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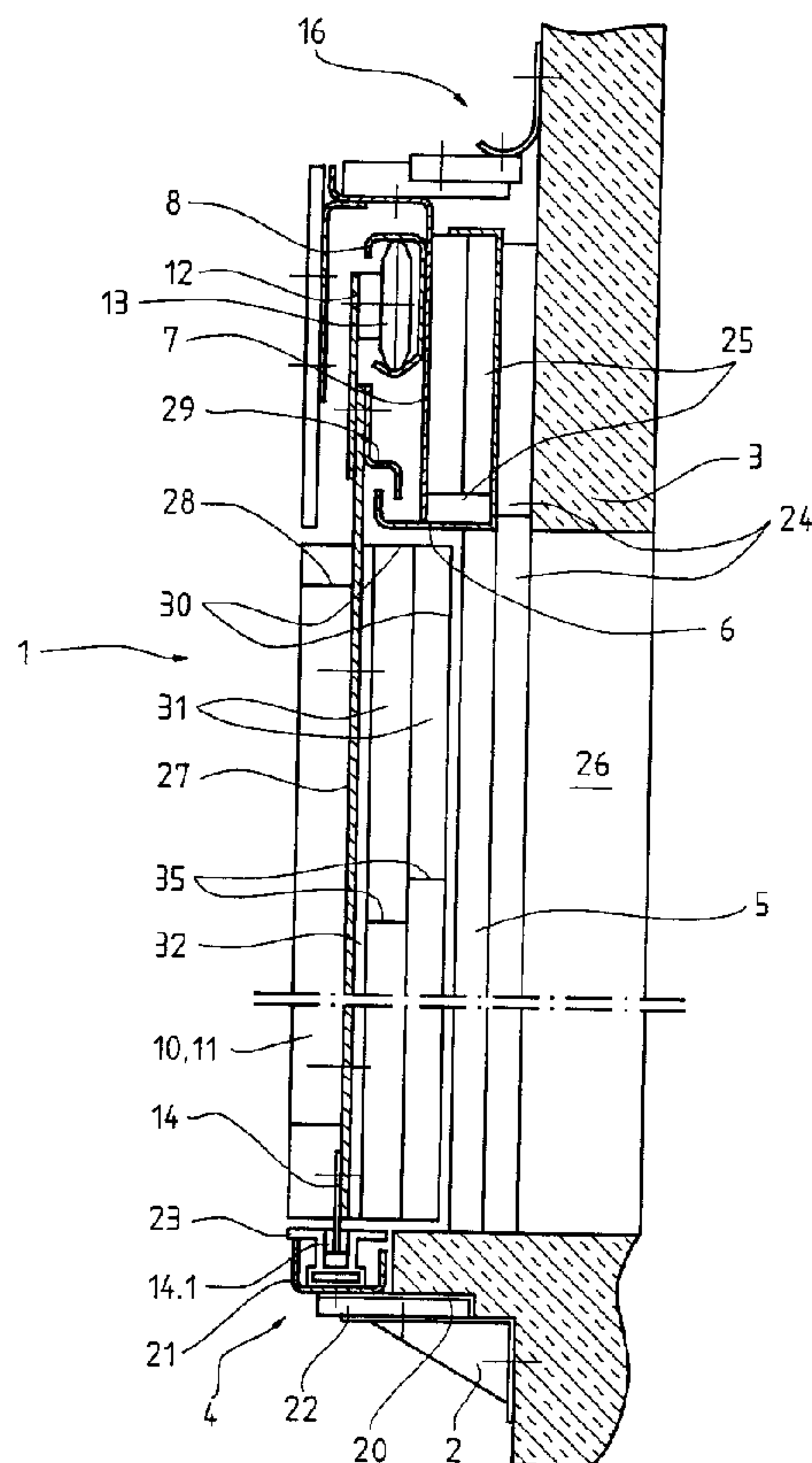
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(54) **PORTE DE CAGE D'ASCENSEUR A L'EPREUVE DU FEU**

(54) **FIREPROOF LIFT SHAFT DOOR**



(57) There is created in a modular shaft door system a fireproof lift shaft door (1) predominantly by flange-mounting, to standard shaft door panels, of flat insulating material housings (30) filled with high-efficiency, novel insulating material layers (31). These insulating material housings are so constructed that they have throughflow chicanes in the region of the closing edge and form, in the closed state, additional labyrinth-like obstacles (36) against the passage of flame and gas in co-operation with the door frame. An overall flat mode of construction of the shaft door (1) enables, with minimal loss of usable shaft cross-sectional area, the doors to be mounted in rational manner by simple flange-mounting to the shaft wall (3). A wide door frame may compensate for large constructional tolerances, and appropriate fastening elements allow the alignment of the shaft door in all directions and in a range corresponding to the large constructional tolerances.

**Summary:**

There is created in a modular shaft door system a fireproof lift shaft door (1) predominantly by flange-mounting, to standard shaft door panels, of flat insulating material housings (30) filled with high-efficiency, novel insulating material layers (31). These insulating material housings are so constructed that they have throughflow chicanes in the region of the closing edge and form, in the closed state, additional labyrinth-like obstacles (36) against the passage of flame and gas in co-operation with the door frame. An overall flat mode of construction of the shaft door (1) enables, with minimal loss of usable shaft cross-sectional area, the doors to be mounted in rational manner by simple flange-mounting to the shaft wall (3). A wide door frame may compensate for large constructional tolerances, and appropriate fastening elements allow the alignment of the shaft door in all directions and in a range corresponding to the large constructional tolerances.

15 (Fig. 2)

## Fireproof lift shaft door

### Description:

5 The present invention relates to a fireproof shaft door for lift shafts. Shaft doors form, in the closed state, a safety device against falling down into the lift shaft. If the cage is present behind the shaft door, the latter is unlocked by the door drive, which is mounted on the cage, by way of so-called entrainers and opened together with the cage door. In the open state of the two doors, access from the storey to the cage is possible for the lift  
10 passengers. The doors then close automatically and the shaft door is locked before onward travel of the lift cage.

In addition to the function of security against falling down, lift shaft doors often have the task of preventing a propagation of fire in the building by way of the lift shaft, as well as of  
15 minimising the circulation of combustion gases. Regulations exist in most countries about fire protection characteristics of lift shaft doors as well as about the carrying out of fire tests which are needed for the purpose of gaining a fire protection certificate for a specific construction. Essentially, limits are defined for fire protection doors with respect to loss of rigidity, deformations and maximum gap widths produced by the action of fire during a  
20 certain time period. A minimum temperature gradient between the storey side and shaft side of the shaft door is usually also prescribed.

The subject of the present invention is a fireproof lift shaft door in the form of a double-  
25 panelled horizontal sliding door. Such a door primarily consists of a shaft door frame and two door panels horizontally displaceably thereat. Mounted on the transom of the shaft door frame is a horizontal profile rail, which forms a guide track for the door panel guide rollers mounted at the door panels at the top. The lower end of the door panels is guided in guide grooves in the door threshold by way of guide shoes. The door frame and the door panels are usually rigidly constructed in correspondence with the specific purpose  
30 and equipped at suitable places with heat insulating materials. Gaps between door panels and door frame as well as between the closing edges of the two door panels are to be limited to a minimal width necessitated by mechanical function and manufacturing tolerances and which is also defined in the relevant regulations.

Such a shaft door is known from EP-0 548 486 B1. In the case of the shaft door described in this document the door panels contain, in addition to heat insulating layers, cavities, which can be flowed through vertically, on the shaft side. In the case of a fire at the corridor side, the air in these cavities heats up and rises, wherein cooler shaft air constantly flows after. The temperature gradient which is required in the regulations of some countries between the shaft door wall at the corridor side and shaft side shall thereby be achieved.

The described construction exhibits some significant disadvantages. Firstly, in the case of a fire at the shaft side, for example in the case of a fire of the frequently extensive cage equipment, the described cooling process is not present. Secondly, the use of the described methods has the effect that the thickness of the door panels must, due the additional cooling channels, be considerably increased. This implies, for cage dimensions given by the required transport capacity, larger shaft dimensions which in the case of multi-storey buildings has the consequence of substantial loss of usable area. Thirdly, the production of these cooling channels causes considerably additional costs. As up to 30 such shaft doors are required for a high-rise building, these additional costs have a massive effect on the overall costs of the lift.

The present invention consists of a shaft door construction which does not contain the mentioned disadvantages and which has the characteristics, which are required in the regulations, with respect to heat insulation and stability in the case of fire despite a more simplified, more space-saving and more cost-optimised execution.

According to the invention this is achieved as follows: the fireproofness and the relative flatness of the door panels are essentially brought about in that flat housings, preferably of sheet steel, which contain high-efficiency heat insulating material, are flange-mounted to non-fireproof standard door panels. Optimum results for the present use, i.e. minimal layer thickness for heat insulation in accordance with regulations, have been yielded, in extensive tests, by mats of microporous, fibre-reinforced insulating material produced from a mixture of inorganic oxides. The main component of this novel insulating material is high dispersed silica, which, in the form of a microcellular structure, consists of small hollow balls of 5 to 30 nm diameter. The use of this material allows, by comparison with conventional insulating material and for the same insulating effect, the reduction of the

layer thickness to about a quarter, which has a direct effect of the flatness of the heat insulating housing and thus on the entire shaft door.

5 A further substantial advantage of the fireproof shaft door according to the invention is to be seen in that it arises by flange-mounting of the heat insulating housings by means of detachable connecting elements to non-fireproof door panels of standard shaft doors. In that case, it is to be particularly noted that not only the areal heat insulation is introduced by the insulating material housings, but also these housings are so shaped that when the door is closed they form in the region of the door closing edge a chicane, in the form of a mutual overlapping, against the passage of flames and gases. For the same purpose their  
10 appropriately shaped rearward vertical edges produce, together with the door frame posts, a further labyrinth-like throughflow obstacle. Thus, standard shaft doors are largely converted into fireproof shaft doors by the mounting of the special insulating material housings. The resulting modularity of this shaft door system has the effect of substantial  
15 simplifications and savings in production and logistics.

The heat insulating material is inserted into the insulating material housings in two layers (mats). On the one hand this has the advantage that the cavities of the insulating material housings can be filled out, in the region of the closing edge overlapping, with least effort by  
20 a respective one of the layers. On the other hand, this construction allows, in the case of large-surface door areas, the arrangement of multi-piece heat insulating layers in such a manner that the separating lines in the first layer are offset relative to those in the second layer for the avoidance of continuous gaps.

25 In order to avoid thermal bridges between the surfaces, which are exposed to the fire, of the insulating material housings and the standard door panels and to further increase the fire resistance of the shaft door, an additional, thin insulating material plate is inserted between housings and door panels.

30 The proposed door frame construction is of unique simplicity, wherein, for example, the shaping of the sheet steel profile simultaneously serves for both the stability and the sealing. Thanks to the extremely flat execution of the door posts and of the fireproof door panels, which slide past these and are equipped with flat insulating material housings, this shaft door can, with minimal loss of usable shaft cross-sectional area, be flange-mounted  
35 to the flat shaft wall in simplest manner from the shaft inner side in the region of the

access opening. Thereby they can align in all directions in adjustment ranges which are adapted to large constructional tolerances. Any arising gaps between door frame and shaft wall, which result from wall unevennesses or alignment processes, are blocked by elastic, fireproof sealing profile members.

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The invention is more closely explained in the following by way of an embodiment with reference to the accompanying drawings.

Fig. 1 shows a view of the overall lift door from the shaft side,

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Fig. 2 shows a vertical section through the overall shaft door, and

Fig. 3 shows a horizontal section through the shaft door.

15 Fig. 1 shows a shaft door 1, according to the invention, as it is visible from the inner side of the lift shaft. Illustrated at the very bottom is a support bracket 2 which is fixed to the shaft wall 3 to be vertically adjustable by wall plug screws. It supports a door threshold construction 4 which, together with two door posts 5 and a door transom 6 (not visible in Fig. 1), forms the door frame. At the upper end there can be recognised a roller guide support 7, which is screw-connected with the transom 6 of the door frame and supports a roller guide track 8 as well as a heat insulating cover 9. Two door panels 10, 11 are suspended at roller holders 12 by way of guide rollers 13 (not visible in Fig. 1) at the roller guide track 8 and are guided at the lower end by means of guide plates 14 in the groove of a door threshold profile member 15 (not visible in Fig. 1), which is inserted into the door threshold construction 4. Recognisable in the uppermost region of Fig. 1 are fastening elements 16, which connect the roller guide support 7, and by this the transom 6 of the door frame, with the shaft wall 3 to be adjustable to all sides. Also illustrated are fixing straps 17 which serve for the fixing of the door posts 5 relative to the shaft wall 3.

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30 Additionally visible in the upper region are the door panel entraining mechanisms 18, which form the movement connection between the driven cage doors and the shaft doors, as well as shaft door locks 19, which are actuated by way of the mentioned entraining mechanisms.

Fig. 2 shows a vertical section through the overall shaft door arrangement. The shaft wall 3 with the access opening 26 between storey corridor and lift is illustrated on the righthand side. Flange-mounted to the inner side of the lift shaft is the shaft door frame, which consists of the door threshold construction 4, the two door posts 5 as well as the door transom 6 and the components of which are welded together. The door threshold construction in turn is composed of a base 20, a threshold support 21, several C-shaped fastening profile members 22 welded thereto as well as a decorative threshold profile member 23 fixed in the threshold support. Further visible is the support bracket 2 on which the door threshold construction is fastened to be adjustable in the horizontal plane. The roller guide support 7 screw-connected with the door transom 6 is fixed to the shaft wall by means of several fastening elements 16 to similarly be adjustable in all directions. A sealing mass 22 of fireproof fibres, which after adjustment of the frame is rammed into the intermediate space, is to be seen between the door frame, which is formed from the door transom 6 and the two door posts 5, and the shaft wall. The door transom itself is furnished at its inner surfaces with heat insulating plates 25.

Fixed to the afore-mentioned roller guide support 7 fastened to the door transom 6 is the roller guide track 8, in which the guide rollers 13, which carry and guide the door panels 10, 11 by way roller holders 12, roll. The guide plates 14, which are equipped with guide shoes 14.1 and which are guided in a groove of the door threshold profile member 23 inserted into the door threshold construction 4, can be recognised at the lower part of the door panel. A door panel 10 or 11 essentially consists of a central door area plate 27, which is stiffened by own folded edges 23 at both vertical sides as well as by additional, horizontally arranged folded profile members 34, which are welded in. Its uppermost transverse profile member 28 is prolonged upwardly beyond the actual door area and forms in this region the connecting element to the roller holders 12 and the guide rollers 13. A Z-section profile member 29 mounted at this prolongation over the entire width of the door panel functions, in co-operation with a folded edge at the door transom 6, on the one hand as an emergency guide for the case of failure of the guide rollers in the event of fire and on the other hand as a labyrinth-like throughflow obstacle to hot gases flowing through the gap across over the door panels.

The door panel described up to now corresponds to the standard door panel as is used for applications without special requirements of fireproofness. The fireproof shaft door according to the invention is equipped with flat insulating material housings 30, which are

flange-mounted to the standard door panels by means of screw connections, of folded sheet steel. These are closed off all round and filled with two high-efficiency heat insulating material layers 31. It can be recognised from the drawing that, thanks to the double-layered insulating material, multi-piece insulating plates with mutually offset separating lines 35 can be used for large door areas. A continuous gap, arising through shrinkage due to the action of heat, in the insulating material can thereby be avoided.

A heating insulating plate 32 additionally mounted in between the door area plate 27 and the insulating material housing 30 eliminates the heat bridge formed by the housing.

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Fig. 3 shows a horizontal section through the shaft door. The extremely flat and simple shape of the door posts 5 of folded sheet metal, as well as the fireproof sealing mass 24 mounted between them and the shaft wall, can be recognised therein. The U-shaped edgings facing the door opening on the one hand serve for the stiffening the door post and on the other hand form, in co-operation with corresponding parts of the insulating material housings 30, a labyrinth-like throughflow obstacle 36 to flames and gases. The simple construction of the standard door panels 10, 11, consisting of the door area plate 27 with own folded edges 33 at the vertical sides and welded-in horizontal reinforcements 34, is also visible. The advantageous effects of the insulating material housing 30 according to the invention can be recognised particularly well in this illustration. These receive, by the simple flange-mounting thereof to standard door panels and additionally a labyrinth-like throughflow obstacle 36 in the region of the door panel rear edge as well as an overlapping as a throughflow chicane in the region of the closing edge, the required heat insulating properties, wherein thanks to the double-layered execution of the insulating material insert 31 this overlapping can be filled with insulating material in simple manner. The additional heat insulating plates 32 which for the purpose of avoidance of heat bridges are inserted between the door area plate and insulating material housing are also recognisable.

Also illustrated in this view are the construction of the fixing straps 17 which serve for the stabilisation of the door posts and which are so deformed by manually pressing or pulling during assembly that they compensate for constructional tolerances that are present.

The door threshold profile member 23 with groove, in which the shaft door panels 10, 11 are guided at their lower side, can also be recognised here.

## Patent Claims

1. Fireproof lift shaft door , comprising a door frame substantially formed from a door transom, two door posts and a door threshold construction, as well as two door panels  
5 horizontally displaceable at this door frame, wherein these door panels are guided at their upper and lower ends by way of slide or roller guides at horizontal guide rails at the door frame transom as well as in the door threshold and the door panels have whole-area heat insulating layers mounted in an insulating material housing, characterised in that the insulating material housings are flange-mounted to the door panels and of flat  
10 construction.
2. Fireproof lift shaft door according to claim 1, characterised in that the insulating material housing contains two layers of a high-efficiency heat insulating material.
- 15 3. Fireproof lift shaft door according to claims 1 and 2, characterised in that the high-efficiency heat insulating material stated in claim 2 consists of a microporous, fibre-reinforced mixture of inorganic oxides.
4. Fireproof lift shaft door according to one or more of the preceding claims,  
20 characterised in that the insulating material housings, which are flange-mounted to the lefthand and also the righthand door panel, form fire-retarding chicanes, which are in the form of overlappings, in the region of the door closing edge and that these overlappings are each filled by a respective one of the two insulating material layers present in the housing.  
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5. Fireproof lift shaft door according to one or more of the preceding claims, characterised in that the mentioned insulating material housings are flange-mounted to standard door panels in the sense of a modular system.
- 30 6. Fireproof lift shaft door according to one or more of the preceding claims, characterised in that the insulating material housings form a labyrinth-like throughflow obstacle in the region of the door panel rear edge in co-operation with the door posts.

7. Fireproof lift shaft door according to one or more of the preceding claims, characterised in that in the mentioned insulating material housings the arrangement of multi-piece heat insulating layers is carried out in such a manner that for avoidance of continuous gaps the separating lines in the first layer are displaced relative to those in the  
5 second layer.

8. Fireproof lift shaft door according to one or more of the preceding claims, characterised in that for the purpose of avoidance of heat bridges an additional heat insulating plate is mounted between the mentioned insulating material housings and the  
10 door area plates of the door panels.

9. Fireproof lift shaft door according to one or more of the preceding claims, characterised in that the door posts of the door frame are constructed to be extremely flat, which in combination with the flat insulating material housings enables a simple flange-  
15 mounting of the shaft door to the shaft wall at the access side with only small loss of usable shaft cross-sectional area.

10. Fireproof lift shaft door according to one or more of the preceding claims, characterised in that the door frame flange-mounted to the shaft wall is adjustable in all  
20 directions, particularly also in the direction towards the shaft centre, for the purpose of optimal positioning.

Fig. 1

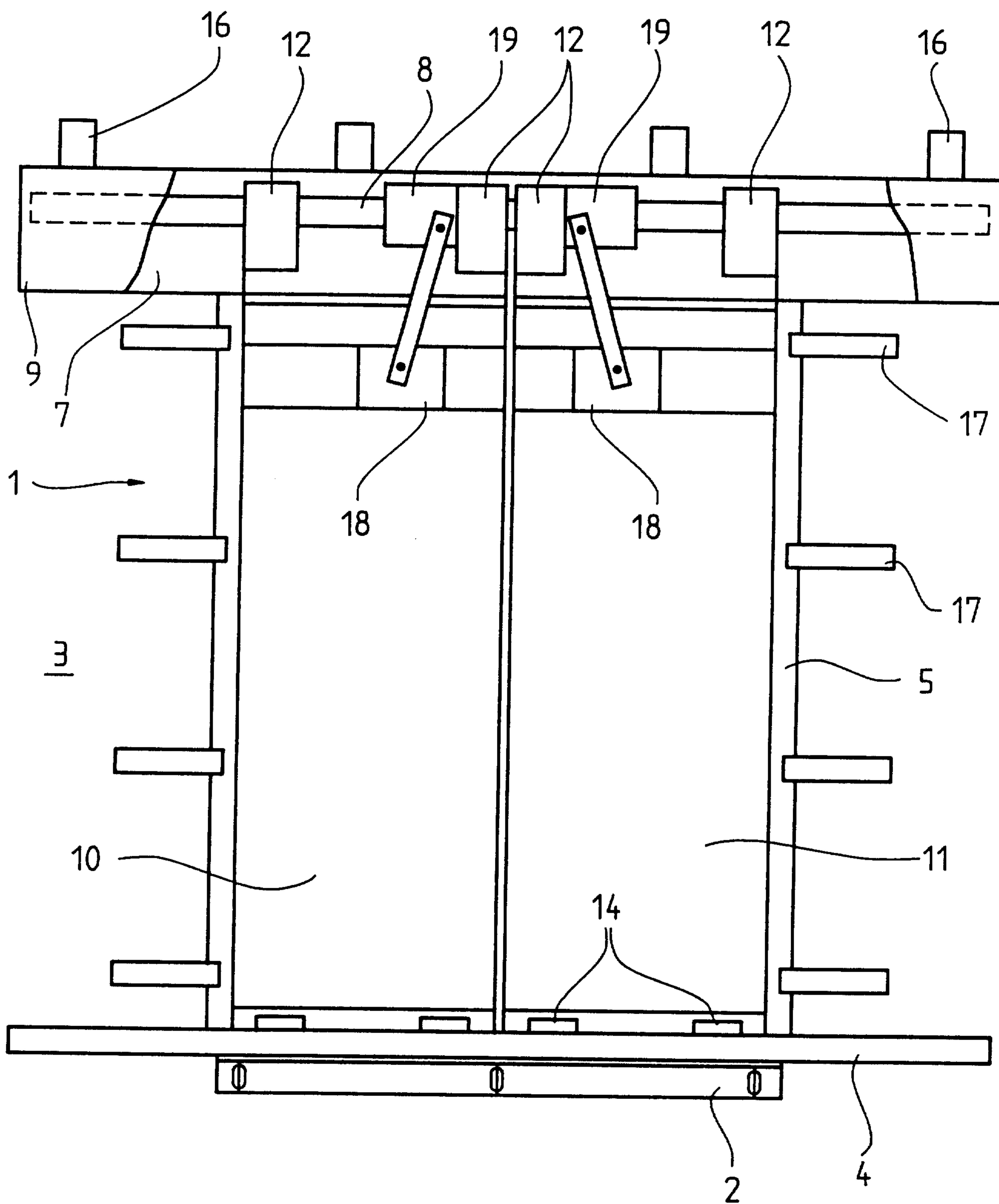


Fig. 2

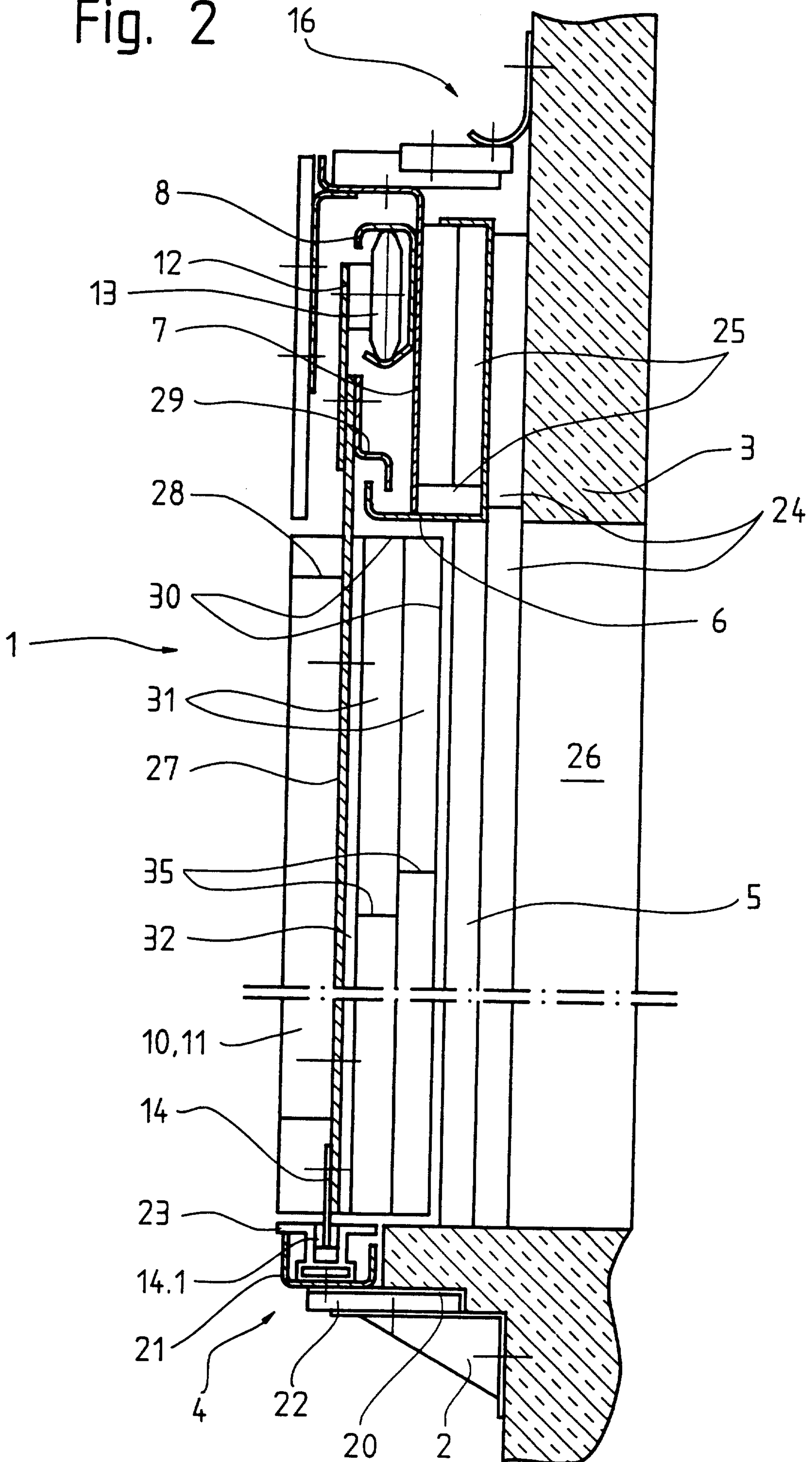


Fig. 3

