



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
20.05.2009 Bulletin 2009/21

(51) Int Cl.:
B24B 7/06 (2006.01) **B24B 7/19** (2006.01)
B24B 7/22 (2006.01) **B24B 19/00** (2006.01)
B24B 29/02 (2006.01)

(21) Application number: **08169051.3**

(22) Date of filing: **13.11.2008**

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

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(30) Priority: **17.11.2007 IT VR20070164**

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(54) **Process and plant for working a stone tile and tile thus obtained**

(57) The present invention relates to a process for working a tile, which comprises the following steps in sequence:

- arranging a work piece having a flat work or open face (SP);
- applying at least one coating or masking layer (5a, 5b) onto at least one portion of the work face (SL), thereby obtaining a work face having at least one coated or

masked area (3a) and at least one uncovered or free area (3b); and

- carrying out at least one finishing operation on the work face by means of at least one working tool, whereby processing the at least one uncovered or free area (3b) of the work face (SL), whereas the at least one coating layer prevents the at least one working tool from processing or thoroughly processing the at least one coated or masked area.

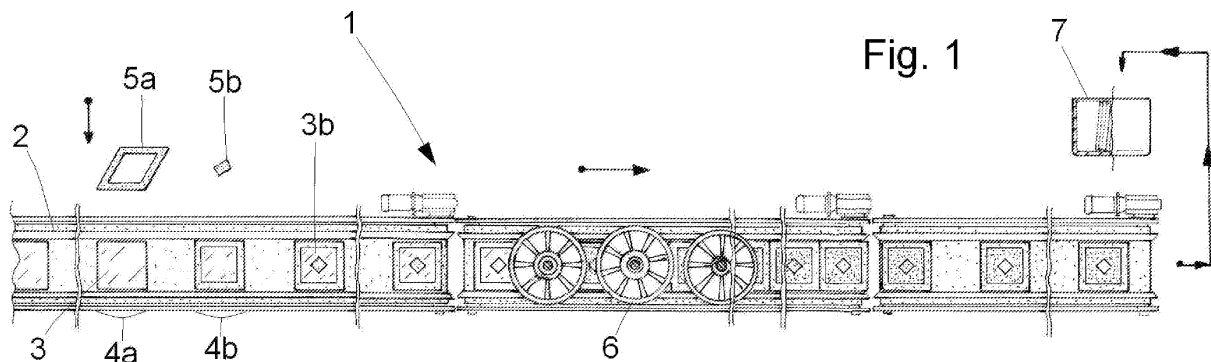


Fig. 1

Description

[0001] The present invention relates to a process and a plant for working tiles, and more particularly for working stone, gres, porcelain, terracotta tiles; cement agglomerates; marbles; quarts; silica; glasses; resins; natural or synthetic wood, or the like, e. g. slabs, tiles, blocks, bricks, or the like, and tiles thus worked.

[0002] In the description and claims, the term "tile" is meant to indicate a work piece having a substantially flat work face as well as a work piece having an uneven work face, e. g. a face provided with shallow depressions and reliefs suitable for being processed by a brush or block tool, as further explained hereinbelow.

[0003] As it is known in the art, in order to obtain a stone slab or tile a block made of a natural or synthetic stone is sawn, thereby obtaining slabs, that, in turn, can be further worked (e. g. smoothed, polished) either before or after having been sawn to obtain tiles of predetermined size.

[0004] Depending upon their final destination, the tiles can be further processed or worked on the open or work face, i. e. the face that, once the tile has been laid, is designed to be in view. An open face can also be subjected to further working processes, such as bushhammering, finishing and/or polishing and the like. Such working processes are generally carried out by using suitable tools, e. g. one or more bushhammers, abrasive blocks, abrasive brushes of synthetic material, optionally mounted on a multiple working head.

[0005] Working processes proposed up to know involve the use of working tools, thereby uniformly processing the entire work or open face of a work piece, such as throughout the whole surface of a tile, slab and the like.

[0006] The main object of the present invention is to provide a tile working process suitable for selectively working one or more areas on a face of a tile.

[0007] A specific object of the present invention is to provide a process for working stone tiles, according to which face portion/s of the tile can be differently worked with respect one another, thereby obtaining opacity/brightness contrast between different portions of a tile face.

[0008] Another object of the present invention is to provide a tile or the like having an open face of new type, i. e. having portions thereof in opacity or brightness contrast with one another.

[0009] According to a first aspect of the present invention there is provided a process for working a tile, which comprises the following steps in sequence:

- arranging a work piece having a flat work or open face;
- applying at least one coating or masking layer onto at least one portion of the work face, thereby obtaining a work face having at least one coated or masked area and at least one uncovered or free area; and
- carrying out at least one finishing operation on the

work face by means of at least one working tool, whereby processing the at least one uncovered or free area of the work face, whereas the at least one coating layer prevents the at least one working tool from processing or thoroughly processing the at least one coated or masked area.

[0010] Thus, a process according to the present invention comprises a first step of arranging a work piece having a flat work or open face, e. g. a tile, a slab, a brick, and the like, made of stone, such as marble, granite, artificial stone, marble agglomerate; gres, porcelain, terracotta, cement agglomerate, glass, resin, (either natural or synthetic) wood, having a work or open face.

[0011] At least one coating or masking material, e. g. made of a synthetic material, is applied onto one or more portions of the work face of the tile, thereby obtaining a work face having one or more coated or masked areas and one or more uncoated or unmasked free areas. If desired, different kinds of masking material or different number of layers of the same coating material can be used at different masked areas on the work face. Thus, masked areas that are covered with a relatively small thickness of coating material, or relatively easily removable coating material are worked or finished to a lesser extent with respect to the free (unmasked) areas.

[0012] A tile coat or mask according to the present invention can typically comprise a film applied onto the working surface and fixed thereto by means of a suitable adhesive material, or a resin which is hardenable at room temperature or a thermosetting resin. A coating film according to the present invention can typically be made of a component selected from the group comprising polystyrene (PS), polyvinylchloride (PVC), polyethylene terephthalate (PET), polycarbonate (PC), polyethylene (PLT) or the like.

[0013] A tile can also be coated by at least one slurry, e. g. a liquid or semifluid resin. According to such embodiment, for example, a coating or masking layer is obtained by spreading at least one fluid or pasty compound. Once the fluid or pasty compound, e. g. a thermosetting resin has been applied to the tile, it is heated, and thus caused to set and reticulate at one or more portions of the work surface of the tile.

[0014] A fluid composition according to the present invention can be selected from the group comprising epoxy, polyurethane, polyurea, epoxy polyurethane, polyamide, polyester resins, UV-hardenable resins, mouldable thermoplastic resins, polymerizable resins, polyols, acrylic resins, and elastomer resins.

[0015] According to another advantageous embodiment of the process of the present invention, a tile can be covered by one or more relatively rigid masks, which are suitably shaped so as to cover a respective area and to leave uncovered one or more areas having a desired configuration. Such a mask can be applied onto the work surface of a tile and then kept adhering thereto by means of one or more presser means, or an adhesive material.

[0016] Before being coated or covered by a mask, a tile can be subjected to one or more finishing operations (such as smoothing, lapping) to obtain a substantially flat and even work surface, i. e. a surface with no surface deficiencies that can be detected at sight.

[0017] According to another aspect of the present invention there is provided a plant for carrying out a process as specified above, which comprises:

- at least one application station of the at least one coating or masking layer; and
- at least one working station designed to carry out at least one finishing operation on the work surface of the at least one tile.

[0018] Further aspects and advantages of the present invention will better appear from the following detailed description of specific embodiments of a working process and plant according to the present invention, the description being made with reference to the accompanying drawings, in which:

Figure 1 is a top view of a portion of a plant according to the present invention for carrying out the process according to the present invention;

Figure 2 is a plan view of a finished or polished tile according to the present invention;

Figure 3 is a cross-section view taken along the line III-III in the tile of Fig. 2;

Figure 4 is a partial perspective view slightly from above of a detail of the tile in Fig. 2 during an application or removal step of a covering mask;

Figure 5 is a view similar to that of Fig. 1 of another embodiment of a plant according to the present invention for carrying out the process of the invention; and

Figure 6 is side elevation view on an enlarged scale of a detail of the plant of Fig. 5.

[0019] In the drawings the same or similar parts or components are indicated with the same reference numerals.

[0020] With reference first to Figs. 1 to 4, a plant 1 is shown, which comprises a conveyor belt 2 designed to receive a succession of tiles 3 having their work surface SL facing upwards and their laying surface SP facing the conveyor belt. The plant also comprises one or a plurality (two in the drawings) of coating or masking stations 4a, 4b designed to apply onto the work surface SL of each tile 3 a respective coating or masking element 5a, 5b. The tiles coming out from a station 4a, 4b have one or more coated or masked areas 3a and one or more free or uncovered areas 3b.

[0021] The coated or masked tiles are then sequentially conveyed to a working station 6 where they undergo one or more finishing operations carried out by a working tool or tools, e. g. one or more brushes provided with synthetic material abrasive bristles or composite brush

(es) comprising synthetic material abrasive bristles and abrasive sectors or blocks, e. g. a tool as disclosed in the Italian patent application no. VR2007A000132 filed on September 25, 2007 in the name of the applicant of the present invention.

[0022] Advantageously, the finishing operation is carried out by means of brushes which are mounted on one or more rotating heads of a suitable polishing machine, and can comprise a predetermined number of working steps. The number of working steps depends on the working depth to be obtained, the hardness of the material to be worked, and the characteristic features of the abrasive brushes. In the embodiment shown in Fig. 1 three aligned rotating heads are provided, and thus each tile undergoes three finishing steps either with heads provided with brushes that differ from each other or with identical brushes, and thus the tile undergoes three subsequent working steps.

[0023] The tiles leaving the working station are fed to a stacking station 7.

[0024] According to the above-described embodiment, one or more films 5a, 5b are applied to each tile (at stations 4a, 4b) to act as coating or covering layer/s. Once the finishing operation is terminated, such covering layer/s can be removed (Fig. 4) or left on the tile to prevent the tiles from being damaged while being stacked and conveyed elsewhere.

[0025] Figures 5 and 6 show a plant 10 for carrying out a working process according to the present invention, which is similar to the plant in Fig. 1 and comprises a cover or mask application station including a distributor 11 designed to distribute or spread a pasty compound, e. g. a thermosetting resin, and a heat source, e. g. a bank of infrared or UV heater, located nearby the distributor and designed to heat the thermosetting resin supplied by the distributor 11.

[0026] According to such an embodiment, the distributor 11 can be advantageously movable, so as to distribute the resin onto predetermined areas of the working surface of the tile 3, thereby obtaining a desired image or inscription on the tile. To this end, the application station 11 and optionally the heating station 12 can be slidably mounted on a guide or bridge 13 extending above the conveyor belt, thus the distributor 11 can be displaced, in use, immediately above the tile 3 to be masked.

[0027] Advantageously, the distributor 11 can be controlled by an electronic processing unit 14 in which designs, images and/or mask shapes (e. g. one alphanumeric sign or logo) to be reproduced onto the tile can be stored.

[0028] According to further embodiment of the method according to the present invention, two coating or covering layers of different thickness are applied to the tile, thus obtaining a coated or masked area 3a having portions that differ in thickness one with respect to the other. Thus, tiles can be obtained which have areas of different appearance one with respect to the other.

[0029] With a process and a plant according to the

present invention, it is possible to obtain tiles having a work surface with finished and non-finished areas. This makes it possible to obtain, on one side, undercut areas with a well limited and precise outline (areas subjected to finishing operations according to the present invention), thus obtaining desired optical contrast effects due to difference in lucidity or opacity degree between finished areas and areas subjected to conventional finishing operations only, and, on the other, areas which are less polished, i. e. and slightly rougher, than the rest of the work surface of the tile.

[0030] By adopting granule size for the abrasive granules embedded in the tool, surfaces with different roughness degrees, e. g. "mirror" flat surfaces or rough surfaces, can be obtained.

[0031] Advantageously, the finished areas of the tiles can be worked to such a degree as to obtain a low slippery open face.

[0032] An advantageous secondary effect of the process according to the present invention is obtained when use is made of a tile coating or mask which adheres to the work surface. In such a case, in fact, the coating or mask is also useful to protect and keep in stacked position a pile of finished tiles.

[0033] A process or plant according to the present invention makes it possible to apply inscriptions, images or logos to a tile, and thus tiles can be personalized.

[0034] The working process as described above is susceptible to numerous modifications and variations within the protection scope of the present invention as defined by the claims.

[0035] Thus, for example, the finishing operation obtained by using brush/s can be a dry process, or preferably use can be made of a suitable liquid.

Claims

1. A process for working a tile, which comprises the following steps in sequence:
 - arranging a work piece having a flat work or open face (SP);
 - applying at least one coating or masking layer (5a, 5b) onto at least one portion of said work face (SL), thereby obtaining a work face having at least one coated or masked area (3a) and at least one uncovered or free area (3b); and
 - carrying out at least one finishing operation on said work face by means of at least one working tool, whereby processing said at least one uncovered or free area (3b) of said work face (SL), whereas said at least one coating layer prevents said at least one working tool from processing or thoroughly processing said at least one coated or masked area.
2. A process as claimed in claim 1, **characterized in that** said at least one coating or masking layer (5a, 5b) comprises at least one film.
3. A process as claimed in claim 2, **characterized in that** said at least one film is made of a material selected from the group comprising polystyrene (PS), polyvinylchloride (PVC), polyethylene terephthalate (PET), polycarbonate (PC), polyethylene (PLT) or the like.
4. A process as claimed in claim 1, **characterized in that** said at least one coating or masking layer is obtained by spreading at least one fluid or pasty compound.
5. A process as claimed in claim 4, **characterized in that** said fluid or pasty compound is selected from the group comprising epoxy, polyurethane, polyurea, epoxy polyurethane, polyamide, polyester resins, UV-hardenable resins, mouldable thermoplastic resins, resin to be polymerized, polyols, acrylic resins, and elastomer resins.
6. A process as claimed in claim 4 or 5, **characterized in that** after said spreading step, it comprises heating said at least one coating or masking layer, thereby causing setting thereof.
7. A process as claimed in claim 1, **characterized in that** said at least one coating or masking layer comprises a relatively rigid mask.
8. A process as claimed in any previous claim, **characterized in that** said at least one coating or masking layer is removed after said finishing operation.
9. A process as claimed in any previous claim, **characterized in that** said at least one coating layer is at least one alphanumeric sign or logo.
10. A process as claimed in any previous claim, **characterized in that** said at least one coating layer (5a, 5b) comprises at least two layers applied to said at least one work face (SL) and having a different coating thickness one with respect to the other.
11. A plant for carrying out a process as claimed in any previous claim, **characterized in that** it comprises:
 - at least one application station (4a, 4b; 11) of said at least one coating or masking layer (5a, 5b); and
 - at least one working station (6) designed to carry out at least one finishing operation on said work surface of said at least one tile.
12. A plant as claimed in claim 11, **characterized in that** it comprises a heating station (12) designed to heat

said at least one coating layer applied to said working surface.

13. A plant as claimed in claim 11 or 12, **characterized in that** said application station comprises at least one dispenser unit (11) arranged to distribute hardenable fluid or pasty resin. 5
14. A plant as claimed in claim 13, **characterized in that** it comprises an electronic control unit (14) designed to control said dispenser unit (11). 10
15. Tile when obtained by a plant as claimed in any claim 11 to 14. 15

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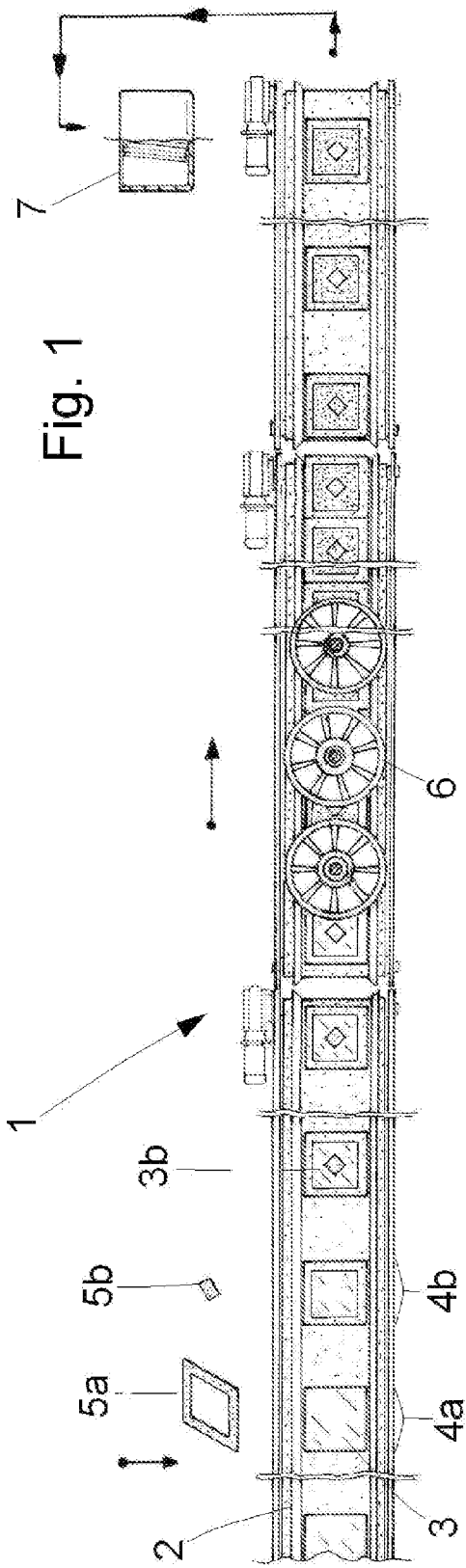


Fig. 1

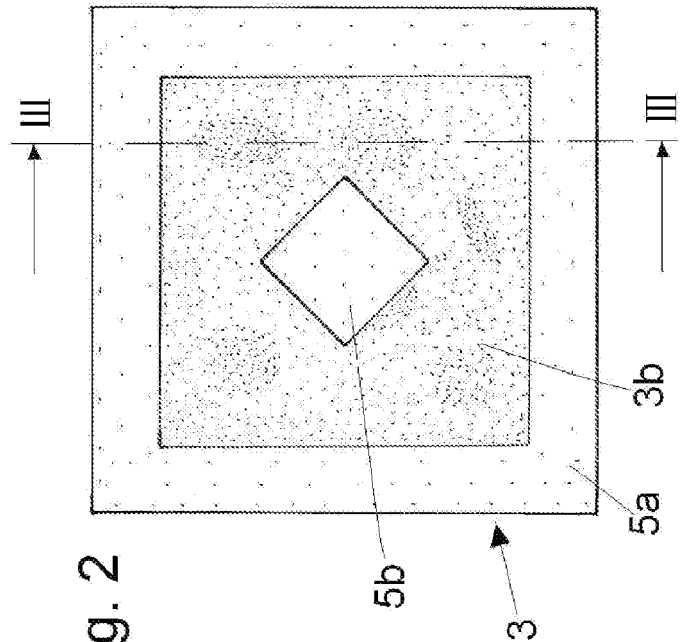


Fig. 2

Fig. 3

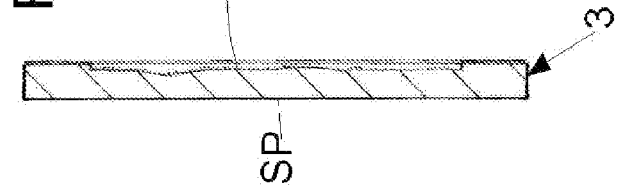
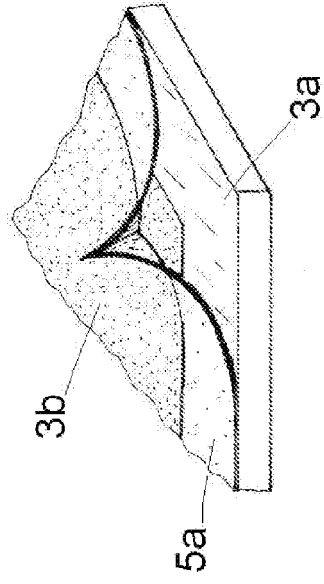
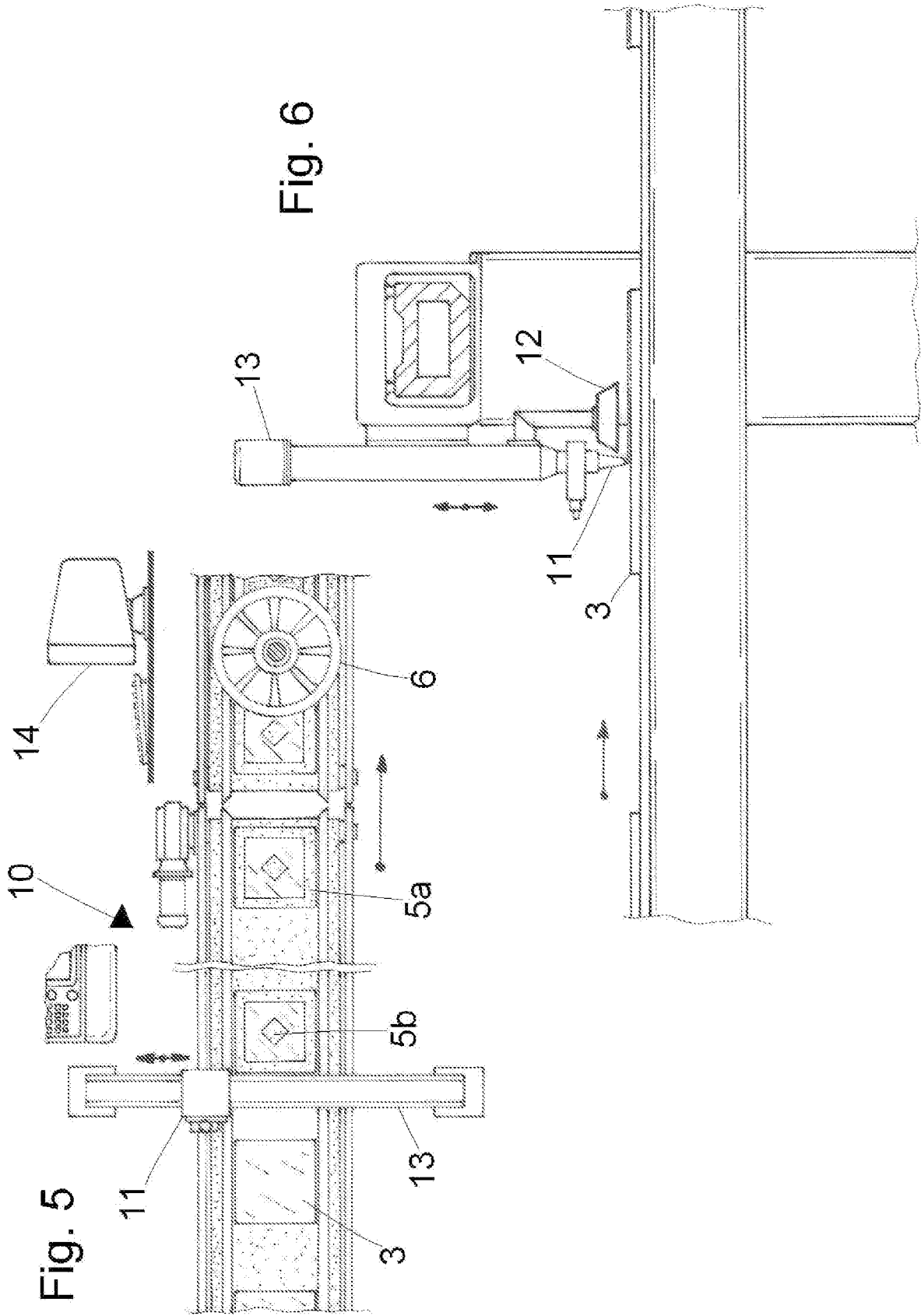


Fig. 4





REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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