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(54) Thermal and fire resistant barrier

(57) A thermal insulating wall and joint for use with cold rooms providing fire resistance. The individual panels comprise slabs of infected polyurethane foam (10,12) as thermal insulation faced with cast foamed

magnesium oxychloride panels (16,18) clad with sheet metal (20,22,24). Straightline paths between adjacent abutted panels are avoided by infills of high density mineral board and intumescent fillers (34).

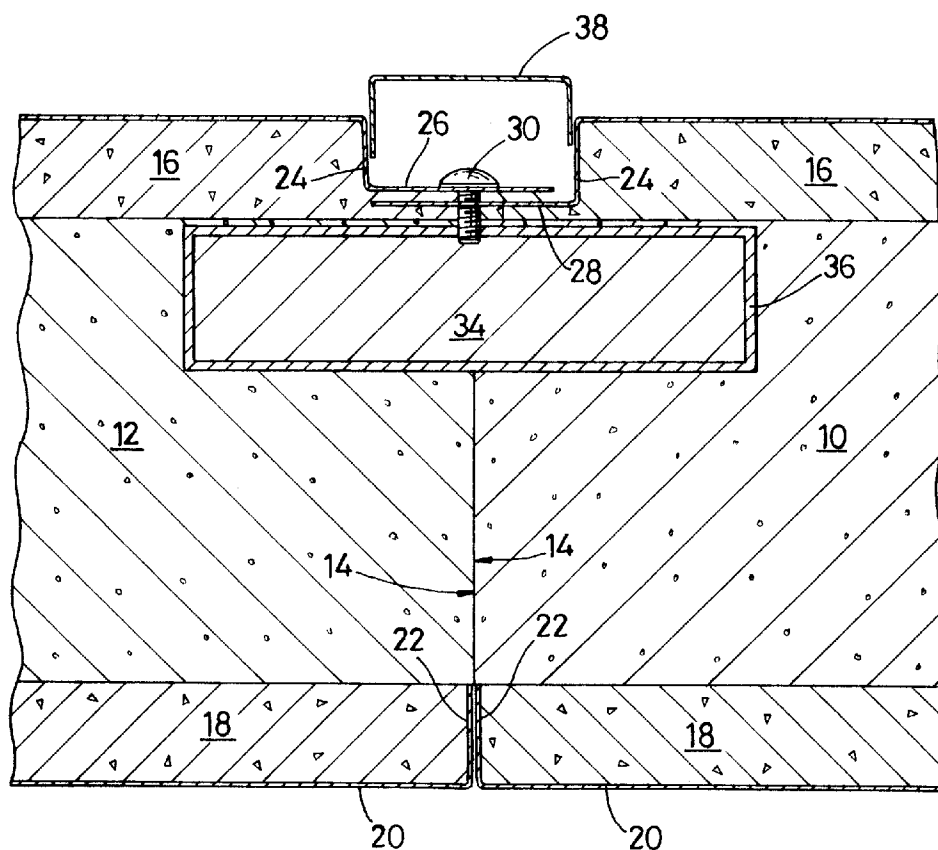


Fig.1

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Description

The regulations applicable to the construction of cold-stores for foods do not call for fire resistance, perhaps because of the supposed unlikelihood of fire occurring, and/or because employees spend only minimal time in such stores. However, the possibility of a fire from an electric fault, coupled with the flammability of certain food stuffs e.g. those having a high fat content render fire protection desirable. The conventional construction method for mere thermo-insulation relies upon panels of insulant with only minor structural strength to extend as cladding over a skeleton framework and provide at least the walls of the store. The panels abut edge-to-edge.

Where food manufacture is carried out, so that the occupancy factor is higher, there is or may be at least similar thermo-insulation requirements, and fire resistance may be a legal requirements at least for a certain time, for example 30 minutes. It is found that the conventional panels, even when provided with a reinforcing panel notionally having a suitable fire resistance do not in fact meet the requirements when tested to destruction.

The object of the invention is to resolve this problem.

According to the invention a thermally insulating and fire resistant barrier panel comprises a slab of polyurethane foam or like thermal insulation and a sheet metal layer, with a layer of mineral insulation comprising a cast foamed magnesium oxychloride material sandwiched between the thermal insulation and the sheet metal.

Also according to the invention a thermally insulating and fire resistant barrier comprises a series of panels having tongue and groove or like connections or otherwise arranged at adjacent and abutted edges so that there is no straightline path through the joint between the panels from one to the other face.

Various embodiments of the invention are now more particularly described with reference to the accompanying drawings wherein:-

FIGURE 1 is a section through a joint between a pair of panels forming a barrier, part-assembled;

FIGURE 2 shows a modification;

FIGURE 3 shows a different form of joint structure between adjacent panels;

FIGURE 4 is an alternative joint;

FIGURE 5 is a fragmentary sectional plan view showing construction of a cold room using panels of the invention; and

FIGURE 6 is a sectional plan view showing a fire

door constructed according to the invention.

Turning first to Figure 1, this shows adjacent edges of a pair of panels each comprising a slab of CFC free polyurethane foam, the two slabs having the reference numbers 10, 12 respectively. In this instance the slabs have edges 14 which are substantially perpendicular to the faces of the slabs, that is to say they are not tongue and grooved, but both have substantial recesses extending along their length as explained hereunder. However, if desired they could have complementary edge formations as shown in Figure 5.

Each slab may be of the order of 70mm thickness.

Each slab is faced on both faces with magnesium oxychloride applied by casting this material in a saline solution with a foaming agent and a curing agent and with perlite inert filler material, so that when cured this creates a generally cellular low density mineral board typically of the order of 15mm thick, which is a thickness capable of giving 1 hour fire protection. The mineral material is shown by the references 16, 18 on the respective faces of the slab.

Each panel is completely by a layer of steel which typically may be 0.55 mm thick and of 'food safe' sheet grade, that is to say provided on its outer surface when assembled to the panel with a polyvinyl chloride or other appropriate plastics layer. The sheet steel on one face enclosing the mineral boards 18 bears the reference numeral 20 and these sheets have inturned end edges 22 substantially containing the thickness of the mineral material. At the opposite face the sheet metal is joggled to provide spaced inturned portions 24 and flanges 26, 28 which are overlapped, so that a fixing screw 30 can be engaged through the overlapped portions to hold the panels together. Both faces may be so overlapped and fixed although the drawing shows only one face so arranged. The overlapping is one way of preventing the existence of a straightline path through the joint. The tongue and groove or like is another way.

The slabs 10 and 12 are recessed adjacent one another as mentioned earlier, the joggled portions to create a cavity extending along the length of the edges which abut, to receive a mineral board strip 34 which extends across the joint and substantially fills the recess. A relatively thin space about the board is filled with a fire-resistant mastic material and preferably one which is intumescent, indicated in Figure 1 by the reference numeral 36.

The channel defined between the joggled edges is by an (in the drawing inverted) U shaped strip 38 of the food safe steel which may be a push fit, and a further filling of intumescent material or a further strip of mineral board substantially fills the cavity defined between the parts 24, 26, 28 and 38. The mineral board filler (not shown in Figure 1) in that cavity like the mineral board filler 34 may be magnesium oxychloride, but in cases high density material, that is to say not made with a foaming agent and possibly without any inert filler.

It will be seen that the boards also span the joint and further ensure that there is no straightline path for flame between the panels. In the event of fire resulting in erosion which might progressively destroy the polyurethane foam at the faces 14, the intumescent strip 36 and the high density mineral component act to provide greater resistance to the flame to prevent it penetrating from one side of the barrier to the other.

Figure 2 shows the mentioned modification where the channel formed between the adjacent sheet metal faces is filled with the mineral board strip, although in this case the flanges 40 corresponding to the ones 24 in Figure 1 have a slight shaping along their length as do the side limbs 42 of the channel member, so that this may be a snap-fit.

Figure 3 shows a modified joint between a pair of ceiling panels each of which is generally similar to the panel of Figure 1 except that each panel is edged with a mineral board similar to the board 34 of Figure 1 and this is indicated by the reference numeral 44.

At this point it may be convenient to discuss methods of manufacture of the panels. The preferred method is to locate the core slab 10 in a mould in spaced relation to the pair of sheet metal panels 20, 21 and cast the foamed mineral material 16, 18 to fill the spaces. In the case of Figure 3, the boards 44 may likewise be located within the mould so as to further define the cavities into which the mineral material is cast.

The curing period recommended for boards of this kind is six hours oven curing plus a minimum of 14 days air curing.

In Figure 3 the two panels are joined together by a sheet steel coupling member having co-planar limbs 56 extending away from the edges of a channel section 48 and as seen in the Figure said co-planar limbs 46 are in face to face contact with the adjacent panels. This arrangement of Figure 3 is primarily intended as a suspended ceiling for a cold room where a screwed stud 50 depends into a space between the panels, and extends through the channel 48 being fixed thereto by a pair of nuts 54 one on each side of the base of the channel. The space between the two panels surrounding the stud and substantially filling the channel section may be packed with mineral wool thermal and fire resistant insulating material. The wool is kept in place and the joint further improved by a further board of high density mineral material 56.

Turning now to Figure 4, this shows a modified joint similar to Figure 1 but in this case a pair of panels generally similar to those in Figure 1 are secured together by a tie-bolt 60 extending through the thickness of the panel instead of being a short screw extending merely through the overlapped flanges as in Figure 1. The end of the bolt where it is secured to nut 62 is enclosed by a mineral board 64 held in place by a sheet metal pressing 66 shown partly assembled in the figure.

Figure 5 shows a fragmentary plan view of a cold room made of panels generally similar to those dis-

cussed in herein, but without showing any of the joints between adjacent panels except at corners of the room. In this case the panels are shown with tongue and groove connections between the polyurethane foam core slabs these joints being indicated by the reference numerals 70. An angle section folding of the facing sheet metal material 72 is located in each corner to cover the joint and a board typically of the order of 12 mm thickness and made of the high density mineral material indicated by the reference numeral 74 is located outside each joint to extend across the abutted edges of the panels. Intumescent material 76 is sandwiched between the mating faces of the foamed mineral material e.g. by mastic injection.

Figure 6 shows a typical door construction. The door is hinged adjacent one edge 80 and sealed at the opposite edge 82. Intumescent material 84 is trapped as a gasket between the door and the outer face of the wall around the perimeter of the door. The door panel comprises inner face 86 of the food safe sheet metal, a core slab 88 of the CFC polyurethane foam, an outer layer 90 of the foamed mineral material 80 and a further sheet metal layer 92 on the outer face of the door. The door may comprise a wooden frame 94 at a location where it does not provide a flammable bridge between interior and exterior.

In all cases the adjacent panels are most desirably mechanically coupled together by members embedded in the slabs during manufacture, so as to give structural strength to the barrier. These conventional couplings are not shown in the drawings.

The door frame with which the door is dissociated may be secured to similar panels to those used in the barrier elsewhere or in this relatively small area a heavier denser material (e.g. brickwork) may be used in the interests of structural rigidity.

Panels barriers and doors substantially as described and illustrated herein have been tested e.g. with respect to clause 6 of British Standard BS 476:Part 22: 1987. The door set mentioned provided 62 minutes integrity and insulation performance with respect to this performance. The partition wall assembly e.g. according to Figure 1 and Figure 4 was tested for a 67 minute period at which time tile test was discontinued with no loss of integrity. The tests were performed in the case of panels on 1 metre square sections of the partition panel. The unexposed surface did not exceed the rise allowable within BS 476: Part 20: 1987 during a 95 minutes test duration.

Further tests have been performed on a 100 mm thick partition panel of similar construction to that shown in Figure 1 again using 15 mm thick foamed mineral material of the kind mentioned herein and in this case with an 85 mm thick foam core slab. During a 60 minute fire test there was no penetration of fire or flame through the panel although a temperature rise in excess of 180°C was exceeded on the face of the panel.

Further tests carried out on barriers comprising

jointed panels substantially as shown in the accompanying drawings reveal that during 50 minute test duration flame did not pass through the joint and the surface temperature did not exceed the maximum allowable mean or individual values.

Accordingly, it is believed that the constructions according to the invention are substantially better than the 30 minute fire test requirements of contemporary regulations.

Claims

1. A thermally insulating and fire resistant barrier panel comprising a slab of polyurethane foam or like thermal insulation and a sheet metal layer, with a layer of mineral insulation comprising a cast foamed magnesium oxychloride material sandwiched between the thermal insulation and the sheet metal. 15
2. A thermally insulating and fire resistant barrier comprising a series of panels as claimed in Claim 1 having tongue and groove or like connections at adjacent and abutted edges so that there is no straight-line path between the joint between the panels. 20 25
3. A barrier as claimed in Claim 2 wherein the adjacent panels are mechanically coupled together.
4. A barrier as claimed in Claim 2 wherein intumescent sealing means are provided between adjacent panels. 30
5. A barrier as claimed in any preceding Claim comprising two layers of the mineral insulation sandwiching the slab and two sheet metal layers sandwiching the mineral insulation layers. 35
6. A method of making the barrier panels as claimed in Claim 1 comprising casting a saline solution of the mineral with a foaming agent, a curing agent and an inert filler onto a sheet metal panel before assembly to said slab. 40
7. A method of making a panel as claimed in any of Claims 1 to 5 comprising assembling a slab of the polyurethane foam and the sheet metal in a mould in spaced relation and filling the space therebetween with a saline solution of the mineral material with a foaming agent, a curing agent and an inert filler. 45 50
8. A barrier as claimed in any one Claims 2 to 5 wherein each joint between adjacent panels further comprises a pair of adjacent recesses formed in the respective foam slabs, and a mineral board strip bridging the joint and substantially filling both recesses, spaces between the strip and the recess 55

walls being filled with an intumescent strip.

9. A barrier as claimed in any of Claims 2 to 5 and 8 wherein adjacent edges of two sheet panels are overlapped and secured together, said edges being joggled to provide a recess and a U-section channel of the sheet metal is inserted in said recess to be co-planar with the sheet metal panels adjacent the recesses.
10. Fire resistant panels and barriers substantially as described with reference to the accompanying drawings.

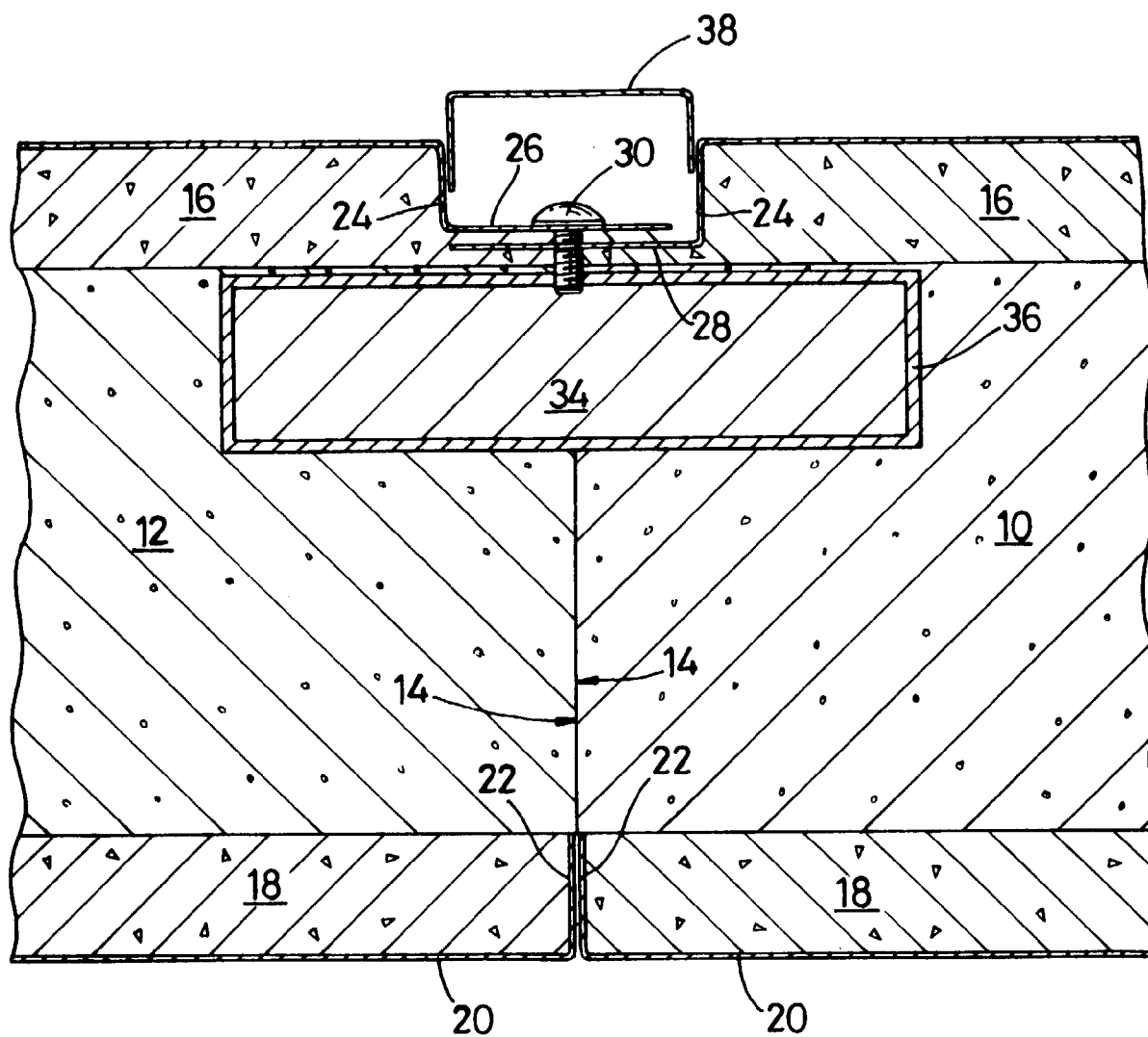


Fig. 1

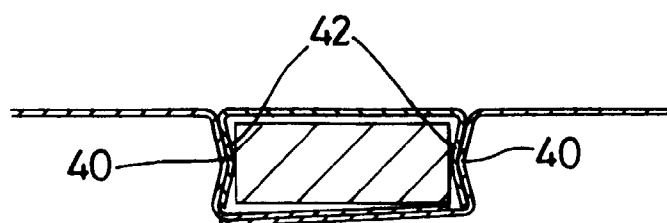


Fig. 2

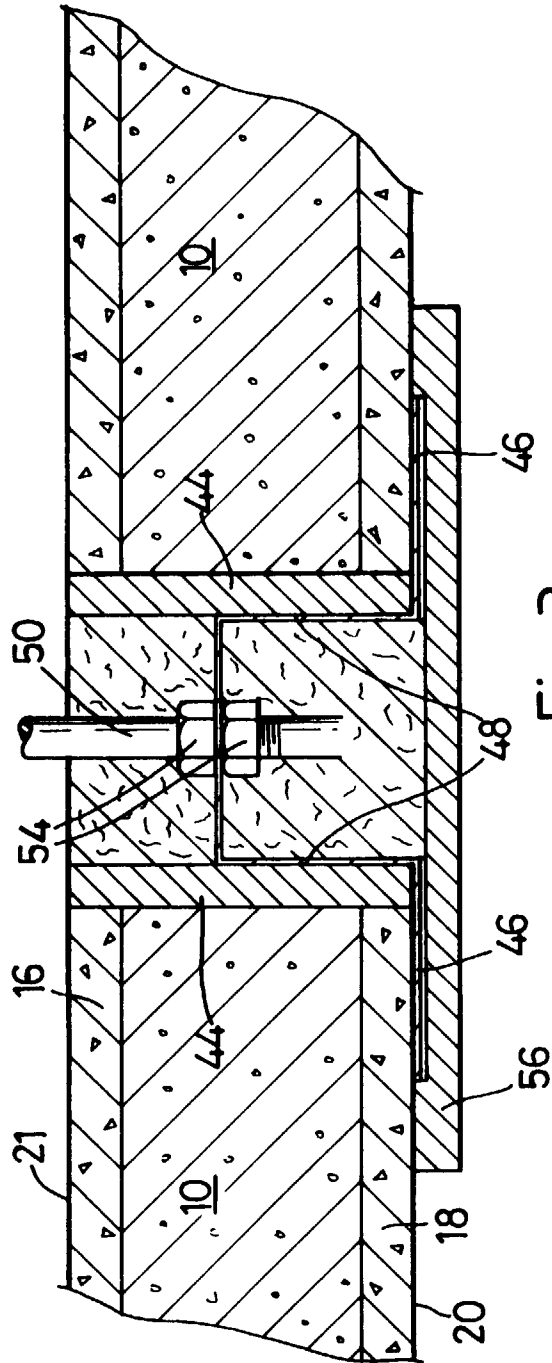


Fig. 3

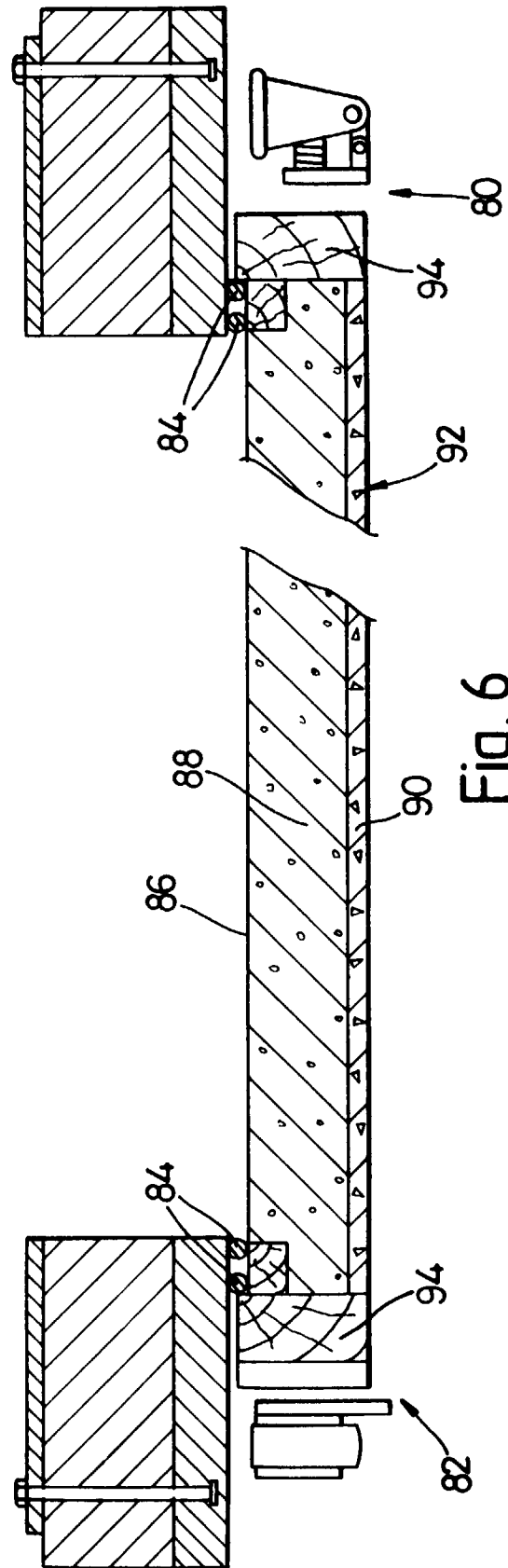


Fig. 6

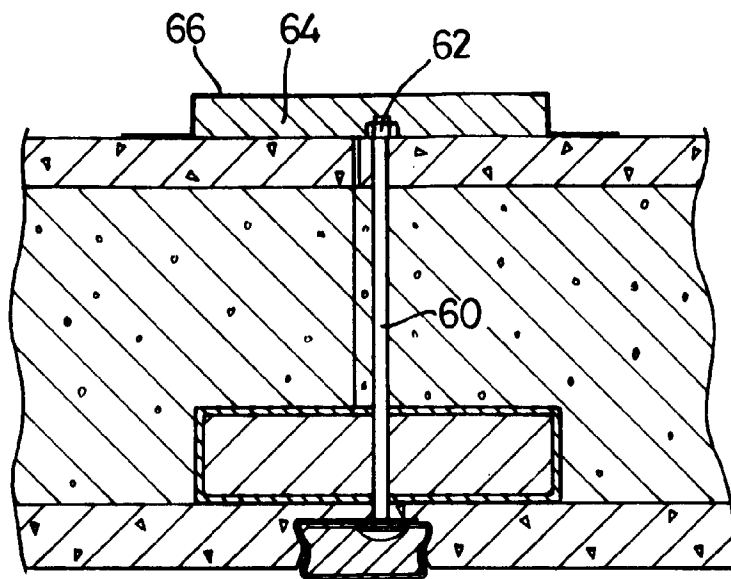


Fig. 4

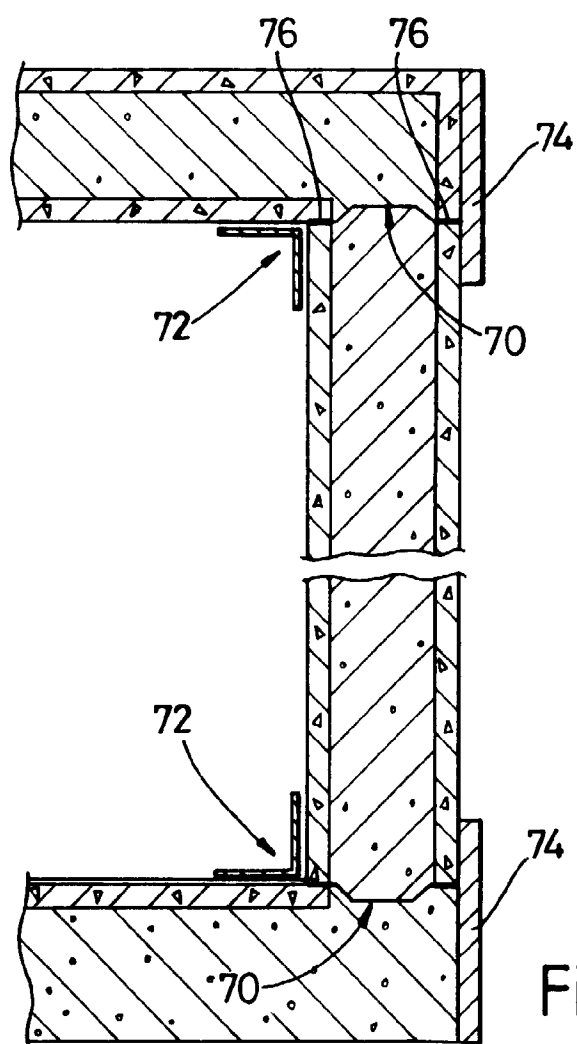


Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 96 30 0930

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.6)
A	DE-A-25 33 300 (ROMAKOWSKI KG) * the whole document * ---	1-5,8,10	E04H5/10
A	DE-A-20 07 423 (ISOLA-HILVERSUM) * page 7, paragraph 3 - page 8, paragraph 2; figure * ---	1,3,4	
A	WO-A-90 02855 (COMBAL & CO AS) * page 6, last paragraph - page 7, paragraph 2; figures 4-7 * ---	1,2,8-10	
P,A	EP-A-0 648 905 (DAGARD S A) * the whole document * ---	1-4,6,8-10	
P,A	DE-A-43 37 878 (BAUELEMENTE GMBH FRANZ JOSEF L) * the whole document * ---	1-4,8,10	
P,A	EP-A-0 684 348 (ISOBOUW SYSTEMS B V) * the whole document * ---	1,2,5,6,10	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 113 (M-0944), 2 March 1990 & JP-A-01 314156 (SHIKOKU KAKEN KOGYO CO LTD), 19 December 1989, * abstract * -----	1,6,7	E04H E04B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 April 1996	Examiner Vrugt, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

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