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(54) Radiator for heating rooms and the like, and method for manufacturing it

(57) A radiator for heating rooms and the like, comprising a continuous plate member arranged adjacent to a wall, the plate member being closed at the top and at the bottom against the wall and laterally in order to form a box body which is in contact with the wall. The plate member is constituted by a plurality of pipes which are connected without welds by means of manifolds that close, in an upper region and in a lower region, the plate member against the wall.

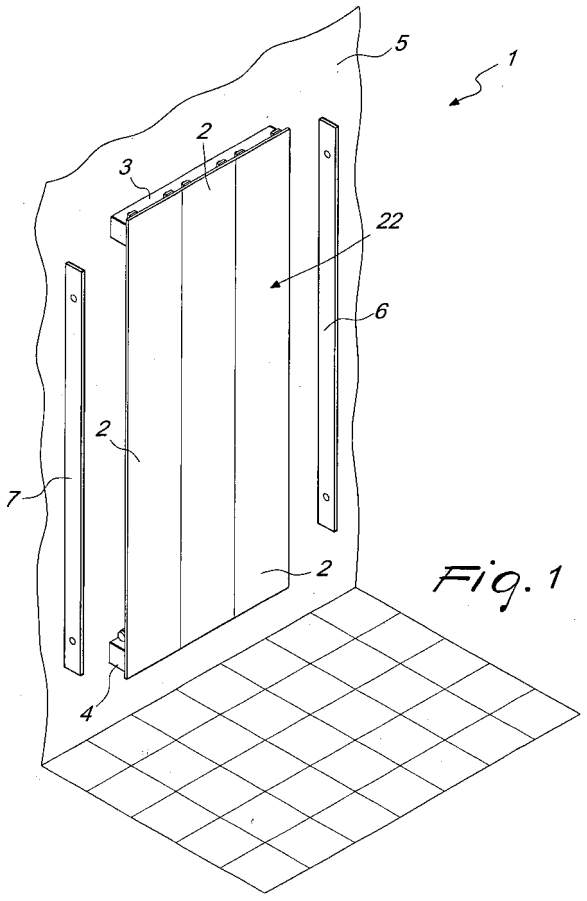

Fig. 1

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Description

[0001] The present invention relates to a radiator for heating rooms and the like and to a method for manufacturing it.

[0002] As is known, the heating of homes, offices and the like, is generally provided by radiators which, by means of the circulation of heated water inside them, allow to maintain a temperature which is suitable for a comfortable habitat of the people that occupy the room.

[0003] As is known, among the three forms of heat transmission, i.e., among conduction, convection and radiation, the energetically most effective and efficient form of energy transfer for heating a room is radiation.

[0004] Currently, conventional radiators heat the room by convection, i.e., they heat a fluid which rapidly tends to cool when it is not heated any longer.

[0005] For this purpose, conventional radiators are constructed so as to have air passages or air vents which, by flowing over the hot surfaces of the radiator, become warm as they rise and, by then cooling, descend back to the floor to be again drawn by the radiator and propelled upward.

[0006] Therefore, conventional radiators are constituted by mutually adjacent connected bodies between which air can pass.

[0007] As is known, comfortable conditions for a human being are defined by the balance between humidity and temperature. This balance must be kept constant in order to ensure the comfort of the person.

[0008] Conventional radiators are not satisfactory from the point of view of maintaining the best comfort for the person and from the point of view of energy efficiency, because they substantially almost exclusively rely on the transmission of heat by convection.

[0009] In the vast majority of commercially available models, the radiator elements are mutually adjacent so that there is a distance between them. Such distance varies, depending on the models and brand, from a few millimeters to a few centimetres. This, together with the fact that they are commonly installed at an average distance of approximately 60 mm from the wall, facilitates the passage of the air in order to form an air vent between the back of the radiator and the wall. Such air vent is indispensable in order to trigger the phenomenon of convection.

[0010] The convective motion produced by those conventional radiators is generated to a large extent by the air that enters from the base, sides and gaps between the elements and which, by passing between the wall and the back of the radiator, becomes warm and then exits from above, and also by the air that flows over the outer face of the radiator.

[0011] In order to promote that phenomenon, almost all commercially available radiators are fed with water at temperatures adapted to provide a difference in temperature, between the heating element and the room, of approximately 50°C.

[0012] Some commercially available radiators are provided with elements which are adjacent and installed so as to close the upper and lower parts. Such radiators allow air to flow in laterally, so as to take advantage of the convective motion generated by its heating in the area behind the heating body comprised between the body and the wall. However, such radiators still fall short of reducing to a minimum the phenomenon of convection and of maximising radiation.

[0013] Regarding the methods of manufacturing the radiators, it is currently known to assemble the various parts of the radiator by welding.

[0014] The most common method among the many available is to join a plurality of vertical elements, which are mutually connected by means of a manifold, which is welded either from the top or in the part behind the elements.

[0015] An example of a method for manufacturing a radiator is as follows.

1. Producing a plurality of iron rods measuring 11 x 70 mm, with a thickness of 1.2-1.4 mm.
2. Cutting the rods at 40-45° in bars of the size suitable for providing the dimensions to be manufactured.
3. Arranging a selected number of bars on a plane, depending on the size of the radiator to be obtained.
4. Locking the bars laterally and spot welding between one bar and the others in order to keep them together in a rigid structure.
5. Welding the upper and lower parts of the bars so as to seal the top and bottom thereof.
6. Bending a 1.4-mm metal plate in order to obtain a U-shaped profile with dimensions of 55 x 50 x 44 mm.
7. Welding the folded metal plate to the bar structure.
8. Welding plugs to the sides of the folded metal plate with ½ gas inch holes.
9. Welding couplings for ½ gas inch valves inside the head (in a crossed configuration).
10. Welding the side strips.
11. Welding the wall fixing brackets. At least two brackets at the top, for a unit up to 12 bars, and subsequently in a number suitable to bear its weight, at the bottom a bracket in a central position to prevent lateral oscillation and separation from the wall. The brackets at the top must be at 250 mm from the internal manifold and the one at the bottom must be at 350 mm from the manifold.
12. Drilling the side strip so as to be able to access the regulator valve for adjusting the flow-rate of the plate.

[0016] In order to manufacture a quality radiator, ensuring that it will not leak liquids, the production method requires highly skilled labor, which is difficult to find and very onerous to maintain.

[0017] Moreover, it should be noted that the radiators

have dimensions which can vary, depending on use, between 400 and 3000 mm in height, with variations of 200 mm and between 210 and 1400 mm in width with variations of 70 mm.

[0018] In a normal home there can be ten different radiators of ten different dimensions, heights and/or widths, and this, in addition to increasing the complexity of it their manufacture, also makes packaging and subsequent shipping very difficult.

[0019] Any robotization of the assembly process by welding is particularly complicated and also has few assurances of producing a product which is perfectly sealed.

[0020] One must also consider that a completed radiator plate would have to be discarded, in case of leaks during testing, because its reworking would no longer be economically convenient.

[0021] According to a different production process, an aluminum panel is provided with a manifold for the passage of water which is also designed to act as a mechanical connection, i.e., keeps the various elements joined, connecting the manifold to the elements by insertion from above.

[0022] However, such radiator does not have sufficient characteristics of tightness and duration over time.

[0023] The aim of the present invention is to provide a radiator for heating rooms and the like which allows to minimize the effect of convection and to use mainly heating by radiation.

[0024] Within the scope of this aim, an object of the invention is to provide a radiator which can be manufactured by means of an economically advantageous production method which also ensures a finished product with high-level technical characteristics.

[0025] A further object of the present invention is to provide a radiator which can replace the conventional radiators provided in rooms at present.

[0026] A further object of the invention is to provide a radiator which allows to raise the temperature of the walls of the room in order to reduce the thermal difference between the temperature of the walls and the temperature of the human body.

[0027] A further object is to provide a radiator which allows to obtain maximum comfort for the persons with the lowest possible energy expenditure.

[0028] This aim and these and other objects, which will become better apparent hereinafter, are achieved by a radiator for heating rooms and the like.

[0029] This aim and these and other objects, which will become better apparent hereinafter, are also achieved by a method for manufacturing a radiator for heating rooms and the like.

[0030] Further features and advantages of the invention will become better apparent from the following detailed description of preferred but not exclusive embodiments of the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is an exploded perspective view of a radiator according to the invention;
Figure 2 is a sectional side view of the radiator according to the invention, applied to a wall;
Figure 3 is a front view of the radiator according to the invention, applied to the wall;
Figure 4 is a broken perspective view of a flat pipe used to provide an element;
Figures 5 to 9 are broken perspective views, similar to the preceding one, showing the manufacturing steps of the element;
Figure 10 is a front view of the elements, joined to form the plate member;
Figure 11 is a perspective view of a manifold;
Figure 12 is an exploded top plan view of a manifold;
Figure 13 is a sectional side view of the step of application of the bushes to the manifold;
Figure 14 is a top view of the step of application of the bushes to the manifold;
Figure 15 is a sectional side view of the step of application of the gaskets to the manifold;
Figures 16 is a top view showing the step of applying the gaskets to the manifold;
Figures 17 is a sectional side view showing the step of mounting the manifold to the plate member;
Figure 18 is a top view of the step of moving the manifold toward the elements;
Figure 19 is a sectional side view of the step for tightening the screws for connection between the manifold and the elements;
Figure 20 is a top view showing the step of tightening the screws for connection between the manifold and the elements;
Figure 21 is a sectional side view of the manifold, permanently associated with the elements;
Figure 22 is a top view of the manifold, permanently associated with the elements;
Figure 23 is a broken perspective view of the assembled structure;
Figure 24 is an exploded perspective view of the structure;
Figure 25 is a view of an element according to a different embodiment, with respect to the element of Figure 9;
Figure 26 is a view of an element according to still a different embodiment with respect to the element of Figure 9;
Figure 27 is an exploded side section view showing the manifold and plate member assembly according to a further aspect of the invention;
Figure 28 is a side section view of the manifold and plate member assembly of the preceding figure shown in the assembled condition;
Figure 29 is a rear view of the radiator showing the arrangement of the feed connections according to a further aspect of the invention;
Figure 30 is a rear view of the radiator showing the arrangement of the feed connections according to

still a further aspect of the invention.

[0031] With reference to the cited figures, a radiator according to the invention, generally designated by the reference numeral 1, comprises a plate member 22 which is constituted by a plurality of flat pipes or elements 2, which are joined so as to form a flat surface without gaps between the elements.

[0032] The plate member is fed by manifolds 3 and 4 which are arranged so as to enclose, in an upper and lower region, the space between the plate member and a wall 5 within which the plate member 22 is rested, so as to close the vent which normally forms between the radiator and the wall.

[0033] The radiator according to the invention has side strips 6 and 7, which are arranged so as to laterally close the space between the plate member 22 and the wall 5 against which the plate member 22 is rested.

[0034] In this manner, a sort of box element is provided in which the front surface is formed by the plate member 22, the upper and lower surfaces are formed respectively by the manifolds 3 and 4, and the lateral surfaces are formed by the side strips 6 and 7. The plate member is completed by the face 5 of the wall, which acts as a rear face of the box element.

[0035] In order to limit the transfer of heat in the rear part of the plate member 22, it is preferable to associate a non radiating panel to the rear surface of the plate member 22. The non-radiating panel may be constituted by an aluminium film or by a panel made of an insulating material, for example polyurethane, which can in any case be covered by an aluminum film.

[0036] Therefore, the radiator according to the invention is conceived to minimize the emission of energy, other than radiating energy, and also to minimize the emission of energy toward the back of the panel, i.e., in an area which is completely closed and therefore useless in energy terms.

[0037] The only convective motion produced by the radiator according to the invention is provided by the air that flows over the outer face of the plate member 22, because the convection caused by the flow of the air between the plate member 22 and the wall face is eliminated completely by closing the plate member 22 against the wall face 5.

[0038] The supply unions and the valves are arranged inside the plate member 22, between the plate member 22 and the face 5 of the wall, and can be reached for example by means of a hole which is provided at one of the side strips 6 and 7, or by means of the simple removal of the side strips, if they have been fixed to the plate by permanent magnets.

[0039] The radiator is preferably designed to work at a supply temperature which provides a difference in temperature between the radiator and the environment of 25-30 °C, in order to provide even less incentive for the convective effect on the front part of the radiator and thus further improve its energy efficiency.

[0040] The radiator 1 is manufactured with a manufacturing method such that the plate member 22 can be assembled in a modular fashion by mating profiles to be assembled by means of a final joint, not by welding but mechanically.

[0041] This allows not only optional disassembly but even to ship the base components which might then be assembled just before use, with a substantial reduction in production costs and in distribution logistics costs.

[0042] In greater detail, the manufacturing method of the radiator according to the present invention comprises the initial provision of the radiator elements, each of which is obtained by cutting to size a flat pipe 31 and applying to the ends two covers 32.

[0043] The covers 32 can be easily applied by automated systems, for example by robotized welding, or by any other system deemed suitable.

[0044] Subsequently, two holes, a lower one 33 and an upper one 34, are provided in the side of each radiator element which will be internally arranged in the finished product.

[0045] Fastening members, shaped like elongated strips 35 or plates 36, provided with equidistant holes, or strips 361 or bolts 362, are then applied in a position which is suitable to ensure the subsequent tightness of the article.

[0046] The completed radiator elements 2 are arranged laterally adjacent, as shown in Figure 10, and are locked by means of strips 50 in order to be associated with the upper manifold 3 and with the lower manifold 4.

[0047] The manifolds 3 and 4 are provided beforehand with a series of holes 37 and fins 38 for the connection of threaded elements 39 which are suitable to be engaged in the holes 40 of the fastening members 35, 36, 361 or also for the connection of bolts which are suitable to be engaged within the holes 40 of the fastening members 362.

[0048] The ends of the manifold are closed by means of covers, not visible in the figures, or are in any case sealed in any other suitable manner.

[0049] Before applying the radiator elements 2 to the manifolds 3 and 4, a bush 41 is applied in each hole 37 of the manifolds for acting as a temporary support for a gasket 42, which, when the threaded elements 39 are tightened, is packed between the surface of the manifold and the surface of the radiator, providing a hermetic connection.

[0050] According to a preferred embodiment of the invention, shown in figures 27 and 28, the elements 2 are applied to the manifolds 3 and 4 by means of a special gasket 142 constituted by a thick portion 141, adapted to engage the hole 34 of the element 2, and a flat portion 143 provided with an annular ridge 144 which provides the seal between the facing surfaces of the manifolds 3 and 4 and of the element 2.

[0051] As an alternative, the gasket can be kept in position by a seat formed within the water passage hole both in the radiator element and in the manifold or only

in the radiator element or only in the manifold.

[0052] Once the plate member 22 has been assembled, it is possible to arrange brackets 51 for anchoring to the wall.

[0053] Additional fastening members 43 can be applied in intermediate positions on the radiator elements 2 in order to constitute supports for fastening brackets for connection to the wall.

[0054] Once the brackets 51 have been installed, the radiating plate is ready to be installed and, once the plate has been fastened to the wall 5, the side strips 6 and 7 and the upper strips, not shown in the figures, are positioned by means of screws, clips or magnetic elements 53, as shown schematically in Figures 23 and 24.

[0055] Figures 29 and 30 schematically show a preferred system for connecting the radiator according to the invention to the inlet and outlets of the water feed system.

[0056] It is evident that by virtue of the modular structure of the radiator according to the invention, it is possible to provide a wide variety of radiators of different sizes, by using a reduced number of standard components.

[0057] The radiator elements can be provided in different heights, but the radiator elements can be associated in a different number to provide a plate member of the chosen width.

[0058] In practice, with a limited number of radiator elements of different height and of manifolds of different length it is possible to provide radiators of widely different sizes, adapting them easily to the specific requirements.

[0059] Shipping and storage of the radiator elements and of the manifolds is far easier than shipping the finished product, which can instead be completed at the place of destination according to the specific requirements.

[0060] In practice it has been found that the invention achieves the intended aim and objects, a production method for a radiator having been provided which is advantageous both from a production standpoint and from a functional standpoint.

[0061] It is convenient here to point out the basic theory on which the radiator according to the present invention is based.

[0062] Heating methods are intended to compensate for the heat dispersion of enclosed spaces in order to maintain a preset degree of thermal comfort. For this purpose, two different heating techniques have been developed which use heat transmission by convection and by radiation respectively.

[0063] The difficulty of dealing with heating consists in keeping the person within a very specific "climate" region, which is indicated by a chart known as "Bedford-Bachman optimum living comfort curve".

[0064] Indeed according to this requirement, by providing the optimum comfort curve, it becomes evident that comfort is not linked to 20 °C of air temperature but to an interaction between air temperature and the average radiating temperature of the walls of the interior space. In other words, by raising the average radiating temperature of the walls, one obtains maximum comfort even at an air temperature below 20 °C.

[0065] Since most dispersion occurs by radiation, a significant reduction in the heat dispersed by means of this phenomenon increases the perception of well-being and comfort. Therefore, in order to reduce dispersion by radiation it is necessary to raise the average radiating temperature of the walls of the room, and this is possible only by using heating bodies which privilege the transmission of heat by radiation.

[0066] Also, radiation facilitates minimal stratification, i.e., 0.6 °C per meter of height of the rooms, as opposed to 1.6 °C per meter of height of normal convection systems, and a more efficient distribution of the temperatures avoids energy waste, and since, as is well-known, a reduced heating of the air corresponds to a reduced dehumidification, radiation meets the two fundamental parameters of comfort, i.e., humidity and temperature.

[0067] The above is not feasible with ordinary convection systems, whereas with the radiator according to the present invention it is possible to raise the temperature of the walls of the room in order to reduce the heat differential between their temperature and the temperature of the human body. This is possible by using radiation as a heat transmission source. By increasing the average radiating temperature of the walls, the radiation increases the average functional temperature and therefore brings the radiated room to the maximum comfort with the minimum possible energy expenditure.

[0068] Radiation is achieved, according to the invention, by a radiator which, by virtue of its shape, limits convection to a minimum, i.e., is affected by convection only as a secondary phenomenon of the flow of air over the face of the radiator.

[0069] The radiator according to the present invention allows to heat mainly by radiation, substantially limiting to a minimum any heating due to convective motion.

[0070] Also, the plate member is provided monolithically with a series of flat pipes, which are joined so as to leave no gaps, avoiding injuries to the hands since it is not possible to insert ones fingers and therefore suffer torsion, compression or crushing traumas.

[0071] Also, the radiator according to the present invention protrudes very little from the wall, i.e. the radiator is rather flat when compared to conventional radiators, which is a substantial advantage in small rooms.

[0072] The use of a feed temperature which provides for a difference in temperature between the radiator and the room of 25-30°C also allows to reduce the possibility of burns when touching the radiator.

[0073] The materials used, as well as the dimensions, may of course be any according to the requirements and the state of the art.

Claims

1. A radiator for heating rooms and the like, comprising a continuous plate member arranged adjacent to a wall, said plate member being closed at the top and at the bottom against said wall and laterally in order to form a box body which is in contact with said wall, **characterized in that** said plate member is constituted by a plurality of pipes which are connected without welds by means of manifolds which are suitable to close in an upper region and in a lower region said plate member against said wall.

2. The radiator according to claim 1, **characterized in that** it comprises side strips that laterally close said plate member against said wall.

3. The radiator according to claim 1 or 2, **characterized in that** it comprises an insulating layer which is arranged in contact with the rear surface of the plate member and forms a box body with the wall.

4. The radiator according to one or more of the preceding claims, **characterized in that** said insulating layer comprises an aluminum film.

5. The radiator according to one or more of the preceding claims, **characterized in that** said insulating layer comprises a layer of polyurethane.

6. The radiator according to one or more of the preceding claims, **characterized in that** said insulating layer comprises a polyurethane layer coated with an aluminium film.

7. The radiator according to one or more of the preceding claims, **characterized in that** it comprises a means for connecting said manifolds to said flat pipes which is constituted by screws that engage fastening members which are associated with said manifolds and said flat pipes.

8. The radiator according to one or more of the preceding claims, **characterized in that** it comprises a gasket between each flat pipe and said manifolds, said gaskets being arranged at holes which are formed respectively within said flat pipes and within said manifolds.

9. The radiator according to one or more of the preceding claims, **characterized in that** said flat pipes comprise a means for fastening brackets for applying said radiator to a wall.

10. A method for manufacturing a radiator, particularly for heating rooms and the like, **characterized in that** it comprises the steps of:

    cutting a plurality of flat pipes;

    closing each of the cut ends of each of said flat pipes;

    providing an upper hole and a lower hole in each of said flat pipes;

    applying a fastening member at each of said holes;

    arranging side by side a plurality of flat pipes thus manufactured;

    providing two manifolds, each constituted by a cut pipe provided with holes, the distance between said holes being substantially equal to the width of said flat pipes;

    applying fastening members to each of said manifolds in positions which correspond to said holes;

    applying said manifolds to said flat pipes arranged side-by-side by means of fasteners which engage said fastening members of said manifolds and of said flat pipes, so that each hole of said manifolds matches respective holes of said flat pipes.

11. The method according to claim 10, **characterized in that** it comprises arranging a gasket between said manifolds and said flat pipes at said holes before tightening said fasteners.

12. The method according to claim 11, **characterized in that** it comprises arranging a bush at each hole of said manifolds for supporting said gasket.

13. The method according to claim 11, **characterized in that** it comprises forming a seat around each hole of said manifolds or said flat pipes before applying said gasket to said seat.

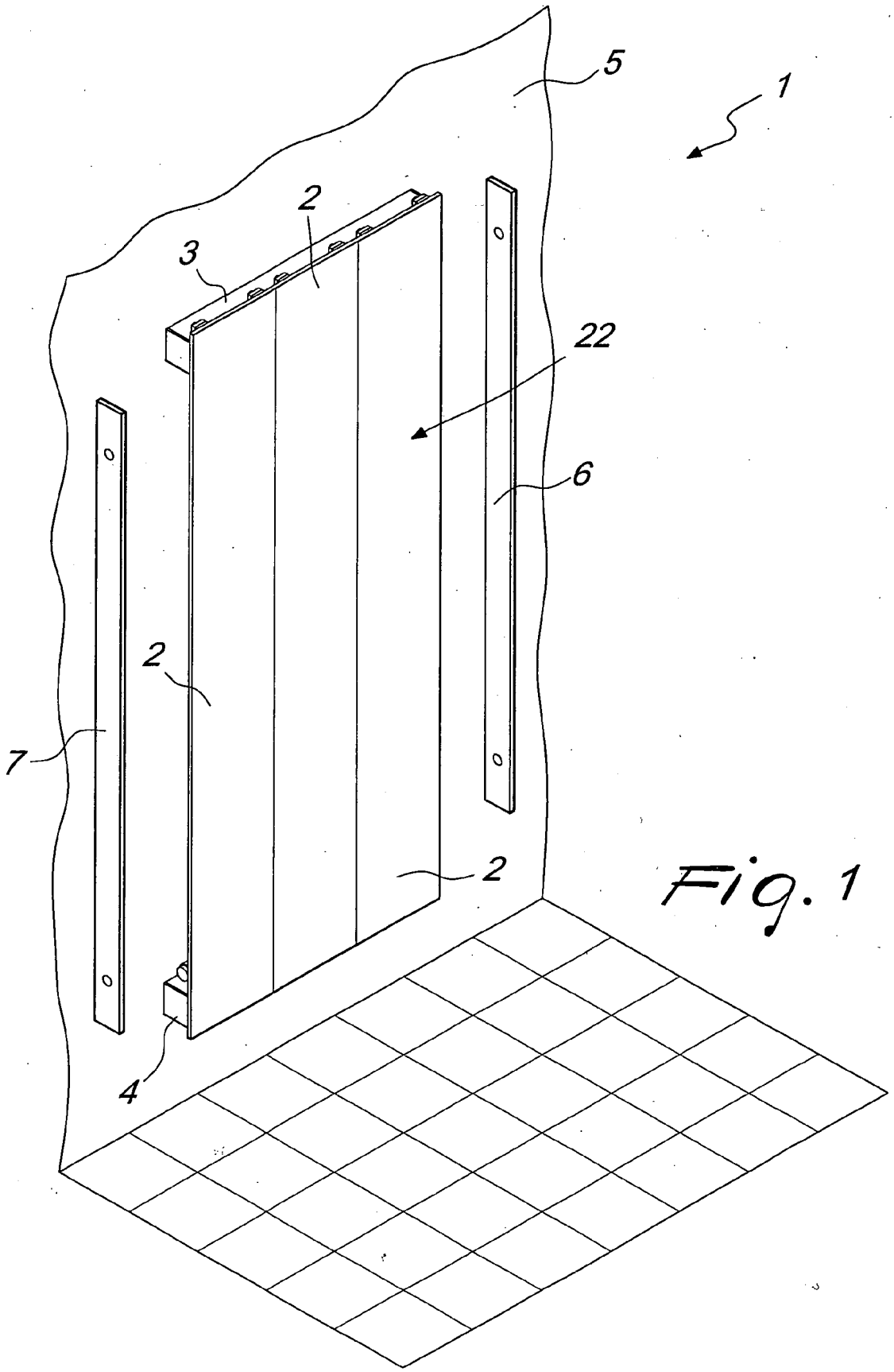

Fig. 1

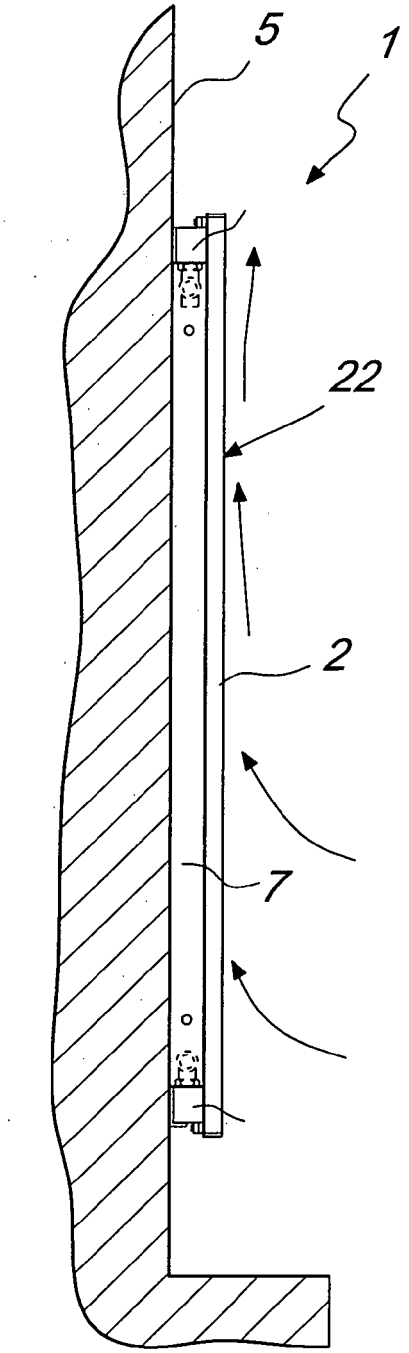

Fig. 2

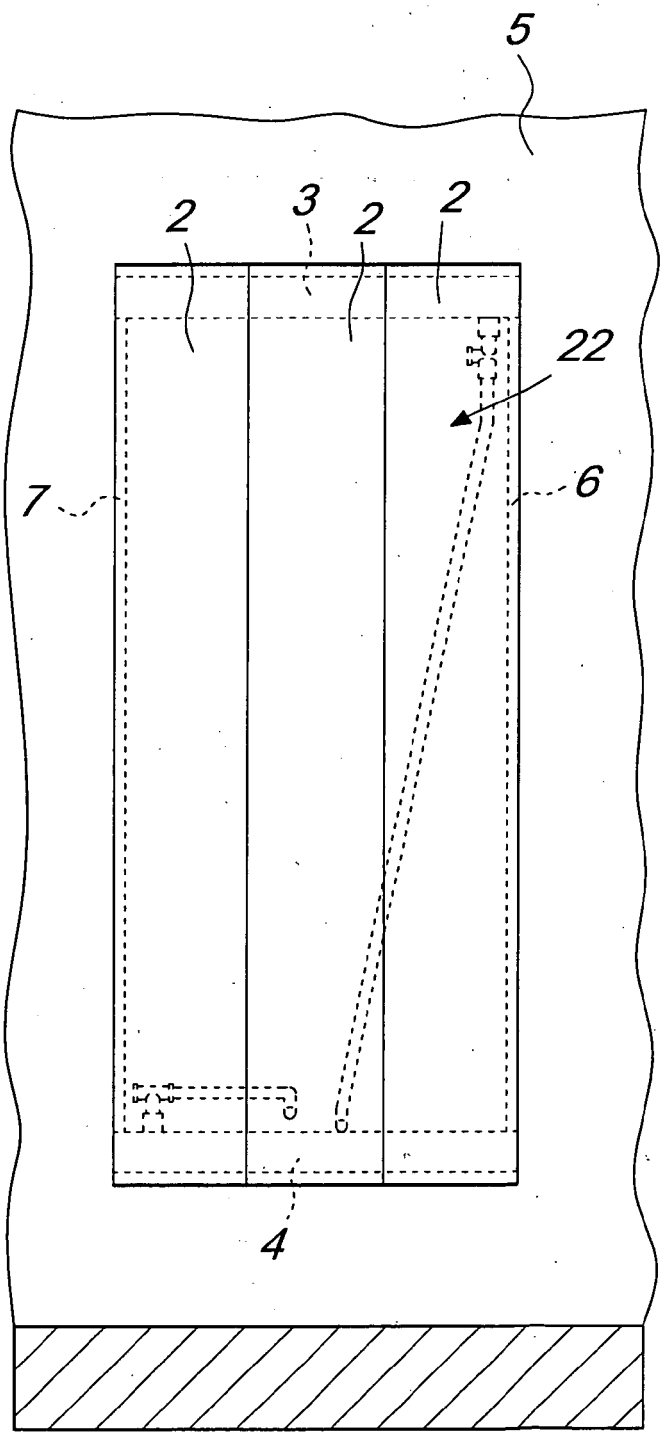

Fig. 3

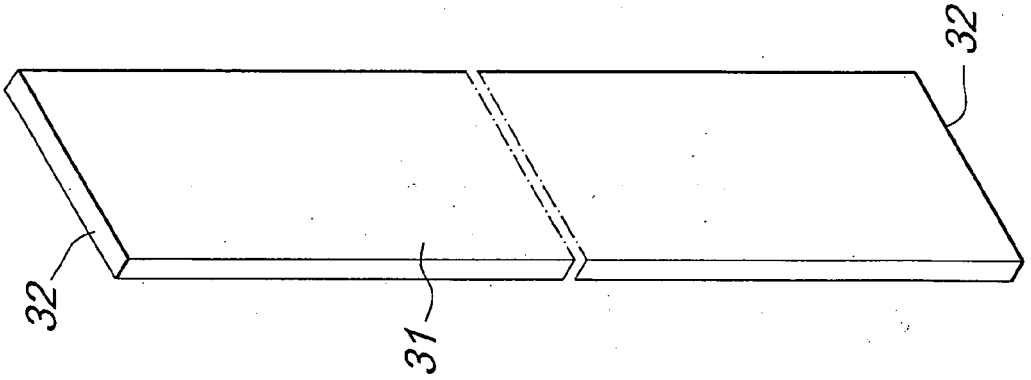

Fig. 6

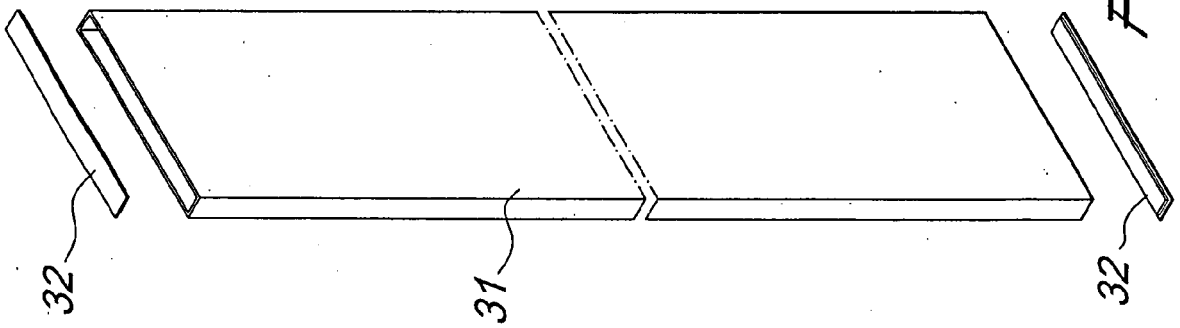

Fig. 5

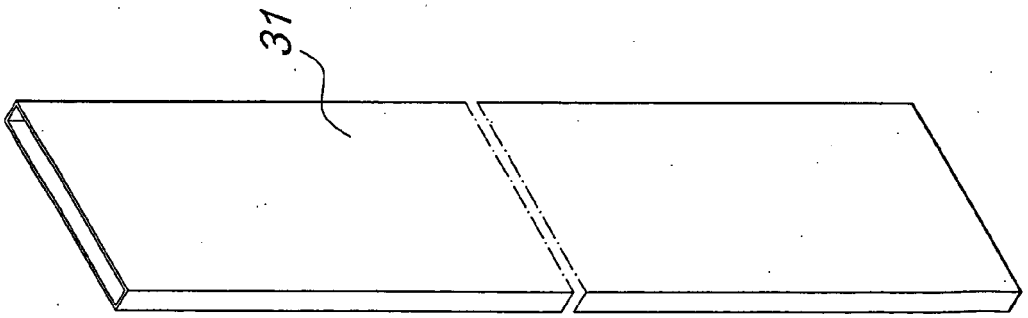

Fig. 4

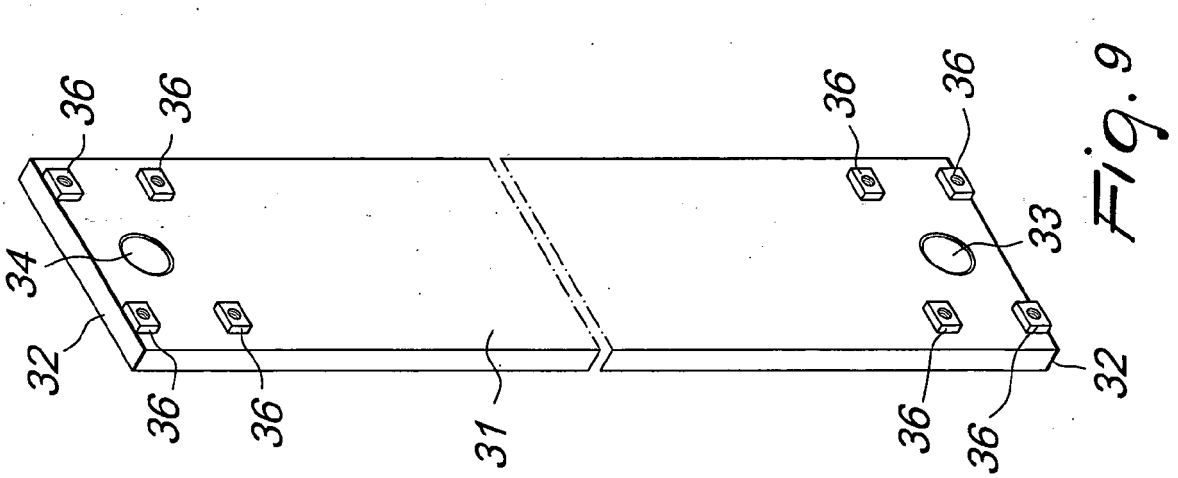

Fig. 9

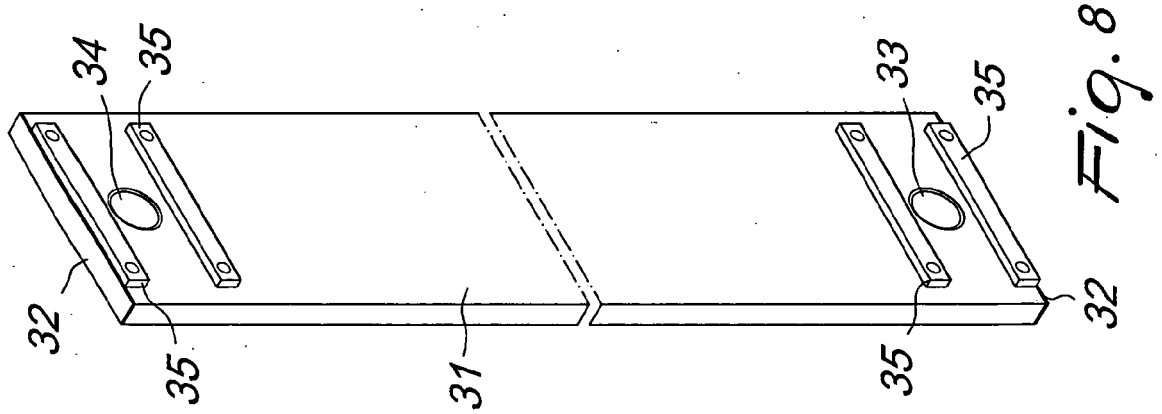

Fig. 8

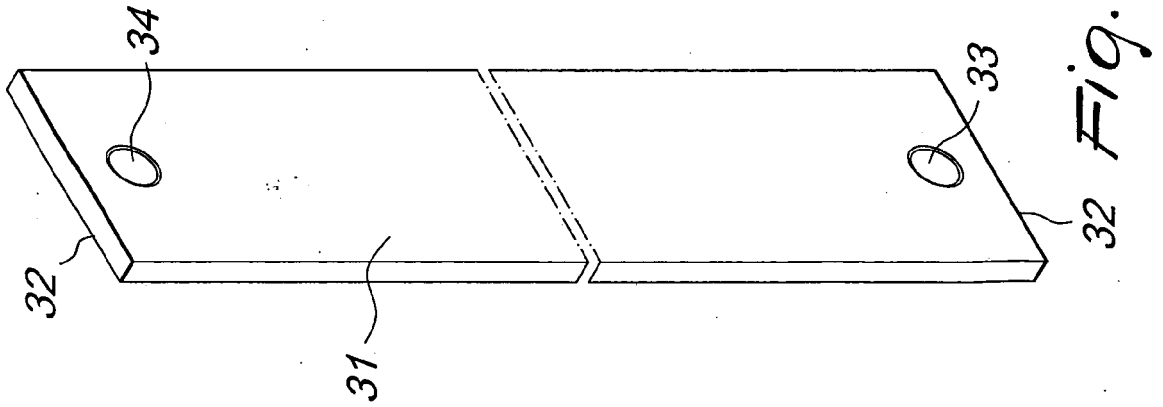

Fig. 7

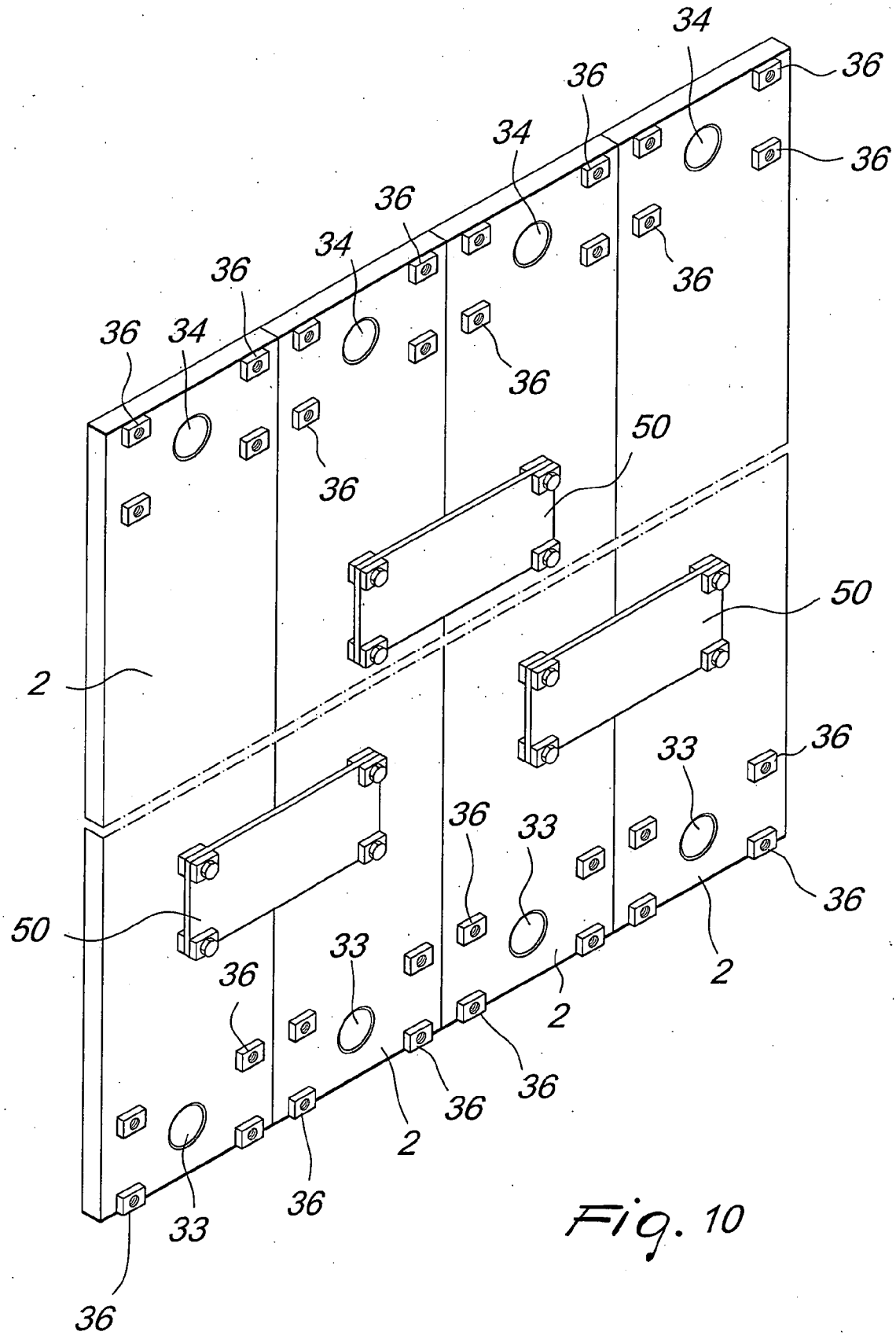
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Fig. 10

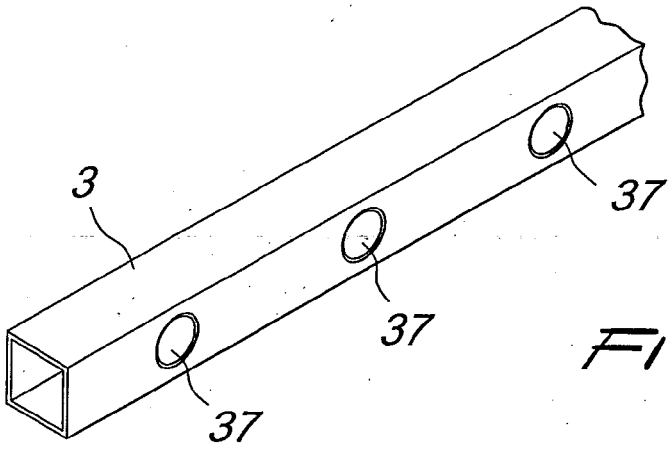


Fig. 11

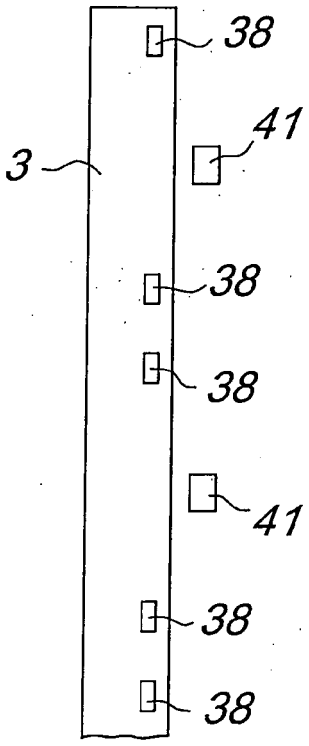


Fig. 12

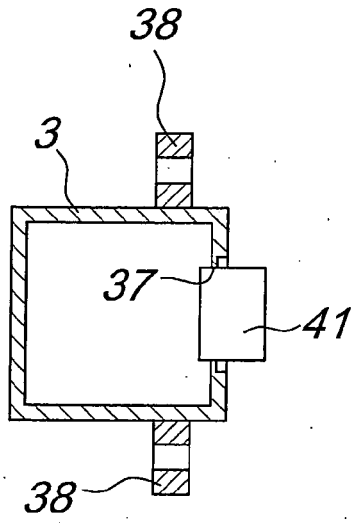


Fig. 13

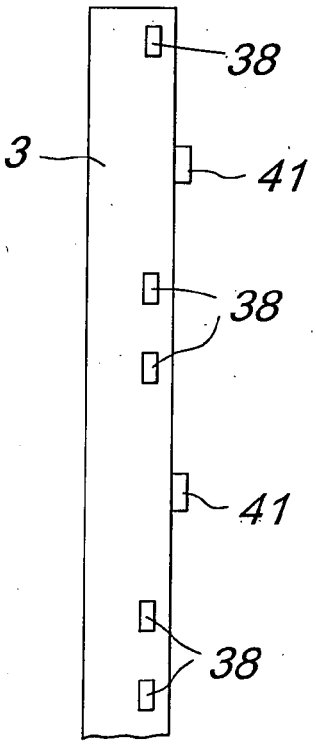
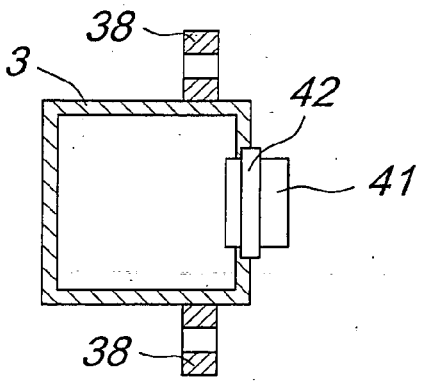


Fig. 14



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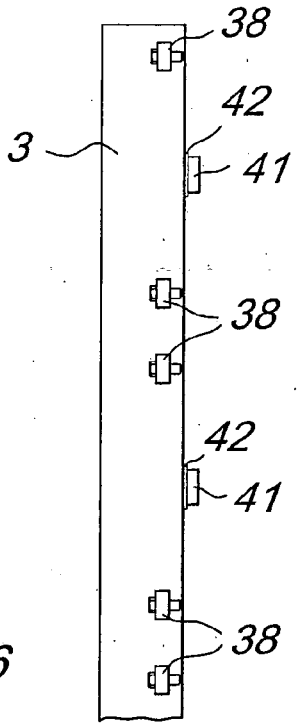

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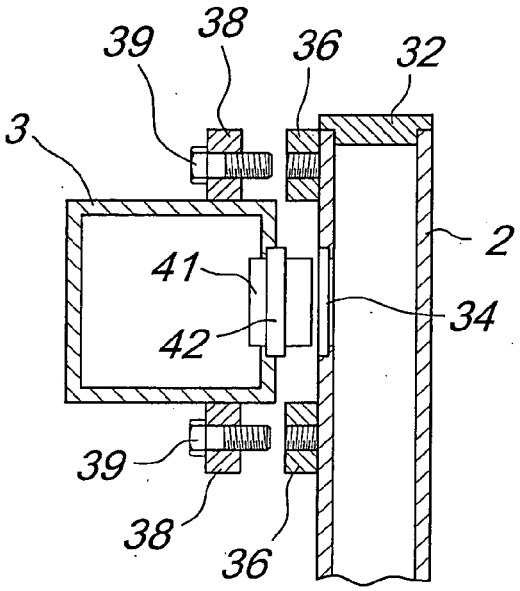

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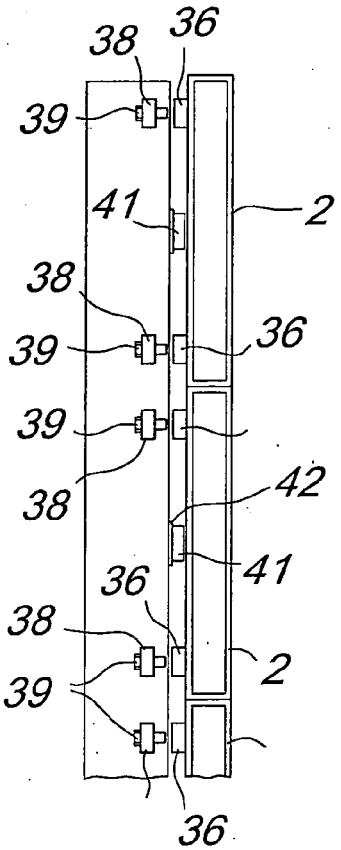

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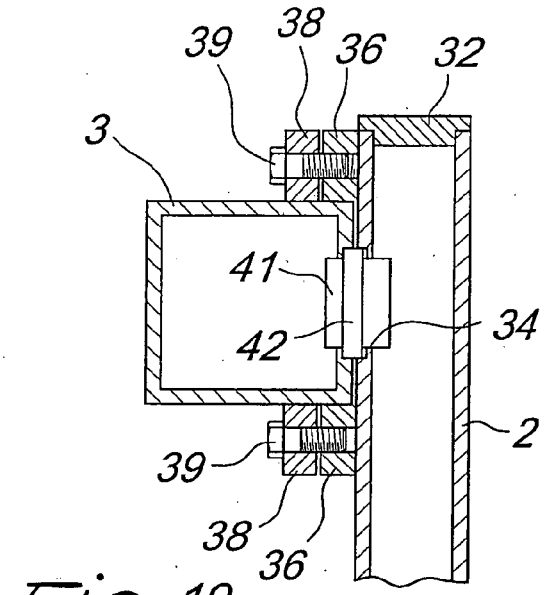
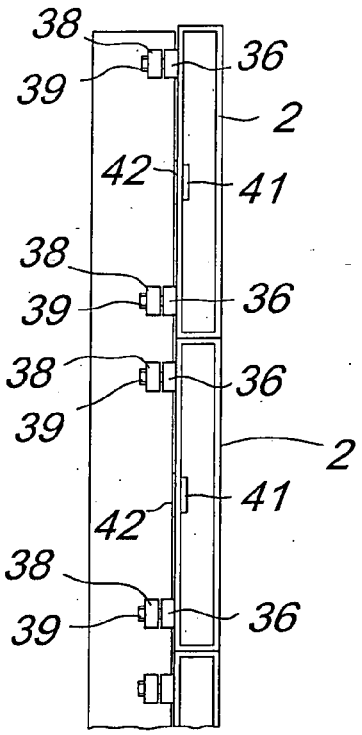


Fig. 19



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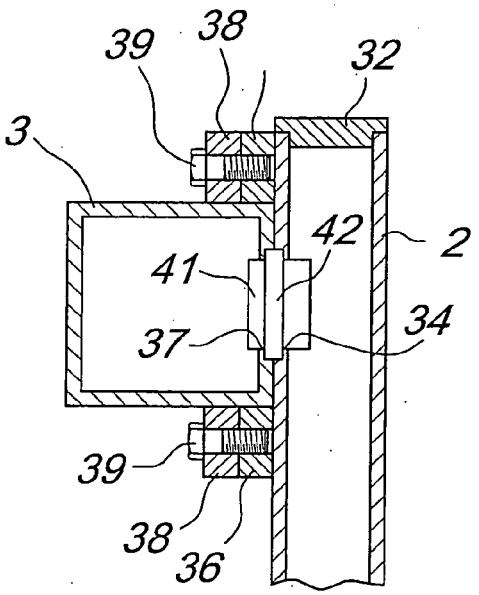

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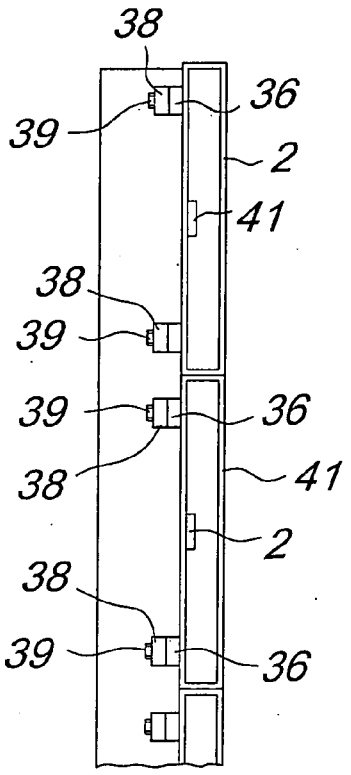

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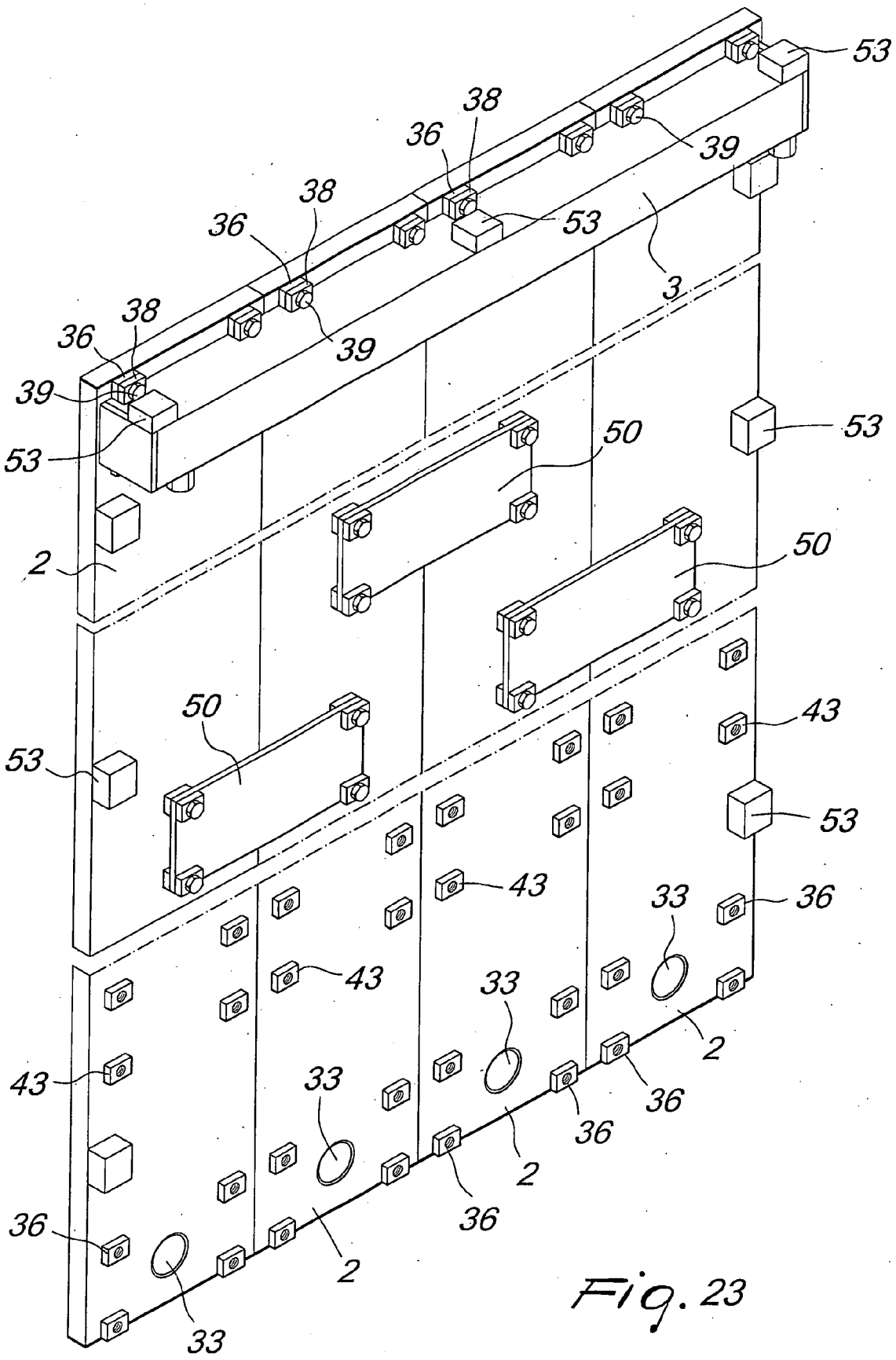
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Fig. 23

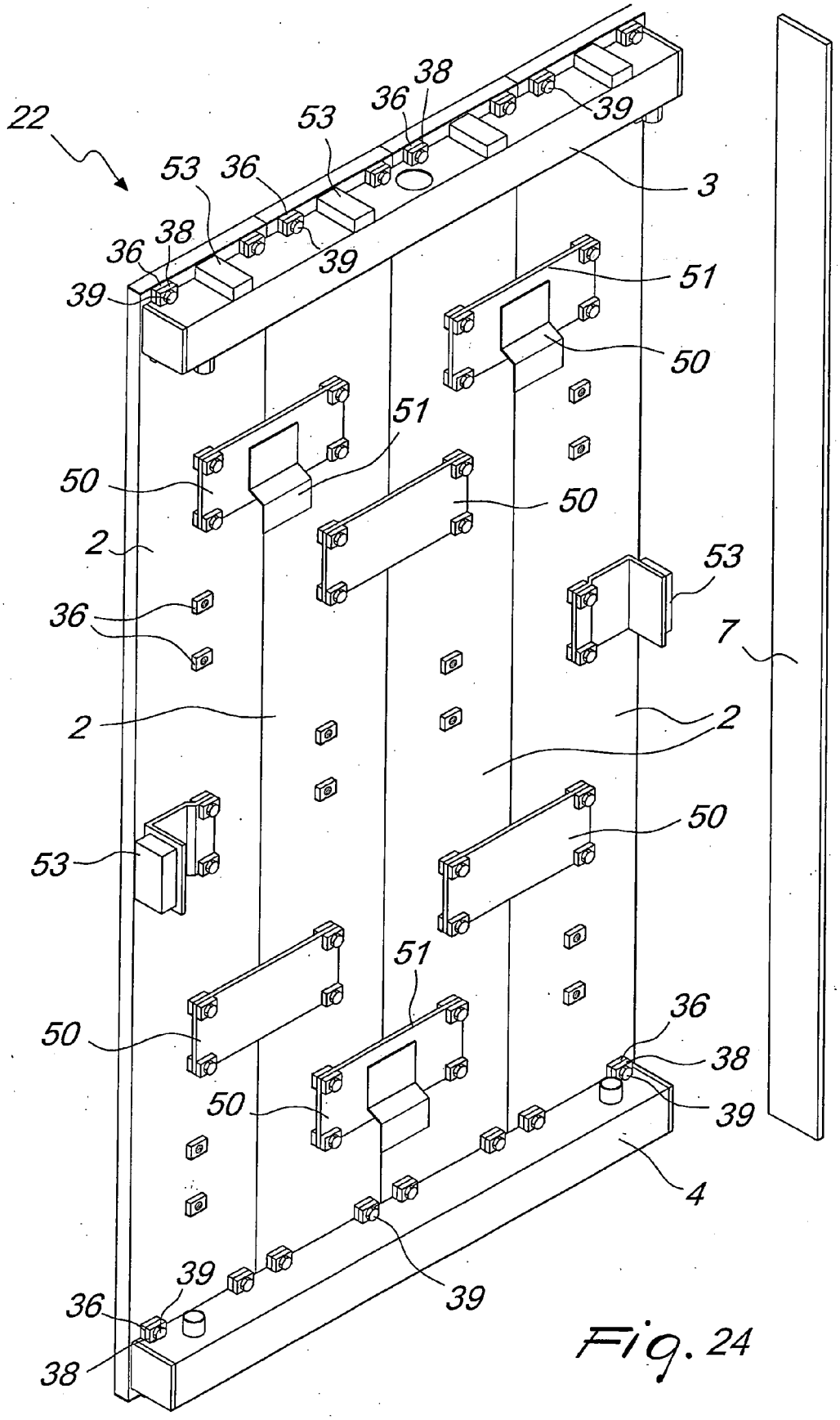

Fig. 24

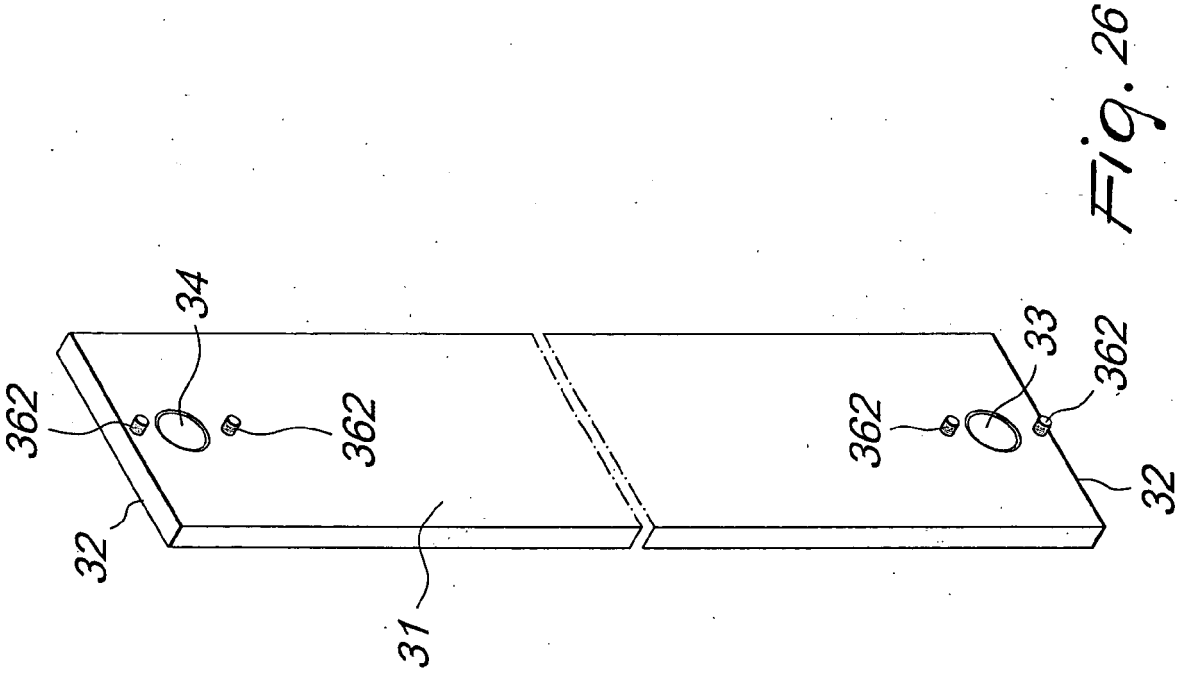

Fig. 26

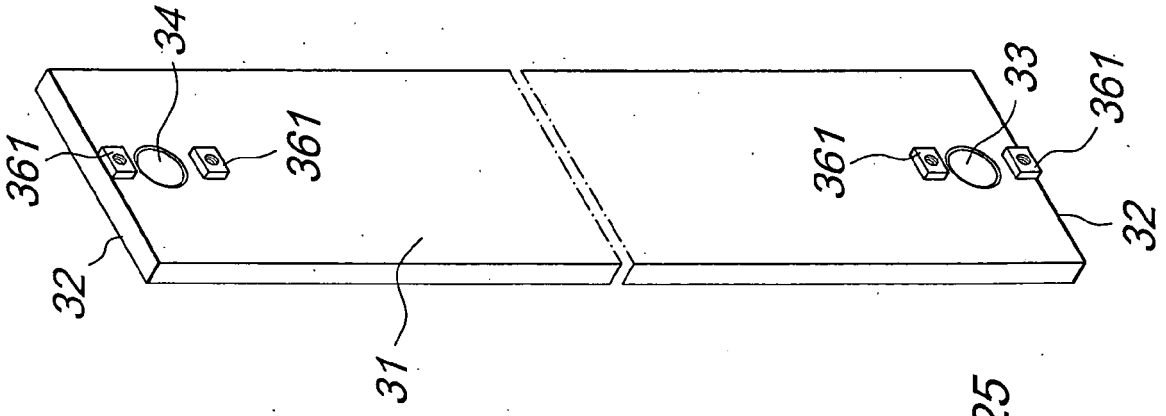

Fig. 25

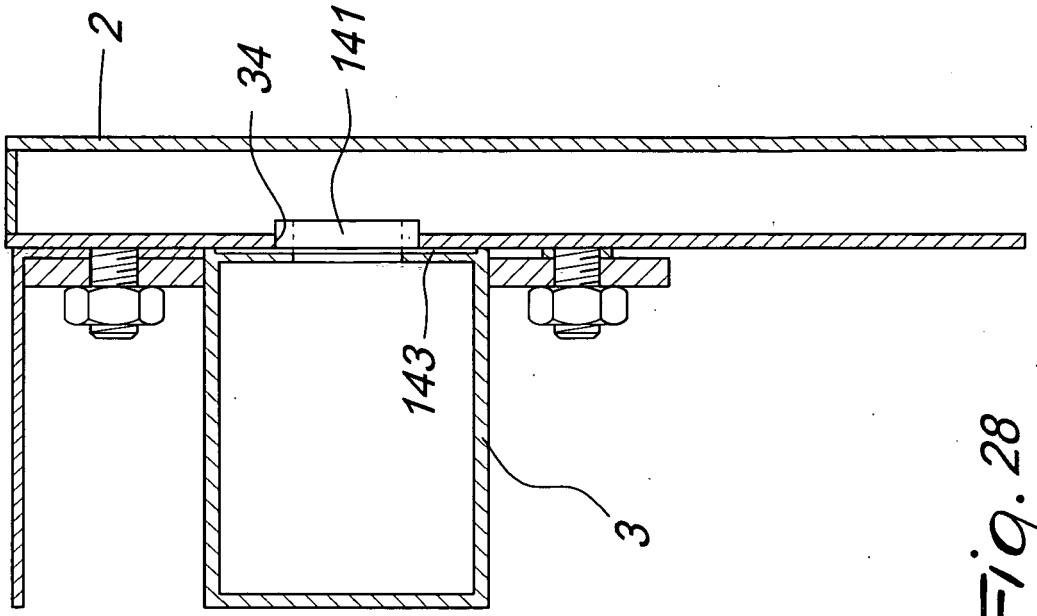

Fig. 28

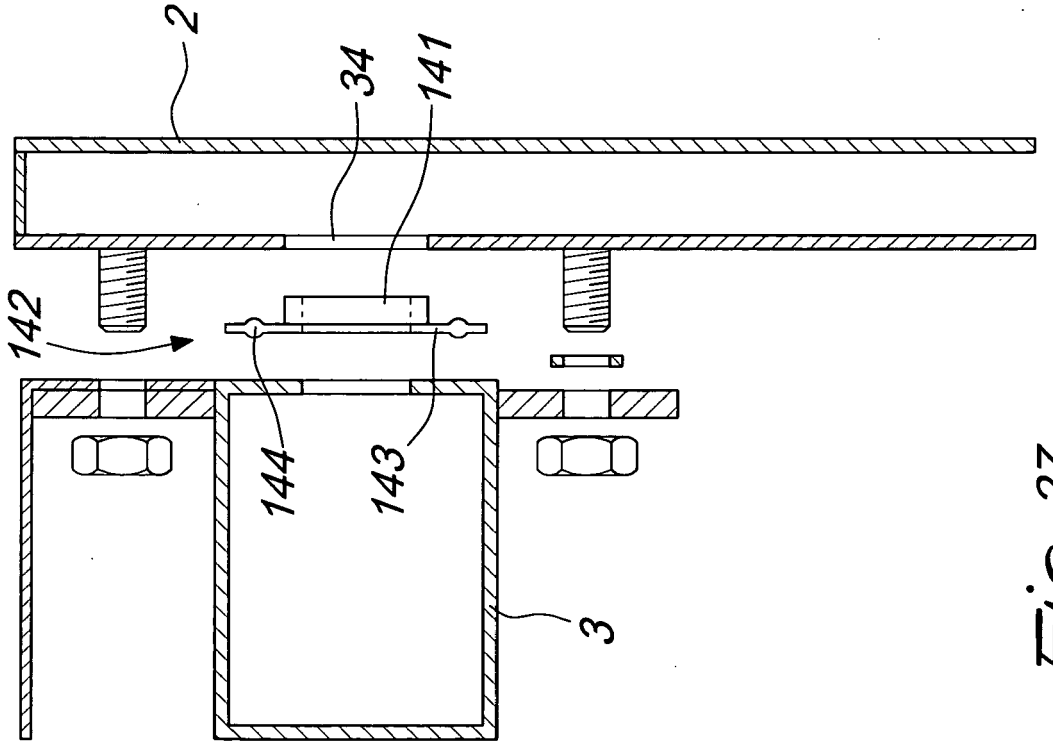

Fig. 27

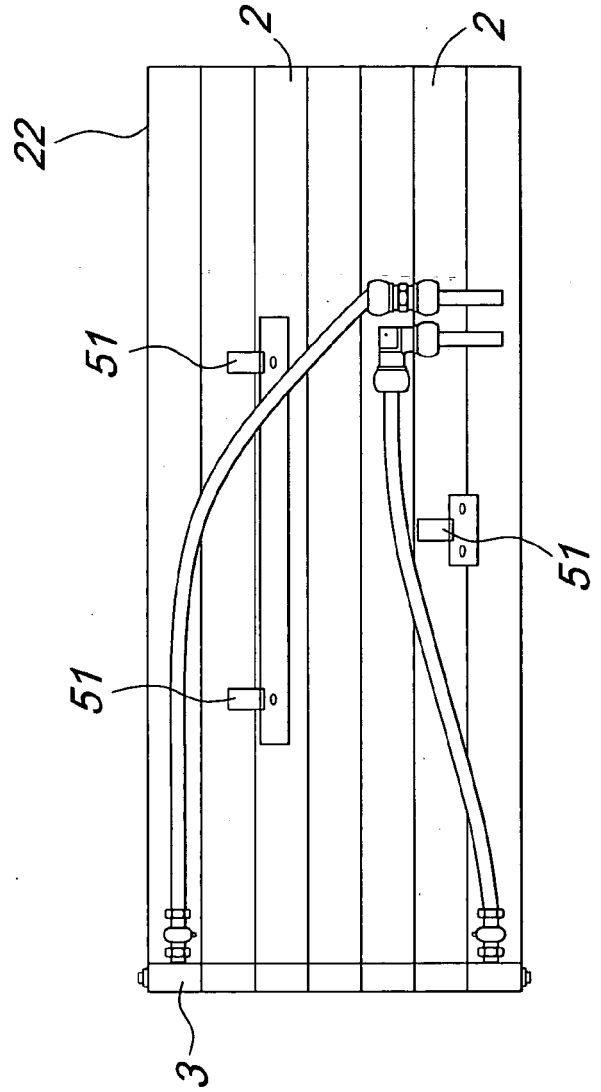

Fig. 30

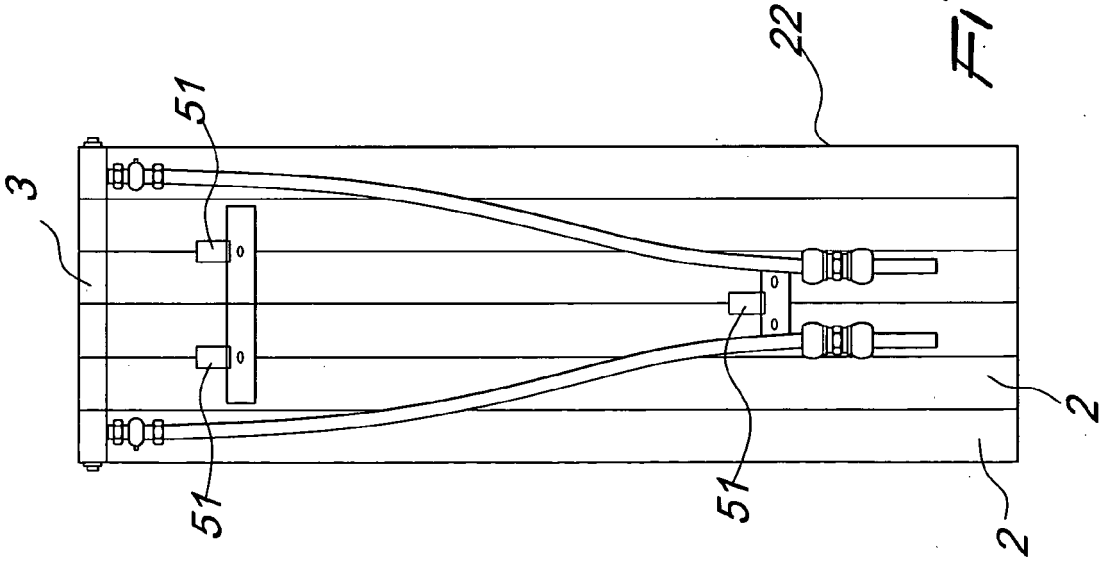

Fig. 29

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Application Number
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Place of search	Date of completion of the search	Examiner
Munich	20 December 2007	GARCIA MONCAYO, O

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