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(54) Wall.

(57) A wall comprising two generally parallel wallboards (1), which form a part of the surface of the wall on each side, together with a post (4) of sheet metal, preferably of galvanized sheetiron, with a flange (5) on each end of the section of the post, where each flange lies in a respective kerf (7) in the edge of a wallboard, wherein each wallboard has a groove (3) in the one edge and a respective tongue (2) at the opposite edge, in addition to the kerf for the flange of the sheet metal post in one or the other edge.

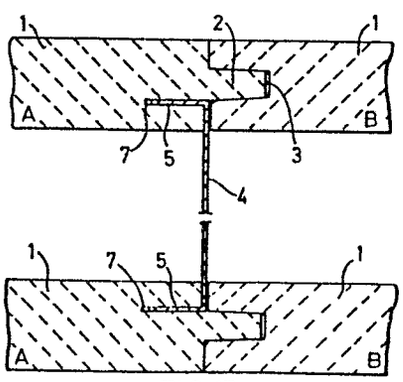

FIG.17.

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"WALL"

This invention relates to a wall, which term is intended to include within its scope not only interior walls and outer walls but also floors and ceilings.

The invention particularly relates to a vertical or horizontal wall (interior wall, outer wall, floor or ceiling) comprising wallboards joined by tongue and groove joints and posts (structural posts or joists) of sheet metal, preferably of galvanized sheet iron. The invention will be subsequently described with particular reference to an interior wall, but also with reference to an outer wall, a floor and a ceiling.

The invention includes an interior wall comprising structural posts made of sheet metal, preferably of galvanized sheet iron, and wallboards joined by groove-and-tongue joints and fastened into runners on the floor, ceiling and sidewalls. The joint of the boards is a groove in the one board and a tongue in the other. Through the wall opposite the joint extends a structural post made of galvanized sheetiron, or other sheet metal. The post extends between two adjacent boards and defines their limits into the central area of

the thickness of the board and thus has at least one bend. The first bend divides the post into a web and a flange, so that the post can resist a bending momentum and prevent the deflection of the wall. In another embodiment the post also extends along the inner surface of one of the two boards and supports it.

In a third embodiment the post is bent over the end of the tongue for increasing the moment of inertia of the post. The web of the post may be made with holes for electrical wiring and with formed barbs for supporting insulating materials and increasing the fire resistance of the wall. On joists there may be special barbs for supporting horizontal boards, and posts in outer walls have reduced section to reduce heat flow.

The wall includes wallboards, fastened to runners on the floor and in the ceiling and on the sidewalls, and the joint of the boards on the one side of the wall are joined to a vertical structural post extending through the wall and joined to a vertically extending joint of adjacent boards on the other side of the wall.

Many attempts have been made to construct such a post in sheetiron and hide it inside the wall. The first type was a U-formed section, where the flanges are adjacent the inner surface of the boards, and the boards are

screwed into them, and the screwheads make holes into the surface. The second type includes many embodiments and is characterized by a kerf in both boards along the joint, where the sheetiron post forms flanges, which enter into both kerfs. Each post then consists of at least two parts (US-A-2,154,520), three parts (GB-A-1,227,763) or six parts besides screws and web or fill (US-A-4,312,158).

The main purpose of the invention is to construct such a post in a sheet metal in one piece.

In all known types the kerfs are cut with sawblade and therefore their width becomes many times the thickness of the sheetiron. To occupy the cavity the sheetiron is bent over and thus the flange becomes double and of the same thickness as the width of the kerf. This involves much work and considerable material, but the main disadvantage is that these posts stack badly for transport. A second purpose of the invention is to construct posts, which stack well for transport, i.e. they stack compactly, support each other and form a group. Clearly this purpose will not be arrived at by means of overbent flanges and kerfs.

The above-mentioned patents include a wallboard with kerf, where the wallboard is connected to a symmetric

wallboard in the opposite surface of the wall by a post having a web, and a flange enters the kerf and connects these two wallboards. The connection includes transferring the forces loading the one wallboard onto the other. The post does not serve another purpose. This is apparent in US-A-2,154,520, fig 10, where the post consists of a right part and a left part, where the right part connects the wallboards on the right side of the joint, but has no influence on the boards on the left. The connection between the boards on the right side and those on the left side is performed by a stretching rod 18, which makes a pressure between the post on the right side and that on the left side, and the friction resulting from that pressure transfers forces from the boards on the right side to those on the left side. The ridges 5 and 12 serve the same purpose. It is thus apparent that at each joint there are really two posts, right and left, and they are mutually connected by the ridges 5, 12 and the stretching rod 18. From the disclosure in this patent the invention includes the following modifications: To omit the one post, the stretching rod 18 and the ridges 12, 5, and to replace a flange thickness of a width of a kerf by a thin sheetiron, which is strong enough to transfer the forces.

The present invention provides a wall (which term as

indicated above is intended to include a floor or a ceiling), comprising two generally parallel wallboards AA, which form a part of the surface of the wall on each side, together with a post of sheet metal, preferably of galvanized sheetiron, with a flange on each end of the section of the post, where each flange lies in a respective kerf in the edge of each wallboard, wherein each wallboard has a groove in the one edge and a respective tongue at the opposite edge, besides the kerf for the flange of the sheet metal post in only one edge.

In use, the edges with the kerfs are first connectable with the post of galvanized sheetiron or other sheet metal and then two other boards BB adjacent to boards AA connectable to boards AA by means of a groove-and-tongue, so that the post only connects boards AA but not board A to board B, and board A is connected to board B by means of a groove-and-tongue, so that the post is single and only has flanges from the one side, and board A is connected to board B by means of a frictional groove-and-tongue joint, which makes nailing unnecessary and a connection in the direction of the wall and transverse to the posts unnecessary.

It will be appreciated that, while the invention as defined above indicates that each wallboard has a groove in one edge and a respective tongue in the other edge,

nevertheless it will be apparent that the invention is equally applicable to a construction wherein pairs of wallboards are provided, one wallboard of each pair having a groove in each of its opposite edges, and the other wallboard of each pair having a tongue at each of its opposite edges.

It will also be understood that the kerf may effectively comprise the groove or a part of the groove formed in the edge of the wallboard. Alternatively the kerf may be formed in the wallboard separately from the groove, in which case the kerf is preferably formed in the edge of the wallboard at which the tongue is located.

The present invention includes connecting the boards on the right side (fig. 1) as before by means of a post, where the flanges of the post enter into a kerf in the boards and thus connects only the boards on the right side, but instead of connecting the boards on the left side in the same way, and then connecting the posts in order to transfer forces between the parts on the right and on the left side, the board on the left side is provided with a tongue, which enters into a respective groove in the board on the right side, the same groove which is entered by the flange of the post. Thus the boards on the left side are not connected directly, but indirectly through the boards on the right side and the post, which is connecting them.

Clearly the board on the right side can be provided with a tongue, which enters a respective groove in the left board, although the boards on the right side are connected as before by means of a kerf, a flange and a post.

It is known to connect surface units by means of a groove-and-tongue. It is also known to connect two parallel boards by means of a post, where the flange of the post enters a kerf in each board, but it is not known to connect those boards to adjacent boards by means of a groove-and-tongue as in the present invention.

Thus in the present invention the post connects two wallboards and forms an U-shaped wall unit, but the groove-and-tongue joint forms the connection between wall units and prevents shearing. That purpose was served by totally different parts in the above mentioned patents.

Thus the invention is a new combination, on the one hand two wallboards with kerfs and a single post of sheet metal with flanges entering each kerf and connecting the wallboards, on the other hand a groove-and-tongue connection between two such units. This whole is symmetric with respect to a centerline in the wall and consists of two panels, which can be independent per se,

for example as a panel on a wall or a ceiling, in other words a single surface but not a wall having two surfaces.

Increased strength and support is obtained by extending the flange further along the inner surface of one of the boards, either the board which has the kerf for the flange, or the other which does not have a kerf for a flange.

Increased strength may be also obtained by glueing of the joint. Galvanized sheetiron is oily, and the oil needs to be cleaned from the surfaces to be glued in order to obtain good adhesion.

A web of a post of sheetiron has only a low moment of inertia in the normal direction and tends to deflect on the pressure side under load. The moment of inertia can be increased by ridges at 45° in the web, preferably a continuous pattern of crosses to both sides, also circular spheres, circles or even extended holes to prevent deflection under load and to stiffen the web. Glueing the flanges to the boards prevents to a reasonable extent the deformation and deflection of the web.

The fire resistance properties of the wall can be

increased by wallboards of fireproof materials having fibres to strengthen the thinner parts in tongues, grooves and kerfs. The cavity in the center of the wall can also be filled with fireproof mats or plates, joined to the web by barbs pricking the mats for supporting them even if the surface boards are burnt or broken.

It is advantageous to provide suitable holes in the post for electric wires and other pipes, which are horizontal in the wall.

The posts stack and fit together if the angle from web to flange is wide amounting to v= arc sin t/h, where the angle is 90 plus v, the sheetiron thickness is t and the piling height is h. If v is 5° , and t is 0.5 mm, the piling height becomes about 6 mm, and thereby 75% of transport volume is saved.

By cleaning of oil from the surfaces of the flanges, they can be glued to the wallboards. In that case the glueing transfers frictional forces or transverse forces in the longitudinal direction of the post, and the moment of inertia of the wallboards is calculated in respect of the centerline of the wall, instead of the centerline of each board.

The web of the post is thin and gives the post a low

moment of inertia in that direction and instability under load, deflection and thereby reduced strength. This can be improved by deforming the sheet metal from the centerline of the web. For example spheres can be formed to the right and to the left sufficiently tightly all over the web. Crosses, circles and even holes with borders have the same effect.

The invention will be further described, by way of example only, with reference to the accompanying drawings, wherein:

Figures 1 to 6 are horizontal views of the ends of joints of walls according to the invention;

Figure 7 is an isometric view of a part of a post;

Figure 8 is similarly an isometric view of a part of another embodiment of a post;

Figure 9 shows a pile of posts stacked together;

Figure 10 is an isometric view showing an embodiment of a wall according to the invention which is a floor or a ceiling;

Figure 11 shows a post with flanges made as diamond-shaped units;

Figure 12 shows a post with an inner flange in an embodiment of an outer wall post;

Figure 13 illustrates the manner of connection of wallboards to a floor or ceiling where the post is not continuous;

Figure 14 shows a post with a flange which is roughened to assist adhesion thereof;

Figure 15 is a horizontal view of an embodiment of a wallboard of a wall according to the invention;

Figure 16 is horizontal view of an embodiment of a post of a wall according to the invention;

Figure 17 is a horizontal view illustrating the method of constructing a wall, according to the invention; and

Figure 18 is a horizontal view of an embodiment of an outer wall according to the invention.

Fig. 1 to 6 are horizontal views into the end of the joint in a wall according to the invention. Wallboards 1 are connected by means of a tongue 2 and a groove 3 at each side of the wall. A post 4 has flanges 5 extending into the joint between the boards, threading the joint into the center area of the board. Fig. 2 shows a construction similar to that of Fig. 1 but having further an inner flange 6, which extends along the inner side of the wallboard 1.

Fig. 3 shows a kerf 7, which extends in the opposite direction from the joint, which respect of the tongue 2, and the flange 5 extends into the kerf 7. Fig 4 shows a construction similar to that of Fig. 3 but having further an inner flange 6 which supports the board

having the groove. Fig. 5 shows the same type as fig. 1, but where an inner flange 6 supports the inner side of the board having the tongue. Fig. 6 shows the same type as fig. 2, but where a flange 8 extends along the end of the tongue 2.

Fig. 7 is an isometric view of a part of a post 1 with a hole 9 for electric wires and a barb 10 for supporting insulating units in the empty space inside the wall, especially insulating mats which can be pushed upon the barbs for fixture for the purpose of resisting fire in order to close the cavity in the centre of the wall. These barbs are by turns to left and to right.

Fig. 8 shows stiffening by spheres 11 formed in the web of the post 1.

Fig. 9 shows a pile of posts 1, where angles between the web and the flange are wide amounting to arc sin t/h. When the posts are in place in the wall, all the angles become right, as the angles in the joint are right angles. The posts are then stressed a little, preventing rattle.

Fig. 10 shows an embodiment of a post, where the wall is a floor or a ceiling. There the post becomes a joist or a floorbeam (which terms are to be understood to be

within the scope of the term 'post'), which resists the loaded weight alone, or is glued to adjacent boards 1, which then are resisting as flanges. The figure shows three forms of barbs 12, which support the boards 1, when they are mounted.

Fig. 11 shows a post 4 with flanges 5 made as diamond shaped units 15, which form a lattice.

Fig. 12 shows a post 4 with an inner flange 5 in the embodiment of an outer wall post, where there are removed parts 13 for reducing coldflow and where the flange 14 is only 1/5 part. Fig. 13 shows a connection of the boards 1 to a wall or a ceiling, where the post is not continuous, but in the form of a tie having a nailhole in the one flange 16.

Fig. 14 shows a post 4 with a flange 5, which is scratched or otherwise made with a rough surface to increase the adhesion of glue.

Posts in interior walls are usually vertical, but according to the invention these posts can also be horizontal, for example as outer walls in industry buildings on the outside of the structural frame. As the tongue turns upwards and the groove turns downwards, rainwater cannot penetrate the joint.

Walls according to the invention have been found to be superior regarding fire resistance as compared to interior walls of any kind, especially walls having cavities. This is because the flange can be made small. The flange on one side absorbs heat in proportion to its size, and the web of the post conducts the heat through the wall. There the other flange convects the heat to the adjoining boards. A normal flange is 40 mm thick but a flange in a wall according to the invention can be only 6 mm thick. A temperature of 1000 C° on the one side of a wall results in 380 C° in a normal wall, but only 154 C° in a wall according to the invention. A fire resistant wall class A-60 heated up to 950 C° may result in 180 C° in spots, but in a wall according to the invention results in only 140 C°, and therefore a wall in accordance with the invention has a much higher fire resistance than a class A-60 wall.

For fire resistant walls there are fire resistant boards needed, for example cement bonded particle boards. They have the disadvantage to be almost un-nailable and therefore they must be screwed for fixture. Regarding these boards a post of a wall according to the invention is of special importance, as a connection into it does not depend on nailing or screwing. Thus walls according to the invention both have higher fire resistance and are much easier to build.

For outer walls there are needed water resistant boards and posts, which do not conduct cold flow sufficiently to dew. Cement bonded particle boards and a post according to fig. 12 suffice these requirements are therefore usable outer wall constructions and at the same time very economical. Fig. 18 shows a section of such a wall, where the posts are of reduced section according to fig. 12.

Fig. 15 shows a board 1 of a wall according to the invention with a tongue 2 in the one edge and a kerf 7 for a sheet metal flange, but in the other edge with a groove 3 for a tongue of an adjoining board. Fig. 16 shows a post 4 with flanges 5.

The method according to the invention may be described with reference to Fig. 17 The boards AA and BB are made according to fig. 15. First the boards AA are connected by means of the post 4, which is made according to fig. 16. Then the boards BB are joined to boards AA by means of the tongues 2 and the grooves 3. As a groove-and-tongue joint is a frictional joint there is a force needed to press the tongue into the groove and for the same reason a force to pull the boards apart, A from B. Therefore the joint is a fixed one and does not need nailing and does not need a connection between posts in the wall for holding the joint together. The

same is valid for all connections according to figs. 1 to 6.

Fig. 18 shows an outer wall according to the invention. The boards and the posts with reductions 17 according to fig. 12 form a definite volume. Thereinto are placed lists 18 connected to a windtight sheet 19 to define an air conduit 22 separate from an insulation 20, which is fastened to a vapour barrier 21. This wall unit can be made as a whole in a factory.

The main advantages of the invention are that the post is reduced to a half, becomes stackable for transport and storing, conducts only half as much cold flow because of its half a section and has in addition much small flanges and therefore conducts less cold flow and is therefore much more fire resistant. The groove-and-tongue gives friction in the joint and therefore does not need any rod connections or nails. The boards with the kerf for the flange are just as suitable, where there is no flange and are therefore doubly competent. As there are no nails needed, the flange becomes smaller.

CLAIMS:

1. A wall comprising two generally parallel wallboards (1), which form a part of the surface of the wall on each side, together with a post (4) of sheet metal, preferably of galvanized sheetiron, with a flange (5) on each end of the section of the post, where each flange lies in a respective kerf in the edge of a wallboard, characterized in that each wallboard has a groove (3) in the one edge and a respective tongue (2) at the opposite edge, in addition to the kerf for the flange of the sheet metal post in one or the other edge.

2. A wall as claimed in claim 1, characterized in that the kerf for the flange (5) is adjacent to the groove for the tongue, so that the tongue and the flange have the same direction.

3. A wall as claimed in claim 2, characterized in that the flange in the kerf extends over the end of the tongue and the bottom of the groove.

4. A wall as claimed in claim 1, characterized in that the kerf (7) for the flange (5) is directed from the groove for the tongue, so that the tongue and the flange have opposite directions.

5. A wall as claimed in any of claims 1 to 4, characterized in that the web of the post is situated at either side of the edge of the board with the groove, and the post further includes another flange (6) nearer to the center at each end of its section, and that flange is adjacent to and supports the inner side of the board adjacent the web, on the interval from the edge of the board to the web of the post.

6. A wall as claimed in any of claims 1 to 5, characterized in that the boards are made of fire resistant or fire proof materials with strengthening fibres, which grooves and kerfs and tongues are formable into or cutable into, for example cement bonded particle boards, so that the wall becomes fire resistant or fireproof.

7. A wall as claimed in any of claims 1 to 6, characterized in that the webs of the posts are formed with barbs (10), for supporting insulating means in the empty space inside the wall.

8. A wall as claimed in any of claims 1 to 7, characterized in that the webs of the posts and the flange on the one side have reduced section, for example amounting to 4/5 parts, in order to reduce coldflow from the outer surface of the wall.

9. A wall as claimed in any of claims 1 to 8, characterized in that the webs of the posts have holes (9), for example for electric wiring, lying transverse to the posts.

10. A wall as claimed in any of claims 1 to 9, characterized in that the webs of the posts are formed with barbs (12), which support the inner side of one or both of the boards.

11. A wall as claimed in any of claims 1 to 10, characterized in that the angle from web to flange of the post is a wide angle amounting to arc sin t/h, where t is the thickness of the sheet metal and h is the pile unit height, when the post are stacked for packing and transport.

12. A wall as claimed in any of claims 1 to 11, characterized in that the flanges of the posts are oil cleansed in order to assist application of glue and glueing of the joints.

13. A wall as claimed in any of claims 1 to 12, characterized in that the flanges of the posts have roughened surfaces, for example scratch-hammered, in order to increase outside friction for example against a glue.

14. A wall as claimed in any of claims 1 to 13, characterized in that the web of the posts is strengthened against bulging under load, for example by corrugation, continuous pattern of crosses, circular bubbles or spheres (11), circles or ridged holes.

15. A wall as claimed in any of claims 1 to 14, characterized in that the posts are made in separate parts as trapezium-shapes or diamonds.

16. A wall as claimed in any of claims 1 to 15, characterized in that the posts are made on the one side with holes in the flange for nails for nailing into a fixed wall or a list.

17. A method of building a wall, which comprises generally parallel wallboards AA, which form a part of the surface of the wall on each side, together with a post (4) of sheet metal, preferably of galvanized sheetiron, with a flange (5) on each end of the section of the post, where each flange lies in a respective kerf in the edge of a wallboard, characterized by forming a groove (3) in the one edge and a respective tongue (2) at the opposite edge of wallboards AA and BB, and at the one side of the tongue forming a kerf (7) for a flange of sheet metal, and a reduction for the web of the post, forming a post of sheet metal by bending parallel

flanges respective to the kerfs into a plane sheet metal, connecting flanges (5) into kerfs (7) of boards AA, and connecting grooves (3) of boards BB onto tongues (2) of boards AA, by pushing them together.

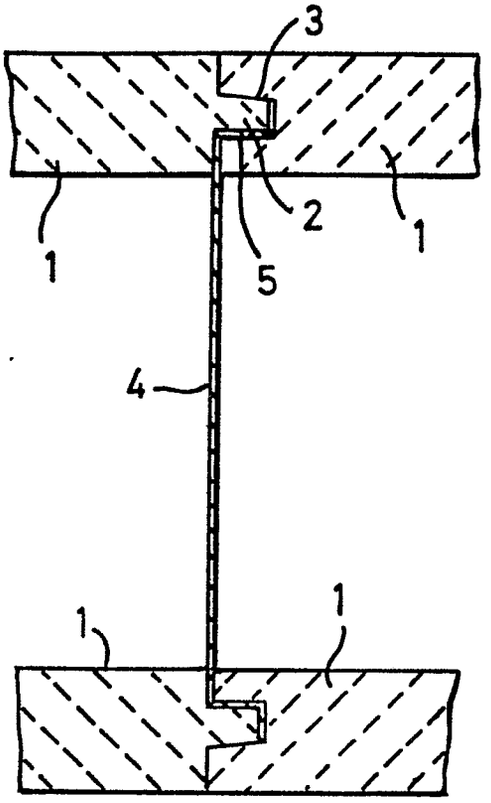

FIG.1.

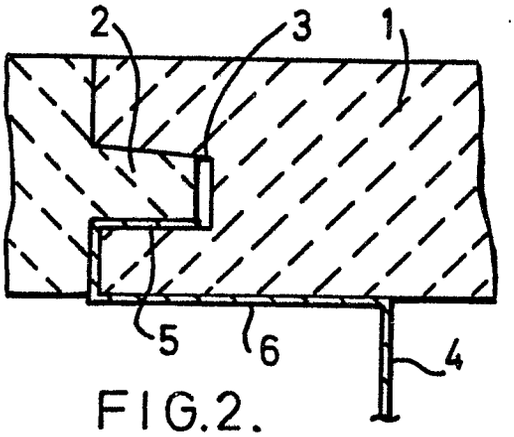

FIG.2.

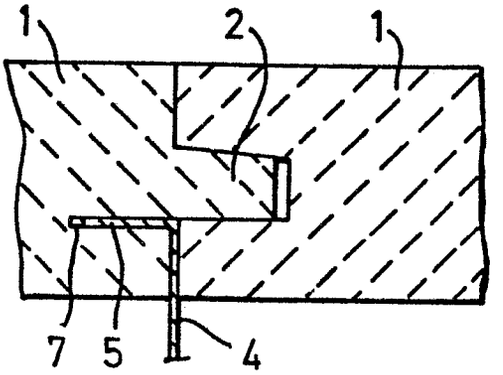

FIG.3.

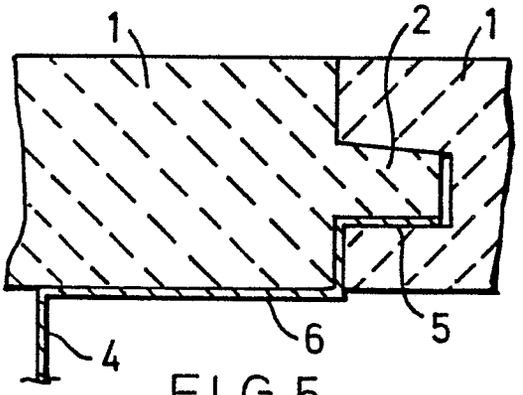

FIG.5.

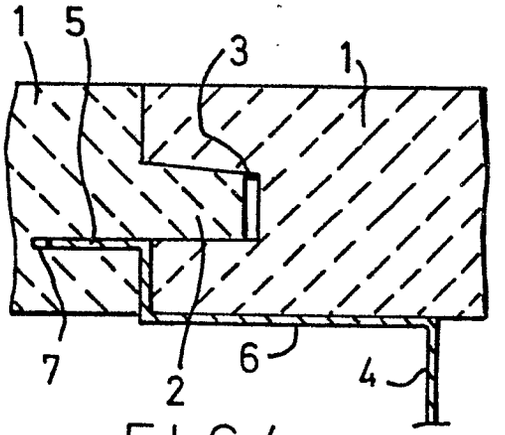

FIG.4.

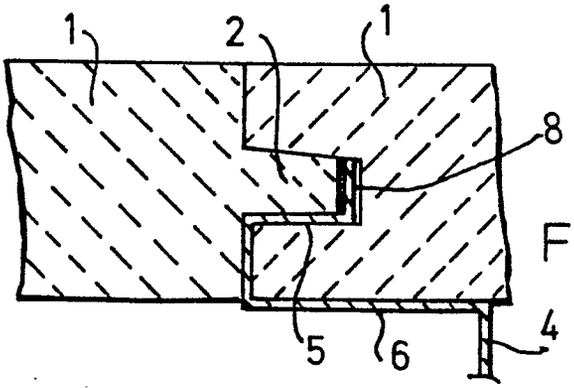

FIG.6.

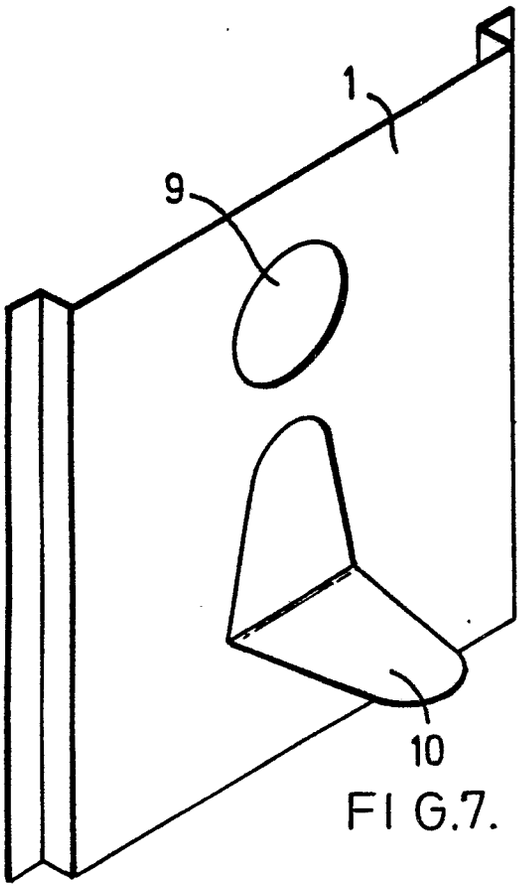

FIG.7.

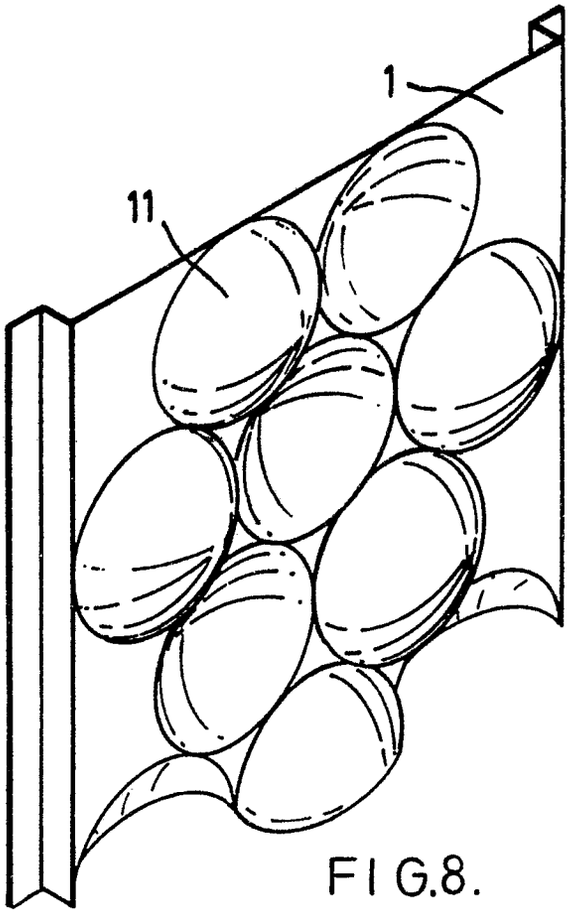

FIG.8.

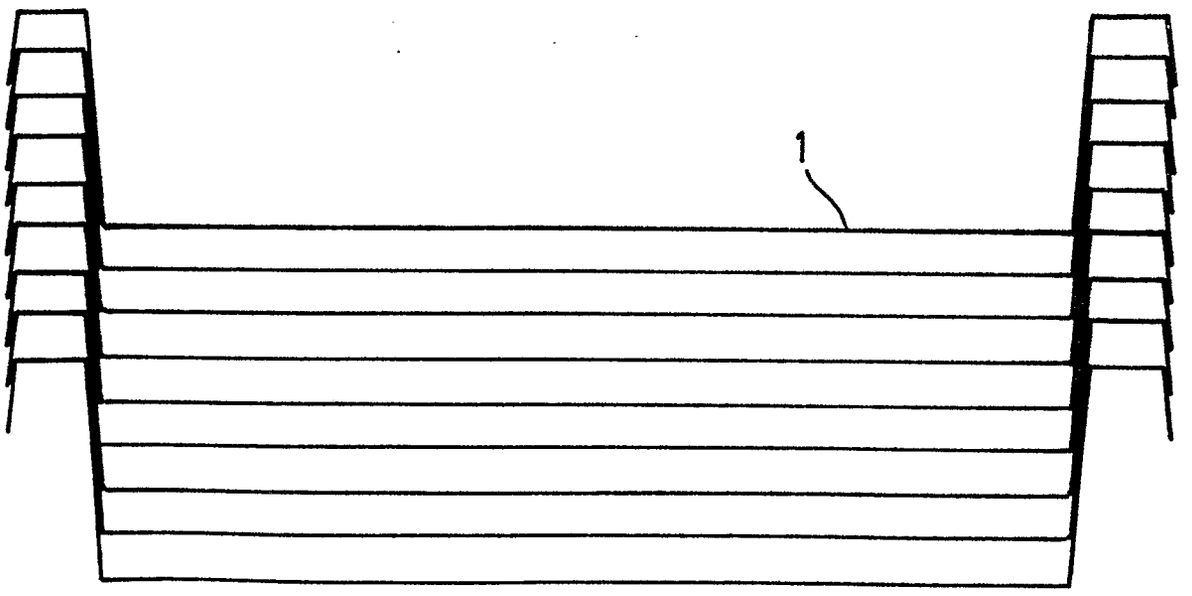

FIG. 9.

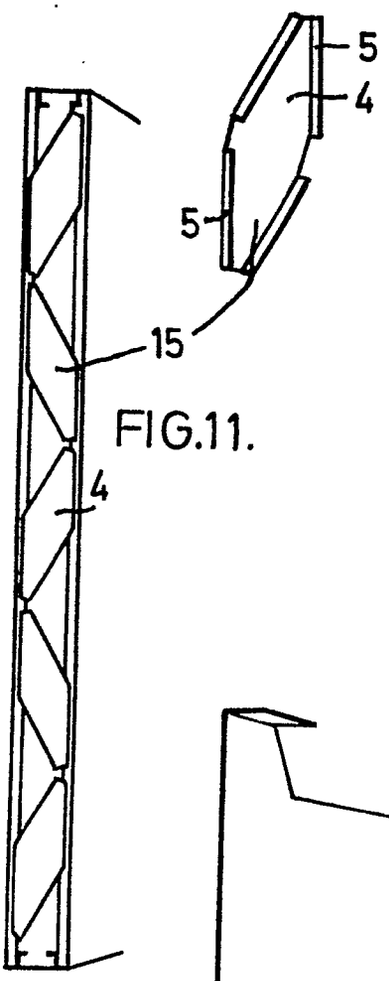

FIG.11.

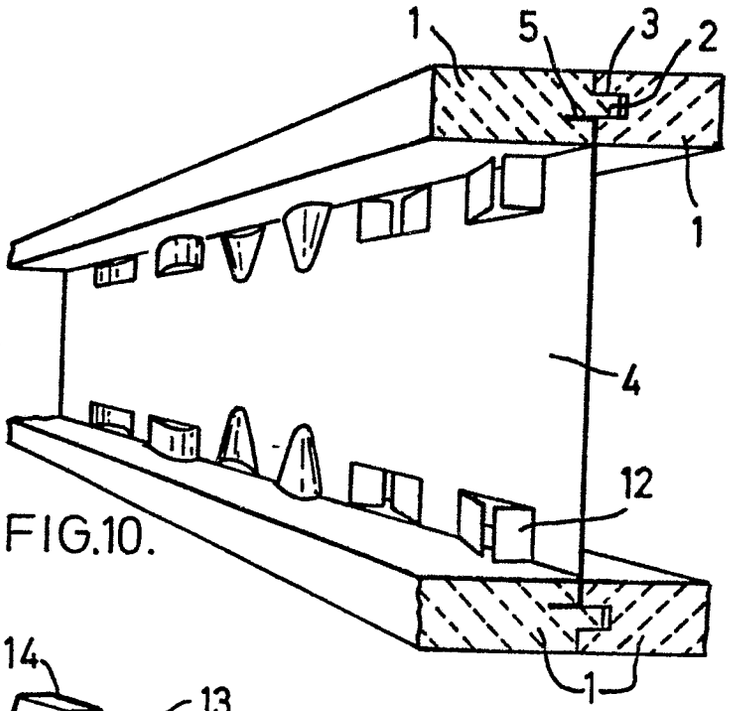

FIG.10.

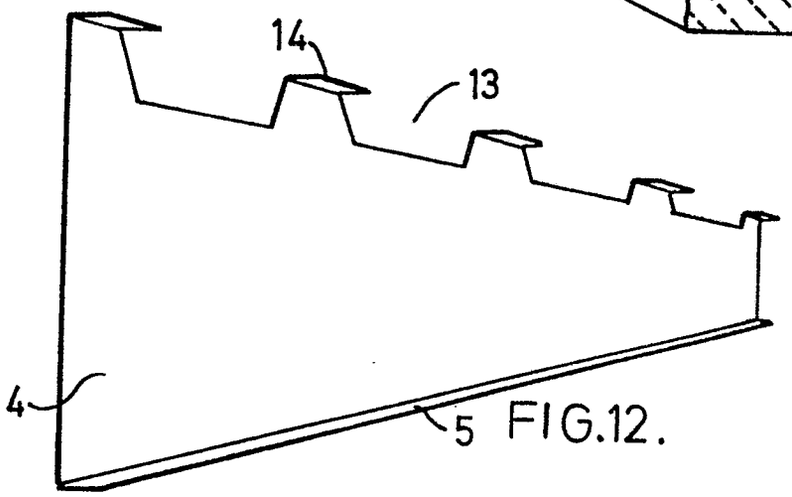

FIG.12.

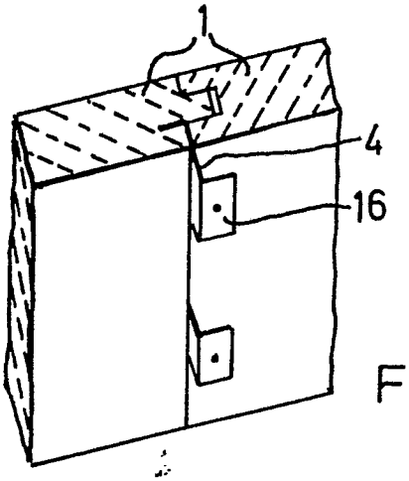

FIG.13.

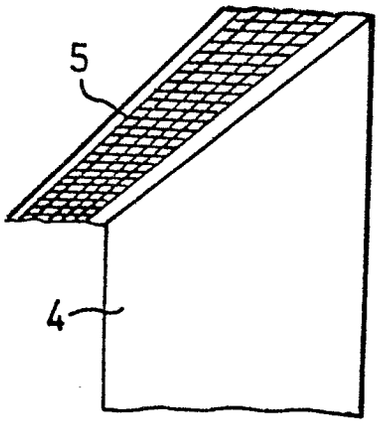

FIG.14.

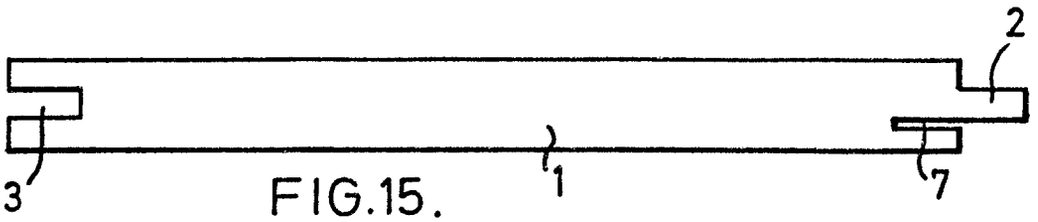

FIG.15.

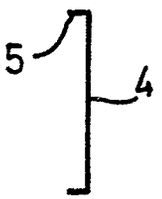

FIG.16.

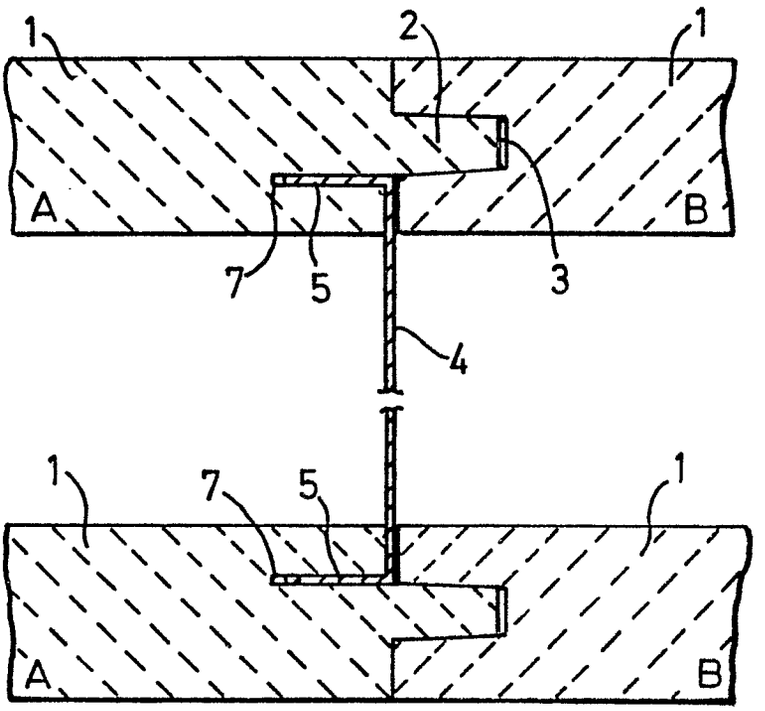

FIG.17.

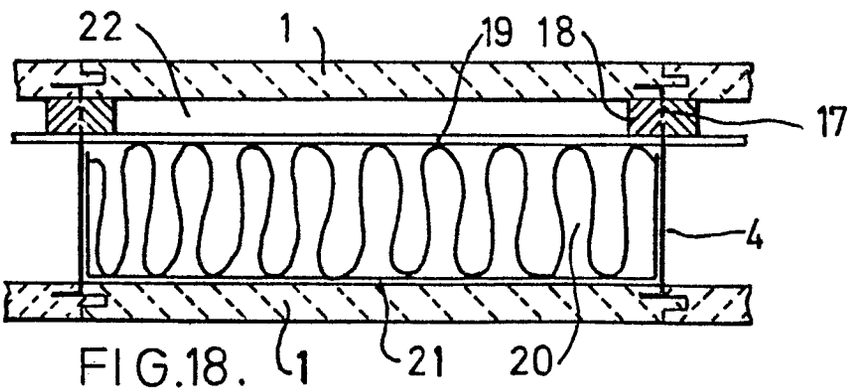

FIG.18.