is for the locking lever (44) a notch (45) which enables the door to be locked while it is open.

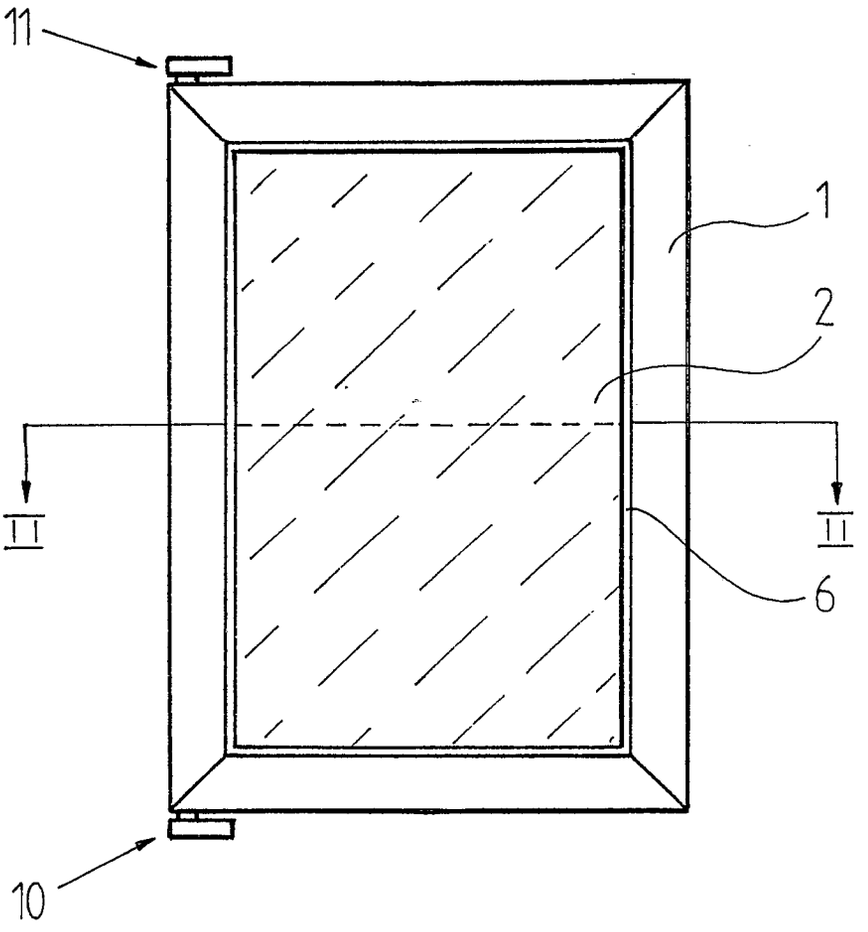

Fig. 1

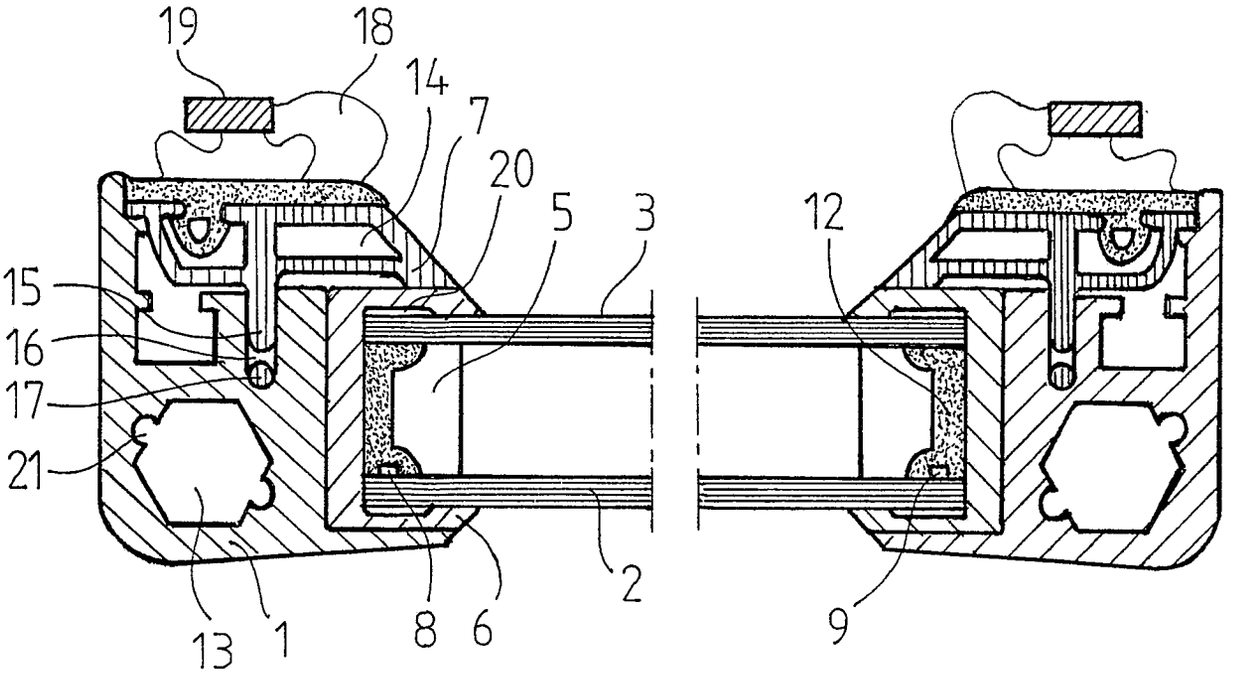

Fig. 2

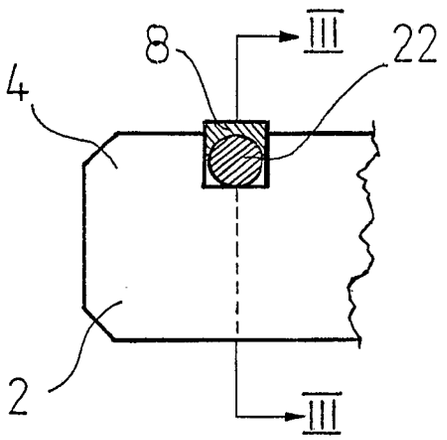

Fig. 3A

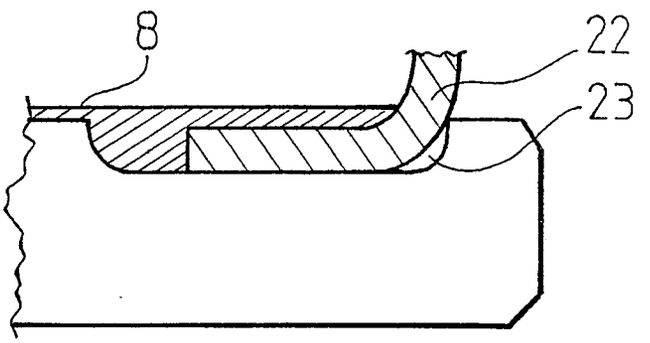

Fig. 3B

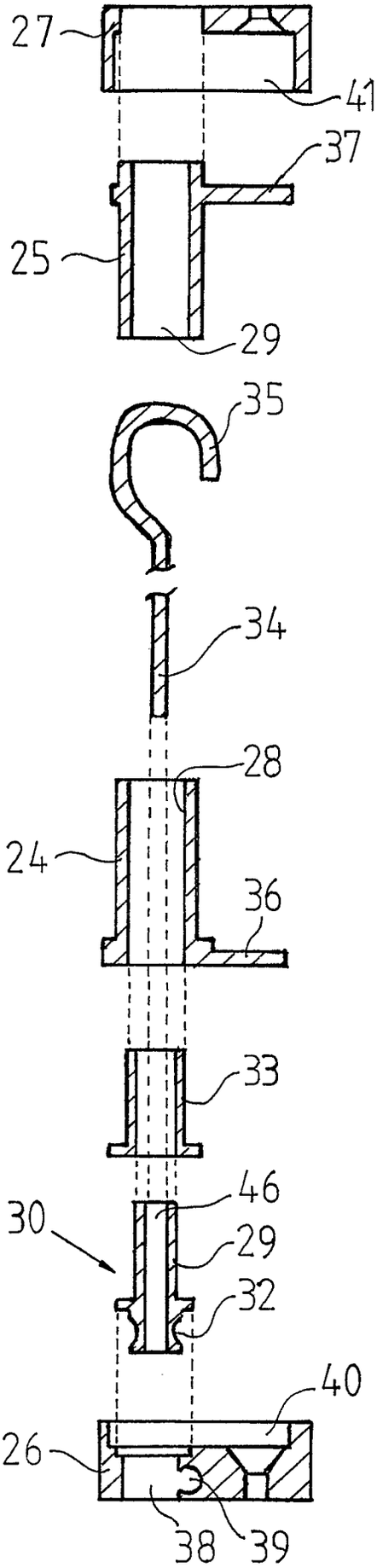

Fig. 6

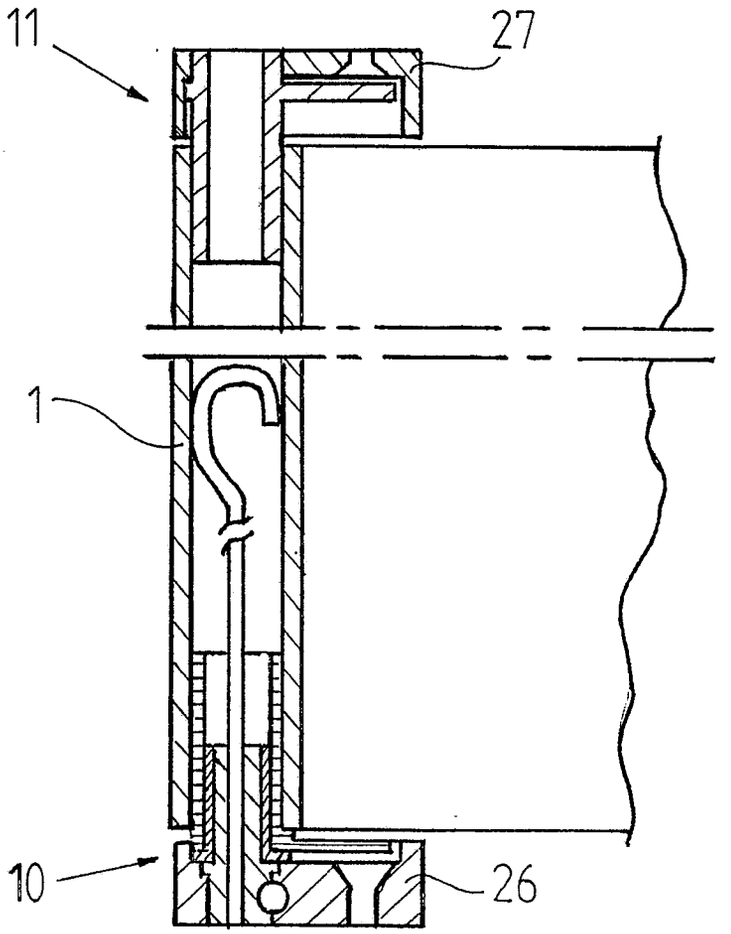

Fig. 4

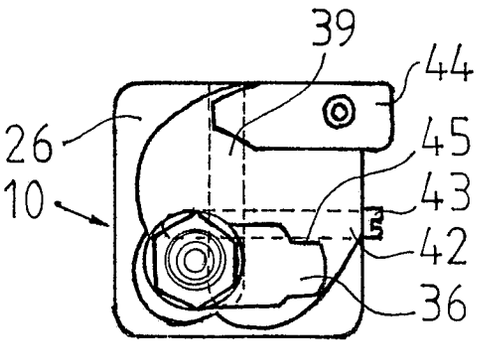

Fig. 5