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(54) Method and apparatus for the making of tiles, in particular for venetian floor tiles and the like

(57) A method for the making of tiles able to be used as surfacing and support plane, which reproduce, in their motifs and techniques employed, so-called Venetian style floors, comprises the phases of: laying a first layer of grout on a planar support; vibrating the grout; placing a quantity of gravel on the surface of said first layer of grout; subjecting said support to sussultatory vibrations, determining the partial burying of the gravel in said first layer of grout; laying, onto said first layer of grout, a second layer of grout obtaining a semi-finished tile; vibrating the whole semi-finished tile; and drying said semi-finished tile.

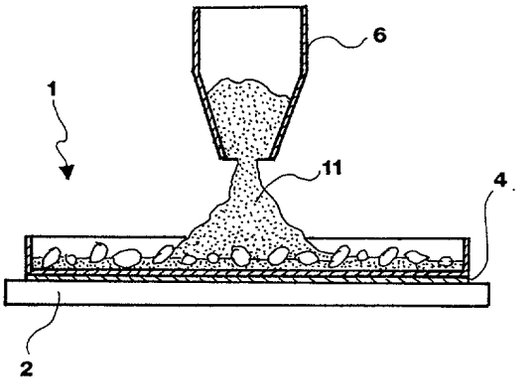

fig.5

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Description

[0001] The present invention relates to a method for the making of tiles and the like, suitable for being employed as surfacing and support plane, which reproduce, in their motifs and techniques employed, so-called Venetian style floors.

[0002] The invention also relates to a device for forming tiles and to a plant for their fabrication.

[0003] This kind of floor, well known for its aesthetic qualities, consists of the application, directly onto the substrate of the ceiling that receives the floor, of a layer of semi-fluid binding material.

[0004] Said material, well known to the person skilled in the art as well as to those who lay this particular type of floor, shall be referred to by its conventional name of grout. It is a mixture substantially of water, cement, marble dust or the like. The characteristics of the mixture may vary to suit the requirements of the laying operation, in particular in regard to porosity, specific weight, colour and more.

[0005] In solidifying, it acquires considerable properties of hardness, resistance, aptitude to be ground and polished, producing a shiny surface. In the liquid state, it has the properties of a liquid-plastic fluid with a low viscosity that allows it to flow.

[0006] On the layer of grout laid onto the substrate with a uniform thickness, are laid discrete elements of broken gravel, and said laying operation is conventionally called seeding the gravel, said elements comprising pebbles, of various shapes and sizes, of stones, marbles, granites, glasses, etc., selected according to colour, size and the effect to be created on the floor.

[0007] It is understood that, when applying said gravel, it is possible to obtain a melange of different colours and stones, but also a well-ordered and precise design, on the pattern of a mosaic and also all imaginable intermediate solutions.

[0008] After applying the gravel, thereon is accurately laid an additional layer of grout which is left to be dried by air, a process that can last many days.

[0009] After the entire layer laid onto the substrate has reached a sufficient hardness and compactness following the complete curing of the cement which lasts for at least one month, it can be ground and polished, starting from grinding wheels with large grains and ending with grinding wheels for polishing.

[0010] The removal of the previously obtained irregular surface allows, on one hand, to obtain a planar surface, free of irregularities, shiny and compacted, with high resistance as a floor against impacts and other types of wear by friction, penetration of liquids and other harmful elements. On the other and, the polishing allows the gravel layer to emerge completely, enabling the motifs created during the laying stage to be fully visible, with their full aesthetic and also, in many cases, artistic impact.

[0011] From the above description it is understood that this type of floor, which is distinguished for its very high value, is reserved to those who can afford the high costs and the time associated to such a complex craftsman like laying process.

[0012] Therefore, methods have been developed and are known in the art for making tiles which, once laid, are able to simulate the kind of floor described above.

[0013] These methods generally derive from the formation of a conglomerate of grout and gravel which, once dried, can be cut into tiles.

[0014] This basic method, however, leads to a series of drawbacks. The formation of a conglomerate entails such drying times as to require enriching the grout with resins that accelerate the hardening of the mixture, resins which, because of their chemical nature, have an environmental impact that is not wholly devoid of negative consequences.

[0015] Moreover, this system allows to produce tiles whose gravel is arranged according to a disorderly matrix, without the ability to obtain designs. Moreover, once the application of the tiles is completed, while minimising the thickness of the gap, the transition between a tile and the other is nonetheless perceivable because of the irregular placement of tiles cut in correspondence with the edge of the tile itself next to each other.

[0016] These drawbacks, in spite of the reduction in the costs associated with the laying operation which is reduced to a simple placement of tiles, are such that they considerably limit the use of this kind of floor.

[0017] The technical problem constituting the basis for the present invention is to provide a method for making tiles that allows to overcome the drawbacks mentioned above with reference to the prior art.

[0018] This problem is solved by a method as specified above, comprising the phases of:

* laying a first layer of grout on a planar support;
* placing a quantity of gravel on the surface of said first layer of grout;
* subjecting said support to sussultatory vibrations, determining the partial burying of the gravel in said first layer of grout;
* laying, onto said first layer of grout, a second layer of grout obtaining a semi-finished tile;
* vibrating the whole semi-finished tile; and
* drying said semi-finished tile.

[0019] According to an embodiment of the invention, the method comprise the additional phase of grinding a surface of said semi-finished tile until obtaining a predetermined degree of finish. Otherwise, the grinding and polishing phases can also be carried out after the laying on a suitably prepared substrate.

[0020] A partial grinding of said surface is also possible. In this case, a method of laying the tiles obtained as described above, provides for laying an additional thin layer of grout on the laid tiles, where the limited thickness of said additional layer enables its rapid dry-

ing, followed by a polishing operation that erases any trace of gap between tiles.

[0021] In any case, the transition between a tile and the other is difficult to perceive, given the absence of cut stones on the edge of the tile.

[0022] The placement of the gravel in the method according to the invention can take place with any degree of accuracy: from a mechanical and automated laying to a manual laying which, among other advantages, allows to obtain well defined designs and mosaics.

[0023] According to the same inventive concept, a device for forming tiles and the like for Venetian stile floors comprises:

* a tray structure able to receive semi-fluid grout;
* means for dispensing semi-fluid grout in said tray structure;
* means for dispensing grout in said tray structure;
* a vibrating element whereon the tray structure is set; and
* means for generating sussultatory vibrations.

[0024] A plant for making Venetian floor tiles and the like comprises the device as defined above, means for drying semi-finished tiles and means for finishing the rough tile surface.

[0025] The present invention shall be described hereafter according to a preferred embodiment thereof, together with some variations, provided by way of non-limiting example with reference to the accompanying drawings in which:

* Figures 1 through 6, 7a, 7b, 8a and 8b schematically show some phases of the method according to the present invention in combination with details of a forming device; and
* Figure 9 shows a schematic plan view of a plant for implementing the method according to the invention.

[0026] With reference to Figures 1 through 6, a device 1 for making tiles is partially shown, limited to the detail in which the tile is formed.

[0027] Said device comprises a vibrating element 2, in particular a planar support element that is set in vibration by vibration generating means 8.

[0028] On the vibrating element 2 the device 1 comprises a tray structure 5 which in turn comprises a planar support 50 delimited by walls 3 that define a pre-determined thickness. Between the vibrating element 2 and the tray structure 5 is interposed a damping layer whose function shall become apparent farther on.

[0029] The device 1 further comprises dispensing means 6 for releasing a quantity of semi-fluid grout. Said dispensing means 6 are conveniently hopper-like structured and receive the grout from a system for mixing and dispensing components of the grout itself.

[0030] With reference to device 1, a first phase of the method according to the present embodiment comprises the phase of laying a first layer of grout 70 determined by the dispensing of a first pre-determined quantity 7 of grout by said dispensing means 6 (Figure 1).

[0031] Once the pre-determined quantity 7 of grout has been cast into the tray structure 5, the vibrating element 2 is set in vibration.

[0032] The vibration generating means 8 are structure in such a way as to comprise a pair of eccentric elements, conventional in nature and thus not shown herein, mounted on mutually parallel shafts that are also parallel to the planar support 50, being connected in rotary fashion, for instance by means of bearings or bushings, to the vibrating element.

[0033] Said shafts are set in mutually opposite rotations, with the same velocity of rotation, in such a way as to generate a sussultatory vibration that assures that the laying of the grout layer takes place in uniform fashion from the viewpoint of density and thickness.

[0034] The damping layer 4 serves the purpose of cancelling the effect of any second-order vibration that should be generated together with the required sussultatory vibrations.

[0035] Incidentally, the term sussultatory vibration means the vibration that determines a reciprocating motion on a direction that is perpendicular to the vibrating element 2, or to the planar support 50.

[0036] The thickness of the first grout layer 70 is equal to about half the thickness determined by the walls 3 of the tray structure 5. In the present embodiment the thickness is 6-7 mm (Figure 2).

[0037] Once the laying of the first layer 70 is complete, the method comprises the phase of placing a quantity of gravel 9 on said first layer. Various systems can be employed to place the gravel; the system found to be most accurate is the manual one whereby it is possible to obtain, thanks to the craftsmen's expertise employed therein, a "natural" appearance or, on the contrary, a precise design, guided with appropriate templates.

[0038] It is in any case clear that this phase can also be carried out with different laying systems, in particular mechanical systems for dropping a pre-determined quantity of gravel.

[0039] It is also clear that the gravel in question is composed of irregular pieces of different sizes, possibly also with several distinct colours.

[0040] With the laying operation, a structure is obtained where the grout layer 70 is superficially covered with gravel whose pieces are partially buried in the semi-fluid grout or are set down superficially (Figure 3).

[0041] At this point the method according to the present invention comprises the phases of subjecting said planar support 50 to sussultatory vibrations, using said generating means 8. Thanks to the particular nature of the vibrations and to the density of the grout 7, the gravel is partially buried in the first layer of grout 70 with a substantially uniform distribution 10 (Figure 4).

[0042] With the dispensing means 6, in a subsequent

phase of the present fabrication method is dispensed a second pre-determined quantity 11 of grout, to fill the tray structure 5 to the top (Figure 5). Said second quantity of grout then goes to constitute a second layer of grout that is laid onto the previous one, to constitute a semi-finished tile 12.

[0043] To achieve this, the tray structure is again subjected to sussultatory vibrations, which determine the laying of the added grout and the uniform distribution of the grout 9 over the whole thickness and over the whole surface of the semi-finished tile 12 (Figure 6).

[0044] Said semi-finished tile, at this point, to undergo the subsequent work processes, undergoes a phase in which it is dried. The drying operation can occur naturally or in an environment that promotes the dehydration and curing (crystallisation) of the grout, for instance by means of steam baking controlled temperature.

[0045] During this phase, the semi-finished tile 12 is contained in the tray structure 5 that will then be eliminated, if it is of the disposable kind, or reused. The separation between tile to be finished and tray structure 5 can be facilitated by lubricating the inner surface of the tray structure 5 before laying the first layer of grout.

[0046] Note that no cut pieces of gravel will fall in correspondence with the edge of the semi-finished tile, as is the case when a whole block of solidified grout and gravel is cut to produce tiles in this way. The presence of said cut pieces would enable a careful observer to notice the presence of a gap, however thin, between the tiles once the laying operation is complete. Moreover, the uniform distribution prevents the edge of the tile to be identified due to a thinning out of the gravel at the margins. These characteristics are highly appreciated because they allow the floor obtained by laying tiles to approximate the floor obtained with traditional methods whereby the grout and the gravel are laid directly onto the substrate.

[0047] Note, additionally, that this traditional effect can thus be obtained avoiding a specific preparation of the substrate and the very long time required for drying the floor on site, all with reduced tile thickness, lesser than 20 mm.

[0048] The finishing of the semi-finished tile 12 can comprise different phases that depend on the type of laying whereto the tiles are destined. In general, the finishing comprise a series of grinding operations, using grinding wheels with progressively finer grain, until obtaining a shiny surface.

[0049] The purpose of the grinding operation is also to level and regularised the pieces of gravel that emerge from the semi-finished tile surface.

[0050] The finishing can comprise a first phase of rough grinding with first grinding wheel means 14 acting on a rough tile P set down on a support 13. An irregular surface 15 is obtained, which can be exploited during the laying operation.

[0051] The rough tile P can be laid normally, obtaining a uniform, but not shiny, surface.

[0052] Onto said surface it is possible to lay, with traditional systems with spatulas, a thin layer of grout, able to dry very rapidly. Subsequently, the floor thus obtained can be ground to the shiny finish, erasing any type of gap or junction between tiles.

[0053] If a more refined tile is desired, it is possible to proceed with a second grinding phase with second grinding wheel means 16, with fine and very fine grain, to obtain a shiny surface 17 (Figure 9). With this tile it is possible to execute a rapid laying, wholly similar to the one that can be executed with ceramic tiles, obtaining a Venetian floor.

[0054] With reference to Figure 9, a plant 20 is described for manufacturing Venetian floor tiles according to the method described above. Said plant comprises a forming line 22 along which the tray structures 5 are moved, passing through a series of sub-stations some of which are provided with vibration generating means 8.

[0055] Said line 22 comprises an inlet 21 that receives the empty tray structure 5. It then comprises a first sub-station 35 where the tray structures are lubricated, and a second sub-station 36 for the laying of the first grout layer 70. For this purpose the plant comprises tanks 25 of fluid material for the composition of the grout in predetermined proportions. Said tanks 25 feed mixing means 26 where the grout is mixed to feed a manifold 27 which in turn feeds a pair of dispensing lines 23, 24 respectively to lay the first and the second layer of grout 70.

[0056] In this part of the plant the colouring of the grout is determined; said colouring usually remains the same for a batch of tiles. In any case, the utmost flexibility is allowed.

[0057] Lubrication may take place manually or automatically.

[0058] The first dispensing line 23 provides grout to said second sub-station 36, which is followed by a third sub-station 37 where vibration generating means 8 are used to lay the first grout layer 70 uniformly.

[0059] In a fourth sub-station 38 the gravel is distributed superficially, preferably in manual fashion by an experienced worker who also positions any templates to guide the laying.

[0060] Note that this approach allows to produce single pieces to compose floors that can have even extremely complex designs. The worker will thus be able to employ templates, for instance made of sheared cardboard, produced automatically through a computerised CAD/CAM system with which the floor itself is drawn and designed.

[0061] In a fifth sub-station 39 vibration generating means 8 contribute to bury the gravel in the grout with a correct procedure, and the worker will immediately be able to check whether the gravel, which is substantially fastened to the grout in this phase, assumes the required disposition.

[0062] In all the phases where vibrations are applied and in particular where the gravel is to be buried in the

grout, the duration of said application may be controlled tile by tile by the worker, to obtain a uniform quality level also by varying the quantity of gravel, the piece size, the density of the gravel, the complexity of the design etc.

[0063] Otherwise, for large scale productions, the duration of the vibration can be pre-set.

[0064] Subsequently, in a sixth sub-station 40, fed by the second dispensing line 24 of the grout, the semi-finished tile is provided with said second quantity of grout 11, and in a seventh sub-station 41 the vibration generating means 8 produce a semi-finished tile with the required thickness.

[0065] The fourth sub-station 38, the one where the craftsman expertise the present method allows to exploit is concentrated, can be subdivided into multiple sub-stations for the laying of different types of gravel. It is in any case understood that the same manufacturing quality can be achieved by a mechanical laying system, active for instance with screens fitted with templates, to obtain designs with the gravel, and conventional systems for transporting the gravel. The same mechanical system can operate with the aforementioned CAD/CAM system, for the large scale production of tiles.

[0066] After the seventh sub-station 41, the tray structures are conveyed in appropriate conditioning spaces 29 for curing the tiles. Conveniently, said space will comprise a multiplicity of shelves 28 to position the tray structures stacked but allowing the flow of the air and of the steam produced by an appropriate controlled temperature conditioning system.

[0067] From the shelves 28 are extracted the tray structures 5 containing cured tiles, able to be conveyed to a finishing plant, globally indicated with the reference number 42, which comprises an inlet 30 with a device 43 for extracting the semi-finished tile from the respective tray structure 5 which, is destined to be reused, will be cleaned.

[0068] From the extraction device 43 branches a transport line for moving the semi-finished tiles through a multiplicity of finishing stations.

[0069] In the embodiment described herein, the finishing plant 42 comprises in succession a first and a second calibration stations 31 and 32, provided with large grain grinding wheels, whereby it is possible to obtain a rough tile already suitable for laying in view of on site finishing.

[0070] Subsequently, the plant has a third finishing station 34 which, with a series of grinding wheels with fine and very fine grain, produces a shiny surface that makes the tiles suitable to the laying of a finished floor.

[0071] From the description above it is readily apparent that the fabrication method and the plant are able to produce not only floor tiles but also any ceramic-like plane, for instance tiles for floors, skirting boards, steps, wall, bathrooms, kitchen and bathroom counters, decorations of various kinds etc.

[0072] The formats may be the most diverse and above all they may be adapted to specific requirements. In particular, the tray structures described above may be fabricated on site, using sheets of plastic material, able to be hot-moulded with the required format.

[0073] In this way, it will be possible to avoid cutting the produced tiles, which could make evident, for the reasons explained above, the junctions between tiles.

[0074] To the method described above a person versed in the art, in order to meet additional and contingent requirements, may make numerous additional modifications and variations, all included within the scope of protection of the present invention, as defined by the accompanying claims.

Claims

1. Method for fabricating tiles and the like, able to be used as floor and support plane, which reproduce, in the motifs and techniques employed, so-called Venetian floors, comprising the phases of:
   - * laying a first layer of grout (70) on a planar support (50);
   - * placing a quantity of gravel (9) on the surface of said first layer of grout (70);
   - * subjecting said planar support (50) to sussultatory vibrations, determining the partial burying of the gravel (9) in said first layer of grout (70);
   - * laying, onto said first layer of grout (70), a second layer of grout obtaining a semi-finished tile (12);
   - * vibrating the whole semi-finished tile; and
   - * drying said semi-finished tile (12).
2. Method as claimed in claim 1, wherein said first layer of grout (70) is laid by applying sussultatory vibrations.
3. Method as claimed in claim 1, wherein said second layer of grout is laid by applying sussultatory vibrations.
4. Method as claimed in claim 1, wherein the laying of the gravel is performed in accordance to a design and by means of a template.
5. Method as claimed in claim 1, wherein a phase of grinding a surface of said semi-finished tile until a pre-determined degree of finish is provide.
6. Method as claimed in claim 1, wherein a partial grinding of a surface of said semi-finished tile is provide.
7. Method as claimed in claim 1, wherein a phase of curing by means of steam baking under controlled temperature is provided.

8. Method as claimed in claim 1, wherein the planar support (50) is lubricated before laying said first layer (70) of grout.

9. Device for forming tiles and the like for Venetian floors, comprising:

a tray structure (5) able to receive semi-fluid grout;
means (6) for dispensing semi-fluid grout (7, 11) in said tray structure (5);
means for dispensing grout (9) in said tray structure (5);
a vibrating element (2) whereon the tray structure (5) is set; and
means (8) for generating sussultatory vibrations.

10. Device as claimed in claim 9, wherein the tray structure (5) comprises a planar support (50) delimited by walls (3) that define a predetermined thickness.

11. Device as claimed in claim 9, wherein between the vibrating element (2) and the tray structure (5) is interposed a damping layer (4) to dampen second-order vibrations.

12. Plant (20) for fabricating Venetian floor tiles, comprising a forming line (22), along which tray structures (5) are moved, having: an inlet (21); a first sub-station (35) where the tray structures (5) are lubricated; a second sub-station (36) for the laying of a first layer of grout (70); a third sub-station (37) with vibration generating means (8) to lay the first layer of grout (70) uniformly; a fourth sub-station (39) for superficially distributing gravel (9); a fifth sub-station (39) with vibration generating means (8) to bury the gravel in the grout; a sixth sub-station (40) fed by a second quantity of grout (11); and a seventh sub-station (41) with vibration generating means.

13. Plant (20) as claimed in claim 12, wherein the fourth sub-station (38) is subdivided into multiple sub-stations for the laying of different types of gravel.

14. Plant as claimed in claim 12, comprising conditioning spaces (29) for curing the tiles with a multiplicity of shelves 28 to arrange the tray structures (5) stacked but allowing the flow of the air and of the steam produced by an appropriate controlled temperature conditioning system.

15. Plant (20) as claimed in claim 1, comprising a transport line for moving the semi-finished tiles through a multiplicity of finishing stations.

16. Tile or the like fabricated according to the method as claimed in claims 1 through 8.

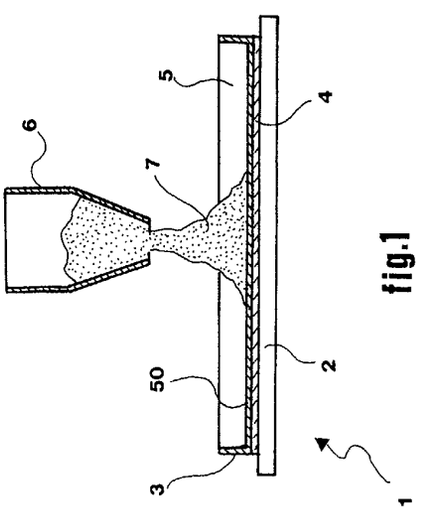

fig.1

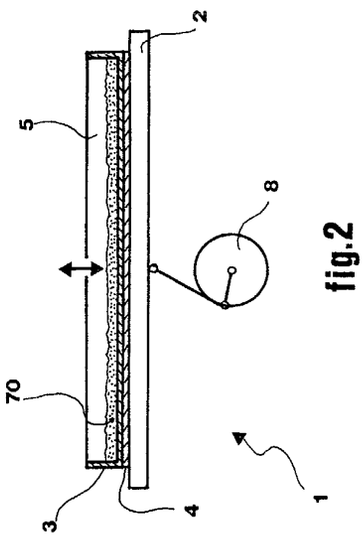

fig.2

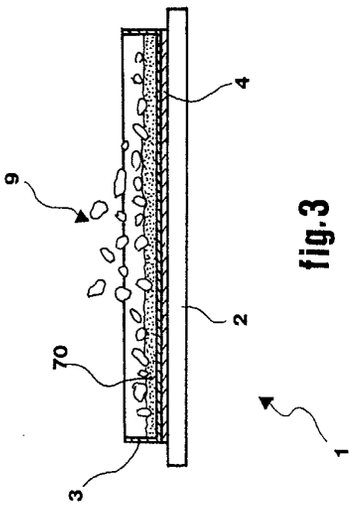

fig.3

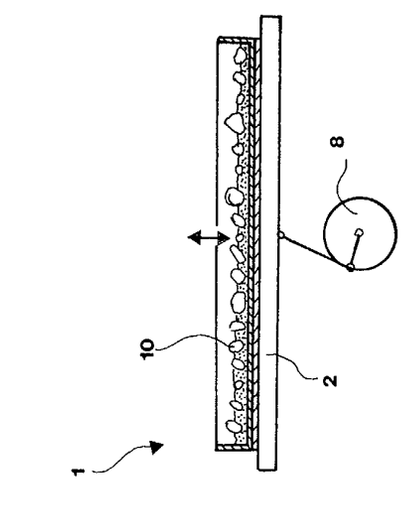

fig.4

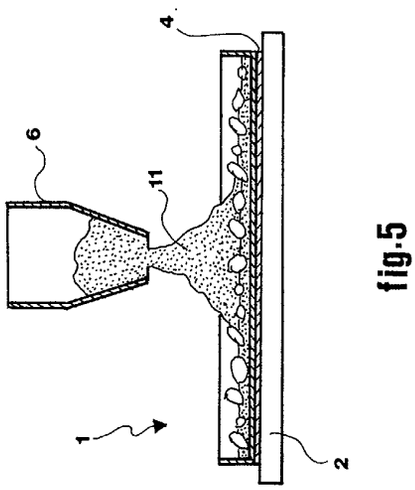

fig.5

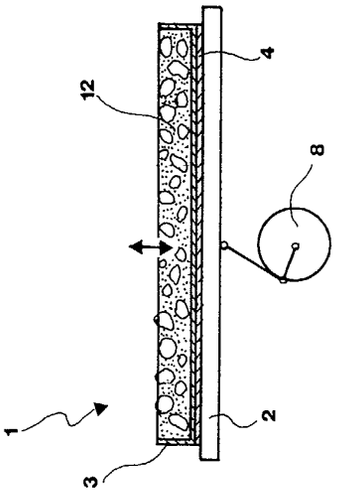

fig.6

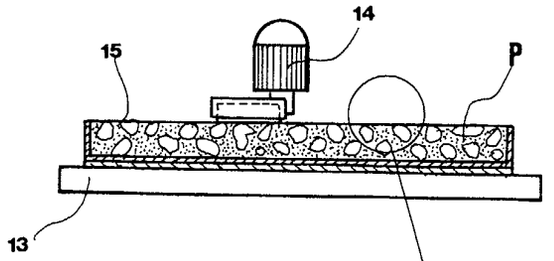

fig.7a

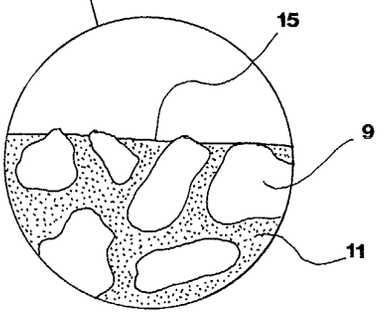

fig.7b

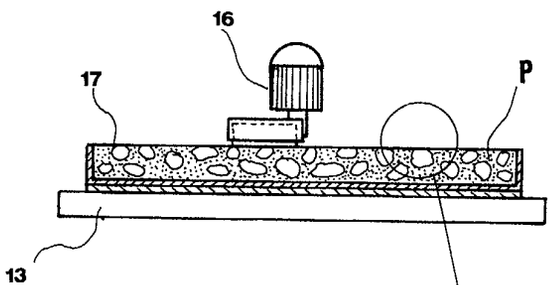

fig.8a

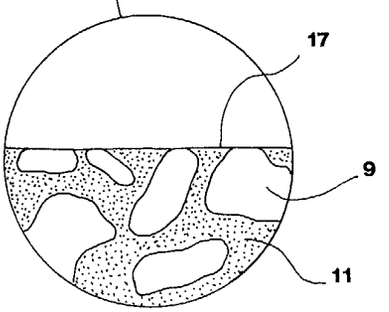

fig.8b

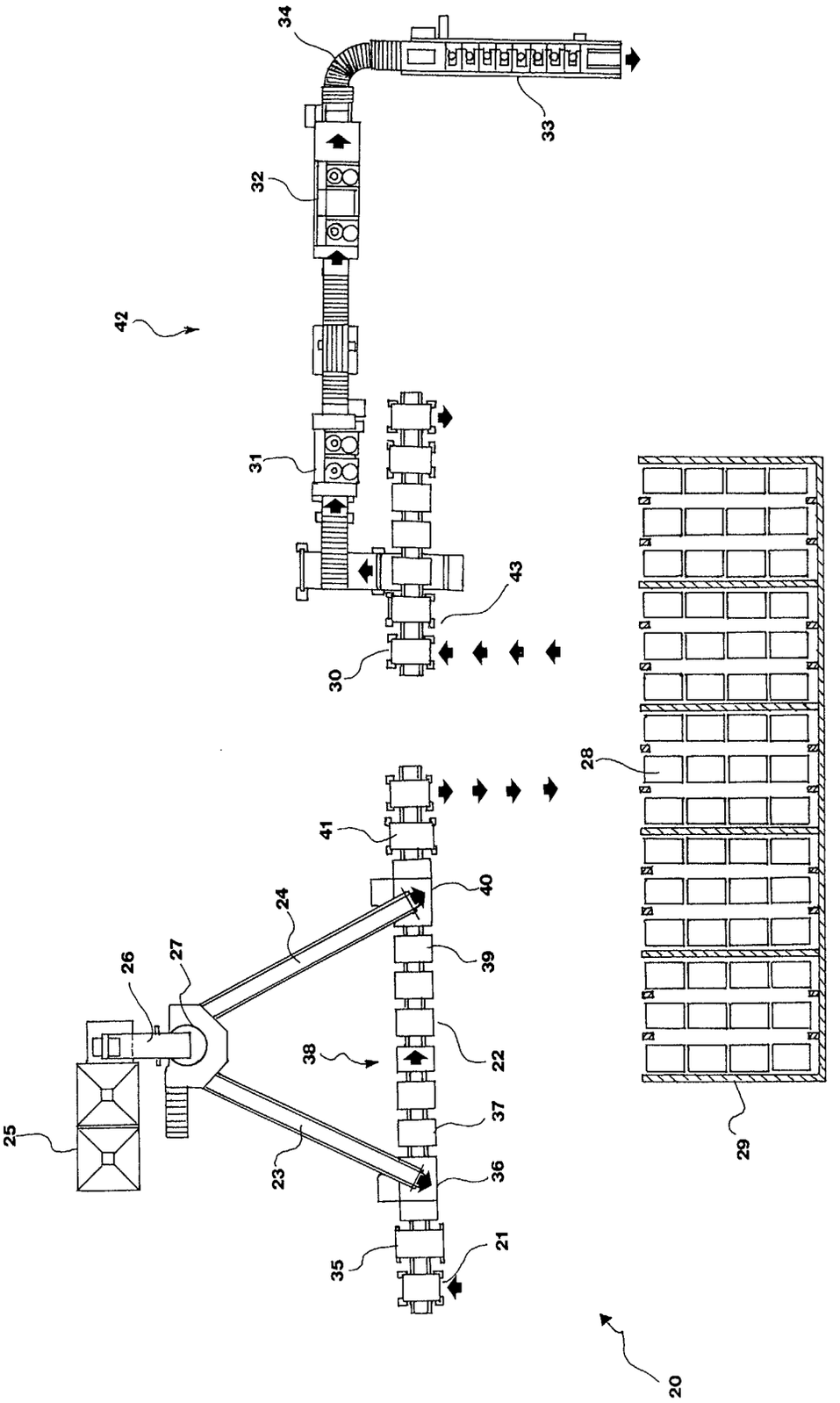

fig.9