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(54) Extruded aluminium alloy tubular sections for floors and floor systems and slab structures formed therewith.

(57) The section (10) has a polygonal cross-sectional shape with a substantially flat, parallel base (16) and top surface (26); a first portion (18, 20) of the side walls is substantially vertical and a second portion (12, 24) is slanting; a pair of coupling means (28, 32, 30, 34) protrude from at least one side.

The structure (50, 60) comprises a plurality of sections arranged side by side and made integral with each other along their longitudinal sides by means of lateral hooks (29,31) and fixing means (42). It may or may not be completed with a layer of concrete (62) incorporating a reinforcing wire net (64).

It can be used for residential, infrastructural and industrial buildings, in ship-building etc.

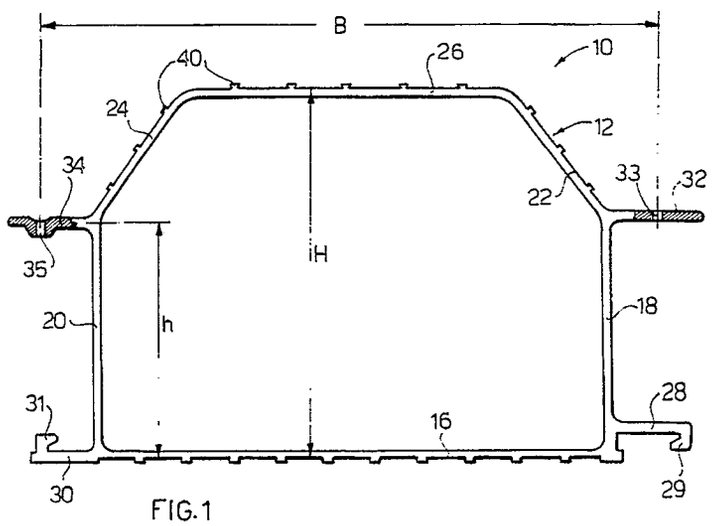

FIG.1

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The present invention refers to the field of load-bearing structures for the building industry.

In the building industry, traditional tile-lintel slabs or floors are generally made by placing lug bricks or tile elements on a frame or lath made of steel or pre-stressed concrete ;oists, by laying special metal reinforcements and then consolidating the whole with a concrete casting.

Obviously the weight of these floors is considerable.

The current trend in this field is towards floors which are equally strong but lighter, so that the structures designed to bear them can be made smaller, both in view of regulations on earthquake-resistance and to allow prefabrication, or in any event to facilitate transportation and handling, thus achieving considerable cost savings.

Fret-shaped corrugated metal sheet is also used, both in the building industry and for ship-building, to form load-bearing or roofing slabs, in combination with concrete reinforced with electrowelded wire net. These structures, however, still have a considerable weight and can be used only to cover fairly limited spans (generally 3-4 meters in the direction of the stiffening rib of the metal).

Extruded light metal box-type elements are also known (GB-A-2 036 150) and comprise a substantially rectangular chamber, the vertical walls of which extend in horizontal flanges. These elements are used to support scaffolding planks; the disclosure also foresees the possibility of joining together two of these box-type elements placing them one on top of the other to increase their strength. However, the teachings of this disclosure cannot be applied to a flat load-bearing structure (floor or floor system) in the building industry.

The aim of this invention is to provide a light extruded element that can be used in the building industry. A further aim is to create a slab, floor or floor system structure for the building industry that is light, easy to handle, meets the requirements of the laws on earthquake-resistance, and can be widely used in both traditional and prefabricated building, in ship-building etc.

The subject of the invention is a tubular section made out of light alloy, particularly aluminium alloy, characterized in that it is substantially polygonal in cross-section, with a substantially flat, parallel bottom and top and sides comprising a substantially vertical lower portion and a slanting upper portion: coupling means extend along at least one side. The invention also includes a slab structure made up of a plurality of sections as described above, placed side by side and made integral with each other along the sides by means of connecting devices. The structure may be completed, if considered necessary depending upon the load it must bear by a casting of concrete reinforced with welded wire net.

The new section can be used to make bearing structures for the building industry; it is easy to handle and to assemble, whether in the factory or on site.

The new structure is strong, light and easy to handle, thus requiring less equipment and less time for assembly and installation with a reduction in the final cost; it complies with earthquake-resistance standards; it is suitable for covering much wider spans than those that can be covered with corrugated metal sheet structures and it can bear greater loads.

The invention can be used in traditional or prefabricated building, for residential, infrastructural and industrial buildings, and in ship-building. The underside can be left on view or it can easily be finished by applying a layer of flameproof material, or else it can be painted after installation.

A further advantage is that the scrap material of the sections can be reused. Moreover, the section is economical to produce. Yet another advantage of these slabs or structures lies in the fact that electrical cables, plumbing or air conditioning pipes can be accomodated inside the sections.

Embodiments of the invention will now be described only by way of unrestrictive example with reference to the attached drawings, in which:

Fig. 1 is a vertical cross-sectional view through an element or section according to the invention, the cross-section being taken on a plane at right angles to the longitudinal axis of the element;

Fig. 2 is a broken away isometric view of the element;

Fig. 3 is a vertical sectional view through a slab structure, shown broken away and on a reduced scale;

Fig. 4 is a detail of the lower coupling for the sections, as shown in fig. 3;

Fig. 5 is a bottom view with respect to fig. 4;

Fig. 6 is a cross-sectional view through another type of slab structure;

Fig. 7 is a sectional view along the line 7-7 in Fig. 6, enlarged compared with the preceding figure.

A tubular element or section according to this invention is designated as a whole by the reference number 10. It is generally a light alloy extrusion, in particular aluminium alloy. It comprises a tubular body part 12, the cross-sectional shape of which is an irregular hexagon with rounded corners; a substantially rectangular lower part of it is defined by a preferably flat base 16 and by substantially vertical sides 18 and 20; a tapered upper part is defined by slanting sides 22, 24 and a substantially horizontal top 26.

Extending outwards from the sides 18, 20, or at least from one of them, are connecting means,

preferably consisting of bottom tongues or flanges, indicated respectively by references 28 and 30, and top tongues or flanges, indicated respectively by 32 and 34. The bottom flanges are staggered in height and hook-shaped; the hooks 29, 31 face and match each other.

The top flanges extend from the sides of the section, each substantially at the angle between the sides 22, 18 and 20, 24, respectively; they are generally staggered in height by a distance equivalent to approximately the thickness of one of them, and can have one or more holes 33, 35 in corresponding positions, to receive fixing means. The axes of the holes are indicated with dashed and dotted lines. Alternatively, the holes can be made after installation. The flange 34 preferably has a thickening around the hole.

The lower surface of the base 16 of element 10 can be smooth or it can have longitudial ridges.

The upper surface of the sides 22, 24, 26 preferably has longitudinal ribs 40.

The total height of the section (measured between the outer surfaces of the section) is H, whereas h is the height of the lower of the two top flanges. B is the center to center distance between the holes 33 and 35 (nominal width of the extruded section).

According to the invention we preferably have:

$H<B<1.7\ H$

$H/3<h<H$

It should be noted that although the sides or walls 18, 20 have been described as vertical, they could also be slightly off the vertical axis for example they could be convergent or divergent, or lastly they could curve slightly inwards or outwards.

The element 10 described is designed to be used to form slab structures for floors or floor systems or the like, as illustrated for example in figures 3 and 6. More particularly, figure 3 shows a slab structure 50 consisting only of sections and figure 6 shows a structure 60 with a concrete slab and electrowelded net reinforcement.

In these structures, a plurality of sections 10 are disposed side by side with the flanges 28, 30 and 32, 34 respectively of adjacent sections disposed one on top of the other, so that the axes of the holes 33, 35 in the flanges coincide. The hooked heads 31 and 29 of the bottom flanges engage each other. The longitudinal channel thus formed between the bottom flanges 28, 30 accommodates an eccentric locking device 42 (Figs. 4 and 5) which is inserted with its longitudinal axis aligned with the longitudinal axis of the channel C (dash-line position in fig. 5) and then turned until it is in the full-line position in the same figure. The sections are thus locked together. The channel C formed when the flanges 29, 28 are placed together, where it is not engaged by the eccentric locking devices 42, can be used to attach tie-rods and/or supports for false ceilings or the like.

The top flanges 32, 34 of adjacent elements are superimposed and are joined together by self-threading screws or the like. Assembly can take place on site or at the factory.

The slab structure 50 thus obtained is strong, light and self-bearing.

Figure 6 shows a second embodiment of the slab structure, indicated by 60, which comprises a layer of concrete 62 reinforced with welded wire net 64. The concrete is made to cooperate structurally with the elements 10, and more precisely with the surfaces of the walls 22, 24, 26 by means of connector plates or gussets 66 which are fixed to the top flanges to transmit shearing stress. The connection plates 66 may be C-shaped or Z-shaped or of any other suitable shape for transmitting or transferring shearing stress between two materials.

The underneath of the structure may be left on view or it can easily be finished by applying a mat of per se known flameproof material (not illustrated), glued or applied by means of hooking system that can be applied by means of the channels C.

The slabs obtained can be used to cover spans measuring L, linked to the height H of the section by the relation

$L/50<H(</15.$

Claims

1 An extruded tubular element (10) made of aluminium alloy, characterized in that it has a body (12) and longitudinal tongues or flanges (28, 30, 32, 34) extending along at least one side of the body, the body having a polygonal cross-sectional shape with a substantially flat base (16), substantially vertical first walls (18, 20) and slanting second walls (22, 24), and a substantially horizontal top wall (26).

2. An element according to claim 1, characterized in that the bottom flanges (28, 30) extend approximately from the base and the top flanges substantially from the respective areas where the vertical and slanting walls meet.

3. An element according to claim 1, characterized in that the ends of the bottom flanges (28, 30) comprise matching hook shapes (29, 31).

4. A section according to claim 1, characterized in that the top flanges (32, 34) are staggered in height and can be made with holes (33, 35) to accommodate the fixing means.

5. An element according to claim 1, characterized in that:

$H/3<h<H$

wherein H is the total height of the element and h

is the height of the base of the lower flange (34) of the two top flanges.

6. An element according to claim 4, characterized in that:

$H<B<1.7\ H$

wherein B is the center to center distance between the holes (33, 35) on the flanges, H is the overall height of the element.

7. A load bearing slab structure characterized in that it comprises a plurality of extruded aluminium alloy tubular elements (10) set side by side and made integral with each other along their sides.

8. A structure according to claim 7, characterized in that it also comprises a layer of concrete (42) cast over the tubular elements (12) and reinforced with welded steel net (44).

9. A structure according to claim 7, in which said elements are as stated in the preceding claims 1-6, characterized in that:

$L/50<H<L/15$

where Z is the span of the structure and H is the height of the element.

10. A structuire according to claim 9, characterized in that connection plates or gussets (66) are placed over the superimposed flanges (32, 34) of the elements and spaced longitudinally to make the structure integral with a layer of concrete cast over it.

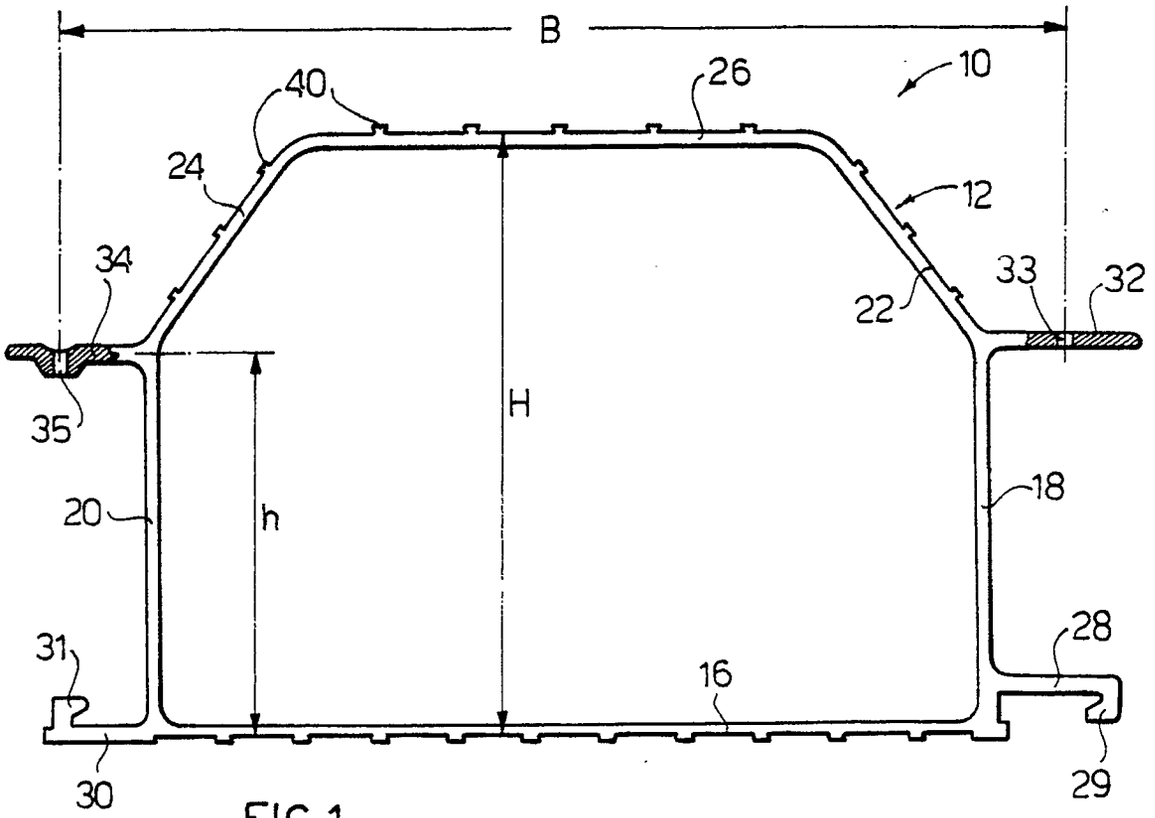

B
10
40
26
24
12
34
33
32
22
35
H
h
20
18
31
28
16
30
29

FIG.1

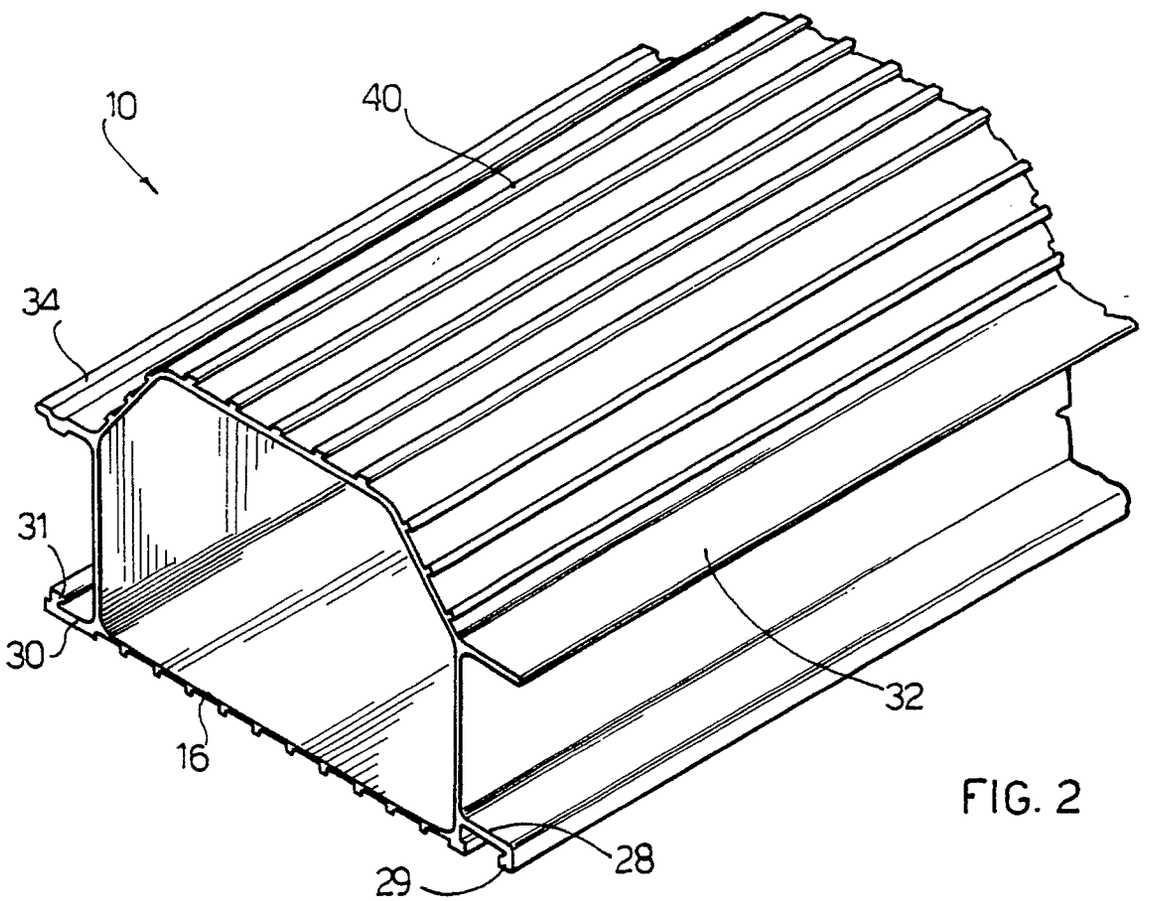

10
40
34
31
30
16
32
28
29

FIG. 2

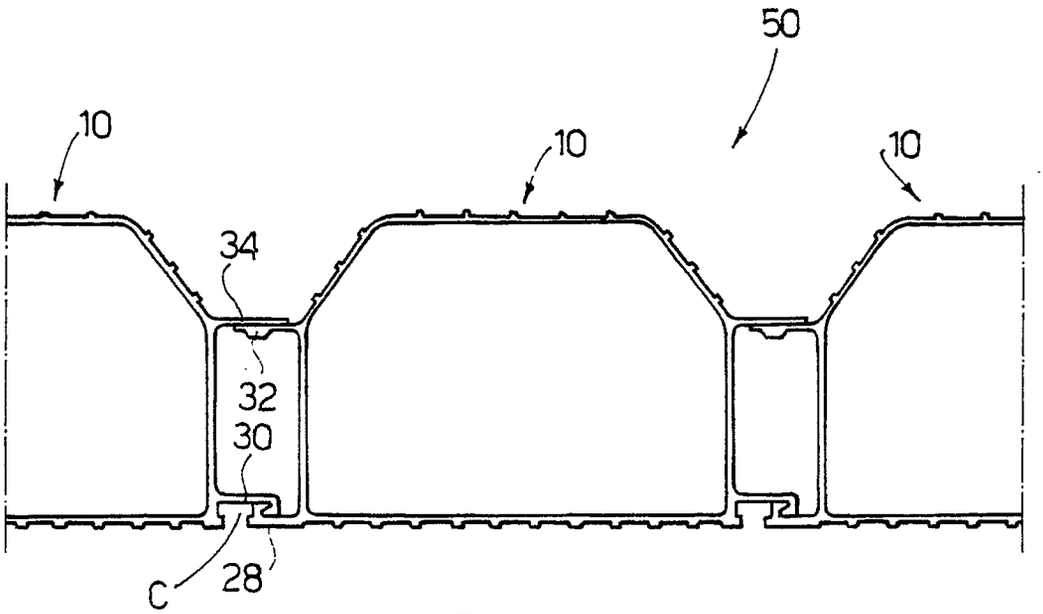


FIG. 3

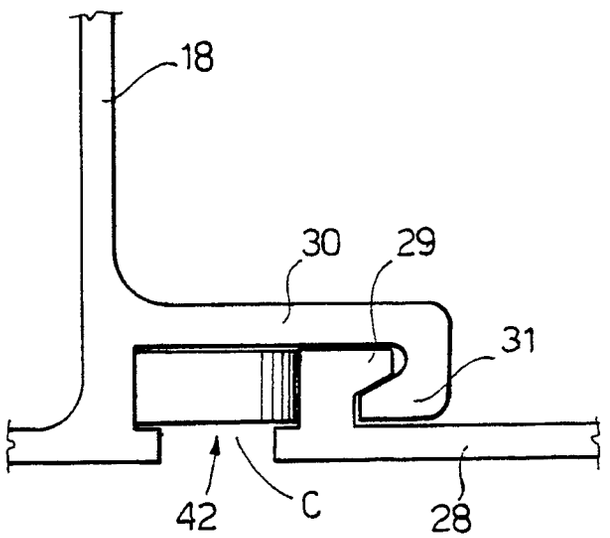
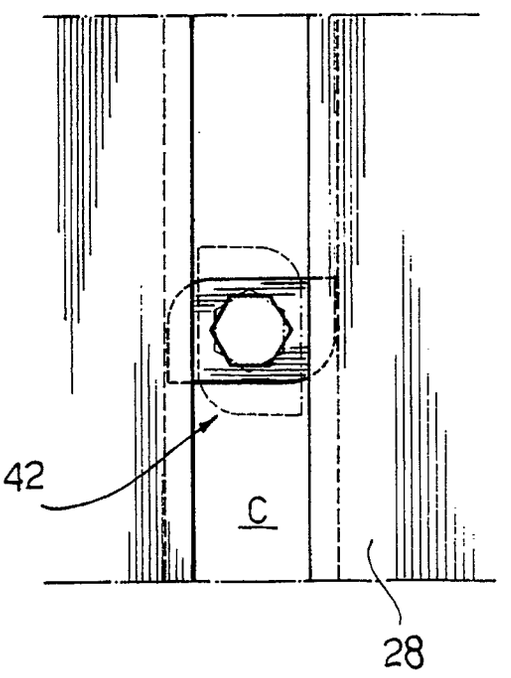


FIG. 4

FIG. 5



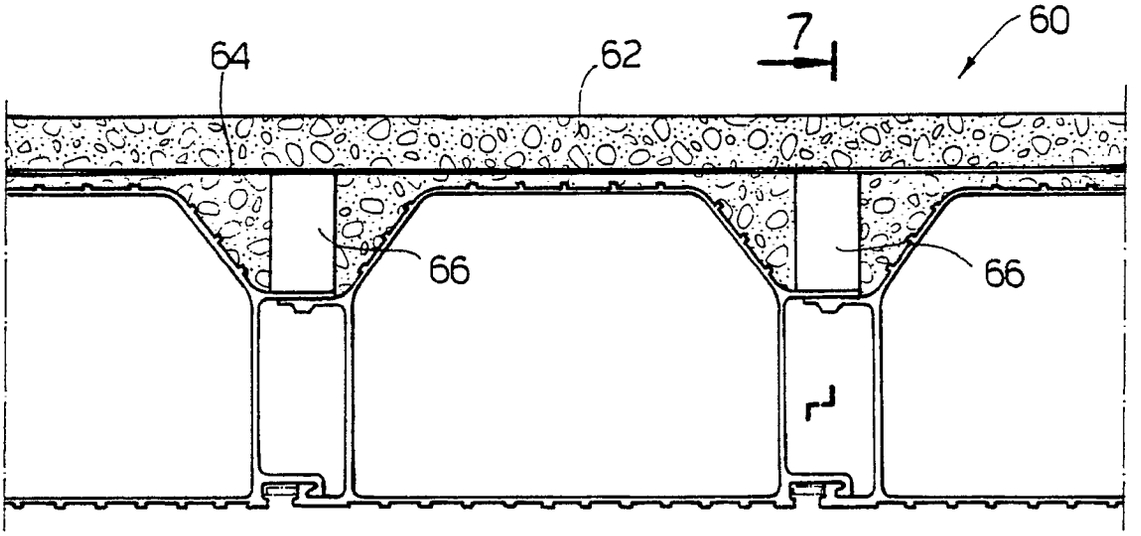


FIG. 6

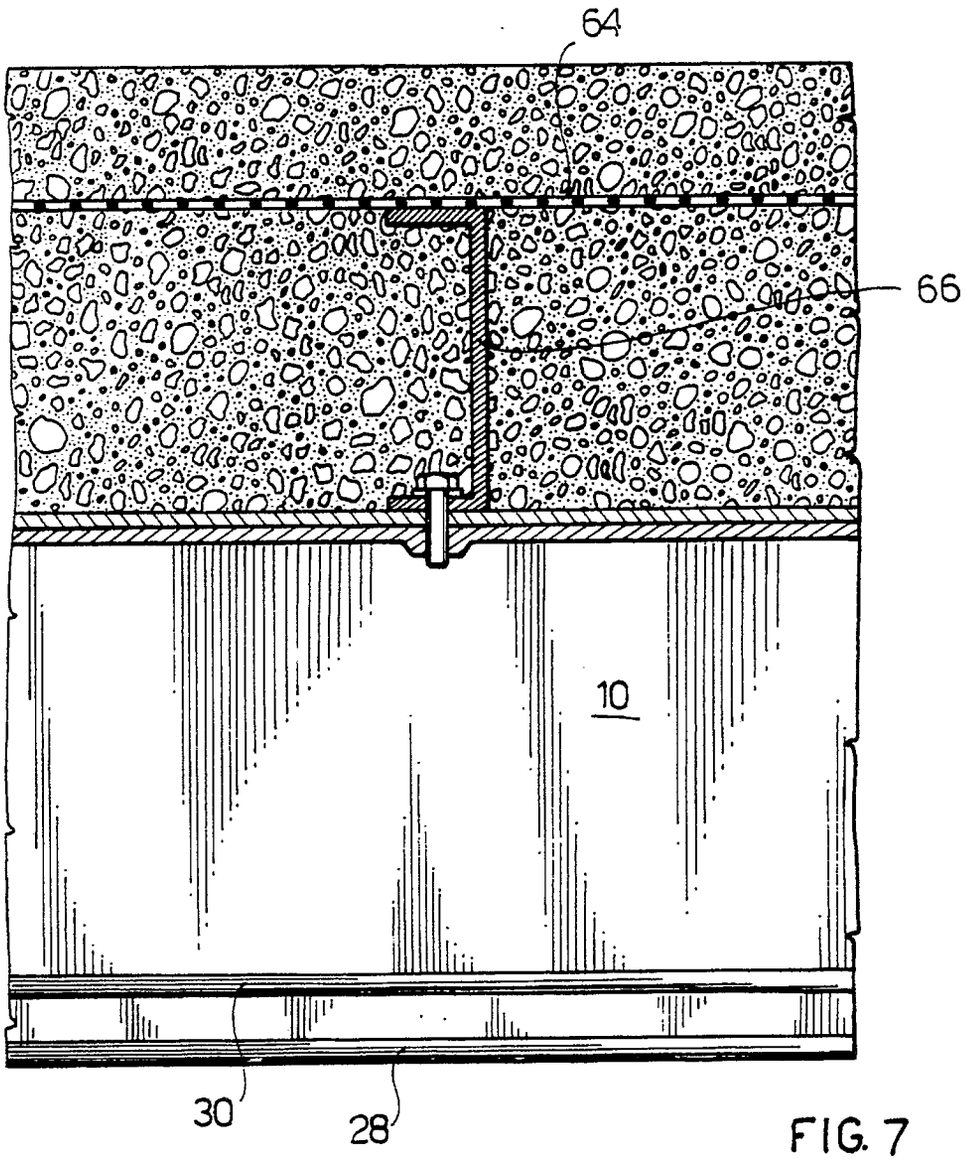


FIG. 7

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EUROPEAN SEARCH REPORT

Application Number

EP 90 12 1375

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X,Y	BE-A-9 028 71 (F. STERNOTTE) * page 4, line 34 - page 5, line 14 * * page 5, line 35 - page 6, line 7; figures 1-3 *	1,2,3,4,7, 8	E 04 C 3/06 E 04 B 5/40
A	DE-A-2 945 358 (M. WIEDERMANN) * page 1, paragraph 1 * * page 5, paragraph 7 - page 6, line 5; figures 1-3 *	1,2	
Y	DE-A-2 552 622 (MESSERSCHMIT-BÖLKOW-BLOHM) * page 6, paragraph 1; figures 1, 2 *	3,7	
Y	FR-A-2 520 483 (MAC GREGOR) * page 7, line 17 - page 8, line 8; figure 3 *	4,7	
Y	US-A-3 093 933 (T. SLINGLUFF) * column 1, lines 12 - 19 * * column 2, lines 20 - 23; figure 1 *	7,8	
A	DE-A-2 600 662 (WESTEEL-ROSCO) * page 8, paragraph 6 - page 11, paragraph 1; figures 1-3 *	7,8,10	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

E 04 C
E 04 B

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	28 January 91	KRIEKOUKIS S.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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