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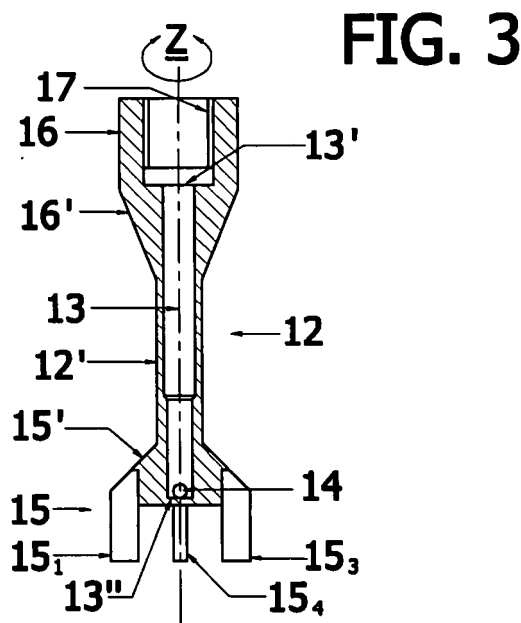
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(54) **Apparatus for producing patterned tiles and tiles obtained thereby**

(57) Apparatus for producing patterned tiles, including: a press with at least one mould; a delivery and mixing impeller (12), including a working extremity (15), an intermediate section (12') and an actuating extremity (16), endowed with means for feeding the working extremity with liquid (13) and intended to rotate on itself about a longitudinal rotation axis (Z); the working extremity (15) including one or more liquid delivery holes (14) and liquid

mixing bladelets (15₁, 15₂, 15₃, 15₄) in radial arrangement relative to the longitudinal rotation axis (Z); a unit for delivering and metering colouring liquid (22) to the delivery and mixing impeller (12), and means for the actuation of the impeller in rotation on itself; in vertical displacement, and in translation on a plane relative to the at least one mould, and a programmable processor to control the unit for delivering and metering colouring liquid and the actuation means.



Description

Field of the Invention

[0001] This invention relates to the field of patterned cementitious agglomerate tiles.

[0002] More specifically, it relates to an apparatus for producing patterned tiles, and to tiles produced thereby.

Background of the Invention

[0003] The manufacturing of cementitious agglomerate tiles, for floors or coverings, and more generally of all the products that can be realized by the same type of agglomerate, such as e.g. steps or tables, envisages the working of a starting cementitious slurry, formed of a dense cementitious suspension, by a press having one or more moulding cavities. The fabrication of a patterned tile involves achieving a pattern or image or a chromatic effect on the surface at sight of the tile itself, which, therefore, will result to be different from the one spontaneously determined by the starting cementitious slurry. In traditional art the pattern is obtained by resorting to the use of a plurality of different mixes and of partitioning elements consisting of small frameworks so manually profiled, that one is able to reproduce a desired image by them. The small frameworks are arranged inside the moulding cavity of the press, in which moulding press they determine precisely defined spaces, that allow an operator to manually introduce mixes of various colours therein, so that each slurry fills a space of its own, and, once the tile finished, the profile of the used partitioning element being reproduced on this one, the desired image turns out to be reproduced. Traditional art, therefore, has the drawback that it involves a manual and complex working, as one has to arrange a plurality of mixes in as many mixers, and a respective partitioning element having to be fabricated for each drawing, the whole being associated to the employment of a highly skilled labour.

[0004] Therefore, this invention proposes the object to itself to provide an apparatus, endowed with programmable data processing means, which apparatus allows patterned tiles to be produced in industrial, automated, programmable way, overcoming the drawbacks of traditional art, by means of a head or impeller including an actuating extremity, an intermediate stem and a working extremity, the latter being endowed with hole liquid dispensing means and with blade dispensing means to dispense and slurry a colouring liquid, composed of a solution of colouring agents, once the impeller has been dipped into the starting cementitious slurry, and driven to move in translation in it by pantograph means, rotating around an own longitudinal rotation axis thereof, dispensing the colouring solution and mixing it with the cementitious slurry to dye a drawing in it, by virtue of the fixation of the colouring agents on the particles of the dense suspension of the cementitious slurry; by means of which apparatus it is possible to produce tiles bearing a drawing

of whichever conception on a surface at sight thereof, with a result of a drawing of value.

[0005] In this spirit, for reducing such a conception to practice, the Inventor of this application has confronted himself with the mixing of the colouring solution dispensed by the dispensing and mixing impeller with the matter of the cementitious slurry that comes into contact with it. He has found the problem of a difficulty in the dispensing of the colouring solution and of a tendency of the cementitious slurry to a reflux of infiltration towards the inside of the impeller, going as far as clogging it, or anyhow adversely affecting the precision of the drawing on the tile. Therefore, it is the object of this invention to provide a solution to this problem.

[0006] Such a problem according to the teaching of this invention is solved by the contrivance of shaping the hole liquid dispensing means as one or more holes in radial arrangement relative to said longitudinal rotation axis of the impeller, i.e. in such an arrangement as to guide the flows of the dispensing of the colouring liquid perpendicularly to said longitudinal rotation axis of the impeller (if a plurality of delivery holes is present, obviously these ones can find themselves with their respective liquid outflow directions all arranged on the same plane perpendicular to the longitudinal axis of rotation of the impeller). By this contrivance the delivery holes find themselves arranged in such a manner, that the centrifugal force field generated by the rotation of the impeller acts in them repelling the particles of the cementitious slurry therefrom and impeding the particles to infiltrate them and promoting the dispensing of colouring liquid.

[0007] The Inventor of this application has also confronted himself with the problem of the mechanical interaction of the mixing blades with the cementitious slurry. He has found a problem of wear of the mixing blades of the impeller in performing their work, caused by the abrasive environment of the cementitious slurry in which they find themselves. It is a further object of this invention to provide a solution to this problem too. Such an object is reached by making the blades in a hard metal, such as e.g. Widia, which can also be pieces inserted on the dispensing and mixing impeller.

[0008] Moreover, he has also found a problem in the mechanical interaction between the dispensing and mixing impeller and cementitious slurry in the vertical motion of the impeller, at the moment of the introduction of it into the slurry and of the extraction of it from the slurry. In order to avoid that the slurry opposes too much resistance to the introduction of the impeller therein, a tapering is envisaged of the body of the impeller from the actuating extremity towards the intermediate stem. In order to avoid that the impeller removes some slurry in its extraction therefrom, a tapering is envisaged of the body of the impeller from the working extremity thereof towards the intermediate stem.

[0009] The inventor of this application also proposes the object to itself to provide a machine that is able to draw tracts having various widths. To achieve this object,

it is envisaged that the dispensing and mixing impeller, and a driving shaft that supports and actuates it of the machine, are endowed with complementary reversible, i.e. easy-disassembly, assembly means.

[0010] The inventor of this application has also found that the dispensing of colouring liquid by the impeller, in order to achieve a good result has to be a function of its speed of translation within the slurry, as well as of the desired drawing, and that the supply of colouring liquid to the impeller has to be a function of the diameter of the impeller. Therefore, this invention provides that said data processing means are programmed to command a colouring liquid supply to the impeller that is a function of the diameter of the impeller and of its speed of translation within the cementitious slurry, as well as of the desired drawing. Subject-Matter of the Invention

[0011] Therefore, it is the subject-matter of this invention a machine for producing patterned tiles including a colouring solution dispensing and mixing impeller according to Claim 1.

[0012] Preferred embodiments are recited in Claims 2 to 5.

[0013] It is also the subject-matter of this invention a patterned tile produced by such a machine, according to Claim 6.

Brief Description of the Drawings

[0014] This invention will be fully understood based on the following detailed description of a preferred embodiment thereof, only given as a matter of example, absolutely not of restriction, referring to the annexed drawings, wherein:

- FIGURE 1 is a top view of a semicircular half of a mould-bearing table of a rotary press machine for producing patterned tiles envisaged by this invention;
- FIGURE 2 is a partial-section view, along line A-A of FIGURE 1 along a radius of the rotary press, of the second station of the machine, which puts the drawing equipment, and the mould in cross-section, into evidence;
- FIGURE 3 represents a preceptive mixing impeller, in longitudinal section, to be employed in the drawing equipment, and
- FIGURE 3A represents a working, lower extremity of the mixing impeller in bottom view.

Detailed Description of the Invention

[0015] Referring to FIGURE 1, a machine envisaged by this invention can include a normal rotary press **P** for single-layer tiles having a mould-bearing table **T** bearing four moulds, three of which visible **1**, **2**, **3**, which a first station **S1**, a second station **S2**, a third station **S3** and a fourth station (not visible) correspond to. The four stations respectively correspond to a first manufacturing

phase, of filling the mould with the cementitious slurry for the fabrication of a tile, to a second manufacturing phase, of drawing of the tile, to a third manufacturing phase, of pressing of the tile, and to a fourth phase, of delivery of the tile. That is to say, in first station **S1** the falling takes place of cementitious slurry **S**, normally including a dense suspension of hard marble grit, marble powders, very fine particle size cement in water (in a composition known to any manufacturer). In first station **S1** a vibration is envisaged of the bottom of the mould to promote the levelling of cementitious slurry **S** in the mould. Once the operations envisaged in first station **S1** have been terminated the mould is rotated, as denoted by arrow **R**, to bring itself in second station **S2**. In the stop in second station **S2** the drawing phase is effected, by virtue of a drawing equipment arranged in correspondence with second station **S2**. The drawing equipment includes a pantograph including an abscissa slide **10** and an ordinate slide **11** interdependent on each other and arranged the one on the other, covered with respective protective sheaths **10'**, **11'**, and movable in both senses along axes perpendicular to each other, as respectively indicated by arrows **X** and **Y**. On abscissa slide **10** a drawing head **H** is assembled, which can be displaced in translation by the pantograph in the area of mould **2**.

[0016] Referring to FIGURE 2, in which mould **2** partially filled with cementitious slurry **S** is visible, drawing head **H** includes a box **101**, for containment and support, which a dispensing and mixing impeller **12**, which radially sprinkles liquid, which overlooks mould **2**, is assembled onto by means of an impeller-bearing driving shaft **100** in turn assembled onto box itself **101** revolvingly supported by means of ball bearings **102**. On drawing head **H** an air cylinder **21** is assembled which performs a vertical movement of dispensing and mixing impeller **12**, it being able to make it to penetrate in cementitious slurry **S**, and to lift it therefrom. On the other side, a pneumatic motor **20** assembled on drawing head **H** and endowed with a pulley **103** and with a belt **104** which engages impeller-bearing shaft **100**, by means of the latter actuates dispensing and mixing impeller **12** in a motion of rotation on itself. The displacement in translation imparted to box **101** by the pantograph evidently actuates a translation movement of dispensing and mixing impeller **12** in the area of mould **2**, in the interior of cementitious slurry **S**.

[0017] Referring to FIGURE 3, dispensing and mixing impeller **12**, preceptive, is a lathe-fabricated piece, which includes a spindle piece shaped with an intermediate stem **12'**, a working extremity **15**, intended to be dipped into cementitious slurry **S** necessary for producing a tile, and an actuating extremity **16**, which takes the motion for actuating the dispensing and mixing impeller. The dispensing and mixing impeller is affected by a supply hole **13** which crosses it axially from the actuating extremity, in correspondence of which it is open **13'**, up to the working extremity, in correspondence of which it is closed as a dead end **13''**. In supply hole **13** a supply hoselet **105**, having a hole having a diameter e.g. of 2-3 mm, which

feeds the colouring water solution to working extremity **15**. Dead end **13''** forces the colouring water fed by the supply hoselet to pour out of the dispensing and mixing impeller through a delivery hole **14** having its axis that perpendicularly intersects the one of supply hole **13**, which is the longitudinal axis of rotation of impeller **12**. The rotation of the dispensing and mixing impeller generates a centrifugal force field by virtue of which the pouring out is promoted of colouring liquid, as well as the particles of cementitious slurry **S** are prevented from infiltrating delivery hole **14**, which so keeps perfectly clean, notwithstanding it finds itself permanently immersed in the cementitious slurry. It turns out to be apparent from this description that the dispensing and mixing impeller, rotating within cementitious slurry **S** and with the supply of colouring water modifies the colour of the cementitious slurry which comes into contact with it, by fixation of oxides, e.g. iron and chromium oxides, onto the particles of the dense suspension of the cementitious slurry.

[0018] On drawing head **H** a colouring liquid metering device **22** is assembled, as can be seen in FIGURE 1 and in FIGURE 2. This one may include four dispensers, each one for a different colour, two of which **22₁**, **22₂** can be seen in FIGURE 2. Metering device **22** supplies the colouring liquid to the dispensing and mixing impeller through aforesaid supply hoselet **105**. Metering device **22** can meter colouring water from its individual dispensers in such a way as to obtain the colourings necessary for realizing a desired image to be depicted on the tile to be manufactured, e.g. a geometric or an abstract image. Metering device **22** also performs a metering of the coloured water flow rate to be fed to the dispensing and mixing impeller, as a function of the diameter of the impeller and of the speed of the shift thereof in translation and as a function of the typology of the drawing to be realized.

[0019] It is envisaged that for the execution of drawings of various conceptions the use is imposed of dispensing and mixing impellers having various diameters. Therefore, this invention envisages a kit of a plurality of mixing impellers. In compliance with this, dispensing and mixing impeller **12** is conceived as an interchangeable piece, by virtue of the following contrivances. Actuating extremity **16** has a threaded hollow **17** for the reversible assembly onto impeller-bearing shaft **100** (by "reversible assembly" an easily disassembled coupling being meant). Impeller-bearing shaft **100** is correspondingly endowed with a threaded connecting projection complementary to the one **16** of dispensing and mixing impeller **12**.

[0020] Referring to FIGURE 3 and to FIGURE 3A working in impeller **12** is endowed with four mixing bladelets **15₁**, **15₂**, **15₃**, **15₄** in radial arrangement, i.e. with each bladelet body generally arranged on a plane passing through longitudinal rotation axis **Z** of the dispensing and mixing impeller itself. The bladelet bodies may be planar. Delivery hole **14** may open in one of the mixing bladelets, or it may open in a gap space between two contiguous bladelets. Mixing bladelets **15₁**, **15₂**, **15₃**, **15₄** promote

the mixing of the colouring solution with the cementitious slurry during the rotation of dispensing and mixing impeller **12** within cementitious slurry **S**. According to a preferred embodiment, the mixing blades are realized with insert pieces in Widia.

[0021] As can be seen in FIGURE 3, actuating **16** and working **15** extremities of dispensing and mixing impeller **12** are filleted to intermediate stem **12'** by means of respective taperings **16'**, **15'**, which get narrower towards intermediate stem **12'**, which solve the problem of the mechanical interaction of the dispensing and mixing impeller with the cementitious slurry in its vertical lowering movements in the latter and in its lifting movements from the latter, without the extraction of the dispensing and mixing impeller from the cementitious slurry modify the latter.

[0022] A machine according to this invention envisages an electronic processor (not depicted), interfaced with pneumatic motor **20**, with air cylinder **21** and with pantograph **PG**, programmed to command movements to these ones to be imparted to dispensing and mixing impeller **12**, and interfaced with metering device **22** and programmed to command to this one to deliver colouring liquids coming from its respective dispensers according to desired relative proportions, and to command the flow rate of the colouring liquid that supplies dispensing and mixing impeller **12** as a function of the diameter and of the speed of translation of the latter, as well as of the desired type of drawing.

[0023] Dispensing and mixing impeller **12**, depicted in FIGURE 2 above mould **2**, is made by pneumatic cylinder **21** to penetrate into cementitious slurry **S** within the mould, rotating under the actuation of pneumatic motor **20**, up almost to reach the bottom of mould **2**. In FIGURE 2 the dispensing and mixing impeller is depicted at the centre of mould **2**, but this circumstance is purely occasional, it being able, in the work reality, to penetrate into cementitious slurry **S** starting from another specific initial position, suggested by a particular drawing to be realized.

[0024] Pantograph **PG** will make dispensing and mixing impeller **12** to perform such a path as to draw a desired pattern. Dispensing and mixing impeller **12**, once a programmed path relevant to the desired drawing realized in the interior of the slurry, is lifted from the mould and so extracted from cementitious slurry **S**, to allow mould-bearing table **T** to rotate for the subsequent pressing phase in third station **S3**, where cementitious slurry, already drawn, undergoes the effect of a strong pressure, so giving rise to the final making of the product, the use surface of which is the lower one.

[0025] Alternately, a slurry dose is poured into the mould more than double of the normal one, to obtain a tile having a thickness more than double. In this case the dispensing and mixing impeller is commanded to penetrate up to half the depth of the slurry, and it will realize the drawing operations at such a depth. The subsequent pressing phase will realize a tile which, once seasoned, will be cut into two parts, realizing two tiles, with the ad-

vantage of doubling the production and of having two tiles bearing perfectly specular patterns.

[0026] The above description refers to a rotary press for single-layer materials, i.e. materials formed of a single slurry. Such a type of machine have the mould bottom which is draining, to allow the removal of excess water from the slurry during pressing. As regards the production of double-layer material the features of the mould-bearing table may differ from those illustrated both for the number of stations and for the features of the moulds, but, anyhow, the features of the assembly of members which the task of drawing is assigned to remain unchanged.

List of Reference Characters

[0027]

H:	drawing head;	
P:	press;	20
PG:	pantograph;	
S:	slurry;	
S1, S2, S3:	first, second and third station;	
T:	mould-bearing table of P ;	
1, 2, 3:	first, second and third mould;	25
10:	abscissa slide;	
11:	ordinate slide;	
12:	dispensing and mixing impeller;	
12':	intermediate stem;	
13:	hole for supplying 12 ;	30
13':	opening of 13 ;	
13'':	dead end of 13 ;	
14:	radial hole for supplying 12 ;	
15:	working extremity of 12 ;	
15₁-15₄:	mixing bladelets;	35
16:	actuating extremity of 12 ;	
17:	threaded hollow of 16 ;	
20:	pneumatic motor;	
21:	air cylinder;	
22:	metering dispenser of colouring liquid;	40
22₁, 22₂:	dispensers of 22 ;	
100:	impeller-bearing driving shaft;	
101:	box of 100 ;	
102:	ball bearing for assembling 100 ;	
103:	pulley of 20 ;	45
104:	belt of 103 ;	
105:	supply hoselet.	

Claims

- Machine for producing tiles, including a press (P) having at least one mould (2),
characterized in that it includes:

a dispensing and mixing impeller (12), including a working extremity (15), an intermediate section (12') and an actuating extremity (16), which

impeller is endowed with means for supplying said working extremity (15) with liquid (13) and is intended to rotate on itself around a longitudinal rotation axis (Z), said working extremity (15) including:

one or more liquid delivery holes (14) and liquid mixing bladelets (15₁, 15₂, 15₃, 15₄), in radial arrangement relative to said longitudinal rotation axis (Z) of the impeller; in combination with:

colouring liquid dispensing and metering means (22) including one or more dispensers of colouring liquids (22₁, 22₂), and means (105) for liquid communication with said dispensing and mixing impeller (12);
means for the actuation in rotation (20, 103, 104, 102, 100) of said dispensing and mixing impeller (12) on itself;
means for the actuation in vertical displacement (21) of said dispensing and mixing impeller (12) relative to said at least one mould (2);
means for the actuation in plane translation (PG, 10, 11) of said dispensing and mixing impeller (12) relative to said at least one mould (2);
programmable data processing means, interfaced with said means for the actuation in rotation (20, 103, 104, 102, 100), with said means for the actuation in vertical displacement (21) and with said means for the actuation in plane translation (PG, 10, 11) relative to said at least one mould (2), and programmed to command movements to the latter to be imparted to said dispensing and mixing impeller (12);
and interfaced with said dispensing and metering means (22) and programmed to command to the latter to dispense colouring liquids from said one or more dispensers (22₁, 22₂) according to desired relative proportions, and to command the flow rate of the colouring liquid which supplies said dispensing and mixing impeller (12) as a function of the diameter and of the speed of translation of this one, as well as of the typology of the pattern to be realized; to obtain tiles bearing a pattern on a surface thereof at sight.

- Machine according to Claim 1, wherein said dispensing and mixing impeller (12) includes:

a liquid supply hole (13) which passes through it along a rotation longitudinal axis thereof from said actuating extremity (16), up to said working extremity (15); said supply hole being open (13') in correspondence with said actuation extremity (16) and being closed as a dead end (13'') in correspondence with said working extremity (15);
and a delivery hole (14) or a plurality of delivery holes that open on said liquid supply hole (13), in radial arrangement relative thereto.

3. Machine according to Claim 1, wherein said working extremity (15) and said actuation extremity (16) of said dispensing and mixing impeller (12) are filleted to said intermediate section (12') of the same by means of taperings (15'; 16') which get narrower towards the intermediate section (12').
4. Machine according to Claim 1, wherein said one or more bladelets (15₁, 15₂, 15₃, 15₄) are in a hard metal, such as e.g. Widia.
5. Machine according to Claim 1, wherein said dispensing and mixing impeller (12) is endowed with reversible assembly means (17) for the purposes of the interchangeability thereof.
6. Patterned tile produced by a machine according to anyone of Claims 1 to 5.

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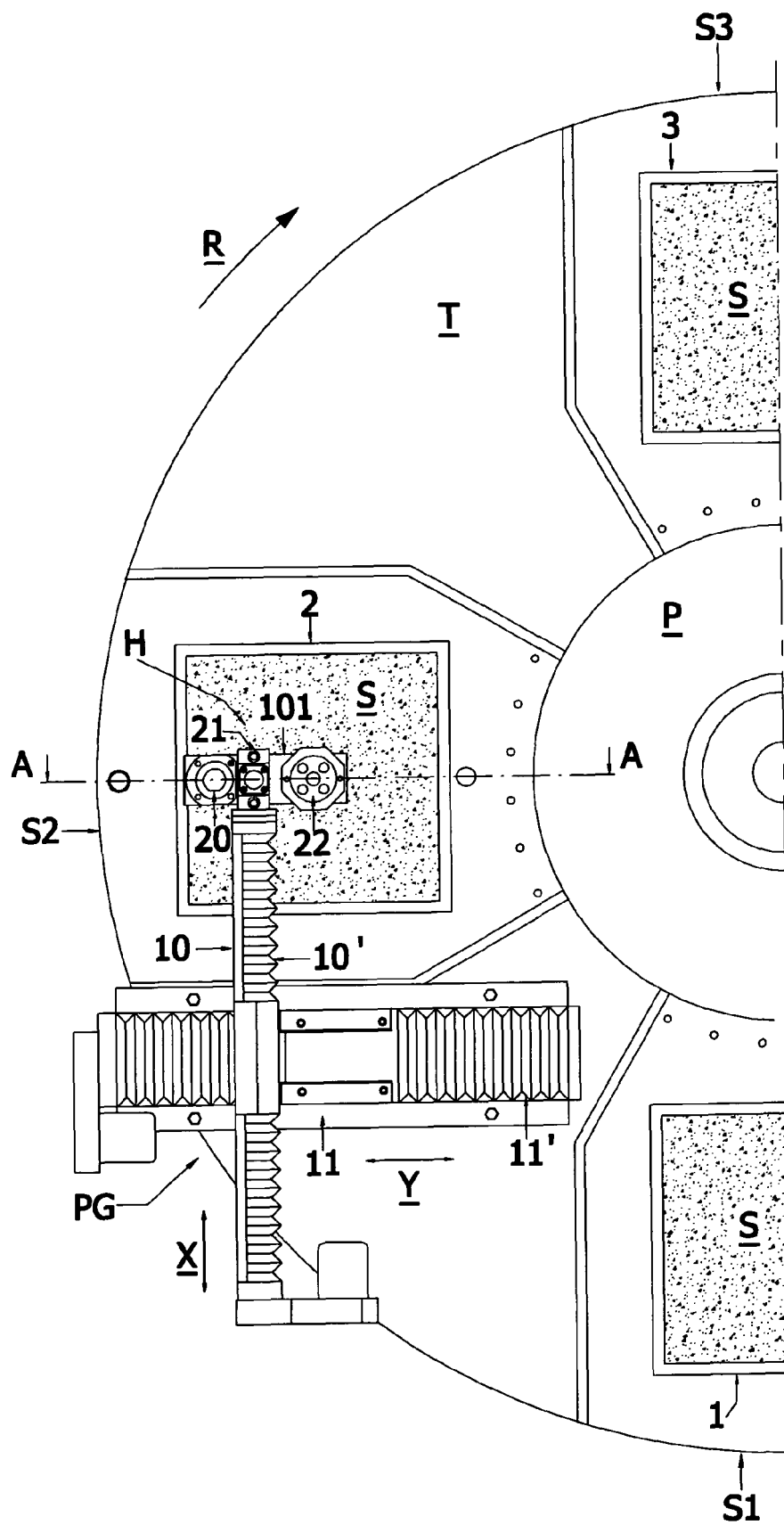


FIG. 3

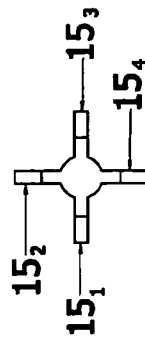
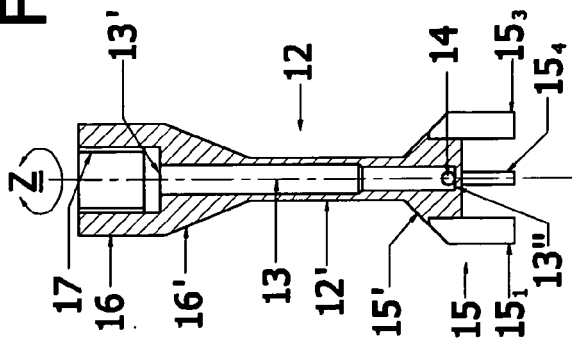


FIG. 3A

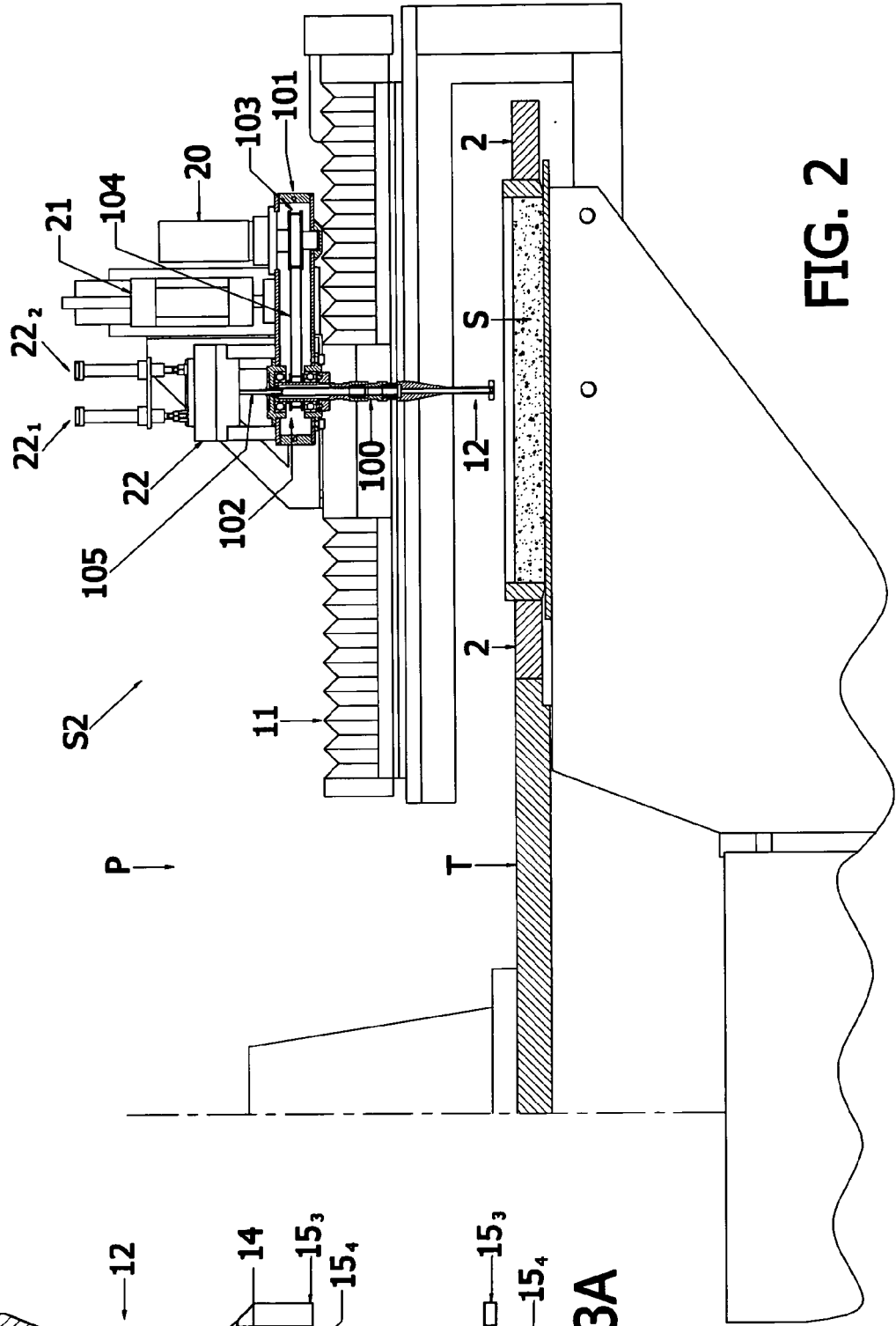


FIG. 2



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	ES 2 191 554 A1 (NORO FRANCO EUSEBIO; MORO FRANCO EUSEBIO) 1 September 2003 (2003-09-01) * claim 1; figures 1-3 *	6	B28B11/04 B28B11/00 B28B11/08 B28B11/12
A	FR 2 271 364 A (HUMILIER GISELE,FR) 12 December 1975 (1975-12-12) * page 1, line 35 - page 2, line 2; figures 1,2,5 * * page 2, line 9 - page 2, line 19 *	1,6	
A	US 5 435 889 A (DIETRICH ET AL) 25 July 1995 (1995-07-25) * claim 1; figures 1,4 *	1	
A	EP 0 319 972 A (METTEN PRODUKTIONS- UND HANDELS GMBH) 14 June 1989 (1989-06-14) * claim 1; figure 4 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			B28B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 16 March 2006	Examiner Boone, J
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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EPO FORM 1503 03.82 (P04C01)

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

EP 05 42 5675

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
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16-03-2006

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
ES 2191554	A1	01-09-2003	ES 2211299 A1	01-07-2004
FR 2271364	A	12-12-1975	NONE	
US 5435889	A	25-07-1995	FR 2697016 A1	22-04-1994
			GB 2273718 A	29-06-1994
			JP 3090457 B2	18-09-2000
			JP 6287092 A	11-10-1994
EP 0319972	A	14-06-1989	DE 3741618 A1	22-06-1989