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(54) Title: METHOD FOR MOUNTING TILTING ELEMENT DISPLAYS BEHIND GLASS PANELS

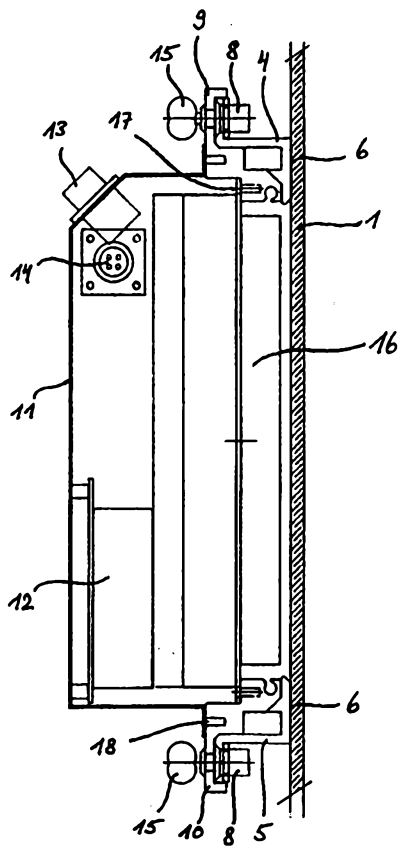
(54) Bezeichnung: MONTAGE VON KIPPSEGMENTANZEIGEN HINTER SCHEIBEN

(57) Abstract

The invention relates to a method for mounting a display module (16) behind a glass panel (1), especially a glass panel of a vehicle. The display module (16) comprises a plurality of display elements, each having a tilting segment and a light source allocated to said tilting element. In order to simplify assembly and to facilitate servicing, the invention provides that the display module is fixed by fixing elements (3) which can be glued on the inner side (2) of the glass panel (1).

(57) Zusammenfassung

Die Erfindung betrifft ein Verfahren zum Montieren eines Anzeigemoduls (16) hinter einer Scheibe (1), insbesondere einer Scheibe eines Fahrzeugs. Das Anzeigemodul (16) umfaßt eine Mehrzahl von Anzeigeelementen, die jeweils ein Kippsegment und eine dem Kippsegment zugeordnete Lichtquelle aufweisen. Zur Vereinfachung des Montageaufwands und zur Erleichterung von Servicearbeiten wird vorgeschlagen, daß das Anzeigemodul mittels Befestigungselementen (3) befestigt wird, die auf die Innenseite (2) der Scheibe (1) geklebt werden.



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Mounting of Tilting Segment Displays Behind Glass Panels

The invention concerns a method for mounting a display module behind a glass panel, in particular a vehicle glass panel, wherein the display module generates a display which is visible from outside the glass panel and comprises a plurality of display elements, each having a tilting segment and a light source associated therewith. The invention also concerns a system of matched components designed to be used with the method and components of this system.

The display modules with which the invention is concerned are disposed behind glass panels. These glass panels may be stationary, e.g. for passenger information, or mobile, e.g. in vehicles used for public transportation. For example, buses often have displays indicating the travel destinations which comprise display modules inside the bus behind the front windscreen, the side windows and the rear window. The invention is described below by way of example with respect to displays showing travel destina-

tions in buses. This is not to be regarded as a limitation.

According to prior art, one or more display modules are arranged in an encased box having its own glass panel on the visible side. The glass panel is independent of the vehicle and is mounted in the vehicle using special fastening means connected to the vehicle chassis. Disadvantageously, special fastening means are required which may differ for each vehicle model. In addition, the fastening casings for display modules are heavy and, for windshield displays, may weigh as much as approximately 60 kg. Moreover, access to the display modules within the closed casings is difficult, which is troublesome for servicing. Visibility is also impaired, since the display is located at some distance from the windscreen and since an additional glass panel is interposed in the casing. To avoid reflections, the glass panels are sometimes provided with an antireflection coating.

Conventional displays comprise a transparent member having an illuminated background or one or more display modules each comprising a matrix of display elements having tilting segments. Each tilting segment thereby comprises a pivotable disc, one side of which is bright, e.g. yellow, and the opposing side of which is darkened, e.g. black. Each tilting segment may be individually brought into the one or other position, preferably by magnetic actuation, such that the combination of the bright sides of the tilting segments can display numbers and letters.

As a particularly advantageous characteristic, the tilting segments can be bi-stable. A control current is thereby only required to tilt the tilting segments, and

the orientation of these segments is stable in both positions without requiring current flow.

In order to improve readability, the tilting segments can be illuminated by a common illumination means, e.g. a neon tube extending along the display module.

Conventional tilting segment displays can also comprise one light source associated with each tilting segment. The light source is preferably a light diode, but may be effected in any other manner, e.g. using optical fibers. The light source associated with each tilting segment may be realized in various ways. For example the light source can be disposed to illuminate the display side, i.e. the bright side of the tilting segment. The light source may e.g. be disposed next to the tilting segment to illuminate it from the side. In other arrangements the light source may be disposed relative to the tilting segment (e.g. in a section thereof or adjacent to the edge of the tilting segment) such that it is visible to the viewer when the bright side of the tilting segment is displayed, and is covered by the tilting segment when the dark side is displayed. In these and other embodiments, the light source may preferably be switched off when the dark side of the tilting segment is displayed.

Display elements with tilting segments having a light source associated therewith are described e.g. in the documents EP 0401980 B1, EP 0463725 A2, EP 0556954 B1, EP 0731435 A1, US 3,942,274, US 4,243,978, US 4,531,318, US 5,005,305 and US 5,022,171.

Up to this time, experts thought it necessary to install displays showing travel destinations by mounting them securely to the chassis and by providing suitable attach-

ment means such as angles, bars and crossbars exhibiting sufficient stability to accommodate the large weight of the casing including the display modules disposed therein.

Departing from the above-mentioned prior art, the purpose of the invention is to create a method of mounting display modules comprising tilting segment displays, an associated system, and suitable components to avoid or reduce the disadvantages of prior art with respect to installation difficulty, casing weight, ease of maintenance of the display modules and visibility of display.

In a method of the initially described type this problem is solved by the present invention by gluing a fastening means onto the inside of the glass panel and by mounting the display module to the fastening element with the display elements having a small separation from the glass panel.

It has been surprisingly discovered within the context of the present invention, that the difficult requirements concerning installation of display modules in vehicles can be solved by glueing these modules to the inside of the vehicle windshield using suitable attachment elements without requiring special components for mounting to the chassis. The invention therefore achieves goals which experts have been trying to achieve for a long time.

The fastening element preferably has an extensive bonding surface to facilitate gluing to the glass panel. If the glass panel is flat, the bonding surface may also be flat. If the glass panel is only slightly curved, the bonding surface may still be flat if gap differences can be compensated for by the glue. For larger glass panel

angles of curvature, the bonding surface of the fastening element may be shaped to follow the curvature of the glass panel. The curvature of the bonding surface may thereby be adapted to that of the glass panel in a horizontal and/or vertical direction.

An expert can select the adhesive from a plurality of suitable, commercially available adhesives taking into consideration the fastening element material. For reasons of appearance, a transparent or colorless adhesive is preferred. The adhesive should be water-proof to prevent detachment of steamed up panels. Moreover, the adhesive should preferably harden at room temperature so that heat treatments are not required to fix the fastening elements to the panel.

The number of fastening elements required for mounting the display module to the panel depends on the structural characteristics of the mounting. If the fastening elements are point-like or have a small bonding surface, a plurality of distributed fastening elements will normally be required. In contrast thereto, the mounting can be effected with only one single fastening element having a sufficiently large, in particular, longitudinal bonding surface. The fastening element could therefore be a fastening frame which may be closed or open (e.g. U-shaped). A frame advantageously provides good dust protection.

In a particularly advantageous embodiment, two fastening elements are used which are fashioned as profiled strips, wherein the profiled strips are glued, parallel to one another, to the panel. In this case, the profiled strips preferentially extend in a substantially horizontal direction and may accommodate one or more display modules arranged next to one another. The height of the display

modules therefore determines the required separation between the profiled strips. Since the height of the display modules produced by different manufacturers is substantially constant, a standardized fastening system can be created. In this connection, a module support profiled strip can be advantageously mounted to the display module and the display module mounted via the module support profiled strip. The module support profiled strip can be directly mounted on the fastening element. In other embodiments, adapting elements may be disposed between the fastening elements on the panel and the module support profiled strips on the display modules, or on the display modules themselves.

The system in accordance with the invention for mounting a display module behind a glass panel, in particular, a panel of a vehicle, wherein the display module is designed to be viewed from outside the panel and comprises a plurality of display elements having a tilting segment and a light source associated with each tilting segment, comprises fastening elements and display modules matched to one another, wherein the fastening elements have a bonding surface for glueing the fastening elements to the panel. Since the display modules themselves, or module support profiled strips or adapting elements mounted thereon match the fastening elements, the display modules can be mounted to the fastening elements with accurate fit with regard to shape and/or arrangement. The inventive system therefore combines bonding and connecting techniques, wherein the connection between the display module and the fastening element is preferably effected for easy mounting.

The invention has the following advantages with respect to prior art:

- installation of the display modules does not require constructive changes to the vehicle chassis and there are no vehicle-specific requirements, e.g. the mounting of casings to the chassis,
- installation can always be effected retroactively without difficult or costly chassis mountings,
- the time required to install a travel destination display can be considerably reduced, e.g. from 150 minutes to 30 minutes,
- the weight can be reduced by up to 60%,
- the depth of installation is reduced, e.g. by 20%,
- the costs are reduced,
- serviceability is improved, since the display modules can be removed, installed and exchanged quickly, so that repairs, servicing, and cleaning operations can be carried out on the bench and must not be effected in the installed state in the vehicle,
- visibility is improved since reflections on multiple glass panels are avoided and the separation between the display elements and the inside of the panel is reduced,
- a steaming-up of the panels is reduced, since the intrinsic heat of the display modules can be discharged into the passenger area, and
- the invention can be realized easily for standardized, uniform configurations, e.g. in series production, and also for customer-specific models.

The embodiments of the invention described in more detail in the drawings illustrate further advantageous features and characteristics.

Fig. 1 shows a section through a glass panel with two fastening profiled strips,

Fig. 2 shows a section through a casing cover with two module support profiled strips,

Fig. 3 shows the parts of Fig. 1 and 2 in the assembled state;

Fig. 4 shows the same as Fig. 3 with a display module in the assembled state;

Fig. 5 shows a variant of Fig. 4;

Fig. 6 shows a section through an upper fastening profiled strip;

Fig. 7 shows a section through a lower fastening profiled strip,

Fig. 8 shows a section through an upper module support profiled strip;

Fig. 9 shows a section through a lower module support profiled strip with a quick-connector;

Fig. 10 shows a modification of Fig. 4 with adapter profiled strip;

Fig. 11 shows a detail of Fig. 10;

Fig. 12 shows a detail of Fig. 11;

Fig. 13 shows a modification of Fig. 10;

Fig. 14 shows a detail of Fig. 13; and

Fig. 15 shows a detail of Fig. 14.

Fig. 1 shows a section through a glass panel 1 of a vehicle. Two fastening elements 3, designed as profiled strips, are mounted on the inside 2 of the glass panel 1. In this embodiment, an upper fastening profiled strip 4 and a lower fastening profiled strip 5 are glued to the panel 1 via the bonding surfaces 6 in a horizontal direction and parallel to each other. The fastening profiled strips 4, 5 are made from one single piece. They could, however, also be made from several pieces.

The fastening profiled strips 4, 5 can be glued to the glass panel 1 using a conventional adhesive. The glueing may advantageously be effected using a template or a suitable fastening tool to mount the fastening profiled strips 4, 6 in a predetermined position. The glass panel 1 manufacturer can glue the fastening profiled strips 4, 6. Alternatively, others could perform the glueing before, during or after the glass panel 1 is installed in the vehicle. The fastening profiled strips may e.g. be extruded aluminium profiles.

The display modules could, in principle, be mounted directly to the fastening elements 3, e.g. to support cams 8 formed therein. However, an embodiment is preferred having module support profiled strips 7 which can be mounted to the display modules and which cooperate with the fastening elements 3. Fig. 2 shows module support profiled strips, e.g. in the form of extruded aluminium profiles. They comprise an upper module support profiled

The module support profiled strips 9, 10 comprise grooves 17 which are suitable for mounting the display modules 16 or for fastening other components. Additional grooves 18 are provided for screwing in bolts to mount the casing cover 11. The module support profiled strips 9, 10, and the fastening profiled strips 4, 5 are preferably completely pre-fabricated, provided with all necessary bores, and cut to the proper length.

The fastening profiled strips 4, 5 are glued to the glass panel 1 and the display module 16 is connected to the module support profiled strips 9, 10 and, optionally, to the casing cover 11. An unit is thereby generated which is ready for operation and installation. It can be precisely fitted to the glued fastening profiled strips 4, 5 and secured by the quick-connectors 15.

In the embodiment shown, the upper and lower fastening profiled strips 4, 5 and module support profiled strips 9, 10, respectively, have the same design. This simplifies stocking, but is not absolutely necessary. In other embodiments, the display module 16 could be inserted for example only with an edge, for example the lower one, into a support groove and mounted on the other side via attachment means.

Installation in accordance with the invention can be advantageously carried out quickly and at low cost. In addition, the tilting segments are disposed at a very small separation from the inside 2 of the glass panel 1. A lower limit is defined by the pivoting radius required for tilting the tilting segments. The distance between the pivoting axes of the tilting segments and the inside 2 of the glass panel 1 may be smaller than five times, preferably smaller than three times the maximum pivoting

radius of the tilting segments (relative to their pivoting axes).

Fig. 5 shows a variant of the embodiment of Fig. 4 having a larger height. This can be effected with identical installation of the display module 16 using identical fastening parts, simply by glueing the fastening profiled strips 4, 5 onto the glass panel 1 at a larger separation from each other. Fastening, using a quick connector 15 or other means, is not effected thereby. In particular, fastening means connected to the chassis of the vehicle must not be modified.

Figures 6 and 7 show detailed sections through an upper fastening profiled strip 4 and a lower fastening profiled strip 5, respectively. The section in Fig. 7 thereby passes through a support cam 8 and that of Fig. 6 through another location. The fastening profiled strips 4, 5 are shown at a separation from the panel 1 so that the bonding surfaces 6 can be better recognized. The legs 19 may have support cams 8 or other bores for mounting an attachment means. The interior extensions 20, i.e. those facing one another, may be sufficiently long as to cover portions of the display module 16 which should not be visible, e.g. such as soldering locations. The interior ends 21 are chamferred to facilitate better viewing of the display elements.

Fig. 8 shows (in correspondence with Fig. 6) an upper module support profiled strip 9. Fig. 9 shows (in correspondence with Fig. 7) a lower fastening profiled strip 10. The grooves 17, 18 and the quick connectors 15 are visible. The leg 22 may also comprise additional bores for fastening the attachment means. One or more sliding surfaces 23 are preferably provided for play-free instal-

lation of the adapting elements 26. Similar to the module support profiled strips 9, 10, the adapter profiled strips 27, 28 are preferably extruded profiles, in particular, made from aluminium. They may have a recess 30 or a corresponding resting edge for positioning the display modules 16 as well as a groove 31 for screwing in bolts to install the display modules 16. The extension 32 may cover portions of the display module 16 which should not be visible. The chamfers 33 facilitate viewing of the display elements at large view angles.

Fig. 13 shows a variation in which the adapter profiled strips 27, 28 comprise an extension which is longer than that of the embodiment of Fig. 10 for bridging a larger distance from the fastening profiled strips 4, 5 and module support profiled strips 9, 10. The associated adapter profiled strips 27a, 28a are illustrated in figures 14 and 15.

For conventional travel destination displays in buses, each individual travel destination display, e.g. the front display, the sideward left-hand display, the sideward right-hand display and the rear display, each has its own intelligent control means for controlling the display module which must be programmed in a customer-specific manner. In the inventive embodiment of the display modules, a central, intelligent control means can be provided for all display modules. This control unit can be disposed at a central location in the bus and can be programmed according to the wishes of the customer to control all display modules. In contrast to practice up to now, the vehicle manufacturers must only install the display modules, define one, preferably standardized, installation location for the control means, and provide the required information to the customer concerning the

display module interfaces. A control unit or its programming can then be provided by the customer or a service company according to the respective requirements.

List of Reference Numbers

1	glass panel
2	inside
3	fastening element
4	upper fastening profiled strip
5	lower fastening profiled strip
6	bonding surface
7	module support element
8	support cams
9	upper module support profiled strip
10	lower module support profiled strip
11	casing cover
12	electronic unit
13	plug connection
14	plug connection
15	quick-connector
16	display module
17	groove
18	groove
19	leg
20	extension
21	end
22	leg
23	sliding surface
24	sliding surface
25	channel
26	adapting element
27	upper adapter profiled strip
28	lower adapter profiled strip
29	connecting piece
30	recess
31	groove
32	extension
33	chamfer

Claims

1. Method for mounting a display module (16) behind a glass panel (1), in particular a glass panel (1) of a vehicle, wherein the display module (16) provides a display visible from outside the glass panel (1) and comprises a plurality of display elements each comprising a tilting segment and a light source associated therewith,

   characterized in that

   at least one fastening element (3) is glued to the inside (2) of the panel (1) and the display module (16) is installed on the at least one fastening element (3) with a short separation between the display elements and the panel (1).

2. Method according to claim 1, **characterized in that** two fastening elements (3) shaped as profiled strips (9,10) are used, wherein the profiled strips (9,10) are glued, parallel to one another, to the panel (1).

3. Method according to claim 1, **characterized in that** a fastening frame is used as the fastening element (3).

4. Method according to any one of the preceding claims, **characterized in that** a module support profiled strip (7) is mounted to the display module (16) and the display module (16) is mounted via the module support profiled strip (7).

5. Method according to claim 4, **characterized in that** the display module (16) is mounted via a quick-connector (15).

6. System for mounting a display module (16) behind a glass panel (1), in particular a panel (1) of a vehicle, wherein the display module (16) generates a display visible from outside the panel (1) and comprises a plurality of display elements each of which comprises one tilting segment and one light source associated with the tilting segment, for use in a method according to any one of claims 1 to 5, comprising fastening elements (3) and display modules (16) shaped for mutual matched cooperation, wherein the fastening elements (3) comprise a bonding surface (6) for glueing the fastening elements (3) to the panel (1).

7. System according to claim 6, **characterized by** module support profiled strips (7) which can be fastened to the display modules (16) and which cooperate with the fastening elements (3) for mounting the display modules (16).

8. System according to claim 7, **characterized by** adapting elements (26) for connecting the fastening elements (3) to the display modules (16) or to the module support profiled strips (7).

9. Fastening element (3) for a system according to any one of claims 6 through 8, **characterized in that** it is designed as a profiled strip (9,10) or a fastening frame.

10. Fastening element (3) according to claim 9, **characterized in that** the bonding surface (6) is shaped to follow the curvature of the panel (1).

11. Module support profiled strip (7) for a system according to any one of claims 7 to 8, **characterized in that** it is shaped as a profiled strip (9,10) or as a frame.

12. Adapting element (26) for a system according to claim 8, **characterized in that** it is shaped as a profiled strip (27,28) or as a frame.

13. Fastening element (3) according to claim 9, module support profiled strip (7) according to claim 11 or adapting element (26) according to claim 12, **characterized in that** at least one sliding surface (23) is provided for play-free installation of the elements with respect to one another.

Abstract

The invention relates to a method for mounting a display module (16) behind a glass panel (1), especially a glass panel of a vehicle. The display module (16) comprises a plurality of display elements, each having a tilting segment and a light source allocated to said tilting segment. In order to simplify assembly and to facilitate servicing, the invention provides that the display module is fixed by fastening elements (3) which can be glued to the inner side (2) of the glass panel (1).

(Fig. 4)

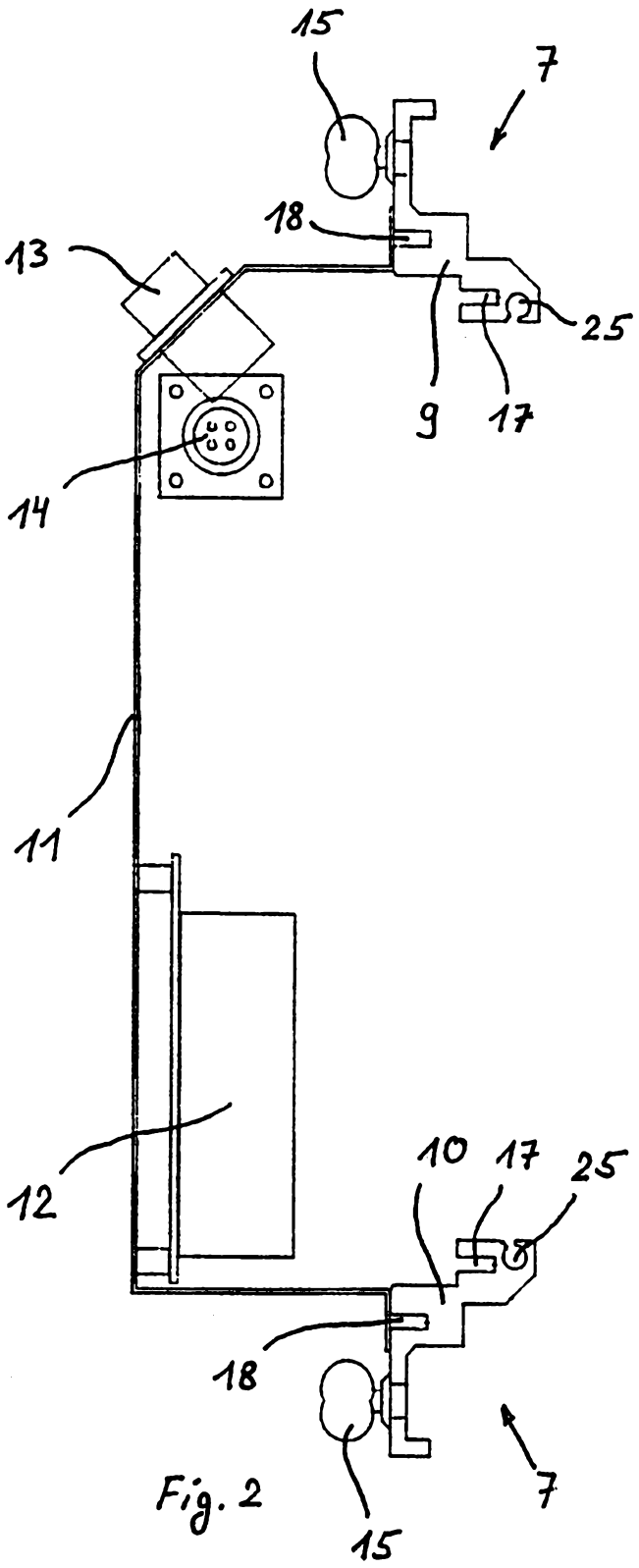

Fig. 2

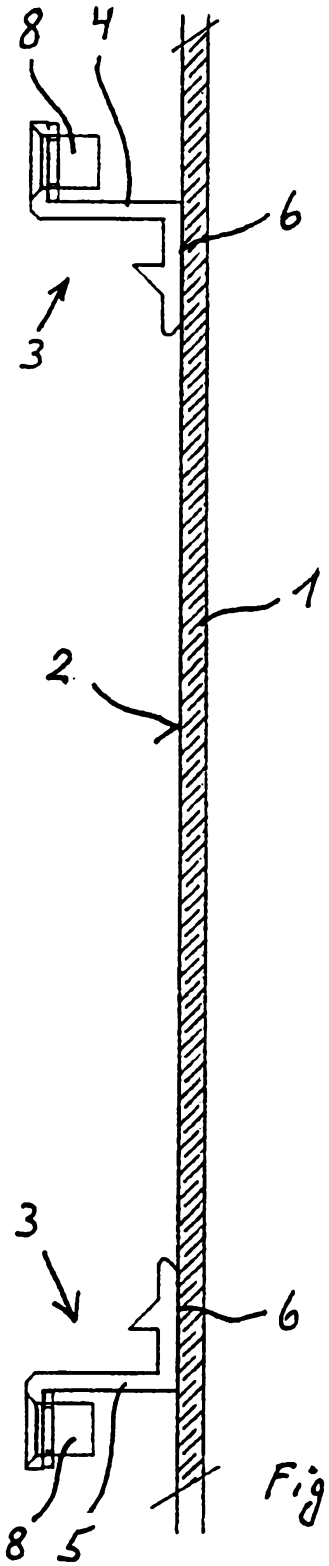

Fig. 1

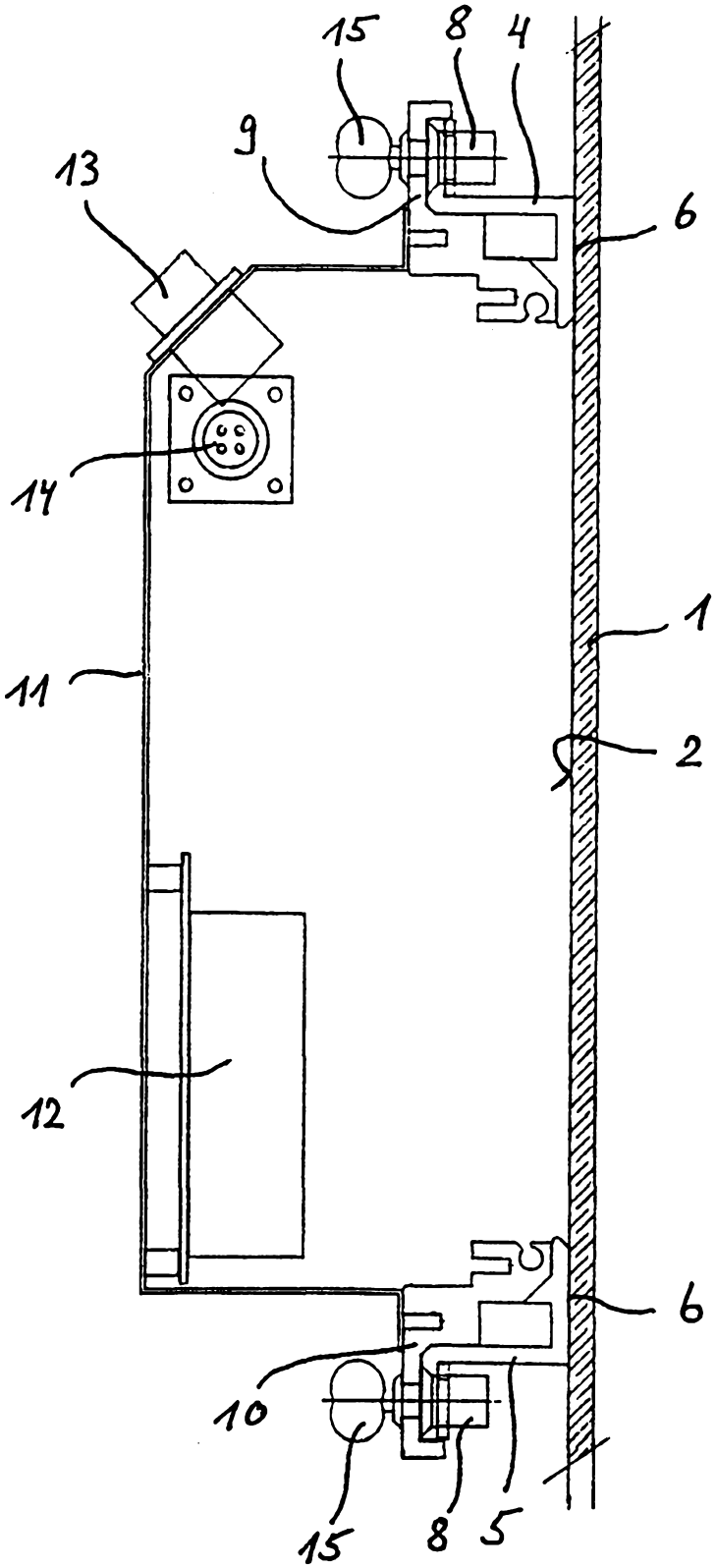

Fig. 3

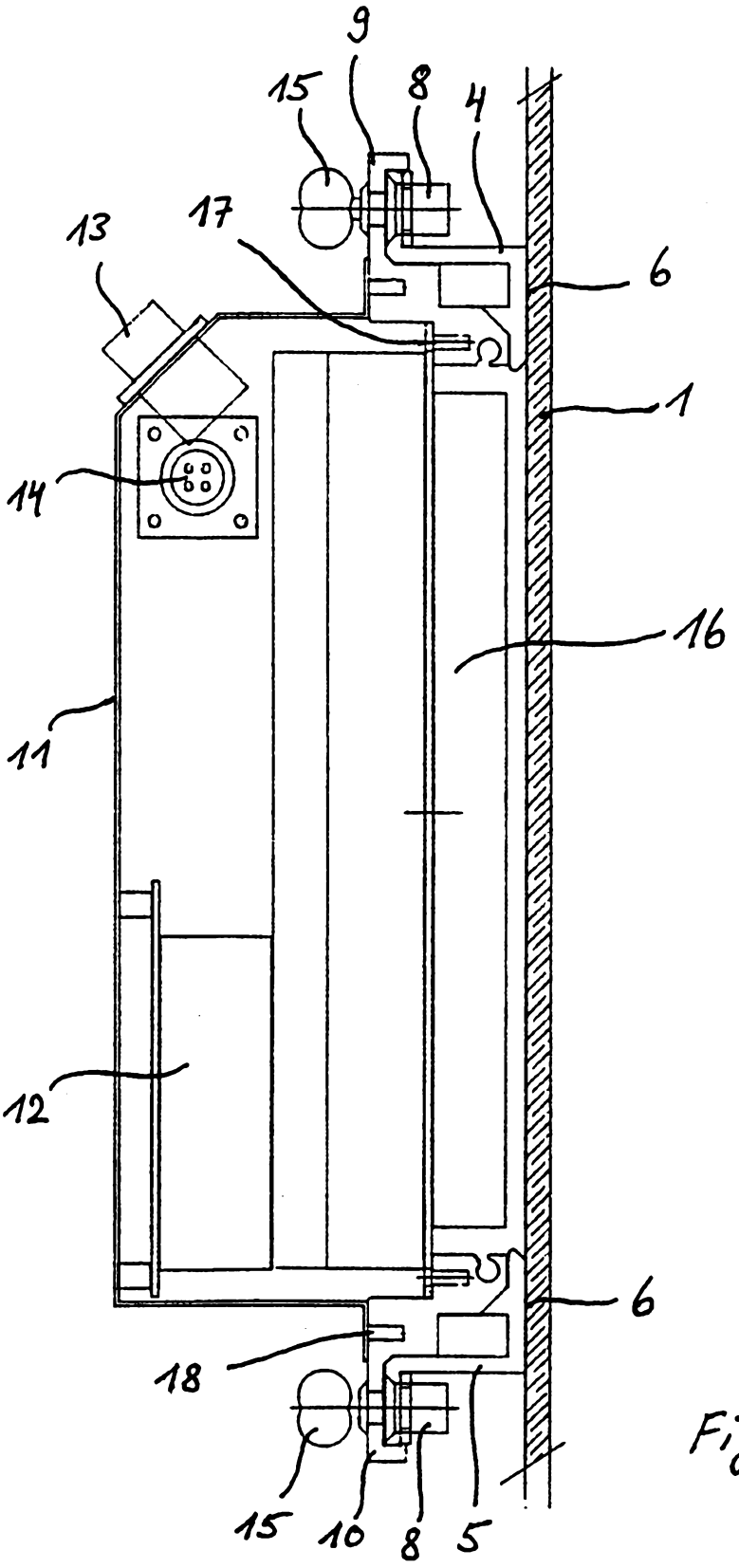

Fig. 4

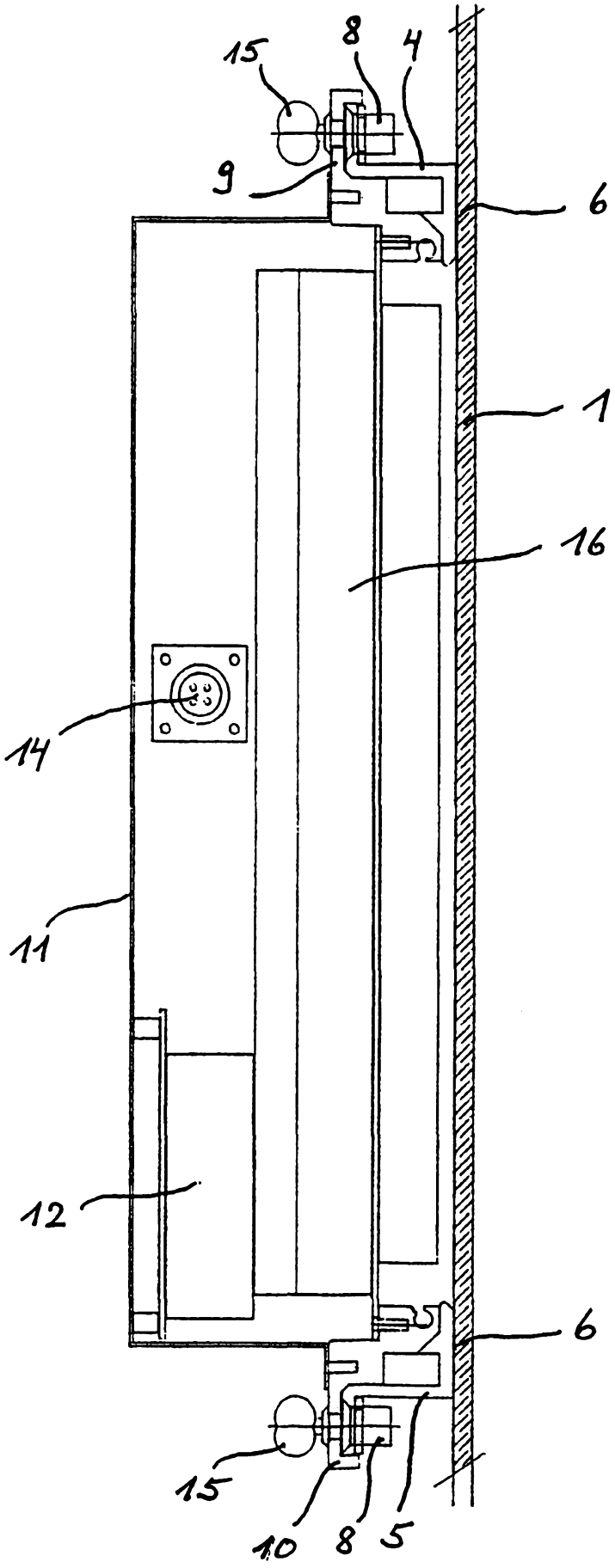

Fig. 5

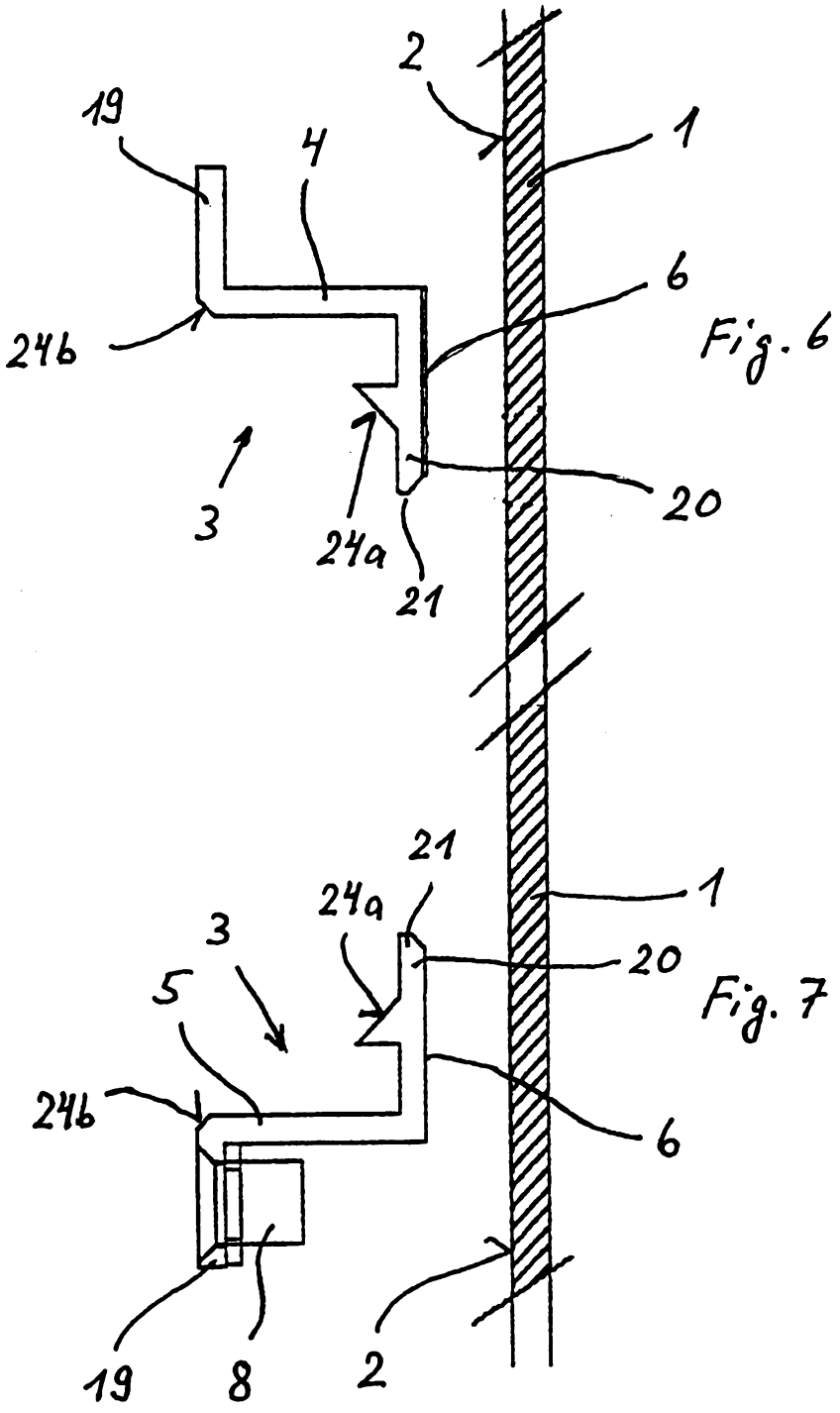

Fig. 6

Fig. 7

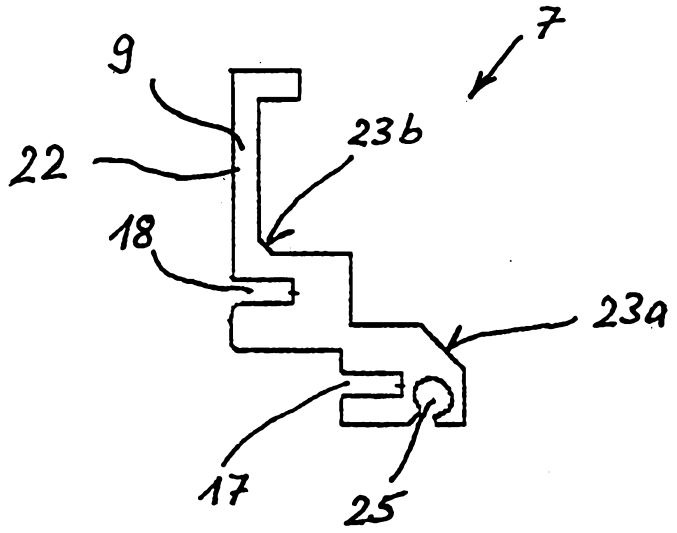

Fig. 8

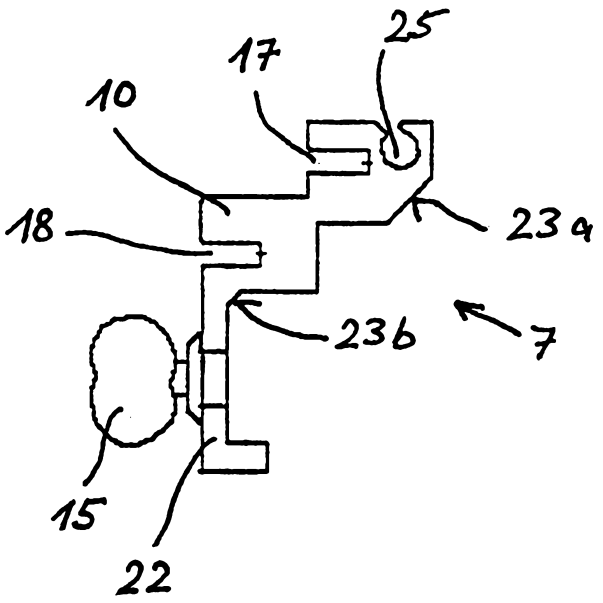

Fig. 9

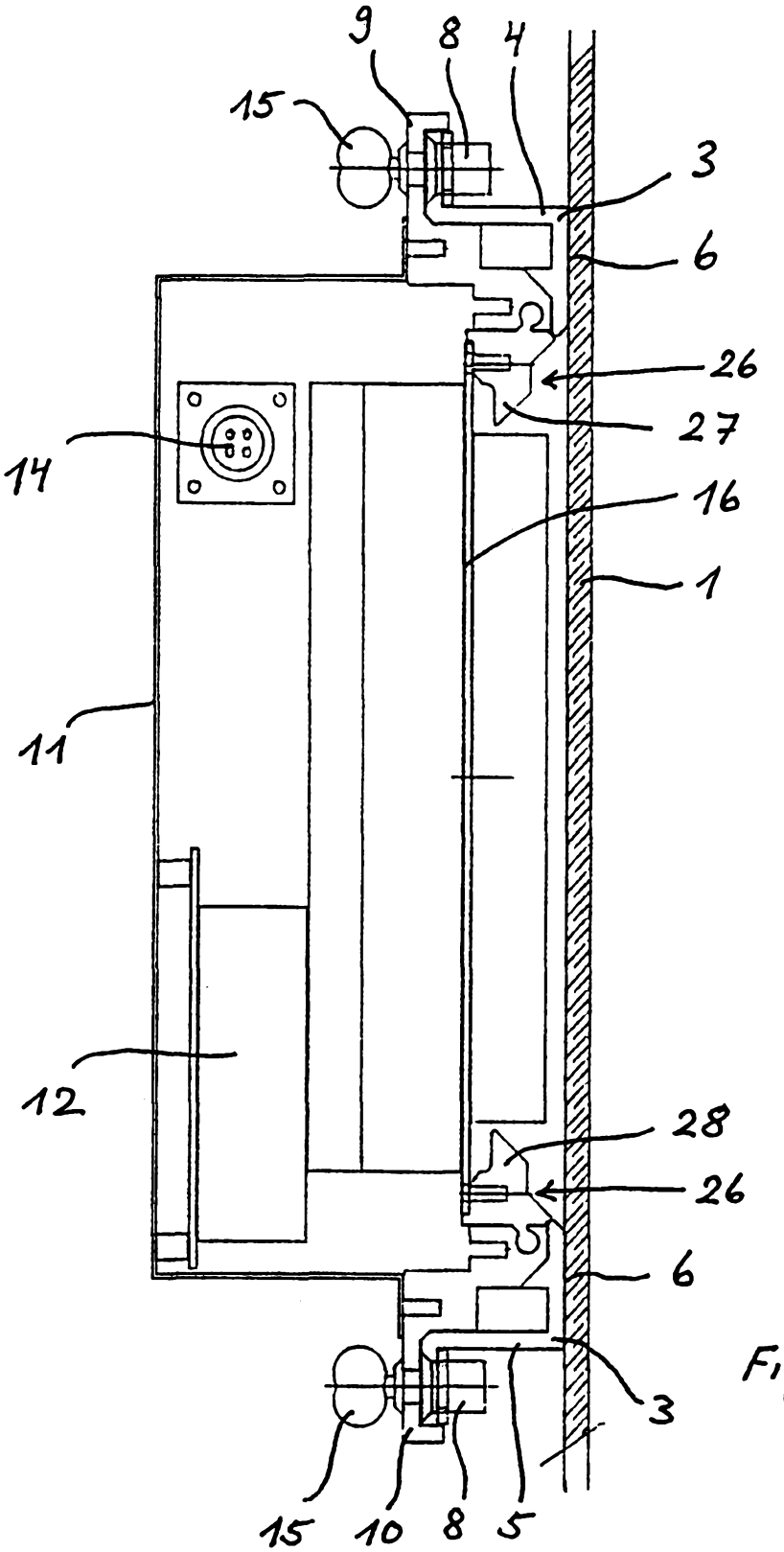

Fig. 10

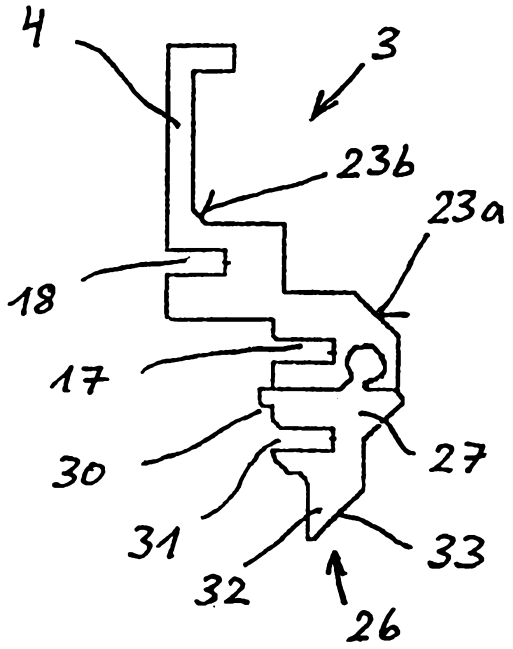

Fig. 11

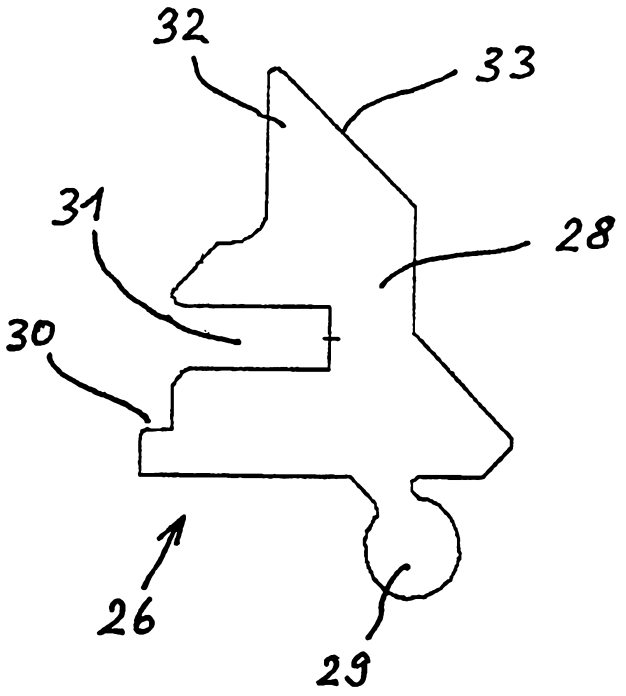

Fig. 12

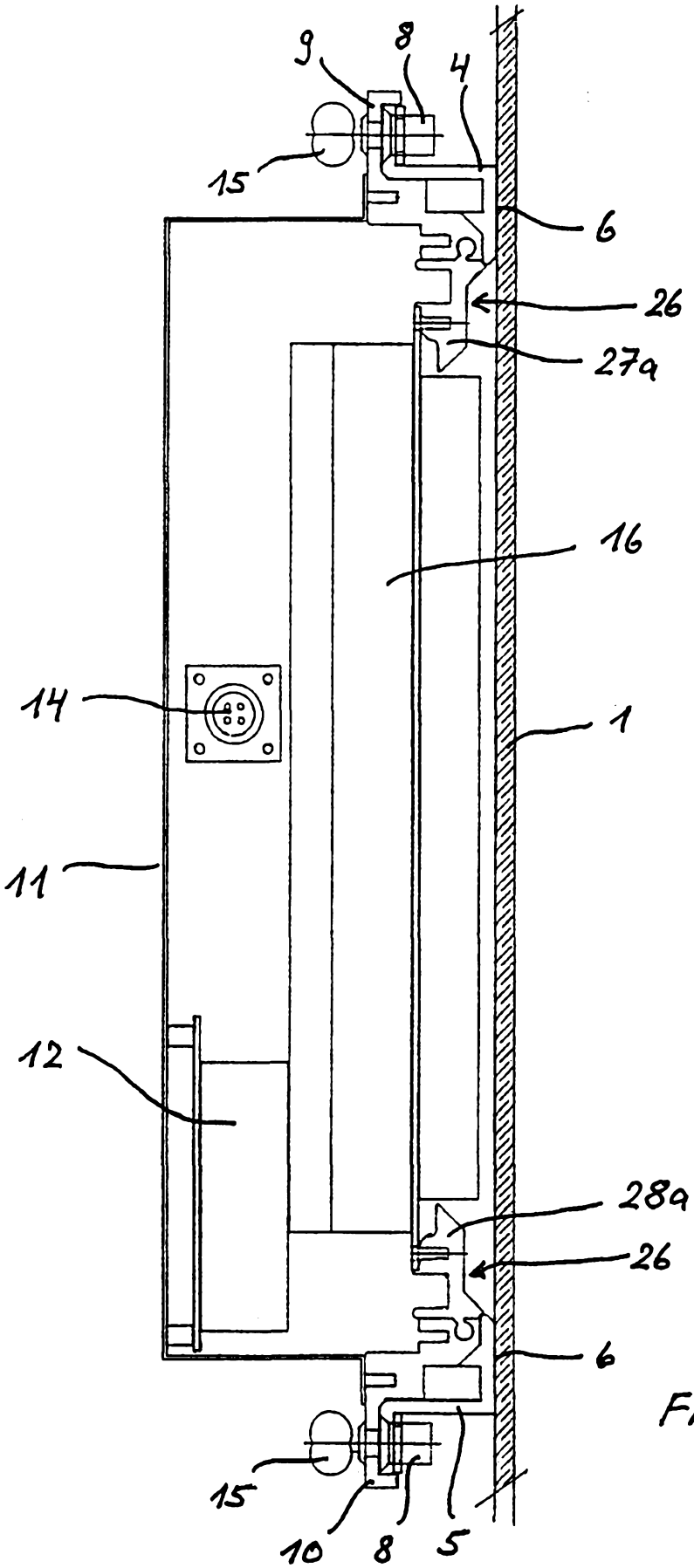

Fig. 13

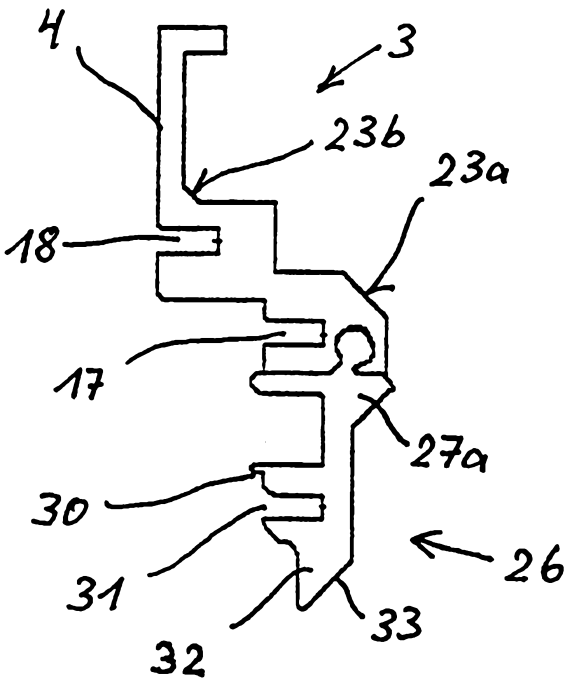

Fig. 14

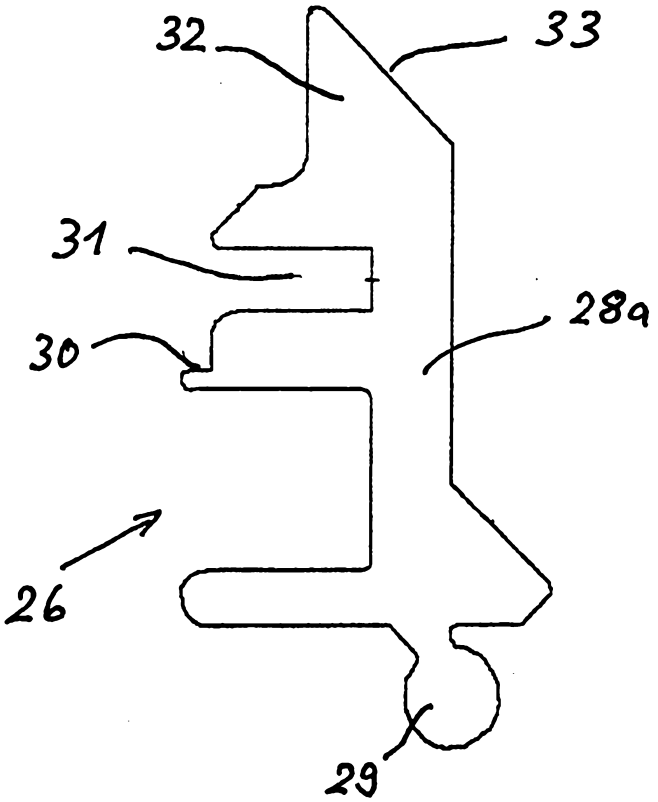

Fig. 15