

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



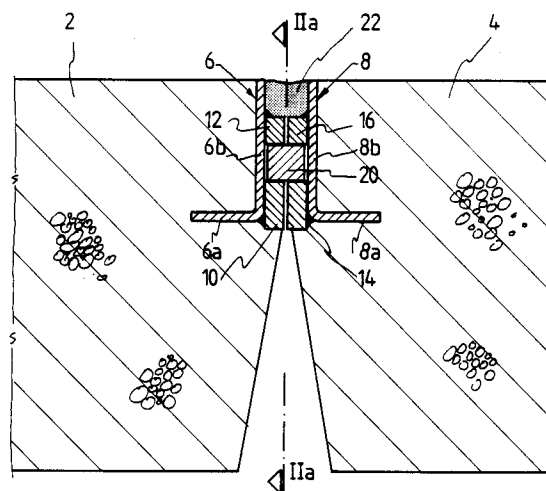
(11) Publication number:

0 500 183 A1

(12)

EUROPEAN PATENT APPLICATION(21) Application number: **92200482.5**(51) Int. Cl.⁵: **E01C 5/00, E04B 5/02**(22) Date of filing: **18.02.92**(30) Priority: **19.02.91 NL 9100291**(43) Date of publication of application:
26.08.92 Bulletin 92/35(84) Designated Contracting States:
AT BE CH DE DK FR GB LI LU NL SE(71) Applicant: **WERNINK BETON B.V.**
340, Morsweg
NL-2332 EX Leiden(NL)(72) Inventor: **Bakels, Friedrich**
1, Merovingersstraat
NL-3962 AR Wijk bij Duurstede(NL)(74) Representative: **Timmers, Cornelis Herman**
Johannes et al
EXTERPATENT B.V. P.O. Box 90649
NL-2509 LP 's-Gravenhage(NL)(54) **Floor composed of interconnected flat slabs, floor slab for such a floor, and method for constructing the floor using the floor slabs.**

(57) Floor composed of interconnected flat slabs (2, 4), in particular concrete slabs. At least one groove (18) is formed along each side edge of the slab, running in the lengthwise direction of the side edge or at an acute angle thereto and having side walls essentially at right angles to the side edge, the grooves in the adjoining side edges of the first (2) and the second (4) slab forming a mirror image of each other relative to the interface between said slabs. At least one key element (20) is wedged in said grooves, engaging on the side walls of the two grooves. A floor slab for such a floor comprises a broad strip (6) which is fitted along the side edges and on which one or more pairs of strips (10, 12; 14, 16) are fitted, the facing side edges of the strips of each pair determining a groove.

**EP 0 500 183 A1**

The invention relates to a floor, composed of interconnected flat slabs, in particular concrete slabs, which floor slabs are arranged in such a way that at least one side edge of a first slab runs parallel to the adjoining side edge of a second slab. The invention also relates to a floor slab intended for the construction of such a floor. In addition, the invention relates to a method of constructing said floor using such floor slabs.

Floor slabs are generally known and are used for constructing floors for storage sites, interior floors in halls and warehouses, or the like. It is known in this case to fix the converging corner parts of the adjacent slabs relative to each other in a direction at right angles to the plane of the floor by means of a connecting element.

The purpose of fixing of the floor slabs relative to each other is in the first place to prevent the occurrence of height differences between the slabs. Also a better load-bearing capacity of the floor is obtained, since the load of each slab is transmitted by means of the connecting elements to the adjacent floor slabs, with the result that the load is distributed over several slabs. Further it is possible to seal the seams between the floor slabs or to provide a drainage system for rainwater under the floor, due to the fact that there is no risk of damage to it through subsidence or tilting of the individual slabs.

Although, in view of the above, the interconnection of floor slabs offers many advantages, one disadvantage of the method of connection of the floor slabs described above is that their corner parts can break off if a great load occurs near a corner part and the floor slabs are insufficiently supported as a result of subsidence of the ground below.

The object of the invention is in the first place to provide a floor whose component floor slabs are firmly interconnected. This connection can be achieved quickly and easily by simple means during fitting of the floor, and is quickly and easily undone when the floor is being dismantled.

A further object of the invention is to provide a floor in which the interconnections between slabs extend over such a large area of the edge of the slabs that there is no risk of part of a slab breaking off if said part is receiving little or no local support from the ground underneath.

The floor according to the invention is to this end characterised in that at least one groove is formed along each side edge, running in the lengthwise direction of the side edge or at an acute angle thereto and having side walls essentially at right angles to the side edge, the grooves in the adjoining side edges of the first and the second slab forming a mirror image of each other relative to the interface between said slabs, and in that at

least one key element is wedged in said grooves, engaging on the side walls of the two grooves. The key elements exert a force solely in a direction at right angles to the slab surface on the two side walls of the groove, and in this direction offer a mechanical locking against mutual shifting of slabs.

In a preferred embodiment the opening of each groove tapers, and the connection between adjacent slabs is achieved with the aid of a wedge-shaped element adapted to the shape of the groove.

In another preferred embodiment the two side walls of a groove are parallel, and the connection between adjoining slabs is made using a combination of at least two opposite wedge-shaped key elements touching each other with a slanting surface. This groove shape has the important advantage that when slabs are lying shifted relative to each other an excellent connection can still be made.

In an embodiment with an improved mechanical resistance to forces which could cause adjacent slabs to move apart, the angle between at least one of the two side walls of a groove and the bottom of the groove is acute, and a connection between adjoining slabs is made using at least one key element which is provided with a V-shaped longitudinal groove whose opening angle is adapted to the angle between corresponding groove side walls and the groove bottom.

The sole right also extends to cover a floor slab for the construction of a floor of the type described above.

In a preferred embodiment of such a floor slab the grooves are provided symmetrically relative to the vertical mid-perpendicular plane of a side edge of a slab. This ensures that the slabs are interchangeable and can be used in various orientations relative to each other for the construction of a floor.

A slab is preferably constructed in such a way that a groove is bounded by a number of elongated thickened parts provided on a slab side edge.

In particular, such a slab comprises a broad strip which is fitted along the side edges and on which one or more pairs of strips are fitted, the facing side edges of the strips of each pair determining a groove. This embodiment is particularly suitable for use in the case of concrete slabs which are generally provided with a protective broad strip. The strips can be placed on the protective broad strip prior to pouring of the concrete slab, but they can also be fitted on the protective broad strip afterwards, if desired.

It is advantageous if the lower strip of each pair extends over the length of the side edge on which it is fitted. If it is ensured that the strips of adjoining slabs lie fully or almost fully against each other, a filling material applied in the seam between the

slabs cannot run off between the slabs.

According to a method for constructing the floor according to the invention from the floor slabs according to the invention, the slabs are placed next to each other in a pattern determined by the shape of the slab, key elements are placed in the grooves, and the key elements are pressed chamferingly into the groove with the aid of a clamping device having two legs which can be moved relative to each other by means of a double-acting cylinder-piston unit, which legs engage on projections forming part of the key elements. The use of the cylinder-piston unit permits rapid and accurately adjustable wedging of the key elements, without the key elements being damaged in the process, as would be the case, for example, if the key elements were to be fitted using a hammering tool.

The invention is explained with reference to the drawing, in which:

Fig. 1 shows a cross-section through a part of two floor slabs interconnected in a first manner;

Fig. 2 shows a side view of a corner part of a floor slab according to Fig. 1;

Fig. 2a is a cross-section through the slab connection along the plane indicated therein by the line IIa - IIa;

Fig. 2b is a cross-section through a second embodiment of a slab connection;

Fig. 2c is a cross-section through a third embodiment of a slab connection;

Fig. 3 shows a cross-section through a part of two floor slabs interconnected in a second manner;

Fig. 4 shows a top view of a number of floor slabs interconnected according to Figs. 1 and 2a or 3 and 2a;

Fig. 5 schematically illustrates a method for fitting the wedge elements in a slab connection according to Fig. 2a; and

Fig. 6 illustrates schematically a method for removal of the wedge elements in the slab connection according to Fig. 2a.

Fig. 1 shows the edge parts of two concrete slabs 2 and 4 which are each provided along the top side of the upright side edges with a metal section 6, 8 which is L-shaped in cross-section and is firmly connected to the concrete mass, one leg 6a, 8a respectively of which section being the concrete mass, while the other leg 6b, 8b forms the edge boundary of the slab 2, 4, respectively. Metal strips 10 and 12, and 14 and 16 respectively are fixed on the upright legs 6b, 8b, and are welded firmly in the case shown.

As Fig. 2 shows more clearly for the slab 2, the lower strip 10 extends over virtually the entire length or width of the slab 2, and the upper strip 12 is of a length which is considerably shorter than the

length of the strip 10. Strip 12 is fitted near a corner of the slab 2 and together with the strip 10 determines between them a groove 18 which narrows gradually towards the corner of the slab 2. The angle between the walls of the groove 18 is, for example, approximately 0.57° . The strips 14 and 16 on the slab 4 have identical dimensions and are fitted at an identical place and in an identical manner to that of the strips 10 and 12 on the slab 2.

Figs. 1 and 2a illustrate the method of connection between the slabs 2 and 4 using a wedge element 20. The wedge element 20 is bevelled over a part of the top edge, the angle of bevel corresponding to the angle at which the strip 12 is placed slanting relative to strip 10. Consequently, the wedge element 20 can be wedged between the strips 10 and 12 over the entire length of the bevelled edge. The width of the wedge element 20 is essentially twice the width of strips 10, 12, 14 or 16, so that the wedge element can be fitted simultaneously wedged between the strips of two adjoining slabs and in this way can bring about a particularly strong connection between the slabs. Near a non-bevelled end of the wedge element 20 it is provided with a projection 21, the purpose of which will be described below with reference to Figs. 5 and 6.

After fitting of the connection described above, a seam between adjoining slabs can be filled with a filling material 22, such as a cement, concrete, asphalt or the like, for sealing the seam in a liquid-tight manner.

In Fig. 2b a short strip 12' is fitted parallel to the long strip 10 on the upright leg of a section 6. In order to obtain wedging with the aid of a wedge element 20 which is equal to that produced with the structure according to Fig. 2a, a second wedge element 13 is fitted between the strip 12' and the bevelled part of the wedge element 20, which second element becomes uniformly thicker from a projection 15 towards its end in such a way that the combination of wedge elements 20 and 13 through mutual longitudinal displacement of said elements can be placed in a uniformly wedging fit between the strips 10 and 12'. This is carried out by, for example, moving the second wedge element 13 into the position shown in Fig. 2b and subsequently fitting the wedge element 20 wedged below that. The projection 15 on the second wedge element 13 in this case ensures that if the second wedge element 13 undergoes higher friction on the contact face with wedge element 20 than on the contact face with strip 12', the second wedge element 13 does not slide in an uncontrolled manner under the strip 12' during the fitting of wedge element 20, with the result that the wedging force exerted by the wedge elements could not be adjusted. Due to

the parallel nature of the strips 10 and 12', a slab connection according to Fig. 2b is not very critical as regards a horizontal deviation in the position of strips 12' of adjoining slabs.

Fig. 2c shows a slab connection which is produced by fitting a wedge element 20 wedged between two identically shaped strips 10' and 12" fixed on the side edge of the slab at an angle relative to the slab surface and at a small angle relative to each other. In the figure the wedge element 20 is fitted from a corner of the slab 2 between the strips 10' and 12", unlike the wedge elements 20 shown in Figs. 2a and 2b. This aspect is not, however, essential for the invention or for a good slab connection.

Fig. 3 shows a cross-section with a wedge element 24 which instead of a flat top and bottom side has a top and bottom side with V-shaped grooves provided therein. The sides of strips 26, 28, 30 and 32 facing the wedge element 24 are slanted off at an angle which is adapted to the angle of the groove walls of the wedge element 24. The design according to Fig. 3 produces a mechanical anchoring between adjoining slabs in the transverse direction (i.e. in the horizontal direction at right angles to the lengthwise direction of the strips) and, provided that the strips 28 - 32 are connected strongly enough to the corresponding slabs, can therefore absorb higher transverse forces than the structure according to Fig. 1, where the capacity for absorbing transverse forces is limited by the friction forces produced between a wedge element and the strips between which the wedge element is wedged.

It is pointed out that it is also possible to provide only the top side or the bottom side of a wedge element with a V-shaped groove, as illustrated in Fig. 3, and to provide the strips which this side faces with a corresponding slanting side.

Fig. 4 shows a part of a floor, comprising a rectangular floor slab 34 which is connected at two sides to slabs 36, 38, which in turn are connected to a slab 40 and possibly other slabs. Each slab 34 - 40 is for this purpose provided near each corner with two combinations of strips 42 and 44 corresponding to the strips 10 and 12 shown in Fig. 2. A maximum of eight connections is therefore possible around the rectangular slabs shown, using wedge elements 20 each of which is provided with a projection 21. In Fig. 4, for the sake of clarity, the usual filling material to be applied in the seams between the slabs is not shown, so that the manner of connection is clearly visible.

The choice of a certain number of connections will, generally speaking, depend on the shape of the slab (triangular, square, rectangular etc.), the slab dimensions, the slab material and the use of the floor constructed with the slabs.

In the case of slabs such as slabs 34, 36 and 38, which bound an edge part of the floor, the connecting strips can, if desired, be left out at side edges where no connection with other slabs is produced.

In Fig. 4 the bevelled ends of the wedge elements 20 are always directed towards a corner of a slab, but generally speaking, they can equally well be directed in the opposite direction.

Fig. 5 shows the basic design of a hydraulic auxiliary tool 46 for fitting wedge elements 20. The auxiliary tool 46 comprises a first arm 48 which is connected at both its ends by means of hinged connections 50 to two second arms 52 and 54. The arm 52 is hingedly connected at a suitable point between its two ends to the piston rod 56 of a double-acting hydraulic cylinder-piston unit 58, in which the cylinder is hingedly connected by means of a rod 60 to the arm 54 at a suitable point between the two ends of said arm. The cylinder-piston unit 58 is connected by means of lines 62 and a 4/3 valve to a pump (not shown) for the supply and discharge of hydraulic fluid under pressure. In the position of the valve 64 shown in Fig. 5 the arms 52 and 54 are pressed apart with a certain force and a part of said force is transmitted to the wedge elements 20 by way of the ends of the arms 52 and 54 placed against the projections 21 of the wedge elements 20. In this way it is possible to wedge the wedge elements between the strips 10 and 12 of adjoining slabs with a predetermined force, which depends on the mutual relationships between the component parts of the auxiliary tool 46, the cylinder dimensions and the pressure of the hydraulic fluid.

Fig. 6 illustrates the way in which an auxiliary tool 46', which is of the same basic design as the auxiliary tool 46, but differs from it in that it is provided with an extended first arm 48' and an extended piston rod 56', is used to remove the wedge elements 20 from a connection between slabs. The free end of second arm 54 is now placed at the connection side of the projection 21 of the wedge element 20, while the free end of second arm 52 is wedged behind an edge of the slab 2. With the valve 64 in the working position shown, the free ends of the second arms 52 and 54 can be pressed towards each other with a predetermined force, with the result that it is possible to pull the wedge element 20 at the side of the second arm 54 away from the connection there. The other wedge element situated at the same side of the slab 2 can also be removed thereafter in a corresponding way.

The use of a hydraulic auxiliary tool, of which only one embodiment is shown in Figs. 5 and 6, but numerous other embodiments of which can be designed by the person skilled in the art, offers the

advantage that the wedge elements can be fitted in a very controlled manner.

The projection 21 on a wedge element 20 acts not only as an engagement point for tools for fitting or removal of the wedge element, but also provides the wedge element 20 a more advantageous tilting moment in the transverse direction, which benefits the sturdiness of the connection made.

Claims

1. Floor, composed of interconnected flat slabs (2, 4; 34, 36, 38, 40), in particular concrete slabs, which floor slabs are arranged in such a way that at least one side edge of a first slab runs parallel to the adjoining side edge of a second slab, characterised in that at least one groove (18) is formed along each side edge, running in the lengthwise direction of the side edge or at an acute angle thereto and having side walls essentially at right angles to the side edge, the grooves in the adjoining side edges of the first and the second slab (2, 4; 34, 36, 38, 40) forming a mirror image of each other relative to the interface between said slabs, and in that at least one key element (20; 13; 24) is wedged in said grooves, engaging on the side walls of the two grooves.
2. Floor according to claim 1, characterised in that the opening of each groove (18) tapers, and in that the connection between adjacent slabs (2, 4; 34, 36, 38, 40) is achieved with the aid of a wedge-shaped element (20) adapted to the shape of the groove.
3. Floor according to claim 1, characterised in that the two side walls of a groove are parallel, and in that the connection between adjoining slabs is made using a combination of at least two opposite wedge-shaped key elements (13, 20) touching each other with a slanting surface.
4. Floor according to any of claims 1 - 3, characterised in that the angle between at least one of the two side walls of a groove and the bottom of the groove is acute, and in that a connection between adjoining slabs is made using at least one key element (24) which is provided with a V-shaped longitudinal groove whose opening angle is adapted to the angle between corresponding groove side walls and the groove bottom.
5. Floor slab (2, 4; 34, 36, 38, 40) for constructing a floor according to any of claims 1 - 4.
6. Floor slab (2, 4; 34, 36, 38, 40) according to

claim 5, characterised in that the grooves (18) are provided symmetrically relative to the vertical mid-perpendicular plane of a side edge of a slab.

7. Floor slab (2, 4; 34, 36, 38, 40) according to claim 5 or 6, characterised in that a groove (18) is bounded by a number of elongated thickened parts (10, 12) provided on a slab side edge.
8. Floor slab (2, 4; 34, 36, 38, 40) according to claim 7, characterised by a strip (6) which is fitted along the side edges and on which one or more pairs of strips (10, 12; 14, 16; 10, 12'; 10', 12"; 26, 28; 30, 32) are fitted, the facing side edges of the strips of each pair determining a groove.
9. Floor slab (2, 4; 34, 36, 38, 40) according to claim 8, characterised in that the lower strip (10) of each pair extends over the length of the side edge on which it is fitted.
10. Method for constructing a floor according to any of claims 1 - 4 using floor slabs (2, 4; 34, 36, 38, 40) according to any of claims 5 - 9, characterised in that the slabs are placed next to each other in a pattern determined by the shape of the slabs, key elements (20) are placed in the grooves, and the key elements are pressed wedged into the groove with the aid of a clamping device (46) having two legs (52, 54) which can be moved relative to each other by means of a double-acting cylinder-piston unit (58), which legs engage on projections (21) forming part of the key elements.

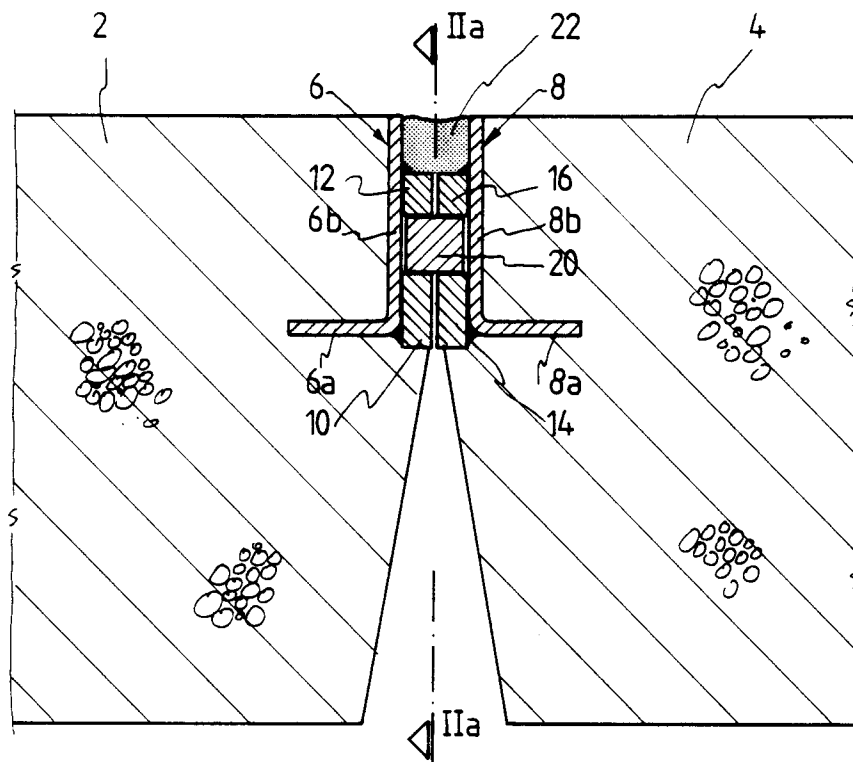


Fig. 1.

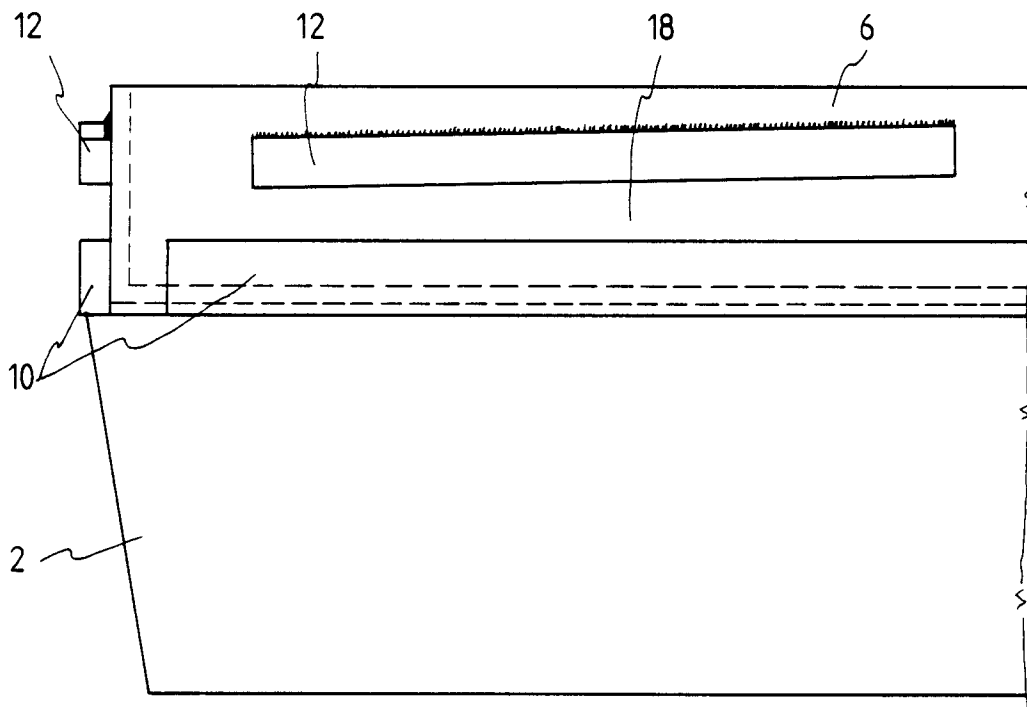


Fig. 2.

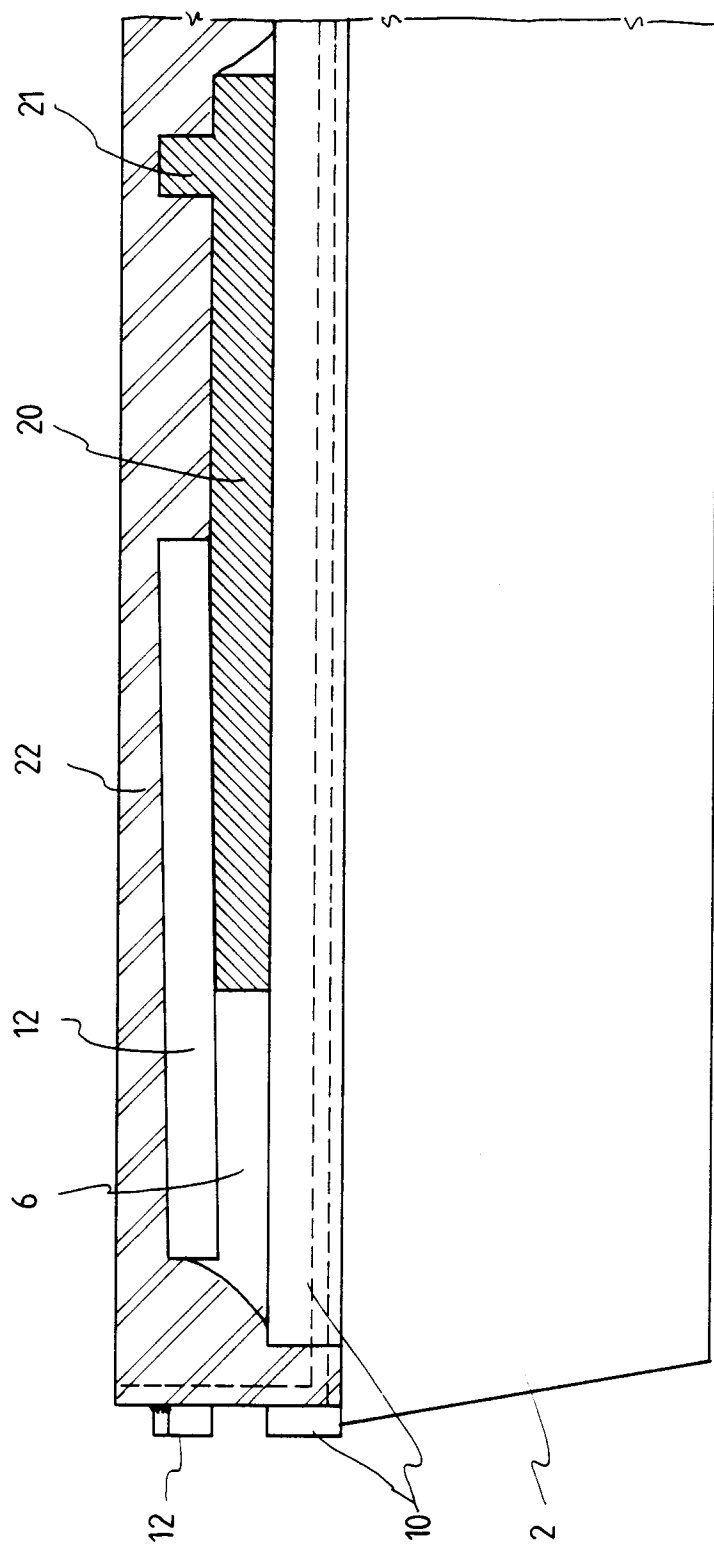


Fig. 2a.

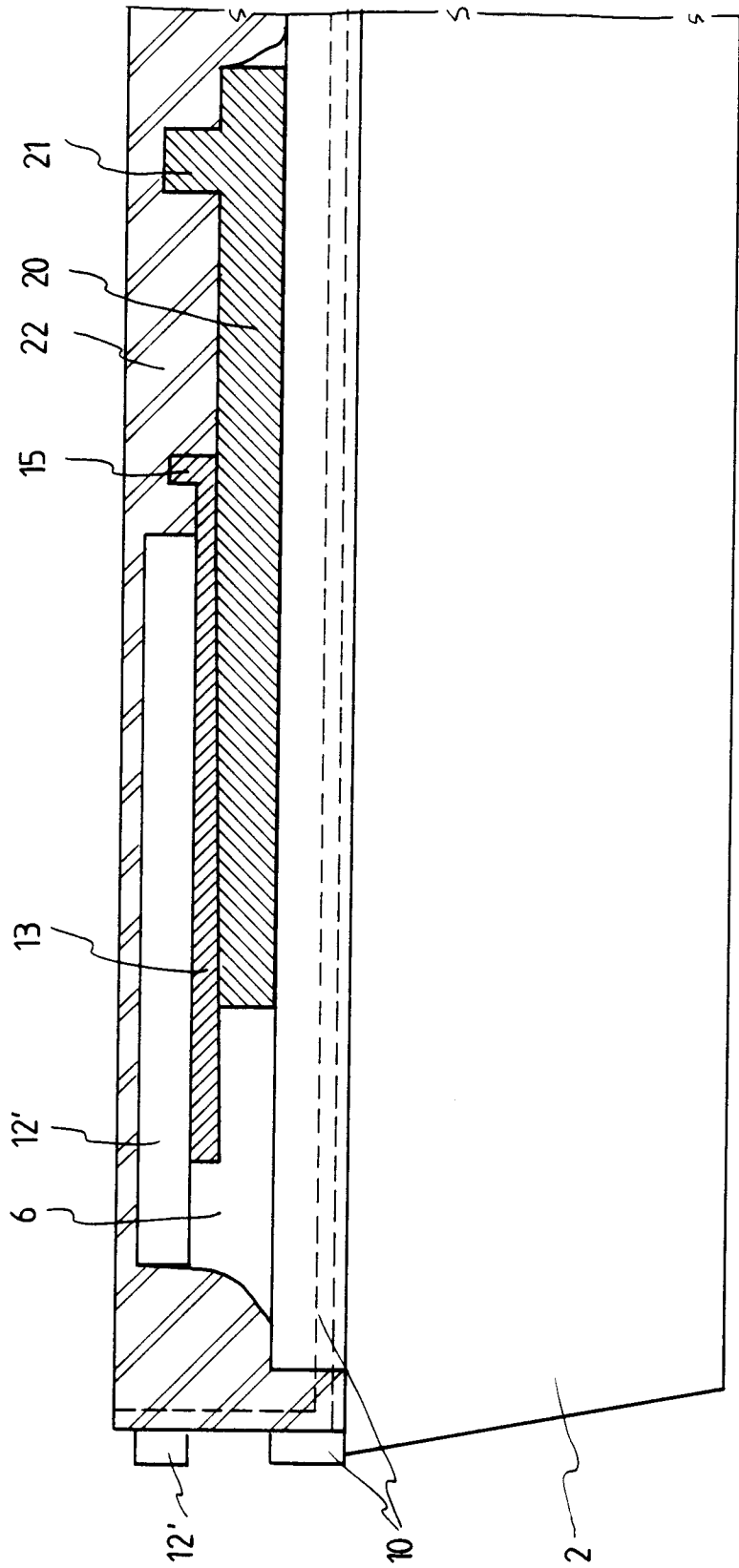


Fig. 2b.

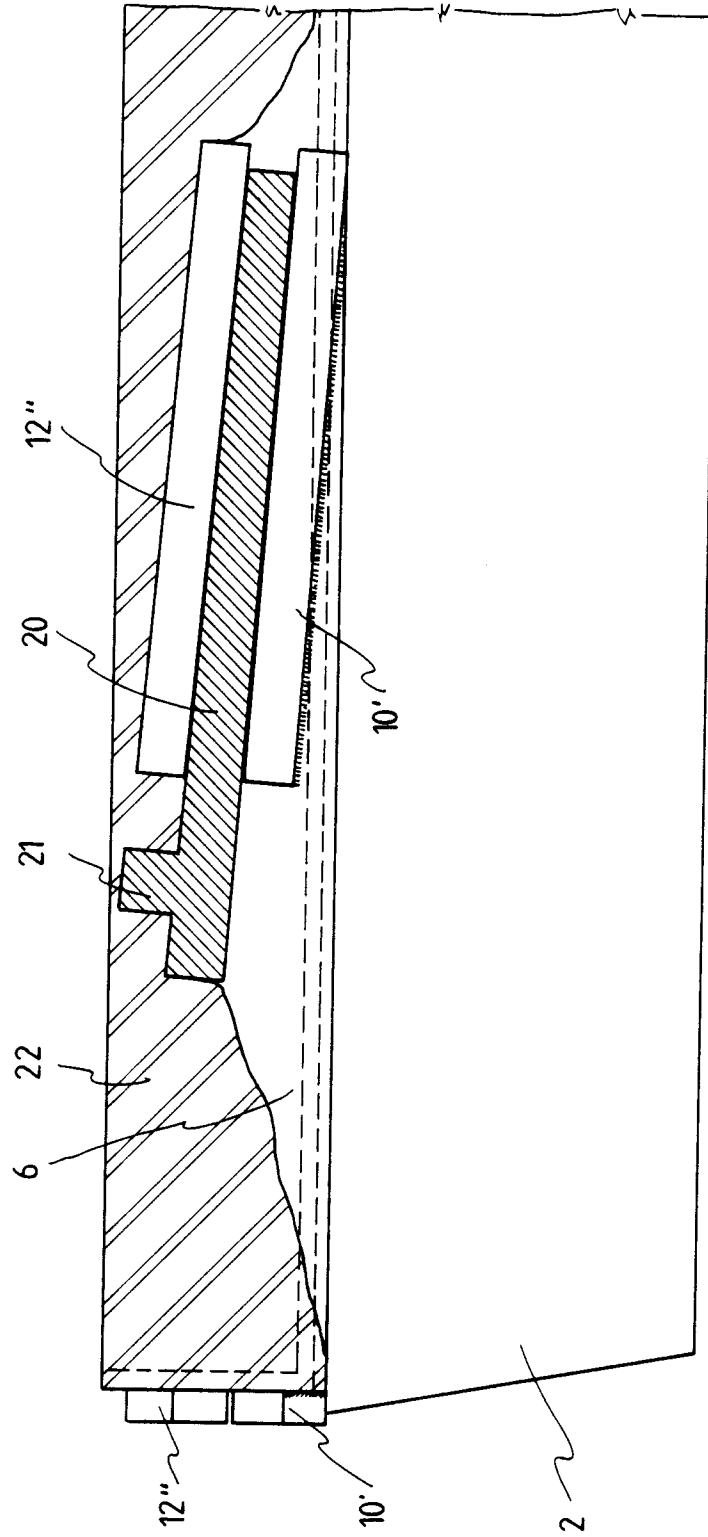


Fig. 2c.

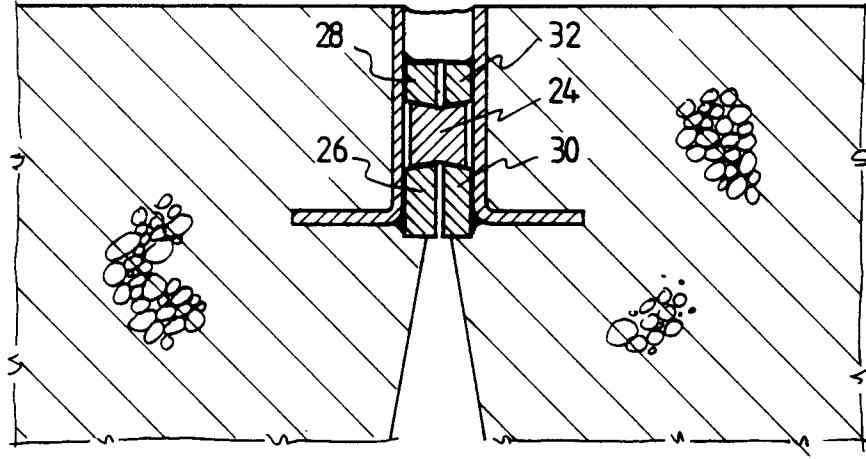


Fig. 3.

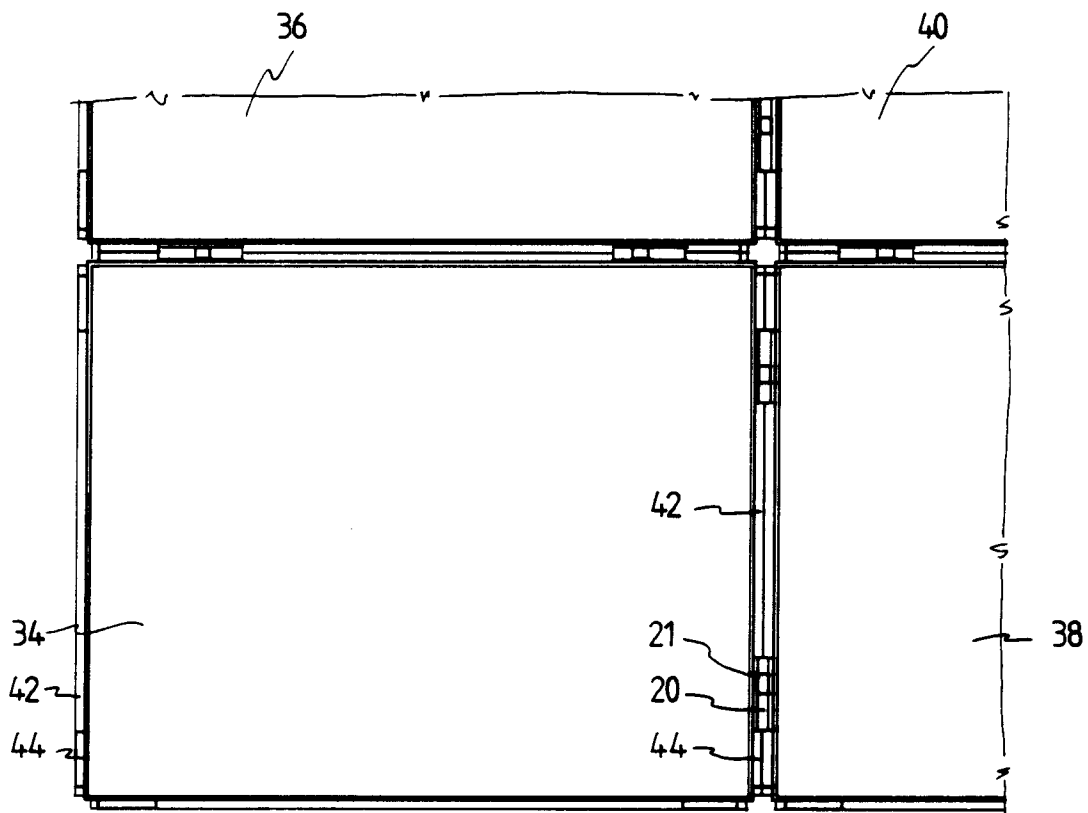
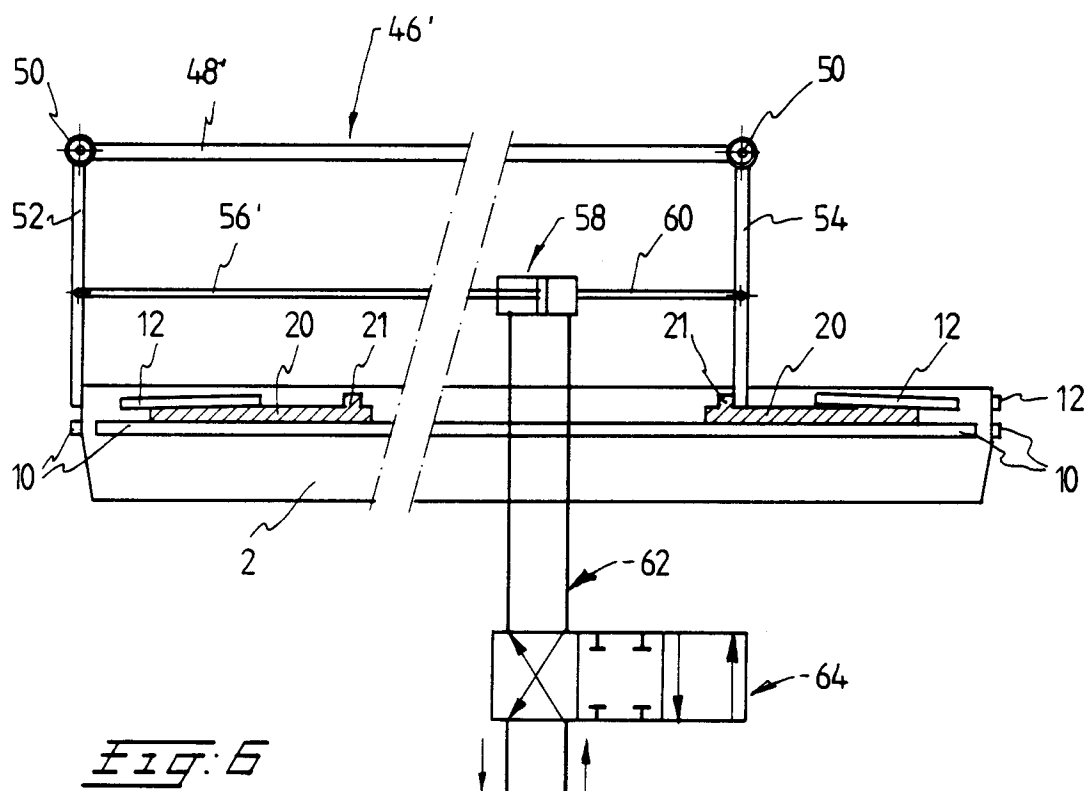
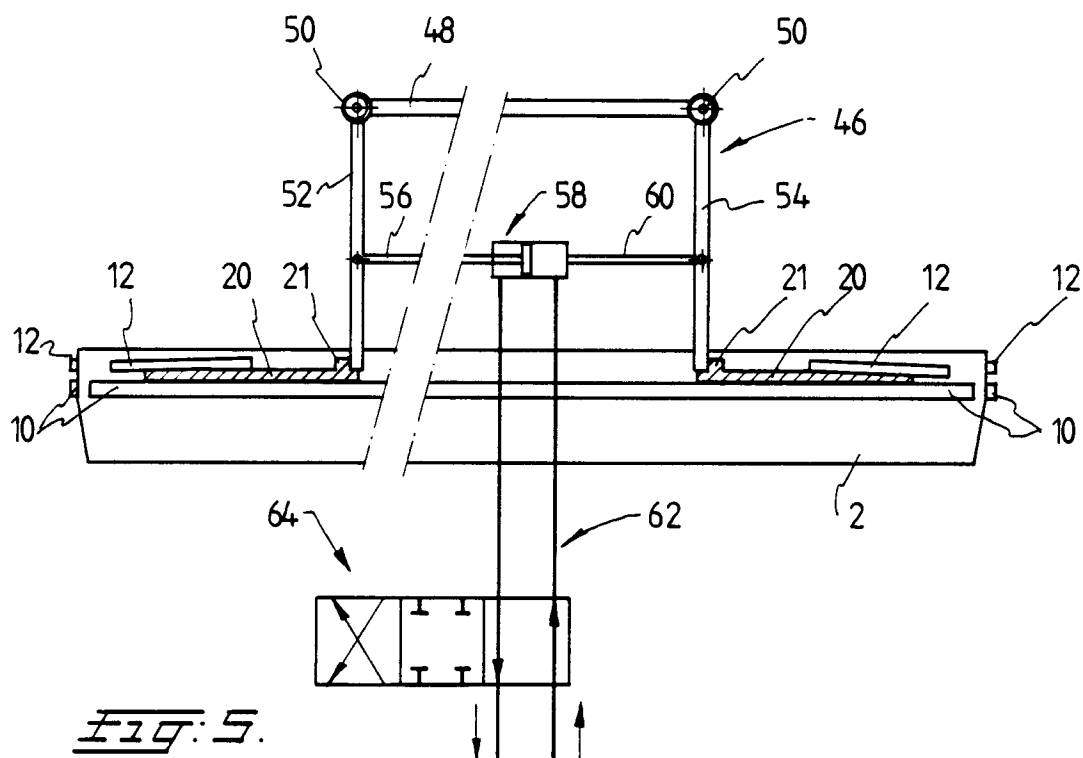


Fig. 4.





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 20 0482

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	BE-A-455 492 (SCHMID) * page 2, line 17 - line 22 * * page 3, line 12 - line 14 * * page 3, line 19 - line 27; figures 1,6 *	1-6	E01C5/00 E04B5/02
A	---	10	
Y	FR-A-1 518 263 (MONTESSUIT) * page 1, left column, line 37 - right column, line 27; figures 1,2 *	1-6	
A	---	10	
A	US-A-1 697 070 (KNIGHT) * page 1, line 1-3 * * page 2, line 33 - line 41; figure 5 *	1,5,6,10	
A	EP-A-0 408 479 (TECHNOLOGIES SPECIALES INGENIERIE -T.S.I. (S.A.)) * column 7, line 41 - column 8, line 12; figures 1-4,9,10 *	1,4-8,10	
A	GB-A-615 470 (ALENIUS) * page 1, line 38 - page 2, line 5; figures 1-8 *	1,2,4,10	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	GB-A-1 598 460 (S. MARSHALL & SONS LIMITED)		E01C E04B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25 MARCH 1992	Examiner DE COENE P.J.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			