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(54) Method for the digital decoration of ceramic tiles and machine for implementing such method

(57) The method for the digital decoration of ceramic tiles comprises the followings stages of:

- providing at least a digital machine (1) comprising at least a bearing frame (2) having a supporting surface (3) for supporting at least a ceramic tile (P', P'') mobile along a forward direction (4), at least a decoration unit (6) arranged above the supporting surface (3) and having a plurality of heads (7', 7'') for digital printing on the ceramic tile (P', P''), the decoration unit (6) being mobile with respect to the surface (3) along at least a first direction (10) substantially at right angles to the forward direction (4) and parallel to the surface itself;

- first decoration of at least a first tile (P') through at least an active head (7') able to dispense glaze inside the decoration area (20), where the other heads (7'') are inactive;
- second decoration of at least a second tile (P'') through at least an active head (7') able to dispense glaze inside the decoration area (20), where the other heads (7'') are inactive;
- moving the decoration unit (6) along the first direction (10) between the first and the second decoration to change at least in part the active heads (7') during the second decoration with respect to the active heads (7') during the first decoration, the decoration unit (6) being stopped during the decoration phases.

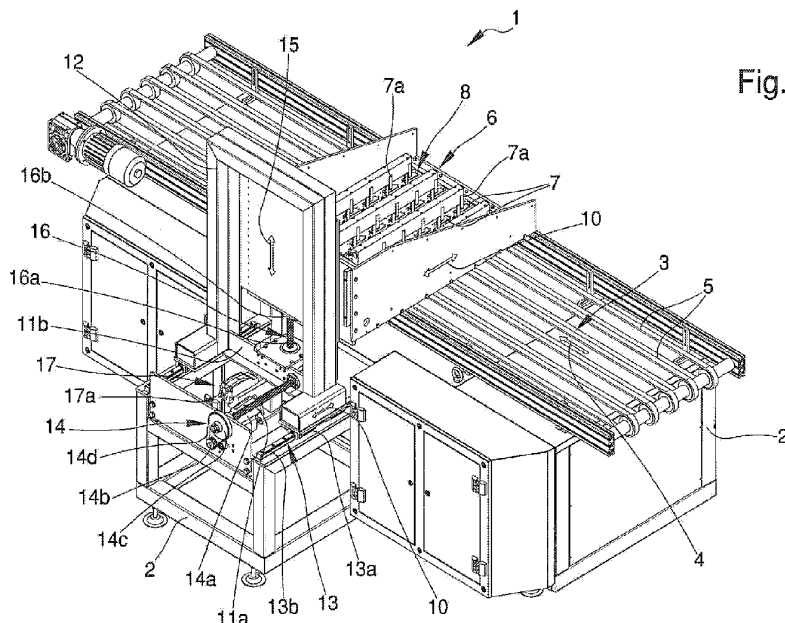


Fig. 4

EP 2 404 724 A1

Description

[0001] The present invention relates to a method for the digital decoration of ceramic tiles and machine for implementing such method.

[0002] The digital machines for decorating ceramic tiles of known type generally comprise a bearing frame to which is associated a supporting surface of one or more ceramic tiles mobile along a forward direction.

[0003] Such machines then comprise a tile decorating unit placed above the supporting surface and having a plurality of digital printing heads.

[0004] The decoration unit of digital machines of known type can be of two types, to each of which types corresponds a different decorating method.

[0005] In the first type, described e.g. in the documents WO 2006/027212, US 2007/031603 and WO 2008/056241, the decoration unit supports a printing head for each colour to be dispensed and is mobile during the printing operation to cover the whole surface of a ceramic tile to be decorated.

[0006] The movement completed by the decoration unit of this first type is of the type of a plotter for printing on paper, where, during the decoration phase, the heads move with respect to the surface to be decorated so as to fully cover such surface.

[0007] This type of digital machine thus contemplates the continuous movement of the relative decoration unit, with a consequent high mechanical stress of the elements kinematically coupled together.

[0008] Furthermore, specially in the case of medium-large sizes, the decoration phase is fairly slow considering the ink jet dispensed by the heads is able to only cover a minimum part of the tile to be decorated and that the heads themselves must move along two directions at right angles to each other to cover the entire surface to be decorated.

[0009] In the second type of known machines, to which the present invention relates, the decoration unit has a plurality of rows of heads for digital printing, where such rows are arranged crossways to the forward direction of the tiles and each of them is suitable for dispensing a specific colour.

[0010] In this second type, the decoration unit and each individual head are stopped during tile decoration. More in detail, depending on the size of the tile to be decorated, the area of decoration changes within which the glaze has to be dispensed from the heads to reach any point of the tile itself. The decoration unit therefore has active heads suitable for dispensing glaze inside the decoration area relating to the tile to be decorated without the need to move the decoration unit itself at all.

[0011] More in particular, depending on the sizes of the tiles to be decorated, the number of active heads varies relating to each colour and which are then used during the decoration process.

[0012] The heads suitable for dispensing outside such decoration area are on the other hand inactive, i.e., they

do not take part in the decoration process.

[0013] For example, in the event of the tile to be decorated being a large-size tile, such as a 700x700 mm tile, such therefore as to substantially occupy the entire transversal overall dimensions of the supporting surface, its decoration is done using practically all the heads of each row of the decoration unit, in such a way as to cover the entire surface of the tile itself.

[0014] In the event of the tile to be decorated being of smaller size, such as a 300x300 mm tile (currently corresponding to one of the most common sizes), for decoration only the heads are used arranged in the proximity of the central area of the supporting surface, i.e., only the heads arranged above the area where the tile transits.

This type of digital machine, and therefore the relevant decorating technology, also has a number of drawbacks.

[0015] In fact, such machines of known type do not allow making uniform decorations, reproducible over time, as sizes change.

[0016] More in particular, the inactivity of a number of the printing heads, which occurs while decorating medium-small size tiles and which sometimes continues for long periods of time, results in these, at the time of their reactivation following a size change, either not working or else producing a decoration different with respect to the heads that have always remained active and which therefore, have a different degree of wear.

[0017] This drawback often results in the need to replace all the digital printing heads at once so that the decoration made is more or less uniform along the entire extension of each row of the decoration unit.

[0018] The replacement of the digital printing heads is very costly from an economic viewpoint and also produces long machine down times, causing an increase in the cost of the end product and a reduction in the output of the machine itself. The main aim of the present invention is to provide a method for the digital decoration of ceramic tiles, and a machine able to implement such method, which allows exploiting in a substantially homogeneous way all the heads of the decoration unit whatever the size of the tile to be decorated.

[0019] One object of the present invention is therefore to optimise the use of all the printing heads in order to obtain an amount of wear more or less constant on all the heads and therefore a substantially uniform decoration over time.

[0020] Another object of the present invention is to extend the life of the printing heads, thereby avoiding their premature replacement and improving the payback on the investment relating to the machine itself,

[0021] Yet another object of the present invention is to increase the output of the machine, reducing machine down times in a specific period of time.

[0022] Another object of the present invention is to provide a method for the digital decoration of ceramic tiles that allows to overcome the mentioned drawbacks of the state of the art in the ambit of a simple, rational, easy and effective to use as well as low cost solution.

[0023] The present objects are achieved by the present method for the digital decoration of ceramic tiles, characterised by the fact that it comprises the followings stages of:

- providing at least a digital machine comprising at least a bearing frame having a supporting surface for supporting at least a ceramic tile mobile along a forward direction, at least a decoration unit arranged above said supporting surface and having a plurality of heads for digital printing on said ceramic tiles, wherein at least one of said heads can be operated to dispense glaze in correspondence to a decoration area defined on said surface so as to reach any point of the tile to be decorated, said decoration unit being mobile with respect to said surface along at least a first direction substantially at right angles to said forward direction and parallel to the surface itself;
- first decoration of at least a first tile through the activation of some of said heads to dispense glaze inside said decoration area so as to reach any point of the first tile itself, wherein the other heads are inactive;
- second decoration of at least a second tile through the activation of some of said heads to dispense glaze inside said decoration area so as to reach any point of the second tile itself, wherein the other heads are inactive; characterised by the fact that it comprises at least movement phase of said decoration unit along said first direction to change the position of said heads with respect to said decoration area between said first and said second decoration so as to modify at least in part the active heads during said second decoration with respect to the active heads during said first decoration, said decoration unit being stopped during said decoration phases.

[0024] The objects above mentioned are moreover achieved by the present digital machine for the decoration of ceramic tiles, comprising:

- a bearing frame having a supporting surface for supporting at least a ceramic tile mobile along a forward direction;
- a decoration unit arranged above said supporting surface and comprising a plurality of heads for digital printing on said tile, of which at least one active head able to dispense glaze in correspondence to a decoration area defined on said surface so as to reach any point of the tile to be decorated; characterised by the fact that said decoration unit is mobile in translation with respect to said supporting surface along at least a first direction crossways to said forward direction and substantially parallel to said supporting surface so as to modify at least in part, between two subsequent decorations, the active heads able to dispense glaze in correspondence to said decoration area, said decoration unit being

stopped during the decoration of said tile.

[0025] Other characteristics and advantages of the present invention will become more evident from the description of a preferred, but not sole, embodiment of a digital machine for the decoration of ceramic tiles, illustrated purely as an example but not limited to the annexed drawings in which:

- 10 figure 1 is a plan view from above of a machine according to the invention in a first configuration of use; figure 2 is a plan view from above of the machine of figure 1 in a second configuration of use;
- 15 figure 3 is a plan view from above of the machine of figure 1 in a third configuration of use;
- figure 4 is a rear axonometric view of the machine of figure 1;
- figure 5 is a plan view from above of the detail of the movement means of the decoration unit;
- 20 figure 6 is a section view along the track plane VI-VI of the second movement means of the decoration unit.

[0026] With particular reference to such figures, globally indicated by reference number 1 is a digital machine for the decoration of ceramic tiles.

[0027] The machine 1 comprises a bearing frame 2 arranged resting on a reference surface and having a supporting surface 3 for supporting one or more ceramic tiles P', P'' mobile along a forward direction identified in the illustrations by the arrow 4.

[0028] In the embodiment of the machine 1 shown in the illustrations, the surface 3 is defined by a plurality of belts 5 arranged parallel with one another and at a distance from one another. The belts 5 are mobile along the forward direction 4. Different embodiment cannot however be ruled out in which the surface 3 is defined by a different movement system such as, e.g., a continuous belt.

[0029] The machine 1 also comprises at least a decoration unit 6 arranged above the surface 3 and comprising a plurality of heads 7', 7'' for digital printing on the ceramic tiles P', P''. The heads 7', 7'' are electronically controlled by a command and control unit, not shown in the illustration, which controls their operation.

[0030] At least a part of the heads 7', 7'' can be activated to dispense glaze in correspondence to a decoration area 20 defined on the surface, 3 and facing the decoration unit 6 so as to reach any point of the tile P', P'' to be decorated. More in detail, the decoration area 20 substantially corresponds to the area of the surface 3 intercepted by the tile P', P'' during its movement along the forward direction 4. The size of the decoration area 20 therefore varies according to the dimensions of the tile P', P'' to be decorated and to its position on the surface 3. More in particular, depending on the size of the tile P', P'' to be decorated, the width varies of the decoration area 20 considered as dimension transversal to the for-

ward direction 4.

[0031] More in particular, depending on the size of the tile P', P" to be decorated, the decoration unit 6 has one or more heads 7' which can be operated to dispense glaze in correspondence to the relative decoration area 20, and which are defined as active heads 7' in the present treatise, and one or more heads 7" able to dispense glaze outside the decoration area 20, and which are defined as inactive heads 7" in the present treatise inasmuch as they do not take part in the decoration phase of the tile P', P".

[0032] The term "active heads" is therefore used to identify all the heads of the decoration unit 6 which take part, from time to time, in the decoration phase of a tile P', P" and which are therefore able to dispense glaze in correspondence to the relative decoration area 20; similarly, the term "inactive heads" is used to identify all the heads of the decoration unit 6 which do not take part in the decoration process and, therefore, remain inactive as the term itself suggests. The number of active heads 7' and their arrangement with respect to the decoration area 20 can be preset by an operator according to the size to be decorated or, alternatively, can be automatically identified by the command and control unit which is operatively connected to sensor means suitable for detecting the dimensions of the tile P', P" and therefore of the relative decoration area 20.

[0033] The active heads 7' therefore belong to an active area defined on the decoration unit, while the inactive heads 7" are arranged outside such active area. Preferably, such active area corresponds to the projection of the decoration area 20 on the decoration unit 6. Different embodiments cannot however be ruled out wherein the dimensions of the active area in correspondence to which are arranged the active heads 7' which dispense glaze during the decoration phase are different with respect to the dimensions of the decoration area 20.

[0034] More in particular, the heads 7', 7" are grouped in several rows 8 arranged substantially parallel the one to the other and which extend along a direction transversal to the forward direction 4.

[0035] The heads 7', 7" of each row 8 are able to dispense the same glaze colour. More in detail, in particular in the event of the tile P', P" to be decorated having dimensions below the maximum dimensions that can be covered by the decoration unit 6, during the forward movement of the tile itself, each row 8 comprises at least one active head 7' and at least one inactive head 7" able to dispense glaze in correspondence to and outside the decoration area 20 respectively.

[0036] As the technician in the sector knows, each head 7', 7" comprises at least a nozzle for dispensing the glaze on the tile P', P", not visible in detail in the illustrations, and a relative electronic part 7a, which can be operatively connected to the command and control unit and is suitable for commanding the dispensing of ink through the nozzle of the corresponding head 7', 7". More in particular, the nozzles of the heads 7', 7" are arranged sub-

stantially facing the supporting surface 3 and the relative electronic parts 7a are arranged above the corresponding nozzles.

[0037] Preferably, the machine 1 also comprise a plate 9 having one or more openings for fitting in the heads 7', 7" and which defines a first face substantially facing the surface 3 and in correspondence to which protrude the nozzles and a second face in correspondence to which the electronic parts 7a are arranged. According to the invention, the decoration unit 6 is mobile in translation with respect to the surface 3 along at least a first direction, identified in the illustrations by the double arrow 10, transversal to the forward direction 4 and substantially parallel to the surface 3, to change the position of the heads 7', 7" with respect to the decoration area 20 so as to modify at least in part, between two subsequent decorations, the active heads 7' able to dispense glaze in correspondence to the decoration area itself.

[0038] In the figures 1, 2 and 3 the different position can be seen taken by the decoration unit 6 with respect to the decoration area 20.

[0039] The decoration unit 6, which is stopped during the decoration phase, is therefore mobile along the first direction 10, between two successive decorations, to selectively change the active heads 7' able to dispense glaze in correspondence to the decoration area 20 of the relative tile P', P" to be decorated.

[0040] Following the movement of the decoration unit 6 along the first direction 10 at least one of the inactive heads 7", during the decoration of a first tile P', becomes an active head 7' during the decoration of a second tile P".

[0041] More in particular, the movement of the decoration unit 6 is suitable for moving at least one of the inactive heads 7" arranged outside the active area relating to the first tile P" in correspondence to the active area relating to the second tile P".

[0042] Suitably, the movement of the decoration unit 6 is suitable for changing the position of the heads 7', 7" with respect to the active area of a relative tile P', P" as well as with respect to the decoration area 20.

[0043] The movement of the decoration unit 6 along the first direction 10 thus causes the active heads 7' and the inactive heads 7" relating to the decoration of a first tile P' to be different with respect to those relating to a second tile P" fed after the first tile itself.

[0044] Suitably, the decoration unit 6 is mobile along the first direction 10 between at least a first and at least a second operating position, where the active heads 7' in the first operating position are at least in part different from the active heads 7' in the second operating position.

[0045] Advantageously, the first direction 10 is substantially parallel to the direction of extension of the rows 8 of the heads 7

[0046] Preferably, the first direction 10 is substantially perpendicular to the forward direction 4.

[0047] More in particular, the decoration unit 6 is mobile along both the sides defined by the first direction 10, as indicated by the bidirectional arrow shown in the illus-

trations.

[0048] The movement of the decoration unit 6, meaning the movement of all the heads 7', 7" together with respect to the supporting surface 3, allows moving any head 7', 7" of each row 8 in the proximity of the decoration area 20 of the tile P', P" to be decorated, according to the specific requirements of the case and to their state of wear.

[0049] Advantageously, the machine 1 comprises first movement means 11 for moving the decoration unit 6 along the first direction 10.

[0050] Preferably, the first movement means 11 are of the screw-nut screw type, e.g., with ball recirculation.

[0051] More in particular, as can be seen in detail in the figure 4, the first movement means 11 comprise at least a first screw 11a connected to the frame 2 and mobile in rotation around the relative axis and a first nut screw 11b that cooperates with the first screw 11a and which is connected integral in translation to the decoration unit 6 along the first direction 10. The first nut screw 11b therefore translates along the first direction 10 due to the rotation of the first screw 11a around its axis.

[0052] Suitably, the first screw 11a extends longitudinally along the first direction 10. The first nut screw 11b is connected sliding to the frame 2 along the first direction 10 while the first screw 11a is integral in translation with the frame 2. Advantageously, the machine 1 also comprises a supporting structure 12 of the decoration unit 6 which is associated sliding with the frame 2 along the first direction 10.

[0053] The first screw nut 11b is therefore associated integral with the supporting structure 12.

[0054] More in particular, between the supporting structure 12 and the frame 2 is placed a slide 13 extending along the first direction 10. The slide 13 comprises a runner 13a associated integral with the supporting structure 12 and which cooperates with a fixed guide 13b, associated integral with the bearing frame 2. Suitably, the machine 1 comprises first starting means 14 of the first movement means 11.

[0055] The first starting means 14 can be of the manual and/or electro-mechanical type. In the embodiment shown in the illustrations, the first starting means 14 comprise at least a first electric motor 14a, mechanically linked to the first screw 11a.

[0056] More in particular, the first motor 11a is connected to the first screw 11a by means of a reduction device, e.g., by means of a belt drive.

[0057] The first starting means 14 also comprise a first pulley 14b, associated integral in rotation with the exit shaft of the first motor 14a, and a second pulley 14c, associated integral in rotation with the first screw 11a, linked together in rotation by means of a belt 14d.

[0058] The first drive pulley 14b has a smaller diameter than the second driven pulley 14c, so as to achieve a reduction of the rotation speed from the first motor 14a to the first screw 11a.

[0059] Suitably, the first motor 14a is associated inte-

gral with the frame 2 and, consequently, it is fixed with respect to the supporting surface 3.

[0060] It cannot be ruled out however that the first starting means 14 comprise, alternatively or in addition to the first electric motor 14a, also manual means mechanically linked to the first screw 11a, suitable for allowing a manual adjustment of the position of the decoration unit 6 with respect to the surface 3 along the first direction 10.

[0061] Advantageously, the decoration unit 6 is also able to move closer/away from the surface 3 along a second direction, identified in the illustrations by a double arrow 15, crossways to the first direction 10.

[0062] Preferably, the second direction 15 is substantially perpendicular to the first direction 10. In the embodiment shown in the illustrations, the second direction 15 is substantially perpendicular to the forward direction 4 and to the supporting surface 3.

[0063] In the preferred embodiment shown in the illustrations, the decoration unit 6 is integral in translation with the supporting structure 12 along the first direction 10 and is mobile with respect to this along the second direction 15.

[0064] Between the decoration unit 6 and the supporting structure 12 a slide is placed, not visible in detail in the illustrations, which extends along the second direction 15.

[0065] The machine 1 also comprises second movement means 16 of the decoration unit 6 along the second direction 15.

[0066] Suitably, the second movement means 16 are associated integral with the supporting structure 12 along the first direction 10.

[0067] Preferably, the second movement means 16 are of the screw-nut screw type, e.g., with ball recirculation.

[0068] More in particular, the second movement means 16 comprise a second screw 16a mobile in rotation around the relevant axis and a second nut screw 16b which cooperates with the second screw 16a and which is associated integral in translation with the decoration unit 6 along the second direction 15. The second nut screw 16b therefore translates along the second direction 15 due to the rotation of the second screw 16a around the relative axis.

[0069] In the preferred embodiment shown in the illustrations, the second screw 16a is associated integral in translation along the first direction 10 with the supporting structure 12.

[0070] The machine 1 then comprises second starting means 17 of the second movement means 16.

[0071] The second starting means 17 can be of the manual and/or electro-mechanical type.

[0072] More in particular, the second starting means 17 comprise at least a second electric motor 17a, mechanically connected to the second screw 16a.

[0073] The operation of the second motor 17a thus involves the rotation of the second screw 16a around the relative axis and, consequently, the translation of the sec-

ond nut screw 17b along the second direction 15.

[0074] It cannot be ruled out however that the second starting means 17 also comprise, alternatively or in addition to the second electric motor 17a, manual means mechanically connected to the second screw 16a and suitable for allowing the manual adjustment of the position of the decoration unit 6 with respect to the surface 3 along the second direction 15.

[0075] Advantageously, the operation of the first motor 14a and/or of the second motor 17a is controlled electronically by the control and command unit according to the sizes of the tiles P, of the production lots, of how long the various heads 7 are used, of the maintenance performed, etc...

[0076] The method is described below for decorating ceramic tiles using the digital machine described above.

[0077] One or more tiles P' are fed into the machine resting on the surface 3 along the forward direction 4 until these reach the area below the decoration unit 6. Generally, the tiles P', P'' to be decorated move forward along the median area of the supporting surface 3, or are arranged substantially symmetrical with respect to its centre distance.

[0078] Preferably, an identification phase is performed of the number and the position of the heads 7' that can be operated to dispense glaze in the decoration area 20 relating to the tile P', P'' to be decorated. Such identification phase is performed in an automatic way by the command and control unit, e.g., by means of the above-described sensor means. Alternatively, the number and the position of the active heads 7' with respect to the decoration area 20 relating to each size can be set by the operator according to the dimensions of the tile P', P'' to be decorated and to the area which the heads 7', 7'' are able to cover.

[0079] The method according to the invention contemplates a first decoration of the first tiles P' performed by activating the heads 7' able to dispense glaze in correspondence to the relative decoration area 20 and which are therefore called active heads 7', while the remaining heads 7'' are inactive.

[0080] During the first decoration, the active heads 7' therefore dispense glaze in such a way as to reach, during the forward movement of the first tiles P', any point of the first tiles themselves, while the inactive heads 7'' do not dispense glaze. More in detail, each row 8 has at least one active head 7'.

[0081] Consequently, the active area relating to the first tiles P' intercepts all the rows 8 of the decoration unit 6.

[0082] After a certain number of decorations, which can be preset or selected from time to time by an operator, it is best to also use at least one part of the inactive heads 7'' which have not operated during the first decoration. This way, the degree of wear and use of all the heads 7' and 7'' of the decoration unit 6 will be as uniform as possible.

[0083] The decoration unit 6 is then moved along the

first direction 10 so as to at least in part modify, with respect to the first decoration of the first tiles P', the heads 7' that can be started to dispense glaze in correspondence to the decoration area 20 relating to one or more second tiles P''.

[0084] Such movement is therefore suitable for moving at least one of the inactive heads 7'' during the first decoration in correspondence to the decoration area 20 during the second decoration.

[0085] In this case too, the number of active heads 7' and their position with respect to the decoration area 20 during the second decoration can be preset or identified automatically by the control and command unit.

[0086] Suitable, the amount of movement of the decoration unit 6 is such as to move the active heads 7' able to decorate the second tiles P'' to the identified position with respect to the decoration area 20, so that the glaze dispensed by these can reach any point of the second tiles P'' during their movement along the forward direction.

[0087] Advantageously, following the movement of the decoration unit 6, at least one of the active heads 7' during the first decoration corresponds to one of the inactive heads 7'' during the second decoration. This generally, albeit not only, occurs in the event of the first and the second tile P' and P'' having substantially the same dimensions and, therefore, of the relative decoration areas being substantially the same. In this case, therefore, following the movement of the decoration unit 6 there is an exchange between at least some of the active heads 7' and a corresponding number of inactive heads 7'' relating to the first decoration of the first tiles P'.

[0088] The movement of the decoration unit 6 is therefore able to modify the active heads 7' and the inactive ones 7'' of each row 8 between the first and flit second decoration.

[0089] More in detail, the movement of the decoration unit 6 conveys at least one of the inactive heads 7'' arranged outside the active area relating to the first tiles P' in correspondence to the active area relating to the second tiles P''.

[0090] The movement of the decoration unit 6 can be performed before the feeding of the second tile P'', e.g., in the event of production being programmed and therefore the command and control unit already knowing the size of the second tile P'' about to arrive, or during the feeding of the second tile itself, before this reaches however the area underneath the decoration unit 6.

[0091] Preferably, the movement of the decoration unit 6 along the first direction 10 is performed during the production stops, e.g., during size changes or during jobs done on the equipment upstream of the machine 1, so as to reduce machine down times as much as possible and optimize efficiency.

[0092] More in particular, in the decoration of medium-small sizes, e.g., of the 300x300 mm tile type, only some of the heads 7', 7'' of the decoration unit 6 need be used and, therefore, the purpose of the movement of the dec-

oration unit 6 along the first direction 10 is to allow the use of any head 7', 7'' to dispense glaze in correspondence to the decoration area 20 of the tile P', P'' to be decorated.

[0093] Obviously, the movement of the decoration unit 6 is not performed in the event of the dimensions of the tiles P', P'' being such that the relative decoration areas 20 comprise all the heads 7', 7'' of the decoration unit 6.

[0094] After moving the decoration unit 6, thereby at least in part modifying the active heads 7' able to dispense glaze in correspondence to the decoration area 20, the second tiles P'' are fed along the forward direction 4 below the decoration unit itself.

[0095] A second decoration is therefore made of the second tiles P'' by means of the activation of the heads 7' which following the movement of the decoration unit 6 are now able to dispense glaze in correspondence to the decoration area 20, where the other heads 7'', i.e., those positioned in such a way as to dispense glaze outside the decoration area 20, are inactive.

[0096] As can be seen from figure 3, each row 8 has one or more active heads 7' and one or more inactive heads 7''.

[0097] During the decoration phases of the first and the second tiles P' and P'', the decoration unit 6 is stopped.

[0098] Furthermore, the opening and closing sequence of the nozzles of the first heads 7' and 7'' is electronically managed by the command and control unit according to the size of the tile P', P'' to be decorated and to the design to be reproduced. It has in fact been ascertained how the described invention achieves the proposed objects and in particular the fact is underlined that it allows using, in a substantially uniform way, all the heads equipping the decoration unit, quite apart from the size of the tile to be decorated.

[0099] In fact, through the movement of the decoration unit along the first direction, it is possible to select which heads to use from time to time to decorate the tiles, including those of medium-small size.

[0100] The movement of the decoration unit along the first direction therefore allows selectively moving each digital printing head in the proximity of the median area of the supporting surface depending on the relative state of wear in relation to the other heads of the same decoration unit.

[0101] The method according to the invention, therefore allows optimising the life cycle of each digital printing head, thus avoiding the prolonged inactivity of a part of these resulting in a not homogeneous decoration of the various heads of the same decoration unit and therefore in the premature replacement of all its heads.

Claims

1. Method for the digital decoration of ceramic tiles, **characterised by** the fact that it comprises the fol-

lowings stages of:

- providing at least a digital machine (1) comprising at least a bearing frame (2) having a supporting surface (3) for supporting at least a ceramic tile (P', P'') mobile along a forward direction (4), at least a decoration unit (6) arranged above said supporting surface (3) and having a plurality of heads (7', 7'') for digital printing on said ceramic tiles (P', P''), wherein at least one of said heads (7', 7'') can be operated to dispense glaze in correspondence to a decoration area (20) defined on said surface (3) so as to reach any point of the tile (P', P'') to be decorated, said decoration unit (6) being mobile with respect to said surface (3) along at least a first direction (10) substantially at right angles to said forward direction (4) and parallel to the surface itself;
- first decoration of at least a first tile (P') through the activation of some of said heads (7') to dispense glaze inside said decoration area (20) so as to reach any point of the first tile itself, wherein the other heads (7'') are inactive;
- second decoration of at least a second tile (P'') through the activation of some of said heads (7') to dispense glaze inside said decoration area (20) so as to reach any point of the second tile itself, wherein the other heads (7'') are inactive;

characterised by the fact that it comprises at least a movement phase of said decoration unit (6) along said first direction (10) to change the position of said heads (7', 7'') with respect to said decoration area (20) between said first and said second decoration so as to modify at least in part the active heads (7') during said second decoration with respect to the active heads (7') during said first decoration, said decoration unit (6) being stopped during said decoration phases.

2. Method according to claim 1, **characterised by** the fact that said decoration unit (6) is mobile along both the sides defined by said first direction (10).
3. Method according to claim 1 or 2, **characterised by** the fact that, following said movement, at least one of the inactive heads (7'') during said first decoration corresponds to an active head (7') during said second decoration.
4. Method according to claim 3, **characterised by** the fact that, following said movement, at least one of the active heads (7') during said first decoration corresponds to an inactive head (7'') during said second decoration.
5. Method according to one or more of the preceding claims, **characterised by**, the fact that said tiles (P',

- P") are mobile along said forward direction (4) during said decoration phases.
6. Method according to one or more of the preceding claims, **characterised by** the fact that said decoration area (20) substantially corresponds to the area of said surface (3) facing onto said decoration unit (6) and intercepted by said tiles (P', P") during their movement along said forward direction (4). 5
 7. Method according to one or more of the preceding claims, wherein said decoration unit (6) comprises one or more rows (8) of said heads (7', 7") for digital printing which extend substantially parallel to said first direction (10), **characterised by** the fact that each of said rows (8) has at least an active head (7') able to dispense glaze in correspondence to said decoration area (20) and at least an inactive head (7") arranged on the side of said active head (7'). 10
 8. Method according to one or more of the preceding claims, **characterised by** the fact it comprises at least an identification phase of the number and the position of said active heads (7') with respect to said decoration area (20). 15
 9. Method according to claim 8, **characterised by** the fact that said machine (1) comprises one or more sensor means suitable for detecting the positions and/or the dimensions of the tile (P', P") to be decorated at least when it transits below said decoration unit and by the fact that said identification is performed in an automatic way by a command and control unit operatively connected to said sensor means. 20
 10. Method according to one or more of the preceding claims, **characterised by** the fact that said decoration unit (6) moves closer/away from said supporting surface (3) along a second direction (15) crossways to said first direction (10) and by the fact that it comprises at least a phase for adjusting the distance of said heads (7', 7") from said supporting surface (3). 25
 11. Digital machine (1) for the decoration of ceramic tiles, comprising: 30
 - a bearing frame (2) having a supporting surface (3) for supporting at least a ceramic tile (P', P") mobile along a forward direction (4);
 - a decoration unit (6) arranged above said supporting surface (3) and comprising a plurality of heads (7', 7") for digital printing on said tile (P', P"), of which at least one active head (7') able to dispense glaze in correspondence to a decoration area (20) defined on said surface (3) so as to reach any point of the tile (P', P") to be decorated; 35
 12. Machine (1) according to claim 11, **characterised by** the fact that said decoration unit (6) is mobile in translation with respect to said supporting surface (3) along at least a first direction (10) crossways to said forward direction (4) and substantially parallel to said supporting surface (3) so as to modify at least in part, between two subsequent decorations, the active heads (7') able to dispense glaze in correspondence to said decoration area (20), said decoration unit (6) being stopped during the decoration of said tile (P', P"). 40
 13. Machine (1) according to claim 11 or 12, **characterised by** the fact that said decoration unit (6) comprises one or more rows (8) of said heads (7) for digital printing which extend substantially parallel to said first direction (10), and by the fact that each of said rows (8) comprises one or more active heads (7') able to dispense glaze in correspondence to said decoration area (20) and one or more inactive heads (7") arranged on the side of said active heads (7'), said decoration unit (6) being mobile along said first direction (10) to modify at least in part the active heads (7') and the inactive ones (7") of each of said rows (8) between two subsequent decorations. 45
 14. Machine (1) according to one or more of the claims from 11 to 13, **characterised by** the fact that said decoration unit (6) moves closer/away from said supporting surface (3) along a second direction (15) crossways to said first direction (10). 50
 15. Machine (1) according to one or more of the claims from 11 to 14, **characterised by** the fact that it comprises a supporting structure (12) of said decoration unit (6) associated sliding with said bearing frame (2) along said first direction (10), said decoration unit (6) being integral with said supporting structure (12) along said first direction (10) and being mobile in translation with respect to it along said second direction (15). 55

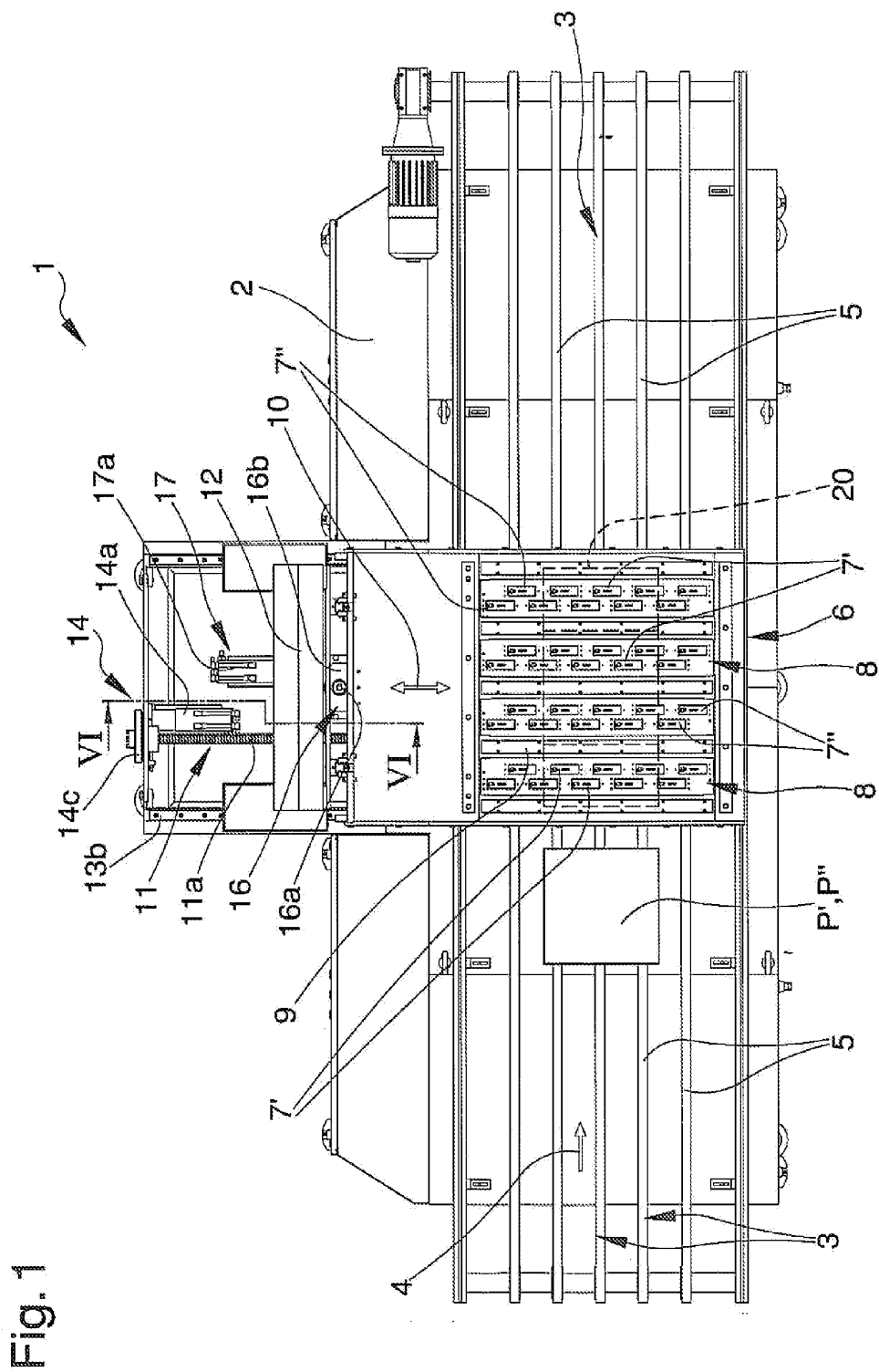


Fig. 1

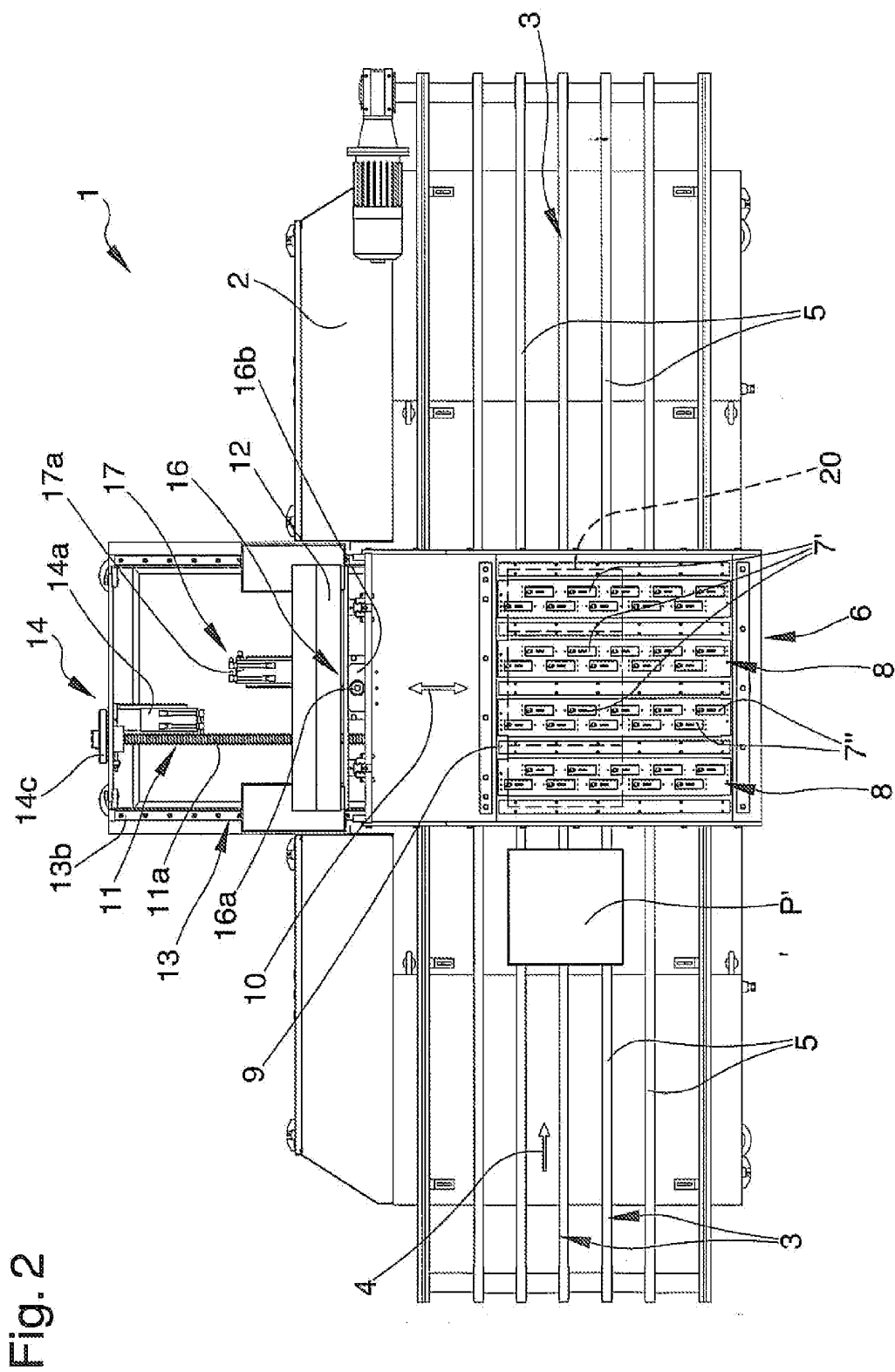


Fig. 3

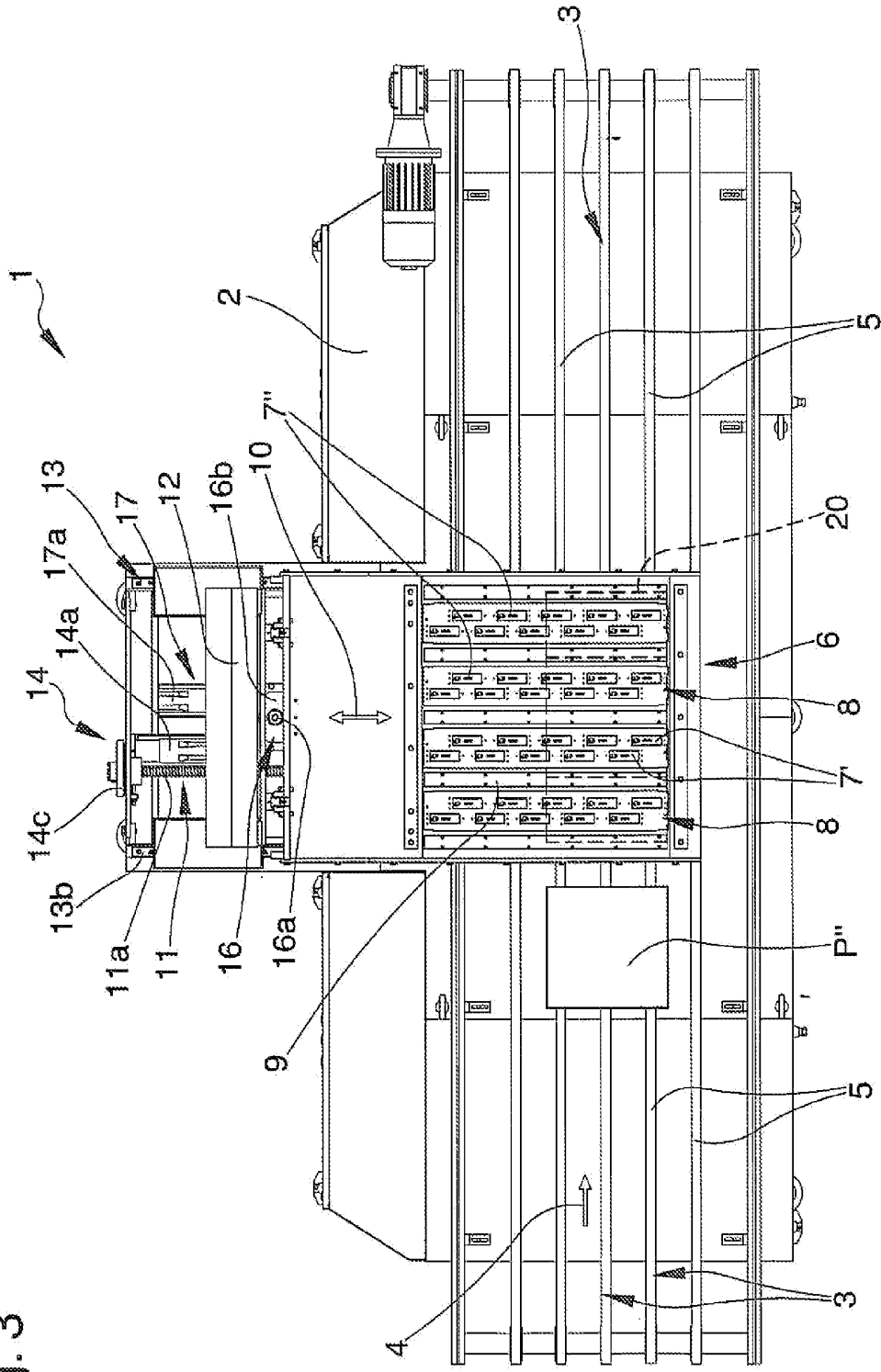
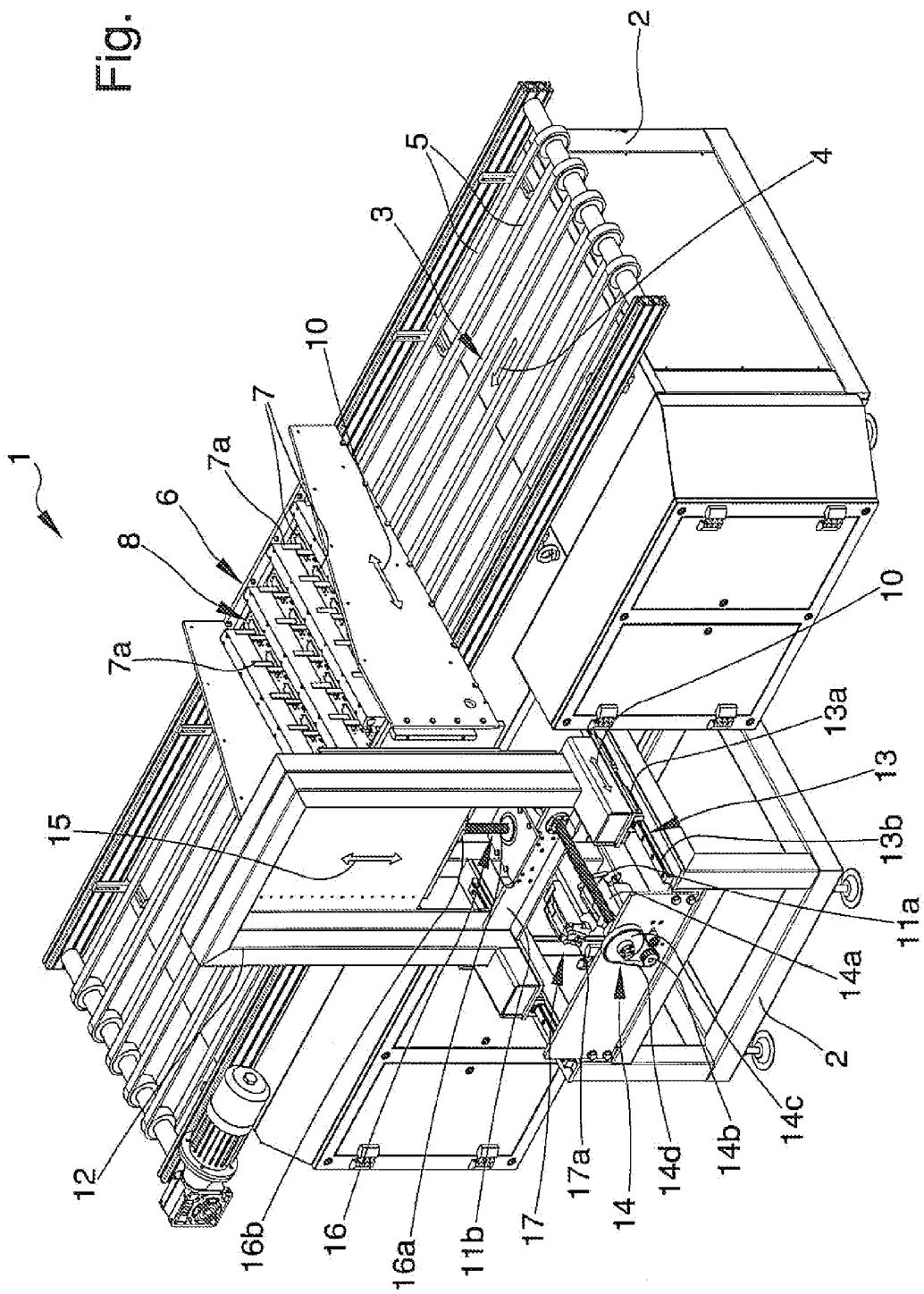


Fig. 4



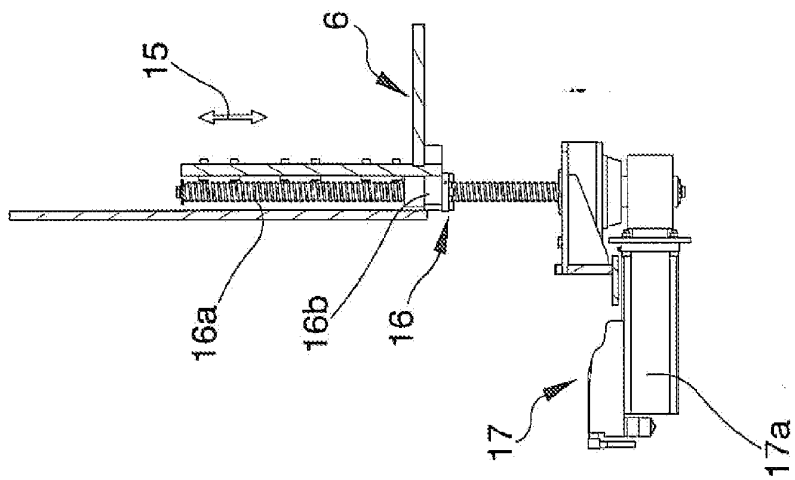


Fig. 6

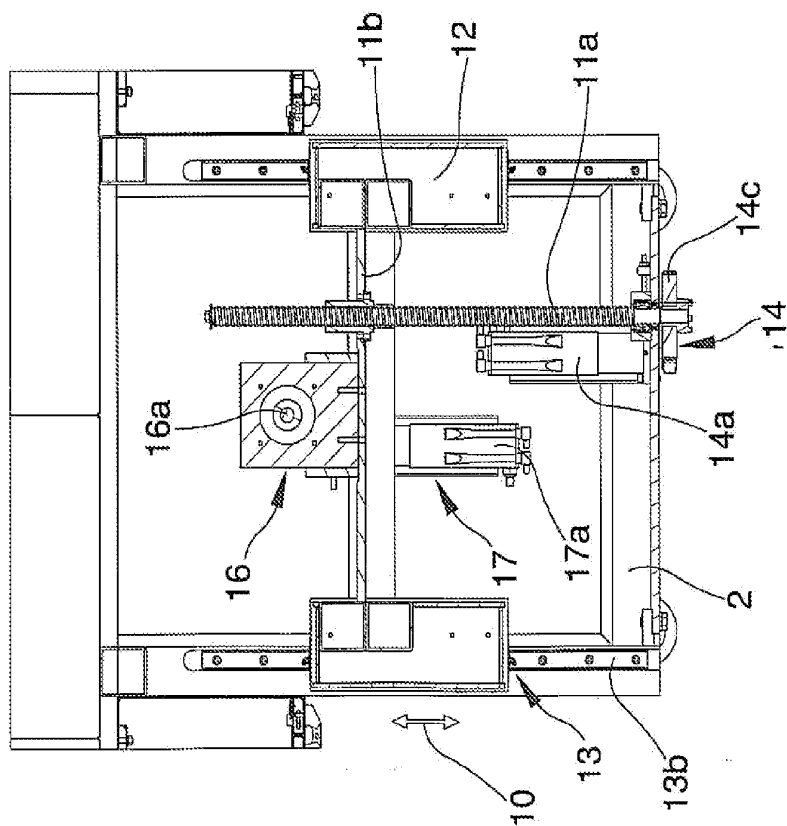


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 11 17 2243

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X	WO 2008/056241 A2 (MACCARI ANTONIO [IT]) 15 May 2008 (2008-05-15)	11,13	
A	* page 4, line 14 - page 7, line 28; claims 1-6; figures *	1	
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 24 August 2011	Examiner Orij, Jack
CATEGORY OF CITED DOCUMENTS		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	
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			

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24-08-2011

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