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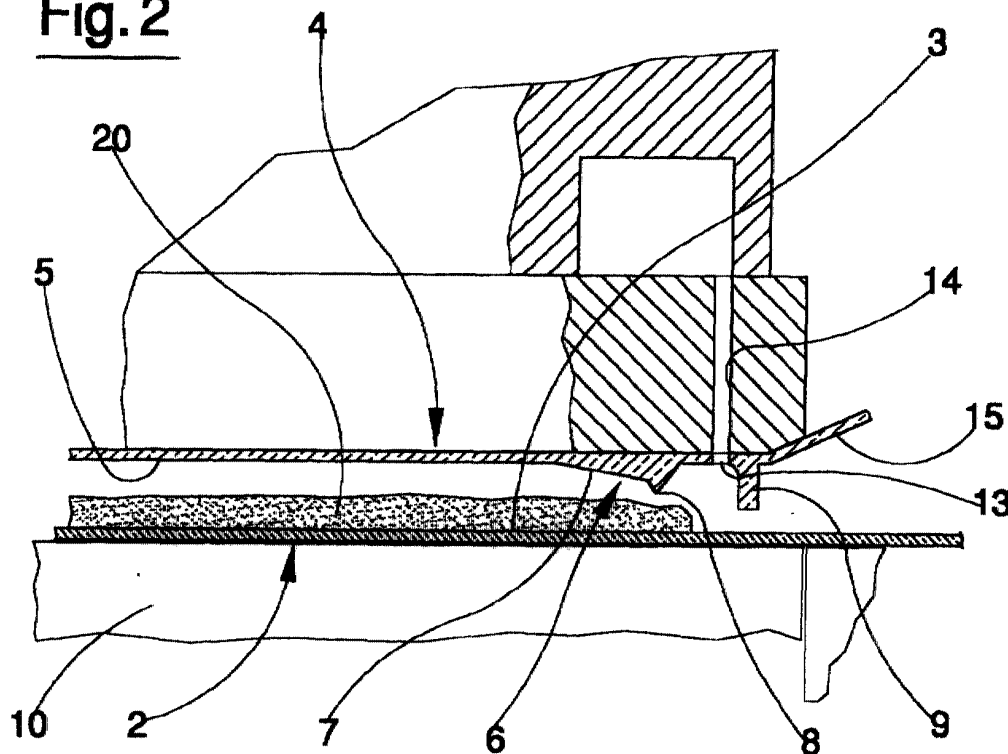
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(54) **An improved device for forming ceramic products, including slabs, tiles and the like, by powder pressing**

(57) The improved device of the invention comprises a lower element (2) for supporting powder (20) to be pressed and an upper element (4) between which two elements (2 and 4) the powder (20) will be pressed. The invention is characterised by the fact that it comprises

means for surrounding and sealingly isolating at least a part of the powder (20) from an outside environment when the two elements (2 and 4) are reciprocally neared. Air is aspirated from the isolated part of the powder, creating a depressed environment.

Fig. 2



Description**Description.**

[0001] The prior art in the field of forming ceramic tiles is based on the use of dies inserted into presses. The dies are, schematically speaking, constituted by a cavity into which powders are deposited, and by at least one punch having the task of pressing the deposited powders.

[0002] Also known is the use of dies in which the cavity is not made in the bottom die; this is instead used for depositing a layer of powders which is then pressed by the top die or punch. Delimitation and lateral containment of the material to be pressed to form the tile or slab is performed by a forming frame associated to the punch or top die, which is mobile and projects from the top die so that it can remain in contact with the bottom plane (bearing the powders to be pressed) during the pressing operation.

[0003] In prior-art devices, the forming is performed in a substantially two-stage pressing operation: a first stage, characterised by a considerable reduction in the volume of the blank tile, during which stage there is also an expulsion of air trapped in the material; a second stage, in which the by-now air-free material is further compressed, with a consequent further but smaller reduction in volume thereof. The forming is thus completed.

[0004] The two-stage pressing operation requires specific press predisposition and management which are necessarily time-consuming and result in considerably longer production times than in those processes which require only one pressing stage.

[0005] On the other hand, single-stage pressing using traditional methods cannot be used because they cannot produce a blank free of serious defects, such as flaking and the like.

[0006] The main aim of the present invention is to provide an improved device for forming ceramic products, such as slabs, tiles and the like, by powder pressing, which device enables pressing to be performed in a single stage but without those limitations and drawbacks which characterise the prior art.

[0007] The invention is constructionally simple and functional.

[0008] A further advantage of the invention is that it enables a considerable reduction in cycle times to be achieved, with an evident and immediate improvement in productivity.

[0009] These aims and advantages and more besides are all attained by the object of the invention, as it is characterised in the appended claims.

[0010] Further characteristics and advantages of the present invention will better emerge from the detailed description that follows of a preferred but non-exclusive embodiment of the invention, illustrated purely by way of a nonlimiting example in the accompanying figures of

the drawings, in which:

figure 1 is a schematic longitudinal section made according to a vertical plane which is parallel to an advancement direction of the materials;

figure 2 is an enlarged-scale view of a detail of figure 1;

figure 3 shows the same detail as in figure 2, in a different operational configuration.

[0011] With reference to the figures of the drawings, 1 denotes in its entirety a device for forming ceramic products, such as slabs, tiles and the like, by powder pressing, which device 1 is schematically constituted by a press 11 having a central aperture crossed by a lower element 2, constituted by a lower continuous belt 12 exhibiting a lower rest plane 3 for bearing the powders to be pressed 20, and by an upper element 4, constituted by a horizontal branch of a continuous belt 15, ring-wound and stretched between two horizontal-axis drums 16 positioned externally, which belt 15 is moved in synchrony with the lower continuous belt 12 constituting the lower element 2.

[0012] The lower element 2 lies and slides along an upper surface of the piston 10 of the press 11 and is commanded by the piston 10 to displace upwards in order to exert the pressing action.

[0013] The upper element 4 is provided with a plurality of active surfaces 5, located and distributed in a predetermined order along the upper continuous belt 15. At each pressing event the active surfaces 5 are brought into contact with the rest plane 3 of the lower continuous belt 12.

[0014] Each active surface 5 is characterised in that it is provided with a forming frame 6 which projects inferiorly (when the active surface 5 is in contact with the rest plane 3) and is predisposed in such a way as to delimit at its perimeter a closed pressing zone.

[0015] The forming frame 6 exhibits an internal part 7 which carries out the pressing of the edge of the final pressed product. This internal part 7 is externally delimited by an edge 8 having a depth, measuring in the pressing direction, which is not less than or is equal to that of the central body of the final pressed product.

[0016] In particular, the internal part 7 inferiorly projects with respect to the active surface 5 and presents a depth which gradually decreases as it distances from the edge 8.

[0017] The whole forming frame 6 is constituted by a material having considerable elastic deformability (rubber or another elastomer).

[0018] The upper branch of the lower continuous belt 12 is moved in synchrony with the lower branch of the upper continuous belt 15.

[0019] In the described structure, the lower rest plane 3 also functions as the bottom die of the forming device.

[0020] During the pressing phase, the piston 10 rises, raising the part of the lower element 2 on which the pow-

der to be pressed has been deposited, thus pressing the powder against the active surface 5 delimited by the forming frame 6 of the upper continuous belt 15.

[0021] The whole pressing operation is completed in a single phase (i.e. in a single continuous upwards stroke by the piston 10) and in a depressed environment, as will be explained herein below.

[0022] Means are provided for sealingly isolating and closing off at least a part of the powders 20 comprised between the lower element 2 and the upper element 4, confining that part of the powders 20 in an isolated environment 17. The means for isolating comprise lateral walls 9 which describe a closed perimeter. The walls 9 are of constant depth and project in the direction of relative motion between elements 2 and 4 during the pressing cycle. The walls 9 are made of a very elastically-deformable material, such as rubber or another elastomer, and are of a size such as to realise an isolated environment 17 just before the powder pressing 20 begins. Also provided are means for aspirating, which aspirate the air from the isolated environment 17 in order to create a depression.

[0023] The means for aspirating comprise aspiration ducts 13 located peripherally of the lateral walls 9 and internally of the perimeter the walls 9 define.

[0024] The aspiration ducts 13 lead into aspiration conduits 14 afforded in the upper body (fixed punch) of the press 11, i.e. the aspiration ducts 13 are in fact through-holes made in the upper continuous belt 15, which is, as mentioned herein above, ring-wound and stretched between two parallel-axis drums 16 positioned externally of the press 11.

[0025] The lower branch of the upper continuous belt 15 constitutes the upper element 4 which is provided with at least one active surface 5 which faces the lower rest plane 3 and is provided with a forming frame 6 which projects inferiorly and is located such as to delimit a perimeter of a closed pressing zone.

[0026] The forming frame 6 is not only designed to create a closed pressing zone which will generate a final pressed product, but also generates, following the pressing operation, an edge zone of the final pressed product which is characterised by a greater density than that of the internal zones of the final pressed product, though a smaller depth.

[0027] For this purpose the forming frame 6 exhibits an internal part 7 especially formed and designed to press the edge zone; the internal part 7 being externally delimited by an edge 8 which is of a depth (measuring in the pressing direction) that is equal or not inferior to the central body of the final pressed product.

[0028] The aspiration ducts 13 are afforded in the upper continuous belt 15 in the zone comprised between the walls 9 and the edge 8, and are therefore in direct communication with the annular zone comprised between the walls 9 and the edge 8.

[0029] By effect of a positioning of the lower branch of the upper continuous belt 15, the aspiration ducts 13

are positioned so as to coincide with the aspiration conduits 14.

[0030] This happens at each pressing cycle when the upper continuous belt 15, ring-wound and housing a plurality of active surfaces 5 delimited by an equal number of forming frames 6, is positioned such that an active surface 5 is facing the lower element 2 bearing the lower rest plane 3 on which the powders to be pressed have been deposited.

[0031] The lower element 2 is constituted by an upper branch of the lower continuous belt 12, which upper branch moves in synchrony with the lower branch of the upper continuous belt 15.

[0032] Starting from the beginning of the pressing cycle, in particular from the moment when the walls 9 make contact with the rest plane 3, an isolated environment 17 is created, which isolates a space from the outside environment, which space contains a layer of powders to be pressed. By effect of the aspiration by the ducts 13, the air freed by the compacting of the powders is extracted simply and effectively. At the beginning of the pressing process, the powders are in a depressed environment, which greatly favours expelling of air from the powders, thus eliminating defects deriving from bad aspiration conditions and rendering the pressing cycle very rapid.

[0033] A further advantage of the present invention is that formation operations of large-format but relatively slim slabs and tiles are completed much more quickly.

Claims

1. An improved device for forming ceramic products, including slabs, tiles and the like, by powder pressing, comprising a lower element (2) for supporting powders (20) to be pressed, and an upper element (4), between which lower element (2) and upper element (4) the powders (20) will be pressed, **characterised in that** it comprises means for surrounding and sealingly isolating at least a part of the powders (20) about to be pressed between the lower element (2) and the upper element (4) from an outside environment and creating an isolated environment (17) for the powders (20); also comprising means for aspirating, which create a depression in the isolated environment (17) by aspirating air therefrom.
2. The device of claim 1, **characterised in that** the means for surrounding and sealingly isolating comprise lateral isolating walls (9) which describe a closed perimeter.
3. The device of claim 2, **characterised in that** the lateral walls (9) exhibit a constant size in a direction corresponding to reciprocal movements of the lower element (2) and the upper element (4) during a

pressing cycle, and in that the lateral walls (9) are made of a very elastically-deformable material.

4. The device of claim 2, **characterised in that** the means for aspirating comprise aspiration ducts (13) predisposed peripherally and close to the lateral walls (9) and internally of the perimeter described by the lateral walls (9).

5. The device of claim 3 or 4, **characterised in that** the lower element (2) bears a lower rest plane (3) for supporting the powders (20) to be pressed, and in that the upper element (4) exhibits at least one active surface (5) facing the lower rest plane (3), which at least one active surface (5) exhibits a forming frame (6) which projects inferiorly thereof and which is destined to delimit a perimeter of a closed pressing zone; the forming frame (6) also and as a consequence being destined to delimit a final pressed product obtained by a forming operation; the forming frame (6) also generating, during the forming operation, an edge of the final pressed product which edge has a greater density than a density of an internal zone of the final pressed product, and which edge has also a smaller depth than a depth of the internal zone of the final pressed product.

6. The device of claim 5, **characterised in that** the forming frame (6) exhibits an internal part (7) which performs a pressing operation on the edge of the final pressed product, and which is externally delimited by a delimiting edge (8) having a depth which, measured in a direction in which a pressing operation is performed, is not less than or is equal to a depth of a central body of the final pressed product (21).

7. The device of claim 5 or 6, **characterised in that** the upper element (4) exhibiting the at least one active surface (5), delimited by the forming frame (6), is constituted by a lower branch of an upper continuous belt (15) which is ring-wound and stretched between two parallel-axis drums (16) located externally of the device; the aspiration ducts (13) being constituted by through-holes afforded in the upper continuous belt (15) in a zone comprised between the lateral isolating walls (9) and the delimiting edge (8).

8. The device of claim 7, **characterised in that** the aspiration ducts (13) are predisposed to be brought into a coincidental position with corresponding aspiration conduits (14) made in an upper body of the press (11).

9. The device of claim 9, **characterised in that** the ring-wound upper continuous belt (15) houses a

plurality of the active surfaces (5) delimited by an equal plurality of forming frames (6) distributed along the upper continuous belt (15).

10. The device of claim 9, **characterised in that** at least the forming frame (6) is made of a material having considerable elastic deformability and in that the lower element (2) bearing the lower rest plane (3) for supporting the powders (20) to be pressed, as well as the final pressed product, is constituted by an upper branch of a lower continuous belt (12) which is moved in synchrony with the lower branch of the upper continuous belt (15).

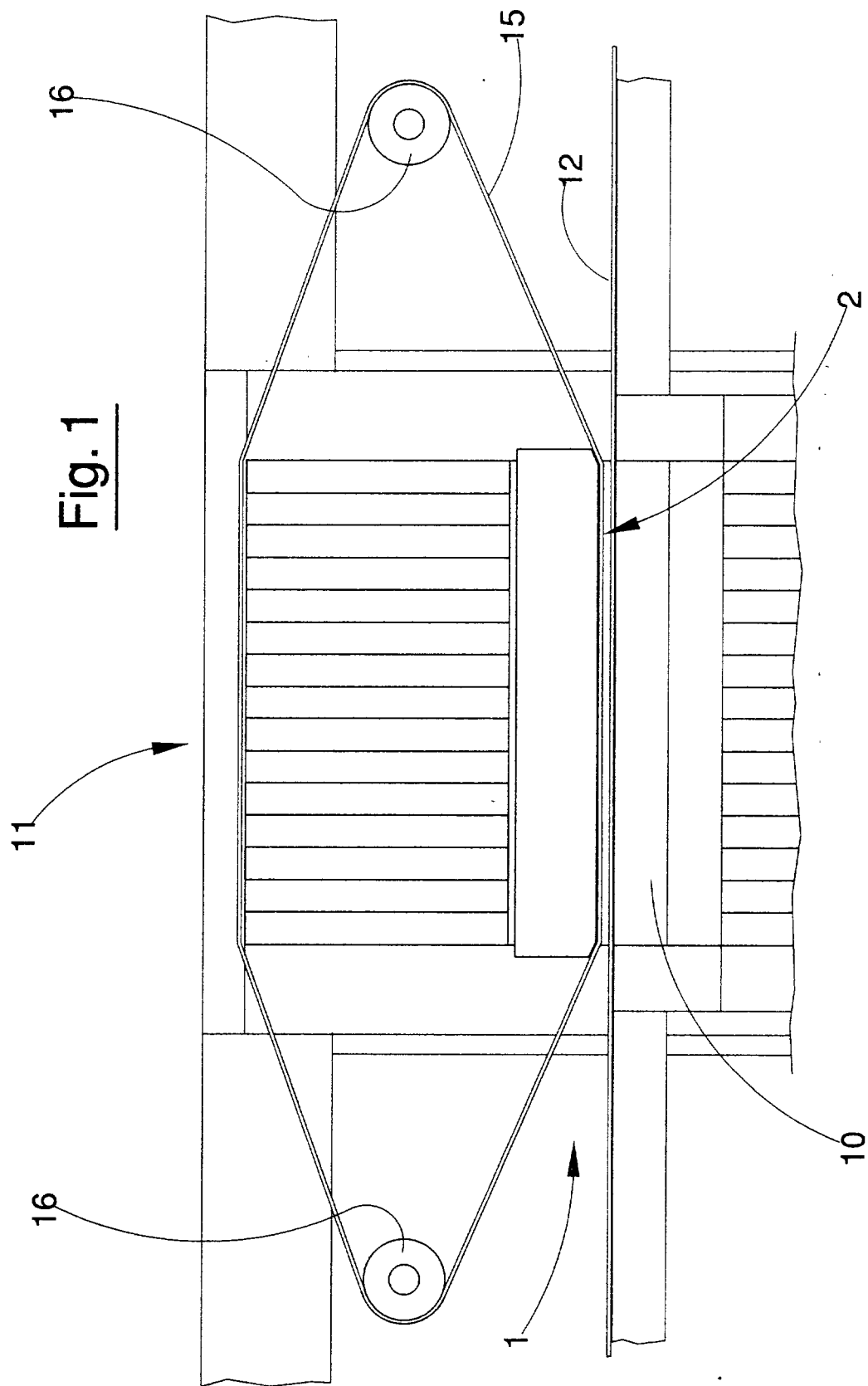


Fig. 2

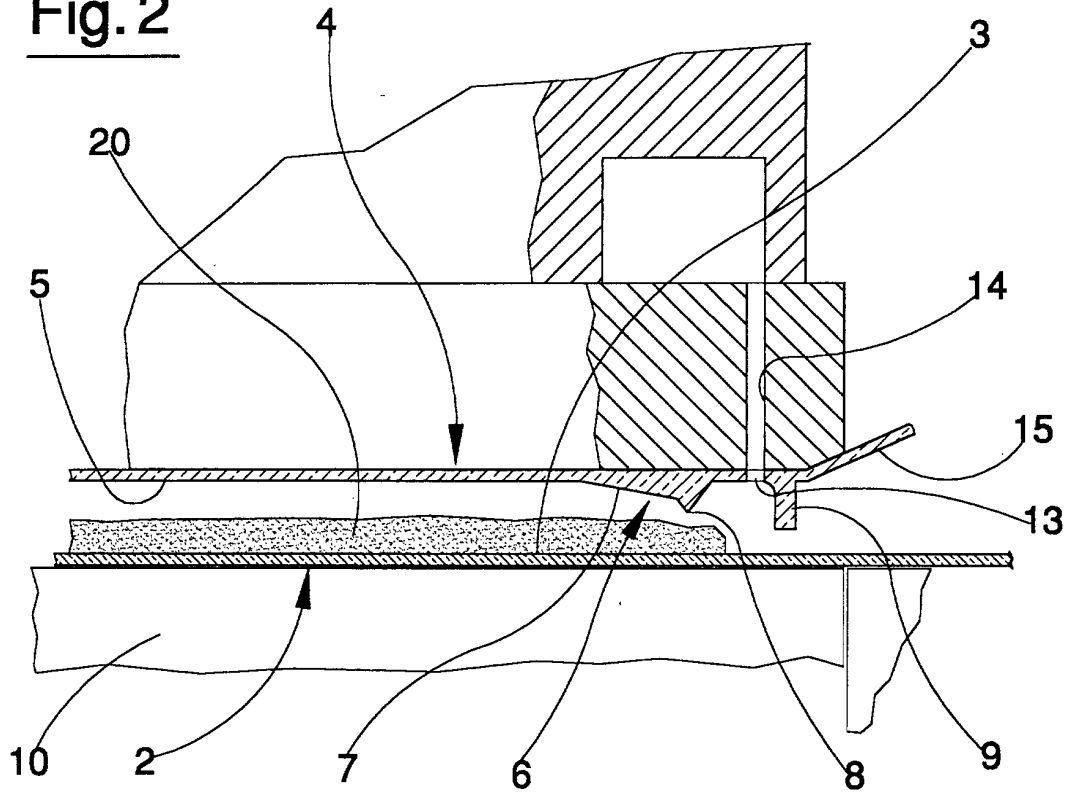
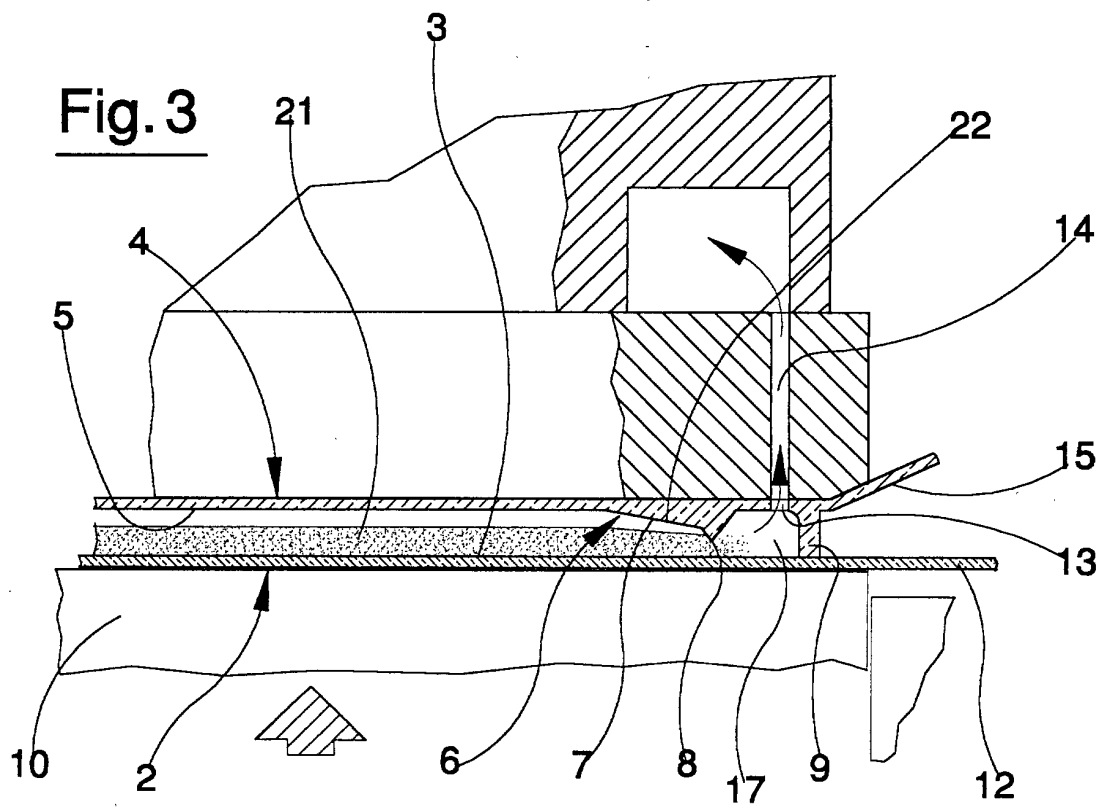


Fig. 3





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 00 20 1040

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.7)
A	US 5 779 957 A (CHAMPOMIER CLAUDE ET AL) 14 July 1998 (1998-07-14) * the whole document * * figures 5,8,11 * ----	1-3,5-7, 9,10	B28B3/02 B28B7/44 B28B5/02 B28B7/00
A	WO 96 15888 A (CAMORANI CARLO ANTONIO ;ALGERI MARIS (IT)) 30 May 1996 (1996-05-30) * page 12, line 23 - page 2, line 34 * * page 19, line 32 - page 20, line 26 * * figures 2-5,28,29,32,33,37-40 * ----	1-3,10	
A	DE 11 42 265 B (JURID WERKE G.M.B.H.) * the whole document * ----	1,2,4,10	
A	GB 2 260 318 A (DAIKEN CORP) 14 April 1993 (1993-04-14) * the whole document * * figures 1-4 * ----	1,2,5,6, 10	
A	GB 647 144 A (THE MALKIN TILES) * the whole document * ----	1,2,5,6	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	WO 98 23424 A (ALGERI MARIS ;CAMORANI CARLO ANTONIO (IT)) 4 June 1998 (1998-06-04) * page 26, line 10 - page 27, line 5 * * figure 30 * ----	1,9	B28B
A	DE 19 65 173 A (STEINZEUG- UND MOSAIKPLATTENFABRIK) 22 July 1971 (1971-07-22) * the whole document * * page 4, line 13 - page 4, line 16 * * figure 4 * -----	1,5,6	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14 August 2000	Examiner Gourier, P
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			

EPO FORM 1503 03.82 (P4/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 20 1040

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-08-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5779957 A	14-07-1998	FR 2714048 A	23-06-1995
		AU 1193695 A	03-07-1995
		CA 2179173 A	22-06-1995
		EP 0734360 A	02-10-1996
		WO 9516644 A	22-06-1995
		JP 9506582 T	30-06-1997
WO 9615888 A	30-05-1996	IT M0940159 A	22-05-1996
		AU 4174396 A	17-06-1996
		BR 9509806 A	21-10-1997
		CN 1173154 A	11-02-1998
		EP 0793565 A	10-09-1997
DE 1142265 B		NONE	
GB 2260318 A	14-04-1993	NONE	
GB 647144 A		NONE	
WO 9823424 A	04-06-1998	IT M0960151 A	22-05-1998
		IT M0970004 A	16-07-1998
		IT M0970005 A	16-07-1998
		AU 5120198 A	22-06-1998
		EP 0939691 A	08-09-1999
DE 1965173 A	22-07-1971	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82