



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
21.07.2021 Bulletin 2021/29

(51) Int Cl.:
B28B 5/00 (2006.01) B28B 5/04 (2006.01)
B28B 5/06 (2006.01)

(21) Application number: **19859984.7**

(86) International application number:
PCT/ES2019/070602

(22) Date of filing: **11.09.2019**

(87) International publication number:
WO 2020/053465 (19.03.2020 Gazette 2020/12)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME KH MA MD TN

(71) Applicant: **Estruch Serrano, Josep Antoni**
46010 Valencia (ES)

(72) Inventor: **Estruch Serrano, Josep Antoni**
46010 Valencia (ES)

(74) Representative: **Espiell Gomez, Ignacio**
R. Volart Pons y Cia., S.L.
Pau Claris, 77 2^o 1^a
08010 Barcelona (ES)

(30) Priority: **13.09.2018 ES 201830887**

(54) **INJECTION PRINTER FOR CEMENT AND METHOD FOR PERSONALISING TREATMENTS FOR CONSTRUCTION**

(57) The application relates to a process that allows the personalisation of treatments (ceramic tiles, paving tiles, etc.) such that customers provide the images that they wish to see on walls, floors or facades. The process allows production to be completely automatic, with no difference from current processes that reproduce pre-established designs selected from a catalogue, and at the same price. The injection printer for cement consists of a circular circuit formed by a circular or polygonal frame

that will rotate in the horizontal plane, in which preferably 14 moulds, and 14 elements that will act on said moulds, will be placed, said elements including means for adding drops or lines to create the image, with the addition of a background layer, an intermediate layer, and the back layer, being recommended, and being equipped with means for pressing and detachment, for printing identifiers and extraction (IE), as well as cleaning means (L).

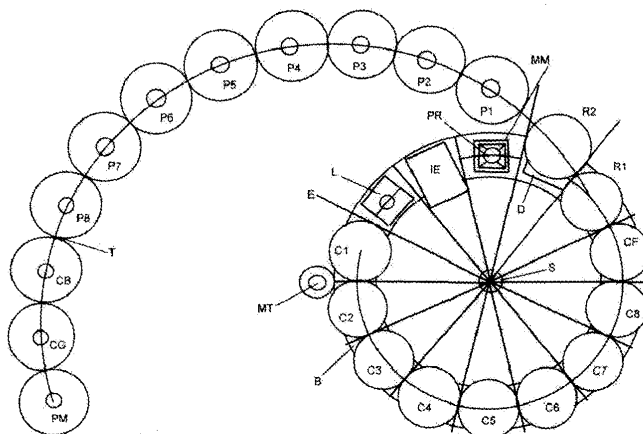


FIG. 7

Description

OBJECT OF THE INVENTION

[0001] This invention refers to a machine designed to produce pressed cement coatings for construction of buildings, pools, public works, etc. to cover floors, walls, ceilings and facades.

[0002] Is also the object of the invention a method for personalizing treatments for construction applicable to the machine of the invention, as well as the production of other type of coatings such as tiles, slabs, plastic and metal parts, of glass or any other material to cover floors, walls and facades.

BACKGROUND OF THE INVENTION

[0003] Machinery for producing slabs based in hydraulic or of other types of presses is known that allows manufacturing one slab each time. The product has been traditionally called "hydraulic slab" since this type of press has replaced the preceding presses of more rudimentary technology ("of balls..") and it is the result of pressing, in a mold, a layer of white cement with mineral dyes or grey cement; mashing with water and marble dust (apparent face), on which one or two layers of mixed grey cement with marble dust or sand are deposited but without adding water (back).

[0004] The product possesses an upper face (apparent face) that can be smooth or with reliefs ("machicolation") and of different types of coloring:

- Different grey shades,
- Of varied colors, monochrome or with geometric patterns, mottled or abstract.

[0005] The lower face has a color and texture similar to the cement formwork.

[0006] Also, automatic or semi-automatic machines are known for producing terrazzo as well as semi-automatic machines for producing smooth hydraulic slab (monochrome and without drawing) but without incidence in the market.

[0007] In any of these cases, the capacity of personalization of the products obtained is minimum with the limitations that means.

DESCRIPTION OF THE INVENTION

[0008] The machine that is preconized solves in a fully satisfactory manner the above exposed problems, making possible to include personalized images in the production chain of treatments for the construction, so that it does not mean an increase of price with respect to the treatments chosen from catalog.

[0009] That means that, if a customer is willing to affix a personalized photo, he obtained on his own, for example on the wall of his kitchen or on the floor of his dining

room, this is possible without altering the industrial processes, therefore the price will be the same and, consequently, it will be available to any customer.

[0010] For this, and more concretely, the machine of the invention is materialized in an automatic computer-controlled or dedicated processor-controlled machine.

[0011] The printer of the machine includes one or several controller cards: For the general synchronization, for the control and maintenance of materials in mixing boilers and for the control of adding material from the injectors and their travel with respective positioning trolleys. The technology to be used in these controller cards can be of the "wiring" type or also it can be implemented by means of cards having programmable microprocessor. The tasks these cards are charged with are similar to those that are charged to control ink-jet printers.

[0012] The final product is the so-called "hydraulic slab" produced in a fully automatic manner, which can reproduce designs or photos in electronic format stored in a memory, which can be provided by the industry itself or by the customer, obtained with digital cameras, mobile phones, design applications etc.

[0013] To correctly understanding, it must be added that the image in electronic format can be reproduced one or several times on each slab or can be divided, like the parts of a mosaic, between the slabs designed to cover a surface; the reconstruction of the full image will occur when all of them have been placed at their place.

[0014] The manufacturing process includes drying the parts and their further immersion in a tank of water (or, instead, irrigation), to complete the cement setting. This subprocess is not included in this description as it is the same, more or less automated, as in the traditional production.

[0015] The production process being completed, it can be proceeded to polishing without abrasives, it can be opted for textile, synthetic or natural materials or for another proceeding but this process is optative to provide the product with a brightness that, anyway, it will acquire along the time as the surface is being stepped on or cleaned with mops, soft cloths, pressurized water etc.; on this point, it has to be warned that the chemical polluting products, such as bleaches, are not necessary for its cleaning.

[0016] The design will be modular, based on the interface strategy that allows to replace a module by another: To be improved, of different technology or due to failure of the original.

[0017] Operating pressure systems will make necessary the inclusion of non-return valves, potentially of different technologies.

[0018] The pressing and up/down systems of the base and lid of the mold can be implemented with hydraulic, pneumatic...technology.

[0019] The driving elements can be implemented by means of electric, hydraulic or air motors.

[0020] The injectors can be similar to those used in the packaging industry or implementing other solutions, for

example, based on fluids heating. The type of implementation of the injectors will affect the final image resolution that is expected to provide the product with, this later been understood as more or less "pixelated",

[0021] The travel of the trolleys, as well for the cement injectors as for the ink injectors of the identifiers printing element, can be carried out by means of pulley and fixed union cable by tooth belt or by another proceeding.

[0022] The white cement, the marble dust and the mineral dyes, it is possible that they require to be ground to achieve a sufficiently fine grain depending on the type of injector.

[0023] The dispensers of materials for the back of the part can be implemented with a simple horizontal travel trolley and take profit of the gravitational force or also with air pressure systems, centrifugal systems or mixed.

[0024] The exact positioning of the underframe and of the base of the mold can make necessary to include stops, travel anchors and position detectors of the "end of stroke" type, of mechanical, optical, etc. technology.

[0025] The details of the type of technology, for example, pneumatic or hydraulic, will have to be determined in the moment of the construction depending on the technological and budget availabilities.

[0026] At least a number of 8 colors is advised for a best adaption to the electronic formats and because it is a well-proved option in other technologies, although it is not an essential requirement. Another factor to be borne in mind is the diversity of mineral dyes available.

[0027] According to this recommendation, the machine will have a circular circuit formed by a circular or polygonal underframe that will rotate on the horizontal plane, in which preferably 14 molds, and 14 elements will be placed that will act on them, these elements will include means for adding drops or strokes to create the image, being advisable adding a background layer, as well as an intermediate layer, as well as adding on the back, counting on pressing or removing, of identifiers printing and withdrawal means, as well as cleaning means.

[0028] It shall be clarified that the number of molds can vary but a number of molds equal to that of the operating elements is advisable, to avoid useless components. To facilitate the description, the number of 14 will be assumed.

[0029] The underframe with the molds will be carried out with the following architecture:

The architecture of the rotatory underframe can be implemented in a similar way as it was traditionally made in machines for the production of terrazzo or for its prior polish before it is delivered.

[0030] The underframe will have to allow mounting in horizontal assembly of the 14 molds on its upper part. In the lower, 14 bases of the mold pressure/rotation actuators will be assembled. It can be implemented by means of metal profiles and plates, of steel or alternative materials that provide similar benefits.

[0031] In order to avoid unwanted vibrations, it will be preferable to join the underframe to a central rotation

shaft, for example, by means of crossbars or blades, avoiding its travel on rails or guides fixed on the floor.

[0032] For structural simplicity and in order to improve the mechanical and energy effort, it is advisable that the driving element is placed on the external part of the underframe assembly, by means of a pulley in the motor and crown in the underframe and tooth tangential contact or by friction; except in the case that the shaft of the underframe is coincident with that of the motor with technology for an accurate rotation by angles. The belt drive, being possible, is not advisable as it adds unnecessary complications.

[0033] In either case the position of each mold must be accurately fixed for:

the correct operation of the injectors that release drops or strokes on the base of the mold and, of the pressing and removing element that will require the exact positioning as well of the lid as of the base of the mold.

[0034] Each mold will be formed by a framework and a base with a single lid for all of them assembled on the upper pressing element.

[0035] The framework, of steel or of another material having sufficient mechanical characteristics, will be horizontally assembled on the underframe and will have a geometric shape. For example, the figures: square, rectangle, triangle or hexagon, allow to cover a surface in a simple manner without leaving gaps. The upper internal edge of the framework can be slightly beveled in order to facilitate the insertion of the lid.

[0036] In order that the framework is more accurately fit to the base of the mold, it can be opted for an architecture in which it will be open, at least, by one of its angles; in the case of the circle, a cut is convenient at the point opposite to the junction to the underframe and the bevel of the faces so generated. The opening will be closed with a sufficient force with pressure devices of any type (including bolt fit) that will act on the two ends to be joined in order that the framework is fit to the base of the mold.

[0037] Anyway, the framework will have to be joined to the underframe at least by one point, angle or side. It can be also opted for elastic spring clamping or of another type.

[0038] The base will be a plate having the necessary mechanical benefits of shape and sizes within the framework and it will be polished on its upper face. The thickness can vary depending on the material used and its horizontal sizes, but approximately 2 or 3 centimeters are expected. On its lower face, it will be joined, in horizontal position, to a lifting mechanism and another rotatory but so that (the base) can be lifted up to the vertical position for withdrawing the part.

[0039] The lifting mechanism will be joined by its lower part to the base of the underframe and it will exert half the pressing pressure by means of the mold base being

balanced by the upper pressure mechanism (operating element 12th) that will exert the pressure by means of the lid. The movement of the 2 pressure elements (lower and upper) will locate the base at the suitable height for each of the 5 mold operation steps:

- 1 Adding materials (1st to 11th elements)
- 2 Pressing (2nd element)
- 3 Removing (12th element)
- 4 Printing part identifiers (13th element)
- 5 Withdrawing (13th element)
- 6 Cleaning (14th element)

[0040] The rotation mechanism of the base will act only at the step of removing, carrying out one or several slight rotations of the base on the horizontal plane to get rid of the suction cup effect last, it will rotate to leave the base at the initial position ready to fit once again in the framework. To secure the correct position of the base with respect to the framework stop and travel anchors can be used. It would be possible to prescind from this mechanism only if there were no adhesion of the pressed cement part to the base of the mold, but generally the rubber bases avoid the adhesion but produce a coarser finish of the upper of the part.

[0041] It is possible, depending above all of the sizes of the slab, that it is necessary to add an extension crown to the surface of the base of the mold during the step of removing. This crown will have the same geometric shape as the base of the mold on its internal face and will fit with this later to extend its surface. On its external face, the circular shape will be preferable and with the sizes necessary in order that the upper surface (located on the lower part of the mold as it is created face down) of the slab does not remain "in the air" during the removing rotation. The upper face of the base extension crown will be polished as the mold base itself.

[0042] Optionally, a vibrator can be included that will act on the mold base, once adding colors is finished (before or after the background color injection, element 9). The objective is a best setting of the cement mixture layers but the side effects have to be assessed, as well on the integrity of the "printed" images as on the structure of the frame and the mold itself.

[0043] As for the operating elements, they will possess the following architecture:

At least 8 deposits, one for each color, as the physical nature of the color makes difficult to overlap them to obtain intermediate tones.

[0044] A solution can be proposed with 16 deposits for 16 colors, but more colors, even though technically possible, would require an increase of resources that have to be carefully valued.

[0045] Each of these 8 deposits will be formed by;

A mixing boiler with sensors to determine the degrees of viscosity and humidity of the mixture, which shall be kept within limits by adding water and re-

mixing. The deposit can also possess a load sensor in the event that measuring the weight is more practical than using dosing apparatuses. The sensors will provide information for the deposit controller card.

The boiler can be cylinder, conical, spherical etc. shaped, but square or angular constructions have to be avoided that make their cleaning and material mixing difficult. The mixer can be located inside it; in this case, it can be implemented as a mechanical rotatory device with different architectures but pressurized air devices must be avoided that would produce bubbles difficult to eradicate. An alternative option for mixing is rotating the boiler itself.

Re-mixing will be periodically carried out to keep the homogeneity of the mixture but it will be not continuously under way in order not to interfere in the times of the cement setting and its properties.

The boiler can be located next to (normally on its external face) or directly on the underframe.

In a position preferably under the boiler, directly on the position of the molds, the injector of the mixture will be located which will travel on the horizontal plane because of the straight horizontal travel of two perpendicular trolleys. The injector will be connected to the boiler by means of a flexible duct.

[0046] A boiler (9th element), similar to the preceding ones, will be in charge of evenly adding on the full surface (on the drops or strokes of the tones added directly on the base of the mold) a layer of background color. The tone of this layer will depend on each image and it will be added with an injector to cover surfaces. The layer of background color has the objective of covering the pores or areas left by the injection of drops or strokes.

[0047] Each boiler will possess a mixture propulsion sub-system and another of automatic cleaning as well of the deposit itself as of the ducts, of the sensors and of the injector. It must be added that the load capacity of the mixing boiler will be limited by the fact that the mixture of cement will create material aggregations on the walls of the full circuit, its periodical cleaning being required, by means of pressurized water (with or without air) before the aggregations harden. The cement setting time has also to be borne in mind to determine the maximum time that the mixture can be kept in the boiler without losing its properties.

[0048] Anyways, the system should be cleaned by hand with a longer periodicity at the same time its inspection and general maintenance are carried out.

[0049] As for the 10th element. It is very advisable to include a deposit to adding a thin intermediate layer of a mixture of grey cement with marble dust (or with finely sifted sand for the construction), on the layer of back-

ground color (9th element) to guarantee the perfect adhesion of the "sandwich". The deposit will be formed by a boiler having a dry material mixer and dispenser to cover the full surface of the mold. The dispenser can be located in a position lower than the boiler and this later will be located laterally to the underframe or directly on it.

[0050] The 11th element will add a layer of grey cement with sand (of the common type for the construction), sifted to avoid gravel waste and lumps, with a boiler and an adding mechanism similar to the 10th element.

[0051] Bearing in mind that the content of the deposits, 10th and 11th, is the same for any type of slab to be produced, they can receive the materials added separate or already mixed.

[0052] It must be clear that the deposits, 10th or 11th, supply dry material mixtures but they will have to be periodically cleaned with pressurized air/water to avoid agglomerations and lumps produced, eventually, because of the residual humidity of the material (such as sand) or environmental. Alternatively, the suitability to previously drying the sand can be assessed.

[0053] In the surroundings of the circuit, the deposit of water will also be located with its ducts and the deposits for loading mineral dyes and, according to the architecture used, white cement, grey cement, sifted sand and marble dust.

[0054] The order of the colors in the mixing boilers is conditioned by the loading technology used, in the sense that such technology (Archimedean screw, pneumatic tube...) facilitates or makes difficult the architecture of the loading ducts and, consequently, the order of the colors in the mixing deposits that will vary depending on the needs. For example, in the event that the injector is made to work as a tracer, this later will have to be that of the first boiler, which will have to be borne in mind in the loading order.

[0055] A same injector can work as tracer and, thereafter, as drops propulsor on the same mold and on others. Also, the strokes of several injectors can be superposed every time that the mold passes under each of them.

[0056] Thus, at least 2 types of architectures are possible:

Architecture n° 1 of duct having a sole load of pneumatic tube technology. It facilitates a greater flexibility in the order of loading the colors in the mixing deposits.

The loading duct will connect all the mineral dyes loading deposits with all the mixing boilers being able to adopt curved or partly straight paths. The origin and the destination are determined by opening and closing valves, the circuit being cleaned with pressurized air between two unloading operations if too much waste remains.

Also, it will connect the loading deposits of marble dust, sifted sand, white cement and grey cement with all the pigments mixing boilers (1st...9th) and with the 10th and 11th deposits.

[0057] Architecture n° 2 of specific ducts: deposit of mixing storage-deposit, with Archimedean screw technology.

In this type of architecture, each deposit of mineral dyes is connected fixed with a single pigment mixing boiler by means of an Archimedean screw, due to the fact that this technology makes more complex the inclusion of selection valves and cleaning the circuit but, above all, because it makes more practical a straight path of the unloading duct, although a curved path being technically possible with flexible materials or a polygonal path with cardan transmission or equivalent. In this architecture, each mixing boiler always receives the same pigment and each injector always work with the same color.

In this case, there will be a single loading deposit with the prior mixture of marble dust with white cement that will be connected with the 1st to 9th mixing boilers by means of 9 different ducts (using a single moving duct with 9 positions is mechanically more complex). A radial architecture of these ducts is advisable, locating the loading deposit at the center of the full assembly on the rotation axis of the underframe so that the 9 ducts start from its base towards the 9 boilers. With this architecture the content of this last deposit will have to be fully replaced if it is decided to change the white cement for grey or vice versa.

According to this schema, it will be simpler to load the 10th and 11th boilers with the materials already mixed.

According to these constraints, the architecture n° 1 allows to produce in a single cycle, that means, the underframe will be able to locate the molds under each of the injectors turning around only once. The architecture n° 2 can oblige that the underframe runs around several times to locate the molds under the suitable injector (or backward movements), during which the rest of the operating elements will stay in standby.

The technologies used for carrying the materials up to the mixing boilers will also condition the choice of the dosing method. In the case of the mineral dyes, a simple manner to implement them will be by means of dosing deposits at the unloading outlets of the deposits of materials. In the case of the other materials, it can be more practical to measure the load in the mixing deposit itself.

As for the 12th element, pressing element, it will possess a downwards pressure system fixed to an arch, tower or any structure allowing the passage of the underframe under it. At its lower part, the lid of the

mold will be horizontally fastened and so that it can be simply and quickly replaced or cleaned if necessary, for the maintenance tasks. As it was already explained, the full pressure force will be supplied at equal parts by the said element and another pressure element located under the base of the mold.

Simultaneously to the periodical cleaning of the mixing deposits the lid of the mold will also be cleaned to avoid the excess of material aggregation accumulated with the successive pressing out. This operation can be carried by hand, bearing in mind its simplicity or it can be automated with different technologies, including roller-shaped or disk-shaped brushes, pressurized air and water, waste vacuum cleaners, retractable arms and levers and boxes having different shapes and closure systems for the devices during and after the operation.

As for the thirteenth element, the order identifier extraction and printing and the order number if it is dealt with a mosaic that will re-construct the image. The extraction will require the withdrawal of the part by means of a carrying strip, having a size and shape similar to those of the slab side, on which one of its sides will rest. The cases of hand or automatic extraction are proposed. In the first case it will be only necessary to include a button, pedal or lever in order that the operator indicates that the extraction has been completed, its exclusion being the potential cause of accidents. The approach of the automatic extraction will require an independent device and its design will have to be explained apart.

Printing identifying numbers will be done on any of the 3 lateral parts (approximately from 1 to 2 cm high, with the slab side length long) not subject to handling during the extraction of the part or on its lower surface that will be accessible because the part is manufactured with its face up. Bearing in mind that the part at that moment will have a poor consistency, inkjet printing is the single advised.

As for the fourteenth element, that of the plate (base) cleaning and eventually of the base extension crown and framework of the mold after each extraction to avoid that any particle of dust impairs the parts finish quality. It will be carried out with mechanisms similar to those disclosed for cleaning the lid of the mold (12th element). Plate cleaning will include, in addition, its lubrication adding the lubricant on its surface by means of a fluids dispenser, preferably a sprinkler and further friction. The potential lubricants to be used are several although it is advised to use the traditional mixture composed of "cleaning petroleum" with linseed oil in a 3:1 ratio.

Passing now to describe the 1st to 9th mixing boilers,

the following operations will be carried out in them:

1. A prior water load will be added.
2. The pigment load will be added while it is proceeded to mixing while loading.
3. The marble dust and cement (white or grey) load will be added, also keeping mixing active. These materials can be added separately or previously mixed.
4. The viscosity and humidity degrees will be measured and, if necessary, more water will be added, re-mixing the content of the deposit until the measures of viscosity and humidity are those suitable. Periodically, the humidity and viscosity degrees will be newly measured in event that it was necessary to newly re-mix.

As for the molds, the following operation steps will be carried out in them:

By the 1st to 11th operating elements:

1. Adding material.

In each mold, the lifting mechanism (lower pressing element), after the steps of cleaning, will lift its base up to the height necessary in order that the base remains in the suitable position (height) of the framework, partly introduced in it (adding position). If it has been decided to adjust it, the closure mechanism will act until it is tightly trapped by the sides of the framework.

The frame will rotate so that each mold will be successively located, first under each of the 8 color injectors, thereafter, under the injector of the background layer and then under the injector of the background layer and thereafter under the material dispensers of the 10th and 11th boilers, then under the upper pressing element, following by the extraction station and, last at the cleaning position. Of all the operations carried out in the molds, the slower will determine the time of rotation of the underframe complete cycle that will be the sum of the time during which the molds will be stopped while some task is carried out in them and the time of travel from one position to another according to the following expression:

T_d = time used for the travel of a mold from one position to another one.

T_{ma} = average operating time, with the time when an element is operating on a mold, including among them the step of extraction (that can be by hand) of the part. This time

will have to be calculated as the average of operation times in each position (1..14) carrying out a sampling.

$T_m = \text{Slower } T_{ma}$.

$n = \text{number of operating elements} = \text{number of molds}$

$$\text{Total } T = (T_d + T_m) n$$

To determine the production final times the loading, mixing and maintenance times have to be added.

[0058] Operations to be carried out for material adding:

1.1 Injection of color drops or stokes. The injectors can leave a color drop or a solid line, depending on the nature of the design to be "printed".

If it is a photo, an abstract image or a mottled pattern, the injectors will add drops of color.

If it is a geometric drawing, the injector operation as tracer, adding a solid line of material can improve the image final resolution. In this case, the gaps between stokes can be filled by means of the same injector or the others or be left for the surfaces injector in the operation number 9.

1.2 Coating with an even layer of color to cover the pores or small gaps left by the color drops or filling the spaces left by the injectors operating as tracers (9th element).

1.3 It has been advised to adding a thin layer formed by a dry homogenous mixture of grey cement and marble dust has been recommended in order to reinforce the junction between the layers of color and that of the back. The ratios of cement and marble dust depend on the type of cement and have to be empirically concreted (10th element).

1.4 Adding a layer of a dry homogenous mixture of grey cement with sifted sand (back). The thickness of this layer and its ratios will depend on the qualities of the materials, the resistance it is wished to provide the part with and the weight of this later that can be assumed (11th element).

[0059] By the 12th operating element. It is a complex description as it includes the steps n° 2 and 3 and in them, the 12th operating element interacts with the lifting mechanism of the base of the mold.

2. Pressing

The lid of the mold goes down until it is introduced

within it, exerting pressure on the materials. At same time, the base exerts an upwards pressure slightly lower than that of the lid, so that, during the materials pressing, the base goes down until it is located at the lower limit of the framework, keeping during this process a constant pressure controlled by means of the information that the manometers of the two pressing elements send to the controller card.

3. Removing the slab

If an extension crown has been included, it will have to go up until its upper part is located at the same height as the upper part of the base, creating an extension thereof. In order to secure a balanced upwards/downwards movement it will be convenient that the base extension crown is moving fastened, at least by three points, for example, three intercommunicated plungers.

The driving element will turn the axis of the base pressure element, making that this later rotates and, if applicable, also the crown. The rotation will be of a few degrees, just to secure the removal of the recently pressed slab and it will be complemented with another reversed direction that will leave the base at its initial position. During the removal process, the lid of the mold will have not moved.

Thereafter, the lower pressure element will lift the base and the upper element will do the same with the lid, synchronously until the slab goes out of the framework by its upper part. At this point, the upper pressure element will move the lid up to the standby height taking it apart from the slab and the lower element will finish lifting the base until locating it at the extraction height.

If a base extension crown has been included, it will have to go down to the cleaning position where it will wait the incorporation to the mold base.

By the 13th operating element

4. Identifiers printing

An ink injector will print the identifier of the order on one of the laterals of each slab or on its lower part in order to facilitate the packaging. In addition, if it is a mosaic slabs, the number of order of placement of each of them will also be printed. A simple embodiment consists of the horizontal movement of the injector, left-right and vice versa, alternatively displacing one position (line break) between each horizontal travel.

During the identifiers printing, the access to the part will be prevented to the operator who carries out its extraction with safety measures to protect the first and the second.

5. Extraction

The protection of the part will be withdrawn and the operator will place the carrying strip on the lower side

thereof and thereafter, with the other hand, he will lift the base of the mold until leaving it in vertical position, a moment when he will lift the part while he takes it apart from the base of the mold, holding it gently by its back part while he keeps it vertical with the carrying strip until depositing it (without withdrawing the strip) in vertical position in a drying box provided with stops that avoid the contact between contiguous slabs.

In the case of deciding to fully automate the process, the extraction can be carried out by means of an articulated arm (robot).

Once the slab has been withdrawn from the base of the mold, the operator will indicate it to the system by means of some type of push-button or lever, to which will follow the travel of the mold up to its following position in the 14th operating element while the base is lowered down to the horizontal position and the lower pressure element locates it at the cleaning height passing through the framework when coming down. If an extension crown has been included to the base, these two will be adjusted to each other until forming a surface without ups and downs.

By the 14th operating element

6. Cleaning

Cleaning will be carried out prior to the travel of the instruments to the base. Anyway, the base has to be lubricated to allow that the following part is removed without damaging it. If it is deemed necessary, the elements involved can be closed and suck wastes. Last, the cleaning instruments will be retracted to allow the underframe travel, during which, the lower pressure element will lift the base of the mold until it occupies the adding position within the underframe.

[0060] As for the personalization process of the treatments used that, as it was said before, is not only applicable to the machine of the invention, but that is also applicable to produce other types of coatings, such as tiles, slabs, plastic and metal parts, of glass or any other material to cover floors, walls and facades, it is a process that allows that the purchaser of the product can supply the images that he is willing to see reproduced on the surfaces of the building, pool, etc.; so that the said drawings can be incorporated to the automatic production system without any difference with the automatic processes that reproduce pre-established drawings.

[0061] In this manner, the production of fully personalized treatments will be not significantly more expensive.

[0062] For this, the production system will be computerized and lines of "image printing" will be installed of ink, cement or any other injection technology that do not need to previously create stencils or templates. It is advisable that the same system also allows writing the numbers or codes of design and of order on the back of

the part to allow personalized packaging; in the case of the drawings of the "mosaic" type, also, on a side or on the back of the part the number of order will also be written (printed) for an on the site assembly, according to the schema supplied together with the packaged parts.

[0063] The drawings, in electronic format, will be added to a printing queue (preferably) with priorities, so that the standard drawings of the producer can be stored in the memory together with the drawing supplied by the customers. An algorithm will decide the printing order bearing in mind the priorities and the state of the production.

[0064] In general terms, the process starts when the customer contacts the technician (architect...) or the retailer although also the producing industry can opt to have its own points of sale or incorporate sale on-line. Anyway, the customer must supply the drawings of the surfaces to be covered (if necessary) and the images to be reproduced. To this set the directions will be joined with the details and they will be forwarded to the department of design (or equivalent) of the producer by means of a corporate intranet, via e-mail or any other electronic communication means including a secondary memory (USB memories, disks...).

[0065] If it was necessary, the department of design will perform the assembly bearing in mind that, sometimes, the image has to be distributed throughout the surface to be covered, resulting in a "mosaic" that, when assembled in the site, reproduces the original image (for example a landscape or the floor mosaic of a Roman villa); in other cases, the image is repeated on each part one or more times, with the possibility that there are several different images in alternate parts or any other criterion.

[0066] If a simulation has been performed, the result will be forwarded to the origin by the same intranet/email proceeding etc. in order that the customer gives his agreement or adds changes that will be returned to the department of design. The department of design of the producer shall have to give directions to the technician/retailer in order that the process does not perpetuate itself. Once the simulation has been approved by the customer, it will be proceeded to the production.

[0067] The image or images (depending on if it is a repetition, variation or "mosaic") will be added to the printing queue of the device (of injection...) in the order that will correspond according to the criteria and priorities established. At the same time, the schemas of the designs assembly of the "mosaic" type will be printed on paper or will be sent through electronic means.

DESCRIPTION OF THE DRAWINGS

[0068] To complement the description that will be done below and in order to assist to best understanding the characteristics of the invention, according to a preferred example of practical embodiment thereof, a set of drawings is attached as an integral part of the said description in which, for illustration and not limiting purpose, the fol-

lowing has been represented:

Figure 1. It shows of a plane view of the static structure that participates in the machine of the invention, in which can be seen the 14 horizontal profiles rest on a support mounted on the central pillar. The 14 peripheral vertical profiles remain concealed under the ends to the horizontal ones.

Figure 2. It shows a profile view of the static structure that contains only the constructive elements of the line A-B-C of the Figure 1. It can be seen the support for the S profiles and the CS and CI bearings for the underframe anchor and two of the P pillars concealed in the Figure 1.

Figure 3. It shows a plane view of the underframe. The central pillar and the CS upper bearing, the S lower support, the CR crown of tangential contact and the MT motor with the PT contact pulley can be seen.

Figure 4-A. It shows a profile view of the underframe. Only the constructive elements of the A-B-C line of the figure 3 have been represented. The P pillar can be seen with the two CS and CI bearings, the TV, TD and TH straps with the cut of the SI support with the cut of the tangential contact crown with the pulleys of the CR motor.

Figure 4-B. Front view of a segment of the underframe. The P central pillar has been represented with the TD and TV straps; also, the SI lower support and the CI lower bearing. Have been included: the EPI lower pressure element fastened to the SI lower support, with the EP pressure plunger, the MM framework, the base of the mold or PL "tray", the MR tray rotation motor and the PC and PR transmission pulleys.

Figure 5. It shows a plane view of a segment of the framework, the CR tangential contact crown and the BS strap can be seen; the framework of the MM mold fastened by an A anchor and the CM framework closure. Also was included the MR tray rotation motor with its AM anchor and PR pulley.

Figure 6-A. It shows a plane, elevation and profile view of the tray.

Figure 6-B. It shows a plane and profile view of the tray lifted in extraction position.

Figure 7. It shows a plane view complete schema of the machine. The B underframe can be seen with the horizontal profiles of the R static structure on the support at the center thereof; anchored on the profiles, the mixing boilers of the C1..C8 eight colors

and the color of the CF background layer close to the deposit "upside down" R1 intermediate fine. Located only partly on the underframe, the R2 "upside down" deposit under it appears the D dispenser. In the 12th position, the upper pressing element is arranged, anchored by its upper part to the profiles; under, appears the MM mold underframe. In the 13th position, is arranged the IE printing and extraction element and close to it, the L cleaning element.

[0069] The train of deposits of P1 ...P8 mineral pigments has been drawn together with those of CB white, CG grey cement and PM marble dust. On the deposits, the D dosing apparatuses and joining the deposits with the mixing boilers, the path of the T pneumatic tube.

[0070] On their part, the trolleys with the injectors remain concealed under the mixing boilers.

PREFERRED EMBODIMENT OF THE INVENTION

[0071] Seen the mentioned figures and, namely, the figures 1 and 2, it can be seen how the machine of the invention, in its simplest version, is constituted from a static structure composed of fourteen peripheral pillars (P) and a central pillar (PC), on which two bearing (CS) and (CI) of rotation of an underframe will be assembled, in which a support (S) is defined to which 14 horizontal segments or profiles will be fastened, having a radial arrangement resting on the ends on the 14 peripheral pillars (P).

[0072] According to the figure 3, on the lower bearing, the lower support (SI) is assembled, a tangential contact crown (CR) and a motor (MT) with a contact pulley (PT) being established.

[0073] In the figure 4a, it can be seen how two bearings (CS and CI) are related with the supports (SI and BS) by means of straps (TV, TD and TH), the tangential crown (CR) travelling thanks to the pulley of the motor (PT).

[0074] According to the figure 4B, each mold will be formed by a framework (MM) and a base or tray (PL), with a single lid for all of them assembled in the pressing upper element, being assisted below by a lower pressure element (EPI) associated to a pressure plunger (EP).

[0075] In the framework, the anchors will be fixed with a system of bolt for the frameworks that can have different geometric shapes. In this example, 14 square frameworks will be assembled on the upper structure of the underframe (figure 7), each of them joined to the underframe by 2 points as illustrated in the figure 5:

(CM): The angle where the underframe is open and is inserted in the mechanism to open and close it, this mechanism will be joined to the structure of the underframe.

(A): The angle of the underframe, opposite to the preceding one, that will be directly joined to the underframe.

[0076] In the lower structure of the underframe, fourteen lifting elements will be assembled, each of them with a base of mold fixed on its upper part as illustrated in the figure 4-B.

[0077] A generator of pressure will provide the force necessary for the operation of:

Pressing

Horizontal rotation movement of the underframe

Movement of rotation of all the mixers of the boilers (C1...C8+CF) in the figure 7.

Travel of the adding trolleys of the intermediate layer and of the back: boilers (R1) and (R2) in the figure 7.

Opening/closing the framework of the molds.

Back and forth rotation of removing the base of the mold

Rise and fall of the extension crown of the base of the mold.

Pneumatic tube

[0078] 9 boilers (C1, C2...C8 and CF) will be located mixing cement with marble dust, pigments and water.

[0079] 9 injectors, each in an assembly of two perpendicular trolleys of horizontal travel and joined to the deposit by a flexible duct.

[0080] The 9 deposits and the 9 injectors in their trolleys will be fixed to the metal structure directly on the path of the molds, as illustrated in the figure 7.

[0081] A dry mixing deposit (R1) assembled on the static structure directly on the path of the molds with a dispenser at its lower part to unload the mixture of grey cement with marble dust directly in the mold (figure 7).

[0082] A lateral tower (R2) external to the underframe with a dispenser at its lower part, radially spread towards the center so that it unloads the mixture on the molds. This deposit will be larger than those described for the mixture of pigments and for the mixture of grey cement with marble dust because the amount of material it will have to contain will be much greater than the weight and volume that is advised to be assembled resting directly on the floor by means of tripods (figure 7).

[0083] In the 12th position, the upper pressure pressing element (PR) will be located with the pressing lid assembled on its lower part; all of it fixed on the static structure, as illustrated in the figure 7.

[0084] An ink injector will be assembled covered by a plate that will prevent the access of the operator to the slab while the identifiers printing is carried out. The printing subsystem will be fixed on a double positioning arm having a shaft at its lower end with a drive element allowing to lift it by rotation up to the vertical position (rest

and lower it to a horizontal position (working position) in order it is allowed to reach the printing position on the base (lower face) of the part and be withdrawn thereafter to allow the part extraction. This assembly will be located at the 13rd position (IE) (printing-extraction) also fastened to the structure (figure 7).

[0085] A cleaning subsystem (L) located the last (14th position), formed by a circular brush assembled on a rotor for horizontal rotation will clean the base of the mold when it has been lowered down the cleaning height. Before brushing, a sprinkler will deposit the lubricating liquid on the base of the mold, the sprinkler same as the brush will have access to its working position by means of a 90° horizontal circular movement arm. This subsystem will be also mounted on the static structure (figure 7).

[0086] As it was previously commented, the set will travel by means of the drive motor (MT) in an assembly tangential to the underframe fixed on the floor with an underframe of its own. Figure 7.

[0087] As for the personalization method of the parts obtained by means of the machine of the invention, as well as in producing another type of coating, such as tiles, slabs, plastic and metal parts, of glass or any other material to cover floors, walls and facades, a LAN network will be available to which will be connecting the following resources:

- one or several printing lines by cement injection, not being inconsistent with the co-existence with lines by ink injection, for the different formats of parts.
- a department of design with several computers for the design and graphic treatment.
- a management department
- a printing server for the production lines
- a corporative intranet having a disconnected technology of the DHTML type installed in an own server also connected to the LAN.

[0088] When a technician or retailer wishes to apply for an order, he shall have to fill a form of the corporative intranet, with prior identification.

[0089] Another form handles the registration of new users. In this form, data are specified such as, for example, the type of notice to be send (email, SMS...) when the simulation ordered is ready.

[0090] To the form will be attached the drawings of the surfaces to be covered and the images to be reproduced in both cases in electronic format of the JPG or PNG type and PDF documents. It is convenient not to use the GIF format as it has a poor quality or other formats of documents as they have problems of copyright. The legal liability of the images is held by the customer.

[0091] Once the application has been registered in the intranet, it receives a notice from the management department for supervision and confirmation. Once it has been confirmed, it is forwarded to the department of design which receives the notice of order pending of simulation together with the priority assigned.

[0092] The simulation having been performed, it is forwarded to the applicant also by means of the corporate intranet for the approval or application for changes and the management department receives a notice on the state of the process.

[0093] When the application has been approved by the customer, the list of images and details of printing are completed and the "package" is inserted in the printing queue having the related part format.

[0094] The finished parts are packaged according to their code and in the even they are for "mosaic" assembly, the schema is included where it is indicated which number of part has to be placed on each place.

Claims

1. Machine for the production of pressed cement coatings for construction based on a cement injection printer to obtain coating parts of pressed cement in which color electronic images are reproduced, **characterized in that** it comprises a structure formed by a central pillar on which a circular or polygonal underframe is assembled, provided with rotation means on the horizontal plane, where the underframe comprises a support on which fourteen operating elements are fixed, associated to respective molds, where each mold comprises an underframe and a base and where the operating elements comprise:

- mixing boilers, first to eighth (C1 ...C8) for different colors, that comprise mixing injectors for adding drops or strokes to the molds to create the image;
- a ninth adding boiler comprising an injector for adding a background color layer (CF) to the molds,
- a tenth boiler for adding to the molds a thin intermediate layer of grey cement (CG) mixture with marble dust (PM), formed by a boiler with a dry mixer and a dispenser of material to cover the full surface of the mold.
- an eleventh element provided with means to adding to the molds a layer of grey cement (CG) with sifted sand with its related boiler,
- a twelfth element comprising a mold pressing system (PR) fastened to a structure allowing the passage of the underframe under it, in which lower part the mold lid is fastened,
- a thirteenth element for extraction of the molds and printing (IE) identifying the part,
- a fourteenth cleaning element (L) of the base of the molds,

where the underframe rotates so that each mold is successively located, first under each of the eight color injectors, then under the background layer in-

jector, and thereafter under the dispensers of material of the tenth and eleventh boilers, then under the pressing system, then under the extraction element and last, under the cleaning element,

where the mixing injectors include means for travelling on the horizontal plane by the movement of two perpendicular trolleys of straight horizontal travel, the injector being joined to the boiler by means of a flexible duct,

and where the printer includes one or several controller cards of a device of general synchronization, control and maintenance of materials in the mixing boilers and of control of adding material of the as well mixture as cement and ink injectors, as well of control of travel of the respective injectors positioning trolleys to create the color image.

2. Machine for producing pressed cement coatings for construction according to the claim 1, where the static structure is constituted by fourteen peripheral pillars (P) distributed around the central pillar (PC) on which fourteen horizontal profiles rest.
3. Machine for producing pressed cement coatings for construction according to the claim 1, where the underframe rotation means include a motor (MT) preferably at the external part of the underframe assembly, associated to a contact pulley (PT) on a tangential crown (CR) fixed to the periphery of the underframe.
4. Machine for producing pressed cement coatings for construction according to the claim 1, where on the base of the molds a vibrating mechanism can be provided.
5. Machine for producing pressed cement coatings for construction according to the claim 1, where each boiler possesses a drive subsystem of the mixture and another of automatic cleaning of the own deposit, the ducts, the sensors, the injector as well as sensors in the boiler itself to determine the degrees of viscosity and humidity of the mixture.
6. Machine for producing pressed cement coatings for construction according to the claim 1, where the injectors include means for working as tracer and as drops propulsor on the same mold or on others.
7. Machine for producing pressed cement coatings for construction according to the claim 1, that includes means to work superposing strokes from several injectors every time the mold passes under each of them.
8. Machine for producing pressed cement coatings for construction according to the claim 1, where the fourteenth element for cleaning the tray includes lubri-

cating means on its surface by means of a fluids dispenser, preferably a sprinkler and further friction.

9. Machine for producing pressed cement coatings for construction according to the claim 1, where the rotation means of the underframe comprise a central rotation axis (PC) in which a pair of bearings is established (CS and CI) to which is joined the assembly of the underframe, by means of straps (TD, TH, TV) or blades. 5
10. Machine for producing pressed cement coatings for construction according to the claim 1, where the travel of the trolleys, as well for the cement injectors as for the ink injectors of the identifiers printing element, is carried out by means of a fixed union of pulley and cable, by tooth belt or any other conventional mechanism. 10
11. Machine for producing pressed cement coatings for construction according to the claim 1, that includes grinding means for the materials used to obtain the part, such as white cement, the marble dust and mineral dyes. 15
12. Machine for producing pressed cement coatings for construction according to the claim 1, that includes the material dispenser for the back of the part implementable with a simple horizontal travel trolley or by means of air pressure, centrifugal or mixed systems. 20
13. Machine for producing pressed cement coatings for construction according to the claim 1, that includes stops, travel anchors and position detectors of the "end of stroke" type for the exact positioning of the underframe and of the base of the mold. 25
14. Method for producing personalized pressed cement coatings for construction by means of: 30
 - machine for producing pressed cement coatings for construction according to any of the claims 1-14. 40
 - a printing server for the machine for producing pressed cement coatings for construction 45
 - a corporative intranet of disconnected technology of the DHTML type, installed in an own server also connected to the LAN.

characterized in that it comprises the following steps: 50

- Providing the drawings of the surfaces to be covered and the electronic images to be reproduced in the intranet. 55
- Performing and forwarding to the customer a simulation of the personalized pressed cement coating for its approval.

• Inserting the electronic images to be reproduced in the printing queue of the machine in the order that corresponds according to the criteria and priorities established to be reproduced as pressed cement parts.

15. Method for personalizing treatments for construction according to the claim 14 **characterized in that** in case that the coating comprises different parts each with a part of the image, it comprises the following steps:

- Performing and forwarding to the customer a simulation of the personalized pressed cement coating and of its assembly for its approval.
- Inserting the electronic images to be reproduced in the printing queue of the machine in the order that corresponds according to the criteria and priorities established to be reproduced as pressed cement parts.
- Inserting the numbers or codes of each part in the parallel printing queue to be printed on one side of the part.
- Packaging the finished parts according to their code.
- Printing in paper or sending by electronic means the schemas of assembly of the coating that comprises different parts each with a part of the image.

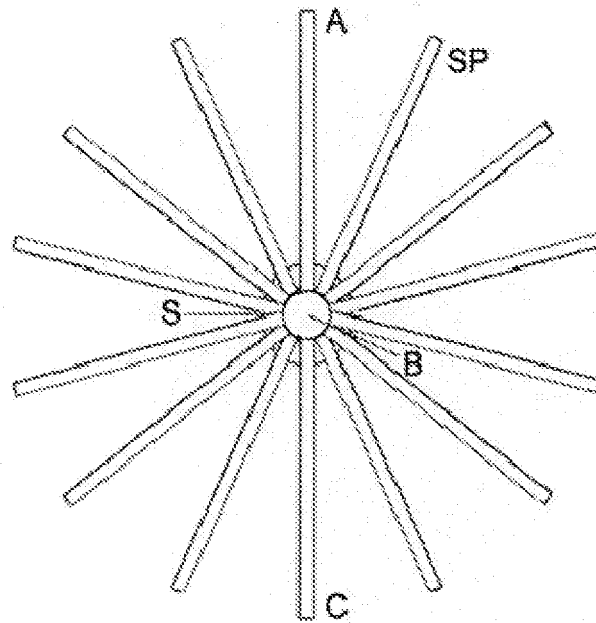


FIG. 1

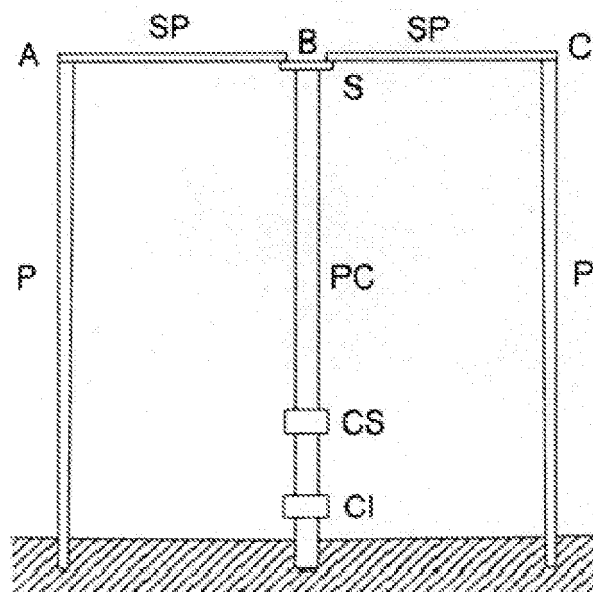


FIG. 2

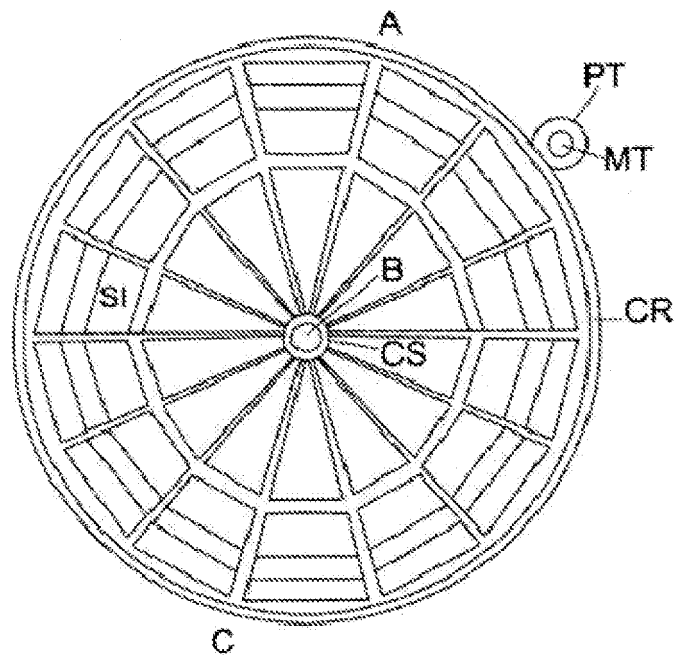


FIG. 3

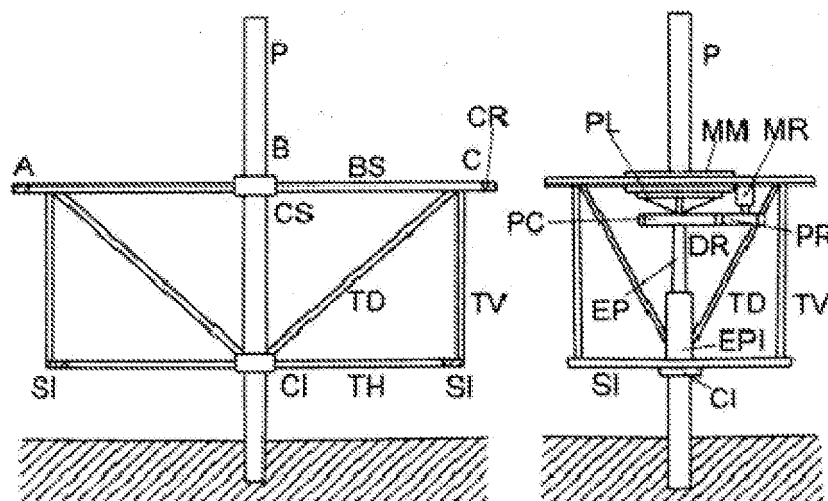


FIG. 4A

FIG. 4B

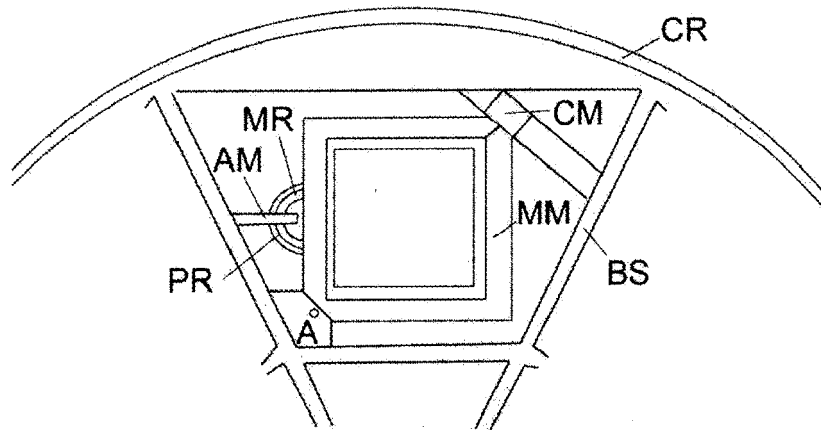


FIG. 5

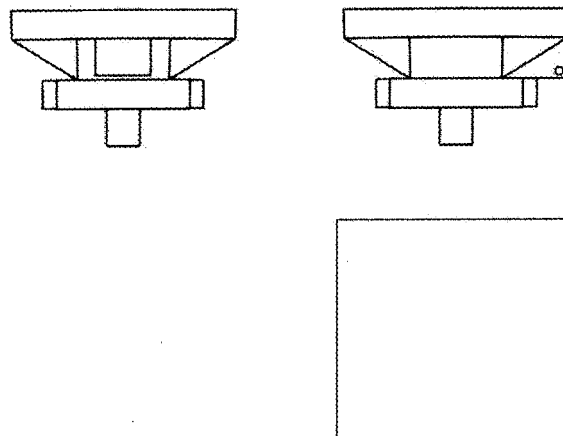


FIG. 6A

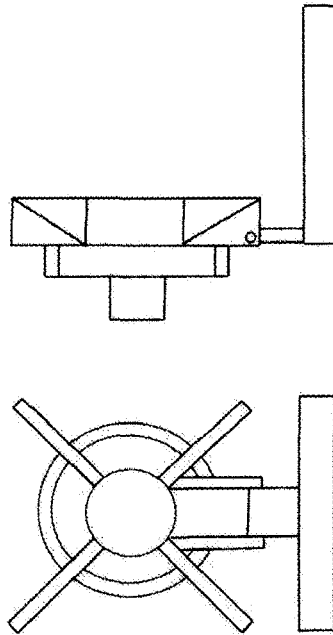


FIG. 6B

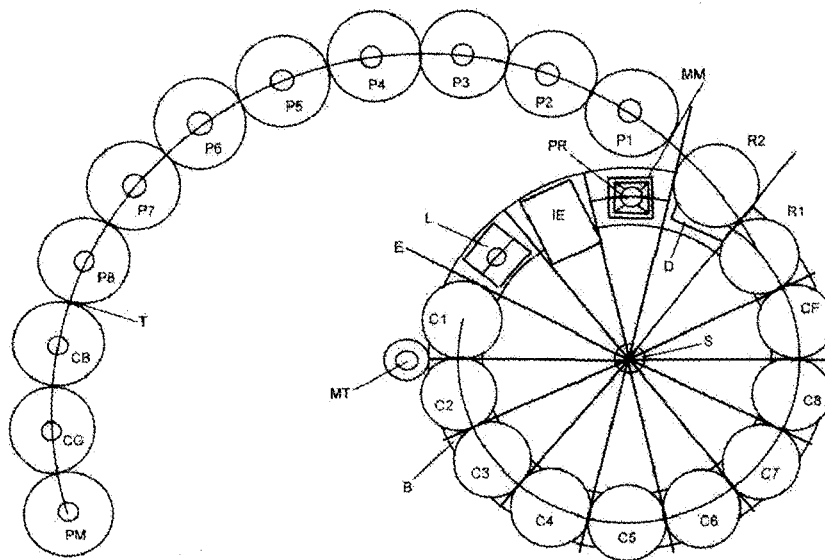


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2019/070602

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B28B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 191402365 A (THOMPSON WILLIAM PHILLIPS) 28/01/1915, page 2, line 6 - page 3, line 19; figures.	1-17
Y	US 5935617 A (UCHIDA HIROSHI ET AL.) 10/08/1999, column 4, line 33 - column 6, line 42; figures 1 - 5, 15, 19.	1-17
A	FR 2239853 A5 (DOMERGUE ROBERT) 28/02/1975, the whole document.	1-17
A	FABRICACIÓN MOSAICO HIDRÁULICO. 17/02/2016 Retrieved from Internet <URL: https://www.youtube.com/watch?v=jpWVmXk97XY > [on line] [15/10/2019] the whole document.	1, 4, 7-9
A	EP 0941824 A2 (CCA INC) 15/09/1999, description; figures.	1-17

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance.	
"E" earlier document but published on or after the international filing date	
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"O" document referring to an oral disclosure use, exhibition, or other means.	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other documents, such combination being obvious to a person skilled in the art
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search
15/10/2019

Date of mailing of the international search report
(18/10/2019)

Name and mailing address of the ISA/

OFICINA ESPAÑOLA DE PATENTES Y MARCAS
Paseo de la Castellana, 75 - 28071 Madrid (España)
Facsimile No.: 91 349 53 04

Authorized officer
M. Pérez Quintana

Telephone No. 91 3495428

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2019/070602

5

10

15

20

25

30

35

40

45

50

55

C (continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of documents, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2007080059 A1 (TONCELLI LUCA) 19/07/2007, the whole document.	1, 5, 8, 11

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2019/070602

Information on patent family members

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
EP0941824 A2	15.09.1999	KR19990077816 A US6103160 A TW406041B B JP2000025020 A CN1229021 A	25.10.1999 15.08.2000 21.09.2000 25.01.2000 22.09.1999
WO2007080059 A1	19.07.2007	US2010159220 A1 RU2008132826 A RU2403149 C2 ITTV20060003 A1 KR20080083691 A EP1973713 A1	24.06.2010 20.02.2010 10.11.2010 11.07.2007 18.09.2008 01.10.2008
FR2239853 A5	28.02.1975	LU70291 A1 IT1016201 B CH592512 A5 BE816407 A	17.10.1974 30.05.1977 31.10.1977 16.10.1974
US5935617 A	10.08.1999	KR950000330 A KR100240516B B1 JPH071418 A EP0629478 A1 CN1103688 A CA2125899 A1 CA2125899 C AU6470494 A AU672692B B2	03.01.1995 15.01.2000 06.01.1995 21.12.1994 14.06.1995 17.12.1994 13.02.2001 22.12.1994 10.10.1996
GB191402365 A	28.01.1915	NL1285C C GB191216923 A FR459285 A FR26786E E FR18806E E CH100108 A CH65683 A	30.11.0002 27.03.1913 31.10.1913 15.03.1924 11.07.1914 02.07.1923 01.07.1914

Form PCT/ISA/210 (patent family annex) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2019/070602

CLASSIFICATION OF SUBJECT MATTER

B28B5/00 (2006.01)

B28B5/04 (2006.01)

B28B5/06 (2006.01)