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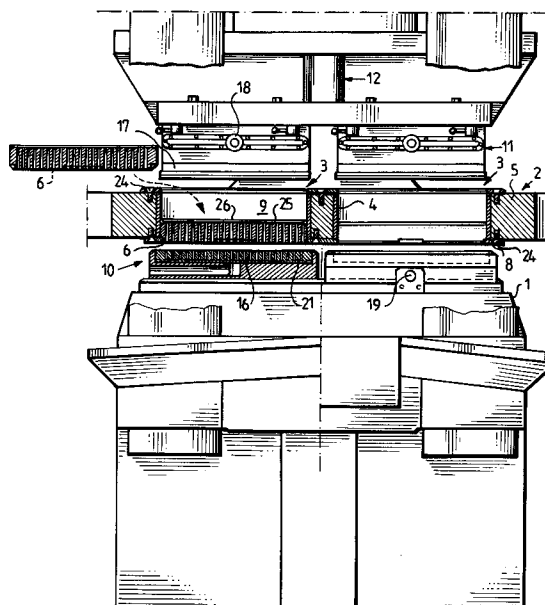
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**AT BE CH DE DK ES FR GB GR IE IT LI LU MC
NL PT SE**(71) Applicant: **MACHINATOR AB**
Storgatan 30
S-753 31 Uppsala (SE)(72) Inventor: **Bonnevier, Roine**
Nyodlarvägen 5
S-740 22 Bälinge (SE)(74) Representative: **Lundquist, Lars-Olof**
L-O Lundquist Patentbyrå
Box 80
S-651 03 Karlstad (SE)(54) **Filter arrangement.**

(57) A filter arrangement for a machine for manufacturing concrete slabs, said machine comprising a plurality of mould frames (4); lower and upper press plates (6, 17) which cooperate with the mould frames (4) to form mould cavities (9) for concrete compound that contains a surplus of water; and channel systems (20, 21, 22, 23) connecting the mould cavities (9) to a vacuum source for evacuation of said excess, said filter arrangement including a filter cloth (25) of a plastic material for abutment against the side of a press plate (6, 17) facing the mould cavity (9). According to the invention the filter arrangement also includes a frame (26) of a flexible plastic material for sealing cooperation with the mould frame and having a rear portion (27) forming an attachment means for cooperation with an attachment means (35) of the press plate (6, 17) for attachment of the filter arrangement to the press plate.

Fig.1

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The present invention relates to a filter arrangement for a machine for manufacturing concrete slabs, said machine comprising a plurality of horizontal mould frames; lower and upper horizontal press plates arranged to cooperate with the mould frames to form closed mould cavities for concrete compound that contains a surplus of water; and channel systems connecting the mould cavities to a vacuum source for evacuation of said excess water liberated during a pressing step, and said filter arrangement including a filter cloth of a plastic material for abutment against the side of a press plate of the type defined, facing the mould cavity.

When compression moulding wet concrete in the manufacture of concrete slabs filters are used, usually of paper in sheet form, for filtering the water liberated from the wet concrete at the pressing step. A machine for manufacturing concrete slabs in this way is described in DE-A1-3 311 965. A sheet of paper is first placed manually on the press plate located in the mould frame which forms the bottom of the mould cavity. When the batch or batches of concrete have been poured into the cavity, a second sheet of paper is placed over the concrete compound, after which pressing can be commenced. The compressed, damp concrete slab is removed from the machine and placed on edge, after which the two sheets of paper adhering thereto are removed manually and disposed of. This procedure requires two men, one applying the sheets of paper before the pressing step and the other removing the sheets of paper after the pressing step. Both work steps are monotonous and at least the first must be executed relatively quickly and with great accuracy so that the paper sheets are correctly positioned. The combination of monotonous work and movable parts of the machine, entails considerable risk of accident, besides the monotonous work being unsatisfactory from the ergonomic point of view. Application of the paper sheets causes delays thereby reducing the production capacity since the number of press strokes per time unit is reduced. Double manning entails extra labour costs. Handling the paper sheets complicates manufacture not only for the reasons mentioned above, but also because the sheets of paper must be stored and specified quantities of sheets of the correct size must be regularly conveyed to the machine and then collected and disposed of after being used only once. The sheets of paper also command a relatively high price since they constitute a special range. In another procedure a filter cloth of synthetic material is placed on the lower press plate and clamped in place using separate attachment devices. A sheet of paper is then placed on top of the batch of wet concrete compound as in the method described first, but in this case with the aid of a robot. This technique thus

eliminates the initial manual work but the manual work of removing the paper sheet from one side of the concrete slab must still be performed. Furthermore, fitting the filter cloth is time-consuming and complicated.

The object of the present invention is to provide an improved filter arrangement that eliminates several of the drawbacks mentioned above and greatly reduces the others.

The filter arrangement according to the invention is characterized in that it also includes a frame of a flexible plastic material surrounding the filter cloth and forming an indivisible unit with the filter cloth, and that the frame has a lateral portion for sealing cooperation with vertical inner sides of a mould frame of the type defined as well as a rear portion forming an attachment means for cooperation with an attachment means of the press plate for detachable attachment of the filter arrangement to the press plate.

The invention will be described further in the following with reference to the drawings.

Figure 1 shows schematically and partially in section the press section of a machine for moulding concrete slabs.

Figure 2 is a view of the press section according to Figure 1 seen from the right.

Figures 3 and 4 are cross-sectional views of filter arrangements and the lower and upper press plates, respectively, during assembly for use in a machine according to Figure 1.

Figures 5 and 6 are perspective views of a filter arrangement according to a first embodiment of the invention.

Figure 7 is a cross section of an outer part of the filter arrangement according to Figure 6.

Figure 8 is a perspective view of a filter arrangement according to a second embodiment of the invention.

Figure 9 is a cross section through an outer part of the filter arrangement according to Figure 8.

Figure 10 is a perspective view of a filter arrangement according to a third embodiment of the invention.

Figure 11 is a cross section through an outer part of the filter arrangement according to Figure 10.

Figures 1 and 2 show schematically the press section of a machine for moulding concrete slabs intended to be placed on the ground or used as wall covering, for instance. The slab-moulding machine comprises a stationary lower stand 1 and a horizontal, circular mould table 2 pivotably journaled at the stand 1 about a vertical shaft by means of an actuator (not shown), and vertically movable by means of an actuator (not shown). In the embodiment shown the mould table 2 has a plurality of moulds 3, e.g. four moulds, which are moved to

different stations in the machine by stepwise rotation of the mould table 2. These stations may include, for instance, a first filling station for filling a wet first batch of concrete having a certain composition and colour, a second filling station for filling a wet second batch of concrete of the same concrete composition but containing different stone material from the first batch and with or without colour pigment, a press station for compressing the concrete and removing water by pressing, and a stripping station for stripping the compressed concrete slabs from the moulds 3 when they arrive in the stripping station. The press section shown in Figures 1 and 2 forms said press station, Figure 1 showing the mould table in raised position in relation to the stand and Figure 2 showing it in lowered position.

The two moulds 3 in each pair are located side by side and constitute exchangeable, quadratic mould frames 4 which are secured to the mould table framework 5 by upper and lower attachment members 24. The mould frames 4 suitably consist of four loose, i.e. separate wall plates. On a level with the lower attachment member 24 are four support bosses 8 arranged in pairs opposite each other and each extending past the inside of the wall plate of the mould frame 3, at its centre. Each mould 3 has a bottom formed by a lowerable lower press plate 6 (see Figure 3) which is provided at its lower edge at the middle of the sides with recesses 7 for receipt of the inwardly directed opposing support bosses 8, upon which the lower press plate 6 will then rest. The lower press plate 6 is free from mechanical locking in the mould frame 4 and can therefore be quickly lifted from the mould frame 4 when desired and replaced therein as illustrated in Figure 1. The lower press plate 6 and upper, vertical parts of the mould frame 4 thus define a mould cavity 9 into which said concrete is dosed in said filling stations.

The press section comprises two lower pressure pads 10 rigidly mounted on the stand, and two upper pressure heads 11 connected to an actuator 12 for moving the pressure heads 10 up and down in relation to the mould table 2. The latter actuator includes one or more hydraulic cylinders. Each lower pressure pad 10 includes a vacuum plate 16 for cooperation with the lower pressure plate 6 in the mould frame 4. Each upper pressure head 11 includes a spacer 14 rigidly mounted to a support element 15 common to both pressure heads 11. Each pressure head 11 is also provided with a vacuum plate 13 rigidly mounted to the spacer 14, and an upper pressure plate 17 located below the vacuum plate 13. Reference number 39 denotes a quick coupling for locking the pressure plate 17 to the vacuum plate 13 as illustrated in Figure 2.

The lower and upper vacuum plates 13, 16 communicate via connections 18, 19 with a vacuum source (not shown), each vacuum plate being provided with a plurality of channel systems 20, 21 opening on the horizontal side facing the mould table 2. Each pressure plate 6, 17 is also provided with a plurality of channels 22, 23 (see Figures 3 and 4) which extend between the horizontal sides of the pressure plate 6, 17 and are arranged to communicate directly with the channels 20, 21 of the vacuum plate 13, 16 when the pressure plate 6, 17 and vacuum plate 13, 16 are in surface contact with each other.

Several single moulds may be used instead of several pairs of moulds, particularly when large concrete slabs are to be manufactured, in which case the press section comprises a lower pressure pad and an upper pressure head.

Each pressure plate 6, 17 is provided with a filter arrangement (see Figures 3, 4, 5, 6, 7) comprising a filter cloth 25 and a frame 26 to enclose the entire filter cloth 25. The filter arrangement and pressure plate 6, 17 are provided with cooperating attachment means to detachably secure the filter arrangement on the side of the pressure plate 6, 17 which is to face the mould cavity 9. The filter cloth 25 consists of a plastic material and is provided with sufficient holes or pores for the water to pass through which is to be removed from the plate being compressed. A suitable plastic material is polyamide. The filter cloth 25 is also strong enough to withstand the high pressure to which it is subjected in the pressing step and can be used repeatedly over a considerable time period, e.g. at least one work shift, without being removed from the machine.

The frame 26 consists of a plastic material such that the frame 26 is yielding and flexible and can be joined to the filter cloth 25 to form an indivisible unit in an operation casting them together. Such a casting to form a unit is preferably performed during actual manufacture of the frame 26. The frame 26 has a rear part 27 which will face the pressure plate, 17 and a lateral part 28 which will face the inside of the mould frame 4, abutting against this to provide a seal preventing liquid and solid particles from penetrating therebetween. In the embodiment shown in Figures 8 and 9 the filter arrangement is shaped so that the finished concrete slab acquires a smooth, i.e. unbevelled surface, since the inner sides of the frame 26 and filter cloth 25 lie in one and the same plane. Alternatively this can be achieved by allowing the filter cloth 25 to cover the entire frame 26, extending right out to the side surface of the frame. In the embodiment shown in the other figures the frame 26 is also provided with a front part 29 which will face the mould cavity 9. The front part 29 has

triangular section and forms a peripheral bevel strip with inwardly facing inclined surface 30. The bevel strip 29 will thus take up a part of the mould cavity, the finished concrete slab thus acquiring corresponding bevelled edges.

In the shown embodiments of the filter arrangement one of the previously mentioned cooperating attachment means is formed by said rear part 27 which is in the form of a snap-in strip thus extending all round the frame 26. The snap-in strip is provided with a central, U-shaped groove 31, seen in cross section, so that two yielding clamp lips 32, 33 are formed. A beadlike protrusion 34 is formed at the outer edge of the snap-in strip 27, i.e. at the outer clamp lip 33. Alternatively such a protrusion 34 may also be arranged on the inner edge of the snap-in strip 27, i.e. at the inner clamp lip 32, or, according to yet another alternative, in both places. The second of the cooperating attachment means mentioned earlier is thus formed by a corresponding snap-in groove 35 on the press plate 6, 17 which, with respect to outer contour, has a cross-sectional profile corresponding to the snap-in strip 27 so that the U-shaped groove 31 is kept free to enable movement between the clamp lips 32, 33 at insertion and removal from the snap-in groove 35. The snap-in groove 35 is also provided with an inner protrusion (not shown) (or several) to receive protrusions 35 of the snap-in strip 27 when locking position is achieved.

Two vertical side walls of each mould frame are provided with two vertical recesses each (not shown), these having a cross section in the form of a circle-segment, for instance, and being arranged to form corresponding vertical protrusions on the finished concrete slab. These protrusions function as spacers between two adjacent concrete slabs to provide a desired gap between the slabs. Two sides of the frame 26 are provided with corresponding circle-segment shaped protrusions 36 arranged to be received in the four recesses of the mould frame to seal them and limit the height of the groove. Similarly the pressure plates 6, 17 are provided with corresponding circle-segment shaped protrusions 37 (see Figures 3 and 4) which will form rear supports for the protrusions 36 in the frames.

Figures 10 and 11 show a filter arrangement of the same design as that according to Figures 5-7, but also provided with members 38 for producing impressions in the concrete slab. These impression-forming members 38 consist of the same plastic material as the frame 26 and are formed simultaneously with the frame 26. They are also cast together with the filter cloth 25 in the same way as the frame 26. In the embodiment shown in Figures 10 and 11 the impression-forming members consist of two ribs intersecting each other, each extending

between two parallel sides of the frame 26 and perpendicular thereto. The ribs 38 suitably have U-shaped or, as shown, V-shaped cross section. Their height may be, for instance, between 5 mm and 15 mm depending on the size of the slab. Using the ribs 38 shown, concrete slabs are obtained with a grid pattern, the squares being defined by grooves having the same cross section as the ribs 38. It will be understood that a filter arrangement with impression-forming members 38 enables the production of concrete slabs with a pattern on the top side which can in principle be varied infinitely within the parameters stipulated.

Claims

1. A filter arrangement for a machine for manufacturing concrete slabs, said machine comprising a plurality of horizontal mould frames (4); lower and upper horizontal press plates (6, 17) arranged to cooperate with the mould frames (4) to form closed mould cavities (9) for concrete compound that contains a surplus of water; and channel systems (20, 21, 22, 23) connecting the mould cavities (9) to a vacuum source for evacuation of said excess water liberated during a pressing step, and said filter arrangement including a filter cloth (25) of a plastic material for abutment against the side of a press plate (6, 17) of the type defined, facing the mould cavity (9), characterized in that it also includes a frame (26) of a flexible plastic material surrounding the filter cloth (25) and forming an indivisible unit with the filter cloth (25), and that the frame (26) has a lateral portion (28) for sealing cooperation with vertical inner sides of a mould frame (4) of the type defined as well as a rear portion (27) forming an attachment means for cooperation with an attachment means (35) of the press plate (6, 17) for detachable attachment of the filter arrangement to the press plate (6, 17).
2. A filter arrangement as claimed in claim 1, characterized in that the rear portion (27) is in the form of a snap-in strip, and that the attachment means of the press plate (6, 17) consists of a corresponding snap-in groove (35).
3. A filter arrangement as claimed in claim 2, characterized in that the snap-in strip (27) is provided with a U-shaped groove (31), seen in cross section, to provide inner and outer yielding clamp lips (32, 33).
4. A filter arrangement as claimed in claim 3, characterized in that at least the outer clamp lip (33), located nearest to the mould frame

- (4), is provided with at least one beadlike protrusion (34) for cooperation with a corresponding recess in the snap-in groove (35) of the press plate (6, 17).
- 5
5. A filter arrangement as claimed in any of claims 1-4, characterized in that the filter cloth (25) has edge portions completely covering the surface of the frame (26) facing the mould cavity (9), for the manufacture of concrete slabs without bevelled edges. 10
6. A filter arrangement as claimed in any of claims 1-4, characterized in that the filter cloth (25) has edge portions covering at least half the frame (26), seen in cross section, the uncovered surface of the frame being located in the same plane as the inner side of the filter cloth (25) facing the mould cavity (9), for the manufacture of concrete slabs without bevelled edges on at least one side. 15 20
7. A filter arrangement as claimed in any of claims 1-4, characterized in that the frame also includes a front portion (29) forming a bevel strip with an inclined surface (30), for use when manufacturing concrete slabs with bevelled edges on at least one side. 25
8. A filter arrangement as claimed in claim 7, characterized in that the bevel strip (29) covers edge portions of the filter cloth (25). 30
9. A filter arrangement as claimed in any of claims 1-8, characterized in that the filter cloth (25) is made of polyamide and the frame of polyurethane. 35
10. A filter arrangement as claimed in claim 9, characterized in that the frame (26) is produced in contact with the filter cloth (25) so that it is simultaneously cast together with the filter cloth. 40
11. A filter arrangement as claimed in any of claims 1-10, characterized in that it also comprises members (38) for forming impressions in the concrete slab, said impression-forming members (38) being located in the plane of the frame (26) and consisting of the same plastic material as the frame (26) and being cast together with this and/or the filter cloth (25). 45 50
12. A filter arrangement as claimed in claim 11, characterized in that the impression-forming members (38) include at least one rib extending between two adjacent or two opposite sides of the frame (26) to form corresponding 55
- grooves in the concrete slab.
13. A filter arrangement as claimed in claim 12, characterized in that the ribs (38) have U-shaped or V-shaped cross section and are straight or curved.
14. A filter arrangement as claimed in any of claims 1-13, characterized in that at least two adjacent sides of the frame (26) are provided with protrusions (36) for receipt in corresponding recesses in the inner sides of the mould frame (4) in order to seal said recesses in one direction, said recesses forming corresponding spacers in the concrete slab.

Fig.1

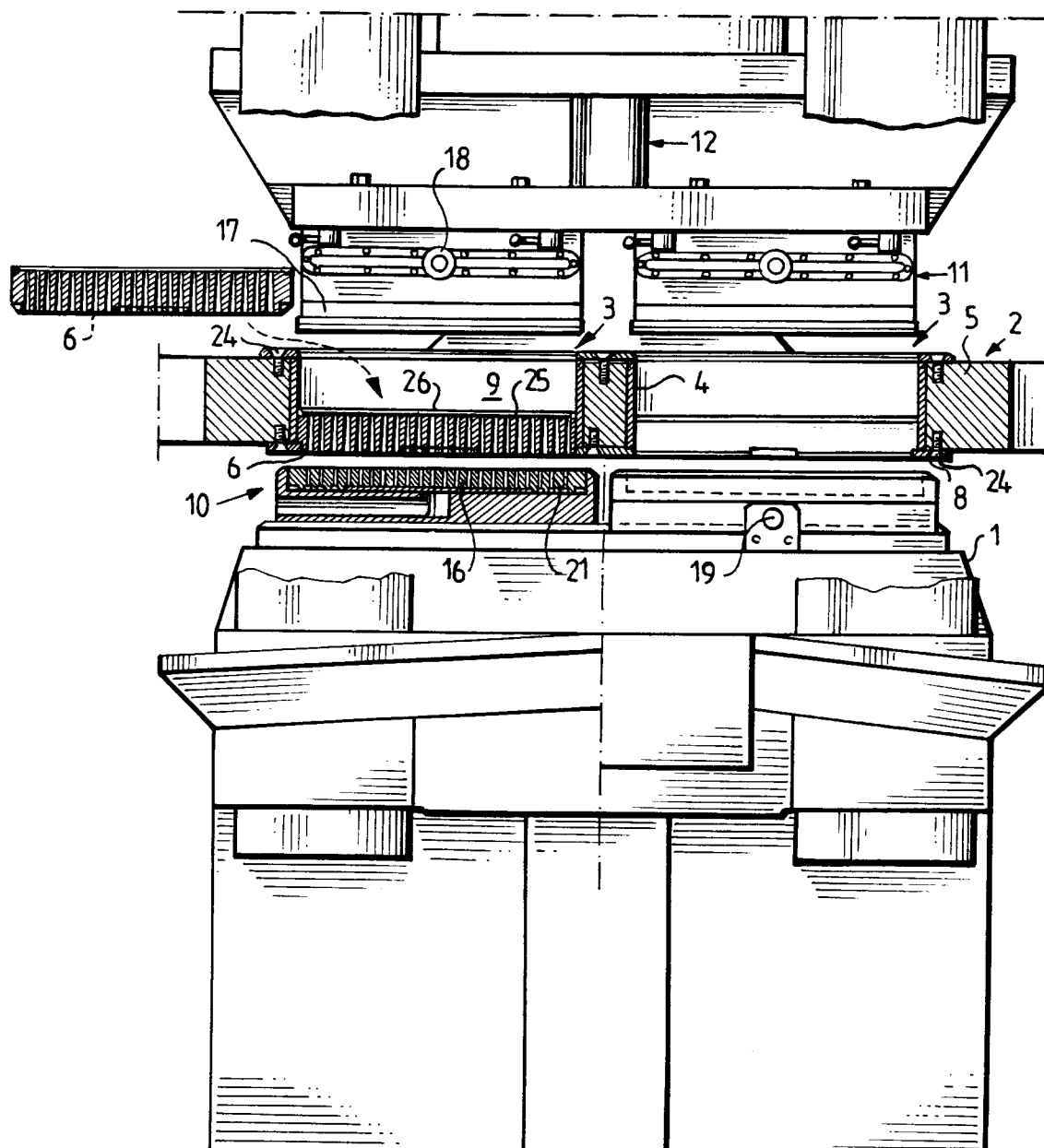


Fig. 2

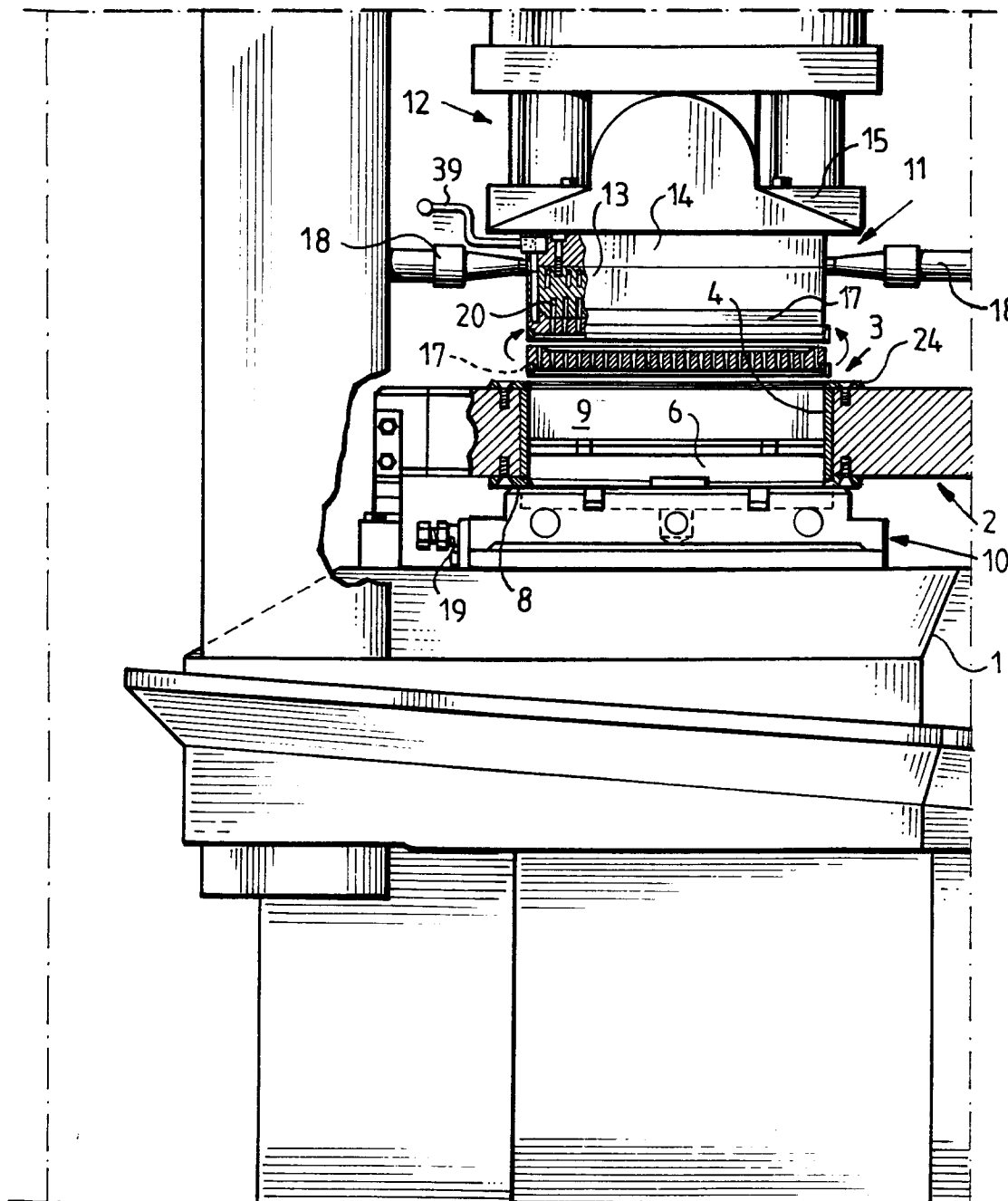


Fig.3

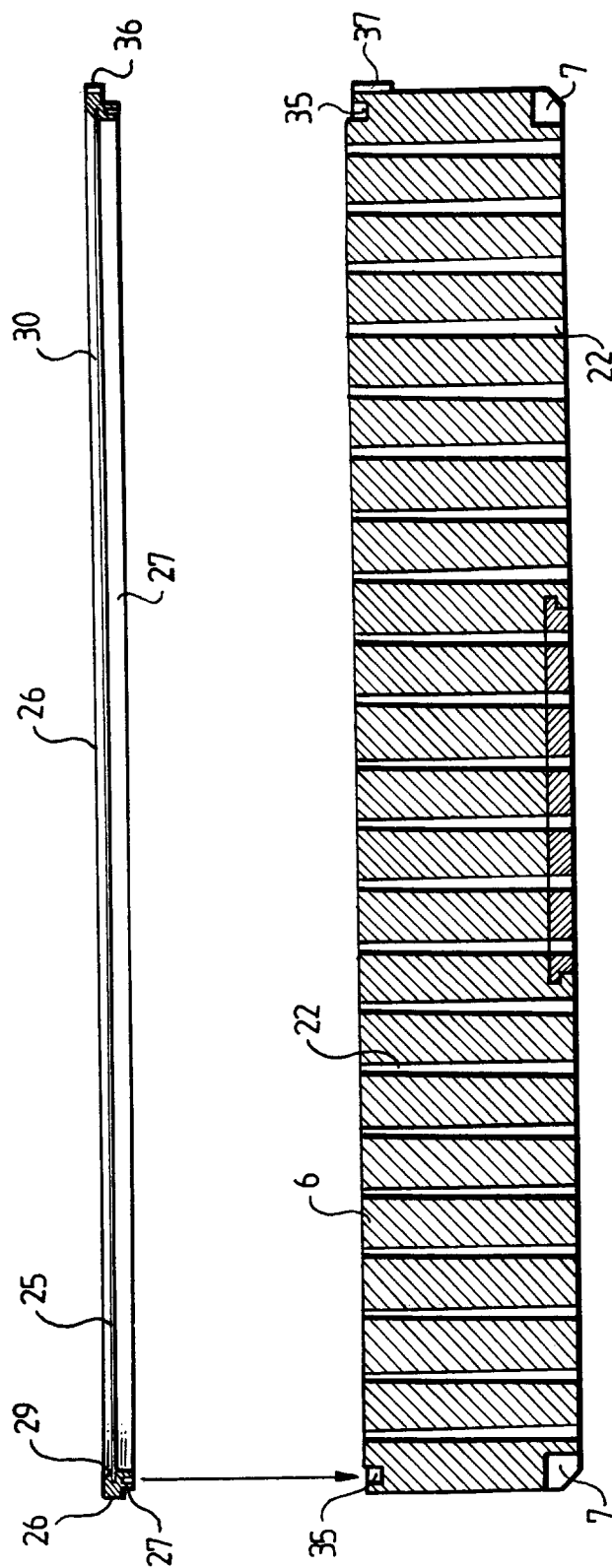


Fig. 4

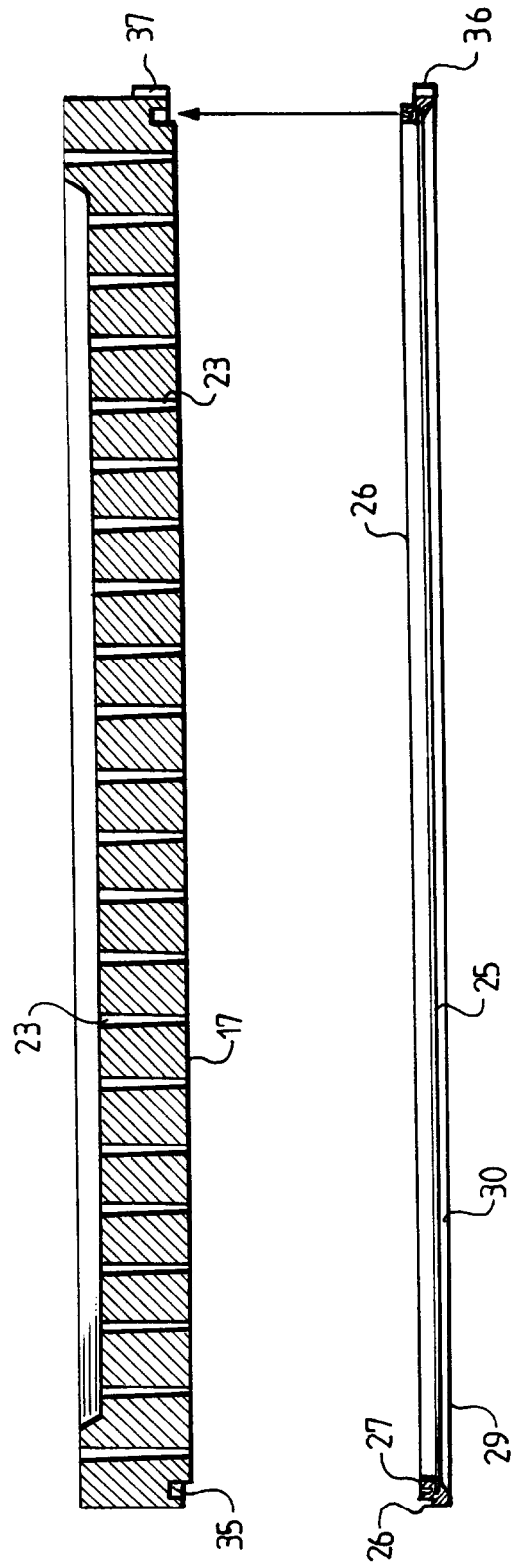


Fig.5

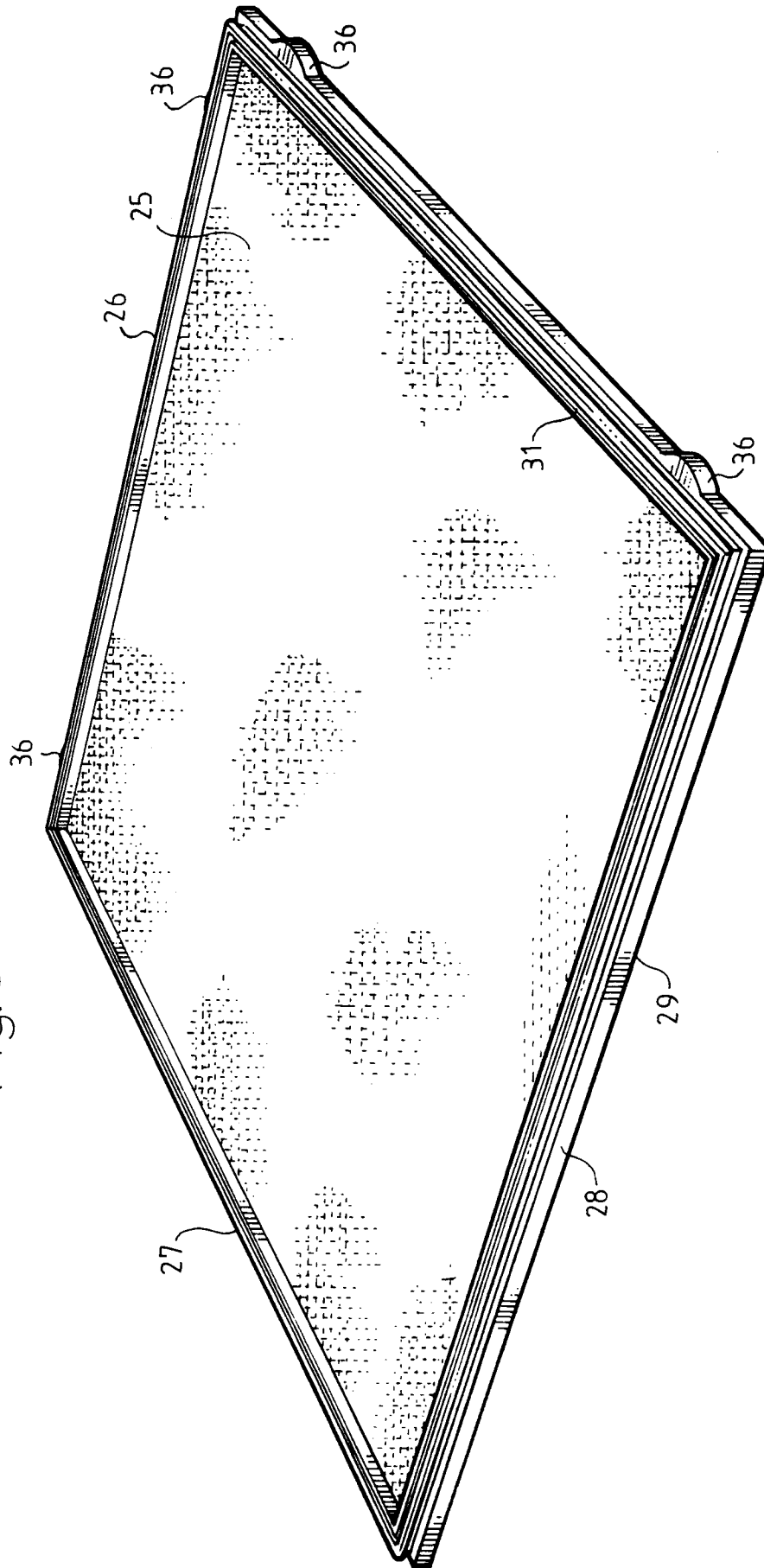


Fig.6

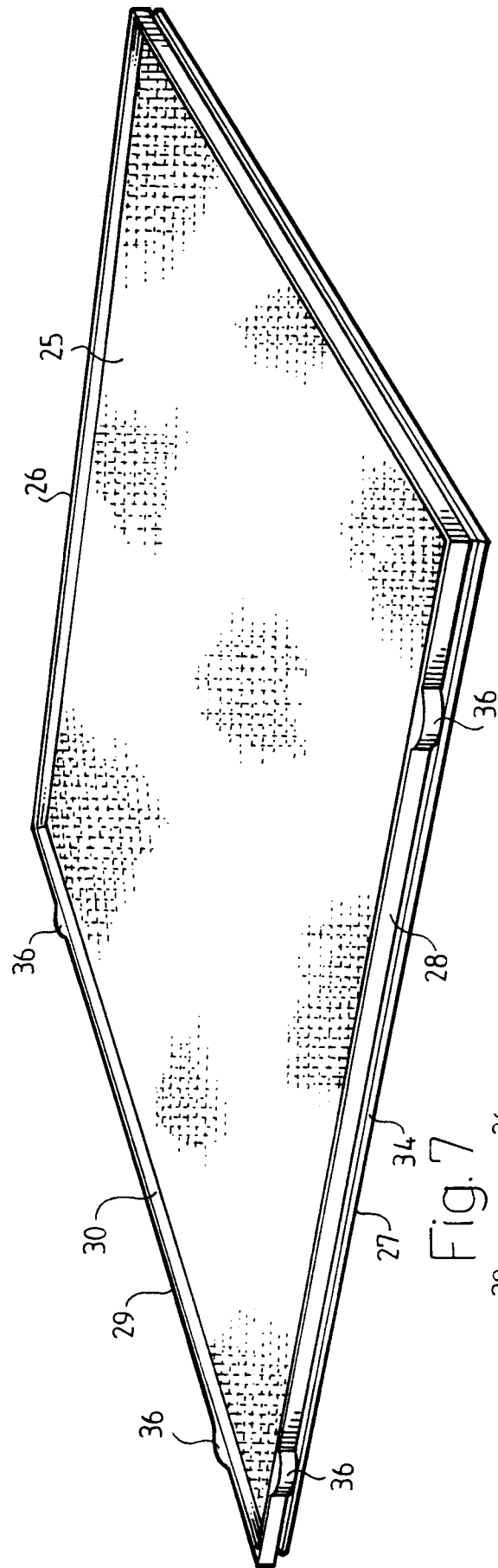


Fig. 7

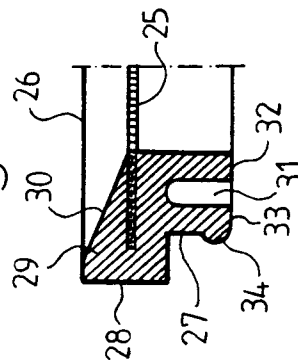


Fig.8

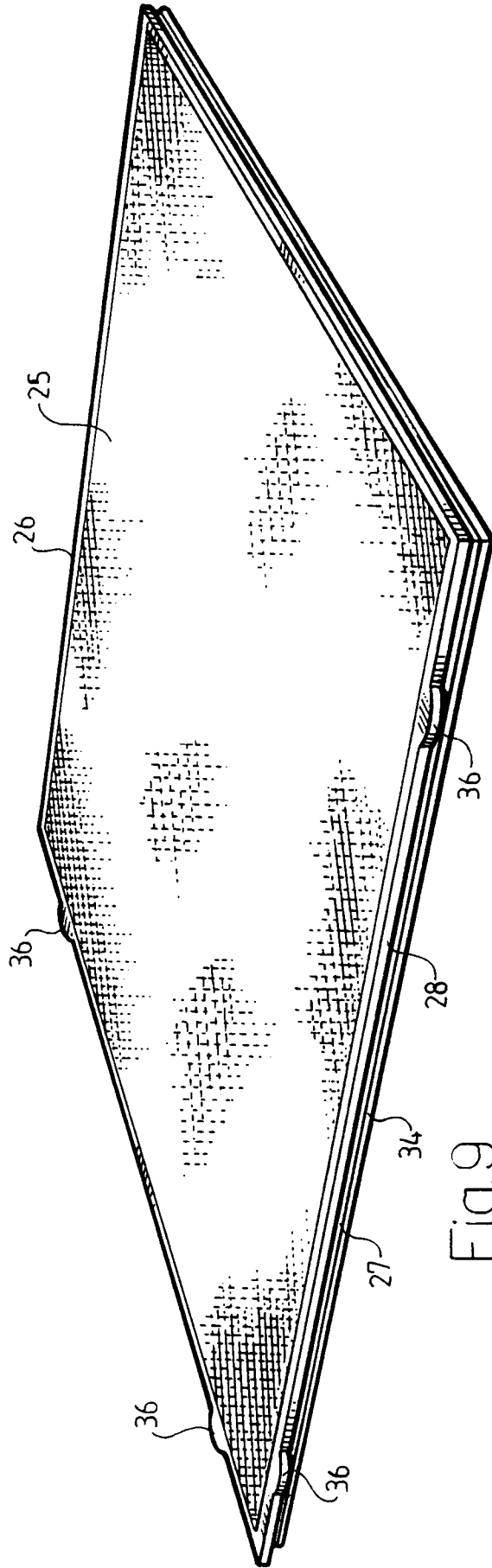


Fig.9

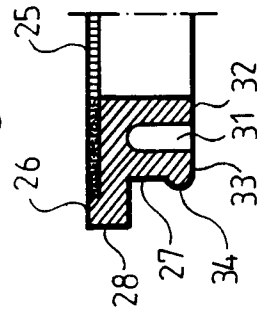


Fig.10

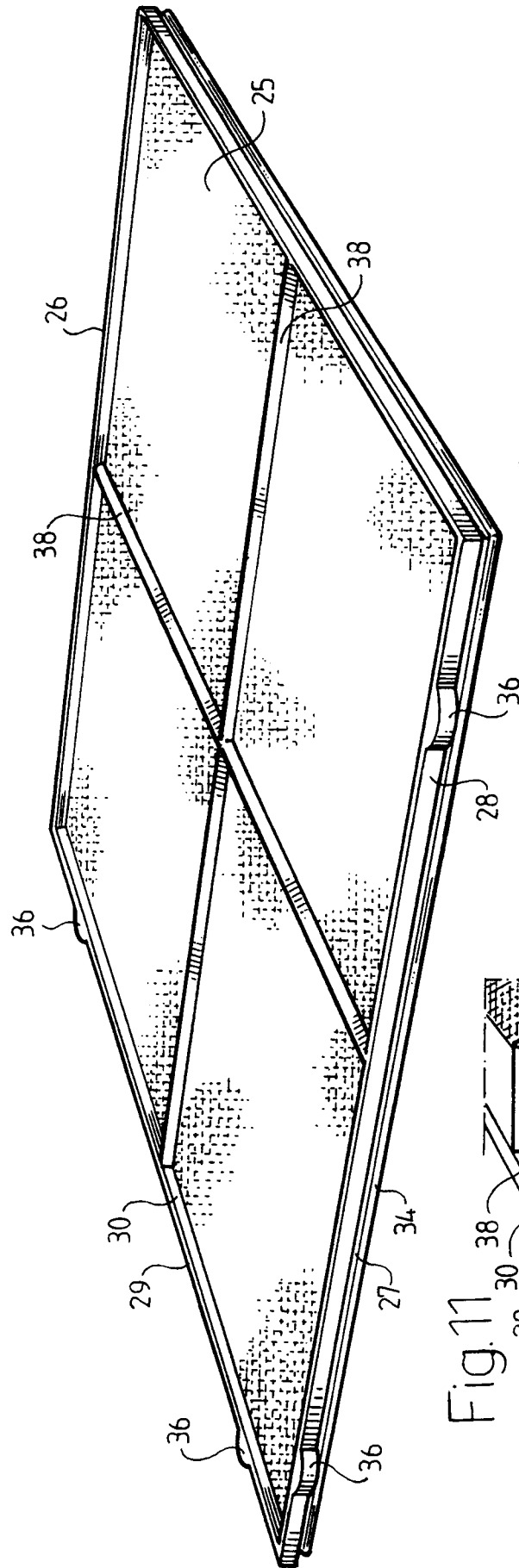
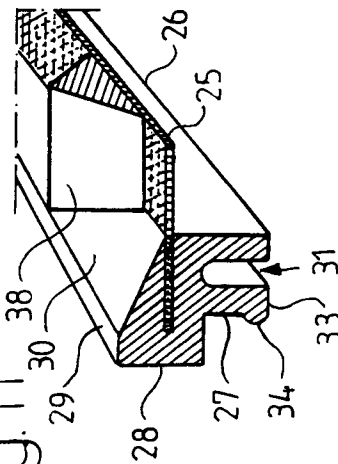


Fig.11





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EUROPEAN SEARCH REPORT

Application Number
EP 94 10 9038

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)
Y	DE-B-25 58 248 (K.K. OSAKA PACKING SEIZOSHO) * column 3, line 30 - line 38; figures 1,2,6 *	1	B28B3/02
Y	DE-B-25 47 542 (LONGINOTTI S.P.A.) * figure 4, detail 16 *	1	
Y	DE-A-33 11 965 (AKTIEBOLAGET S:T ERIKS BETONG) * figure 2, detail 60 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			B28B
The present search report has been drawn up for all claims			
Place of search STOCKHOLM		Date of completion of the search 25 August 1994	Examiner JUVONEN VILHO
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			