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(54) **Building panel.**

(57) A building panel (1) comprising a plate (2) made of insulating foam material wherein, on at least one longitudinal side, a surface relief is provided which is composed of elongated recesses (3) which become in essence wider the deeper they are in the foam material, attachment elements (4, 5) being fitted in said recesses (3) on predetermined distances from one another, and a grid (6) being applied onto these attachment elements (4, 5), said attachment elements having a substantially gutter-shaped profile which extends into said recess (3), with borings being made in said attachment elements (4, 5) and extending further through said plate (2), and attachment members being inserted in these borings connecting the attachment element (4,5) to the plate (2).

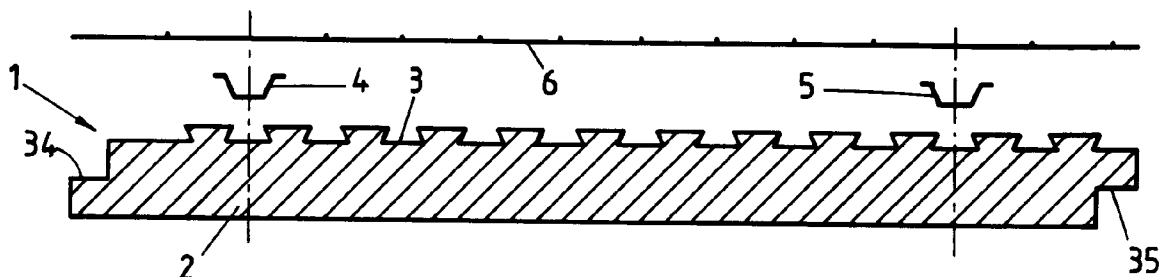


Fig.1

The present invention relates to a building panel comprising a plate made of insulating foam material wherein, on at least one longitudinal side, a surface relief is provided which is composed of elongated recesses which become in essence wider the deeper they are in the foam material, attachment elements being fitted in said recesses on predetermined distances from one another, and a grid being applied onto these attachment elements.

Such a building panel is disclosed in DOS 25 17 095. The panel is made of foam material, such as for example polystyrene, wherein a dovetail profile is applied as surface relief. In some of the recesses of the relief, blocks are clamped having a grid applied thereon so as to obtain a reinforced construction. This grid is made of corrosion-resistant steel wire. The building panel is placed in a mould which is subsequently filled with concrete to manufacture a wall portion. After the transport, the wall portions are mounted on the spot in order to erect a building.

A drawback of the known building panel is that the grid is applied onto solid blocks which are clamped in the recesses. The massive character of the blocks disturbs the relief applied in the plate and is the origin of stresses arising in the plate when the wall portion is going to distort somewhat as a result of thermal influences. These stresses may result then into cracks into the plate or the concrete which adversely affects the rigidity of the construction.

An object of the present invention is to provide a building panel wherein a solution is offered for the above drawback.

To this end, a building panel according to the invention is characterized in that said attachment elements have a substantially gutter-shaped profile which extends into said recess, with borings being made in said attachment elements and extending further through said plate, and attachment members being inserted in these borings connecting the attachment element to the plate.

Due to the fact that the attachment element has a substantially gutter-shaped profile, it fits to the profile of the recess so that the relief applied in the plate is no longer disturbed. The gutter-shaped profile also sets off the thermal fluctuations considerably better so that considerably less stresses arise in the building panel. Due to the further fact that the grid is fixed onto the attachment element and this latter element through the attachment members onto the plate, the so-obtained building plate forms a more homogeneous whole resulting in a stronger construction without affecting the thermal insulation.

A first preferred embodiment of a building panel according to the invention is characterized in that the building panel is provided with first suspension means which are mounted onto said attachment element and which have a substantially hook-shaped profile. In this way, the building panels can simply be

hung up which simplifies their installation and alignment.

A second preferred embodiment of a building panel according to the invention is characterized in that said attachment member is made of synthetic material and comprises a plug and a peg which can be locked therein. The use of a synthetic material enhances the thermal insulation.

Advantageously, said attachment element is provided with longitudinal rims on which an elevation is provided, with said grid being welded onto said elevation. In this way, a well-defined contact surface is obtained for welding the grid onto the attachment element.

The invention also relates to a device for manufacturing a building panel. Such device is characterized in that it comprises a surface relief cutting section as well as a further section destined for putting said grid onto said attachment elements, and an assembly section for putting the attachment elements and grid onto the plate.

The invention further concerns an assembly comprising a building panel and a frame structure. Such an assembly is characterized in that said frame structure comprises first and second beams which are respectively destined for forming upright and transverse beams of said frame structure, said second beams being provided for cooperating with said first suspension means.

The invention will now be explained more into details with reference to the drawing wherein :

Figure 1 shows an exploded view of a first embodiment of a building panel according to the invention ;

Figure 2 shows an exploded view of a second embodiment of a building panel according to the invention ;

Figures 3 and 4 show respectively an attachment plug and a peg ;

Figure 5 shows the attachment member fitted in the plate and the attachment element ;

Figure 6 shows a cross-section through an embodiment of an attachment element ;

Figure 7 illustrates some details of a building constructed by making use of building panels according to the invention ;

Figure 8 shows an example of a second clamping profile ;

Figure 9 shows an example of a device according to the invention.

In the drawing, a same reference numeral has been given to a same or analogous element.

Figure 1 shows a cross-section and disassembled components of a first embodiment of a building panel according to the invention. The building panel 1 comprises a plate 2 made of a foam material such as for example styropore of polystyrene. This foam material has the advantage of having heat and acous-

tic insulating properties and moreover of being cheap. In the panel there is provided, on at least one longitudinal side, a surface relief composed of recesses 3 provided on regular distances from one another. The fact that the recesses are provided on regular distances from one another is advantageous for reasons of manufacture and also in view of the adhesion of the concrete to the panel. However, it will be clear that the recesses may also be provided on irregular distances from one another.

The recesses 3 extend over the total height of the plate and become in essence wider the deeper they are in the foam material. Preferably, the recesses show hereto a dovetail profile. The recesses have for example a large base of 5 cm, a small base of 3.5 cm and a height of 1.5 cm. The distance between two successive recesses is for example 4.5 cm.

Other profiles such as for example a T-shaped or stepwise profile are also possible. Thanks to the use of a profile which becomes in essence wider the greater the depth in the foam material, the concrete which is sprayed during the construction against the panel can penetrate into the recess. Since the base situated in the panel is wider than the small base situated on the surface of the panel, the concrete is locked into the recesses resulting in a good adhesion of the concrete to the panel.

In order to permit the building panels according to the invention to be assembled, attachment elements 4, 5 are provided. For a building panel having for example a length of 1080 mm, two attachment elements 4, 5 are each fitted into a recess. The attachment element shows hereto a geometric profile which corresponds to the one of the recess. Hence, for a recess with a dovetail profile, the attachment element has a gutter-shaped profile as shown in figures 1 and 6. The open side is provided in such a manner that when the attachment element is fitted into the plate, this open side is situated on the side of the outer surface of the plate. In this way, the concrete can also penetrate into the cavity formed by the attachment element. The attachment elements are for example made of steel, preferably stainless steel, or of a rigid synthetic material. Since the profile of the attachment element corresponds to the one of the recess, it fits also well in the recess whilst no stresses can arise in the plate for example as a result of thermal deformations.

Onto the attachment elements 4, 5 there is provided a grid 6. The grid is preferably welded onto the attachment elements. The grid forms a reinforcement for the concrete which is to be provided and is preferably made of steel wire. The thickness of the steel wire depends for example on the load which will be exerted in use onto the building element. Due to the fact that this grid 6 is connected to the attachment elements and the attachment elements are connected to the plate, the grid, attachment elements and the

plate form a relatively light weight unit which is easy to transport and to install.

When both the attachment element 4 and the grid 6 are made of steel, the grid is welded onto the attachment element, for example through electrical welding. In order to obtain a well defined contact surface for welding, an elevation 15 is preferably provided onto each of the longitudinal rims 16 of the attachment element 4. This elevation is provided by a folding operation during the manufacture of the attachment element. The elevation is provided substantially in the middle of the longitudinal rim 16, as shown in figure 6. However, it is also possible to provide the elevation for example on a side edge of the longitudinal rim. The presence of the elevation enables a pure connection for the electrical welding. The grid is welded onto the elevation itself.

In the embodiment shown in figure 1, the building panel is provided only onto one side with recesses, attachment elements and a grid. Such a building panel is suited for outer walls on the ground-floor or further upper floors as well as for the roof construction.

In the embodiment shown in figure 2, the building panel is provided on both longitudinal sides with recesses 3 as well as with further attachment elements 7, 8 and a further grid 9 which are disposed on the panel, on the opposite side of the grid 6. The further grid 9 and the further attachment elements 7, 8 are respectively analogous to the grid 6 and the attachment elements 4, 5. The building panel as shown in figure 2 is for example used for the construction of a cellar wall wherein concrete is sprayed on both sides of the building panel.

The connection between the attachment elements 4, 5 and 7, 8 onto which the grids 6 and 9 are respectively provided and the plate 2 is effected by means of attachment members, an embodiment of which is shown in figures 3 and 4. The attachment member comprises a plug 12 wherein a peg 14 is to be inserted. The plug 12 comprises a disk-shaped head 13 and is provided with a toothed extremity 11 wherein a groove 10 is made. The plug functions according to a principle which is analogous to the one of the known plastic wall plug. For putting in the plug, a boring is made through the plate and the attachment element. This boring is preferably made after having put the attachment element in the recess so that the boring through the plate coincides automatically with the boring through the attachment element. The plug is inserted in such a manner that the head 13 engages the plate while the toothed extremity 11 projects out of the open side of the attachment element, as shown in figure 5. Locking the plug 12 in the attachment element is effected by means of the peg 14. By inserting the peg into the plug, the portions of the toothed extremity are caused to go apart whereby the plug gets stuck in the attachment element so as to connect this latter element with the

plate. In another embodiment, the toothed extremity is fixed into the plate.

The peg 14 and the plug 12 are preferably made of synthetic material or of another thermally badly conductive material, in order to reduce the heat conduction to a minimum. Since plug and peg are made of synthetic material, the heat conduction from the attachment element 4 via the plug 12 and the peg 14 towards the outside is bad.

In order to achieve a good connection between two successive building panels according to the invention, further profiles 34, 35 are provided onto the side walls of the building panels 1. Preferably, use is made of a stepwise profile having complementary notches 34 and 35.

Figure 7 illustrates a building constructed by making use of building panels according to the invention. The illustrated building comprises both a cellar and an upper floor. For the ground-floor and the upper floors use is made of building panels which are provided on one longitudinal side, in this example the side disposed on the inner side of the wall, with a grid 6. For the ceilings use is also made of building panels which are provided on one side with a grid. The building panel 1 for the upright wall is fixed onto upright beams 17 made for example of steel or concrete. On these beams, there is provided a first clamping profile 18 while a second clamping profile 19 (figure 8) is provided on the attachment elements 4, 5. The first and second clamping profiles are fixed for example by means of screws. The building panel provided in this way with second clamping profiles is hung up through these second clamping profiles in the first clamping profiles. Preferably the first and second profiles are further secured to one another, for example by means of screws, in order to ensure a rigid anchoring of the building panel to the upright beams.

The first clamping profile 18 has a substantially C-shaped profile, the open side of which being mounted against the beam 17. The C-shaped profile offers a great strength due to its geometry. The second clamping profile 19 is substantially Z-shaped, as shown in figure 8. The portion 20 of the second clamping profile 19 is fixed onto the bottom 21 of the gutter-shaped profile of the attachment element 4 (figure 6). When hanging the building panel up, the portion 22 is going to rest partially onto the first clamping profile 18 while the portion 23 engages the open side of the C-shaped profile.

Thanks to the use of these clamping profiles, the building panels can be hung up easily, in the case of upright walls, through their Z-shaped profile to the C-shaped relief. Also for the construction of a ceiling, use is made of C- and Z-shaped profiles for connecting the building panel to the supporting beams. Since the building panels are further hung up, it is sufficient that care is taken only when erecting the beams 17 that these beams are accurately aligned to obtain a

straight wall. When the beams 17 are accurately aligned, the first clamping profiles 18 which are fixed thereto will also be aligned and therefore also the building panels attached thereto. Aligning the wall is therefore restricted to an alignment of the beams 17.

After having mounted the building panels, concrete is sprayed under pressure subsequently on those longitudinal side or sides where the grid 6 (and 9) is located. In this way, for a cellar wall 24 concrete is sprayed on both sides whereas for a wall of the ground-floor 25 or of an upper floor, concrete is sprayed on the inner side of the wall. For the roof construction 26, use can also be made of building panels according to the invention, the grid being disposed on the inner side of the roof construction. When concrete is sprayed onto only one longitudinal side of the building panel, a plaster 27, for example of gypsum, is applied on the other side.

Figure 9 shows an example of a device destined for manufacturing a building panel according to the invention. A plate 28, made for example of styropore, is brought to a surface relief cutting section 29. In this section, the surface relief 3 is cut out in the plate by means of a cutting member. The grid 6 (or 9) is welded in a welding section 30 onto the attachment element 4,5 (or 7, 8). Then, both the plate and the grid provided with attachment elements are brought to an assembly section 31 to connect both with one another. The assembly section comprises preferably a drill device 33 provided for drilling holes through the attachment element and the plate. The assembly section comprises further an attachment member insertion means for inserting the plugs 12 and pegs 14 in said holes so as to obtain a building panel 1 according to the invention. The drill device 33 and the attachment member insertion means are preferably disposed on a same axis. In this way, the insertion means 32 does not have to be positioned separately. Besides drilling in the plate, it is possible to use predrilled attachment elements and to shoot or push the plug and the peg into the plate.

Claims

1. A building panel comprising a plate made of insulating foam material wherein, on at least one longitudinal side, a surface relief is provided which is composed of elongated recesses which become in essence wider the deeper they are in the foam material, attachment elements being fitted in said recesses on predetermined distances from one another, and a grid being applied onto these attachment elements, characterized in that said attachment elements have a substantially gutter-shaped profile which extends into said recess, with borings being made in said attachment elements and extending further through said plate,

and attachment members being inserted in these borings connecting the attachment element to the plate.

2. A building panel according to claim 1, characterized in that the building panel is provided with first suspension means which are mounted onto said attachment element and which have a substantially hook-shaped profile. 5
3. A building panel according to claim 1 or 2, characterized in that said attachment member is made of synthetic material and comprises a plug and a peg which can be locked therein. 10
4. A building panel according to claim 1, 2 or 3, characterized in that said attachment element is provided with longitudinal rims on which an elevation is provided, with said grid being welded onto said elevation. 15 20
5. An assembly comprising a building panel according to claim 2 and a frame structure, characterized in that said frame structure comprises first and second beams which are respectively destined for forming upright and transverse beams of said frame structure, said second beams being provided for cooperating with said first suspension means. 25 30
6. An assembly according to claim 5, characterized in that said first and second beams have a substantially C-shaped profile.
7. A device for manufacturing a building panel according to any one of the claims 1 to 3, characterized in that it comprises a surface relief cutting section as well as a further section destined for putting said grid onto said attachment profiles, and an assembly section for putting the attachment profile and grid onto the plate, which assembly section comprising a drill device for making a boring in the plate and the attachment element and further an attachment member insertion means disposed on the same axis as the drill device. 35 40 45
8. A building constructed by making use of building panels according to any one of the claims 1 to 4. 50

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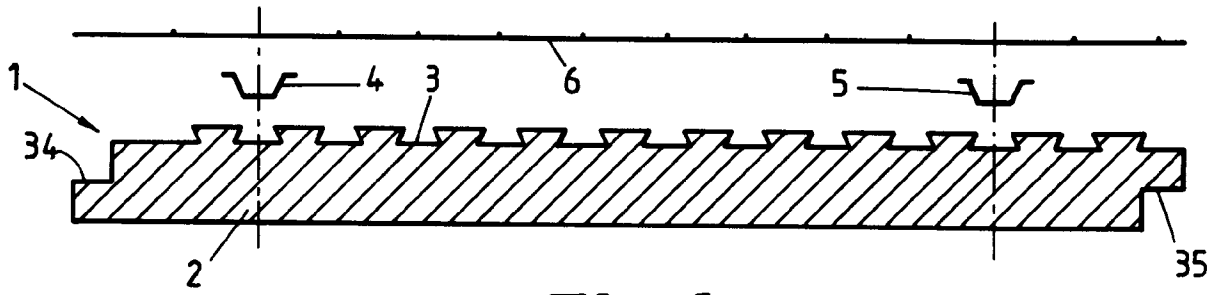


Fig. 1

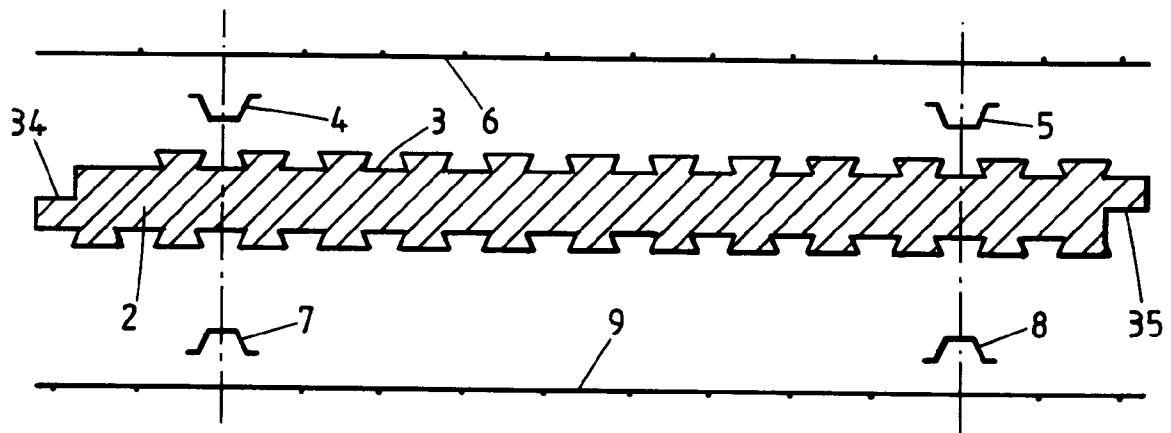


Fig. 2

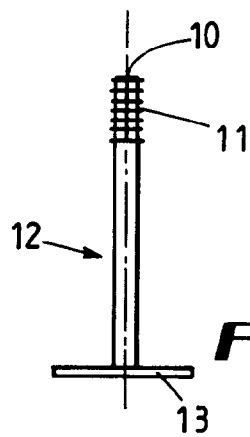


Fig. 3

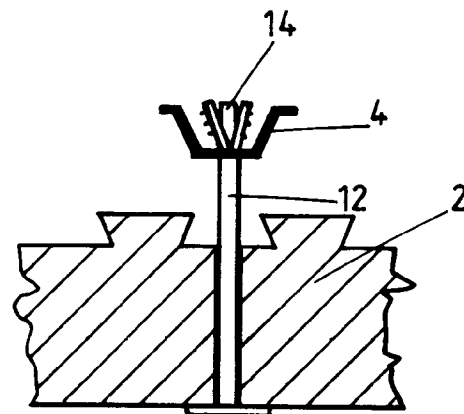


Fig. 5

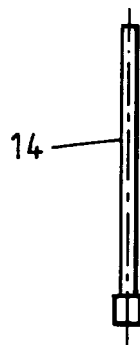
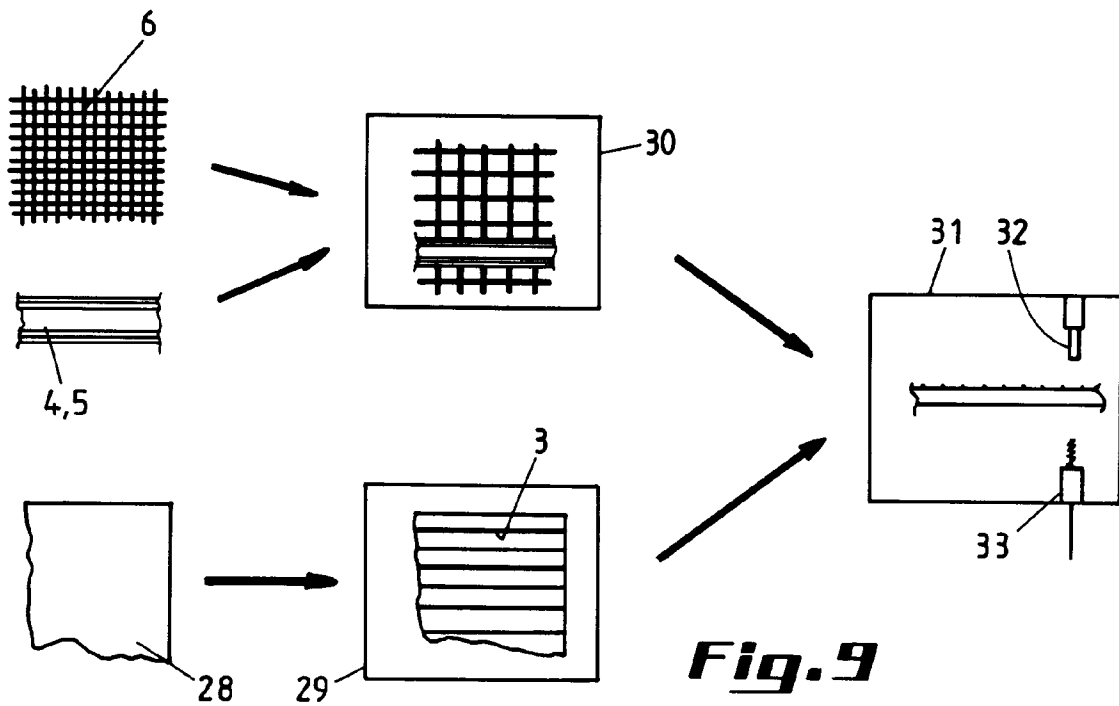
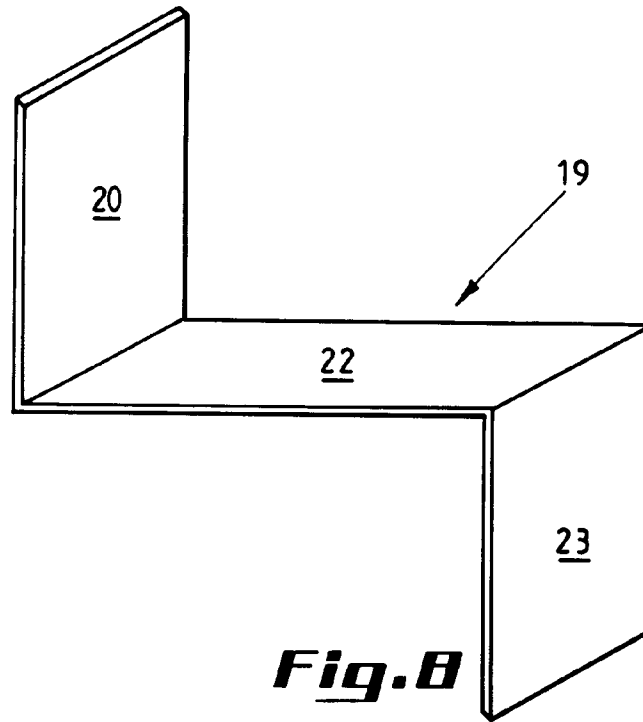
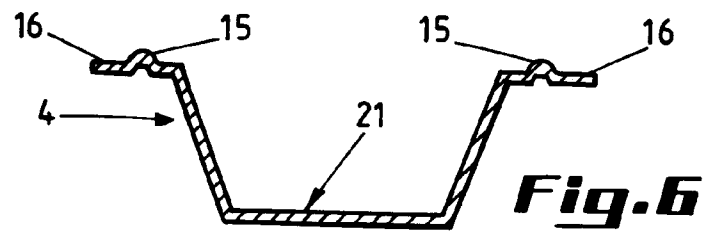


Fig. 4



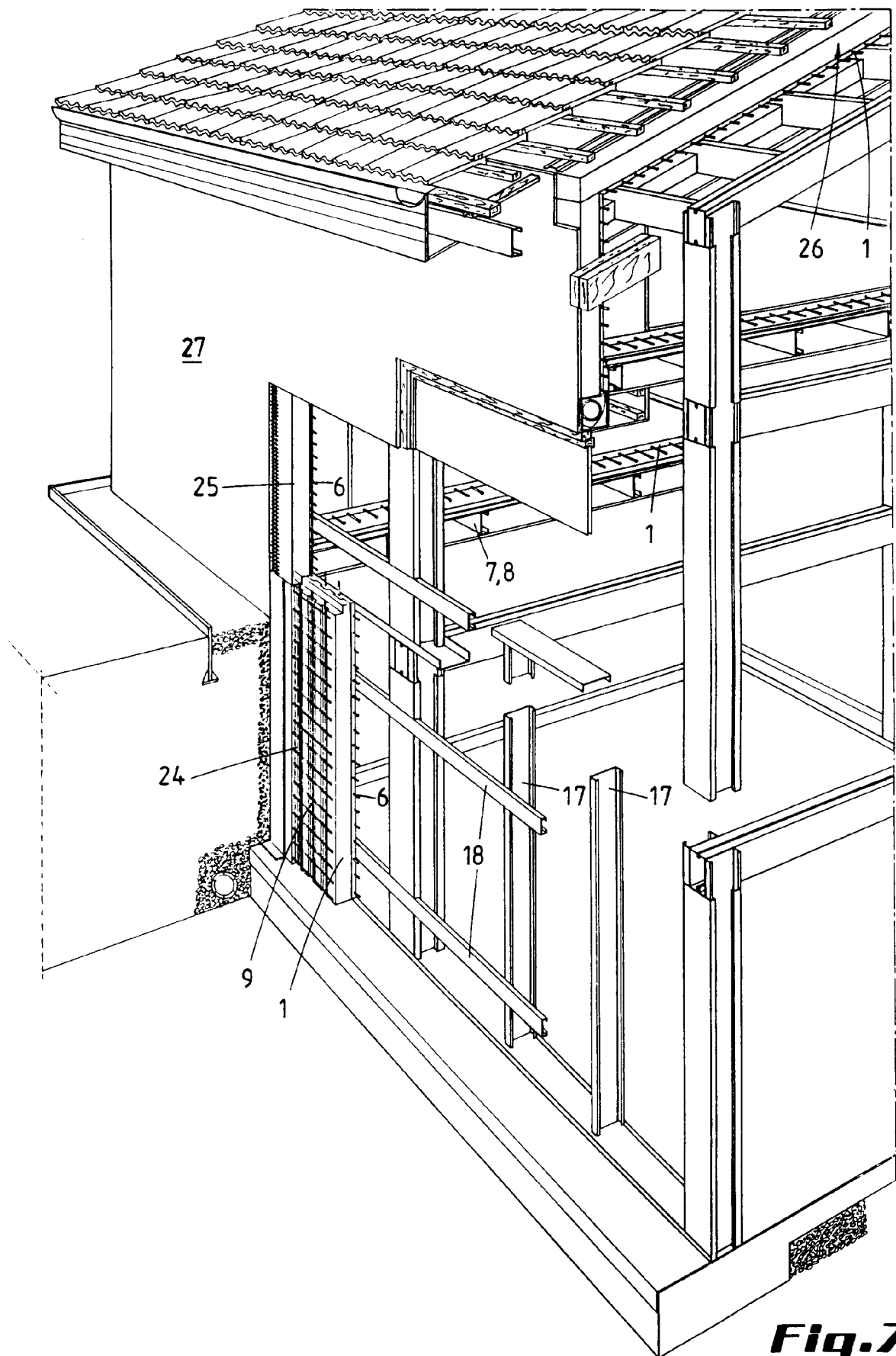


Fig.7



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 93 87 0185

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cls)
D,A	DE-A-25 17 095 (VAN EGTEREN INDUSTRIELE CONSTRUCTIEBETON) * page 3, line 10 - page 5, line 15; claims 1-4,7; figure 1 *	1,7,8	E04C2/26 E04B2/84
A	AU-B-612 849 (MONOLITE S.R.L.) * page 6, line 26 - page 7, line 18; figure 7 * * page 2, line 23 - page 3, line 5 *	7,8	
			TECHNICAL FIELDS SEARCHED (Int.Cls)
			E04C E04B E04H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 7 December 1993	Examiner Mysliwetz, W
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