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(54) METHOD AND APPARATUS FOR MANUFACTURING BRICKS FOR APPLICATIONS IN BUILDING, AND BRICK AND WALL OBTAINED THEREBY

(57) A powder (10) of purified and milled clay is mixed with steam by way of mixing means (12, 12a). The resulting mixture (14) is shaped in the form of a pug (18) by way of extrusion means (16) and is divided into identical segments (26) by way of cutting means (24). The segments (26) are subjected to controlled drying in a drying station (28) and then to firing in a kiln (34). Before dividing the pug (18), it is shaped with at least one smooth side wall (18a) by way of shaping means (19). Before firing, at least the side walls (26c, 26d) that are adjacent to the smooth wall (26a) that corresponds to the smooth face (18a) of the pug (18) are mutually squared and a layer of coating material (33) is applied to the smooth wall (26a) by way of coating means (32a).

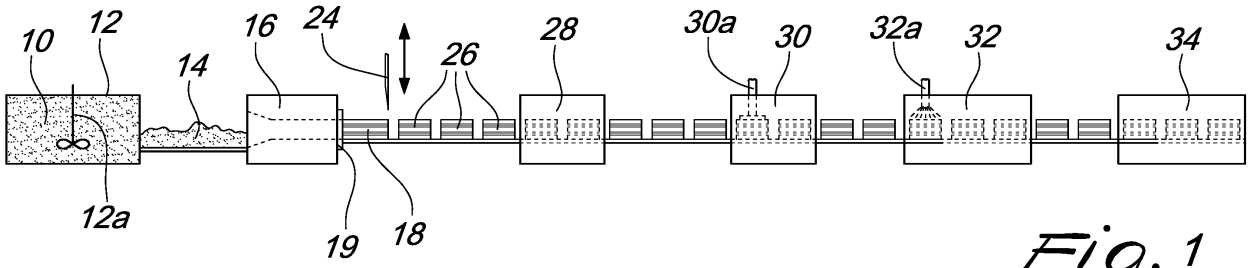

Fig. 1

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Description

[0001] The present invention relates to a method and an apparatus for manufacturing bricks for applications in building and to a brick and a wall derived from them.

[0002] As is known, a generic brick is obtained from a mixture of red clay and steam at high temperature.

[0003] The still-fluid mix is extruded so as to generate a pug. In order to produce so-called hollow bricks, the pug is perforated longitudinally for lightening.

[0004] The pug thus obtained is divided into segments of equal length, each of which constitutes a blank brick. The blank bricks are left to dry for several hours after drawing and then fired in a kiln at a temperature of for example 900°C.

[0005] During firing in the kiln, the silica and the other elements that constitute clay, for example kaolin, feldspathic rocks, quartz, etc., undergo a melting and purification process which gives the brick, once it has cooled, the well-known "biscuit" or terra-cotta consistency.

[0006] As is known, bricks thus provided can be used to provide the load-bearing structure of external or internal walls of buildings by joining them together by means of conglomerates, e.g., mortar based on lime or cement.

[0007] The wall of bricks thus provided is conventionally finished by specialized workers by applying multiple layers of plaster with a progressively higher level of finish, and then a final decorative layer.

[0008] As is known, the walls of some internal rooms, such as bathrooms or kitchens, can be covered by tiles of various kinds, which have both a decorative and technical function. The tiled surface, in addition to being aesthetically pleasant, is in fact practical from the hygienic standpoint, since it has a low absorption and can be cleaned easily with detergents without deteriorating.

[0009] An ordinary glazed tile is obtained starting from a mix of clay materials and quartz sands fired in a kiln at a temperature comprised between 800°C and 1250°C for a time which can vary typically between 6 and 12 hours.

[0010] Glazing is then applied to the substrate thus obtained and usually can be composed of glassy and coloring substances of mineral origin.

[0011] In so-called single-fired processing, the clay substrate and the glazing are subjected to a single firing in a kiln at a temperature comprised typically between 800°C and 1200°C.

[0012] In so-called dual-fired processing, which has a higher value, in a first step only the substrate is fired partially so as to form the so-called "biscuit". Then the glazing is applied and the tile is subjected to a second firing.

[0013] Tiles are conventionally applied to walls by qualified operators by means of specific adhesives.

[0014] The provision of a conventional tiled wall, therefore, requires at least three masonry interventions, which are normally performed by respective different specialized operators (provision of the load-bearing structure made of bricks, plastering, tiling), with a consequent multiplication of times and costs.

[0015] The cost of the materials, essentially bricks, mortars and tiles, also affects significantly the overall cost of the wall.

[0016] Moreover, these materials require large storage spaces, which are not always available in the building yard.

[0017] Furthermore, the processes for manufacturing such materials, especially in relation to bricks and tiles, are long and costly in terms of energy, due to the high firing temperatures, and have a significant environmental impact.

[0018] Therefore, the aim of the present invention is to provide a method for manufacturing tiles for building applications that allows to reduce significantly the times and costs for the provision of a tiled surface with respect to conventional systems, in relation to the materials and processes for their manufacturing and to the labor required.

[0019] Another object of the invention is to provide a method that has a significantly reduced environmental impact with respect to traditional systems.

[0020] This aim and these and other objects, which will become better apparent from the continuation of the description, are achieved by the method described in claim 1, while the dependent claims define other advantageous albeit secondary characteristics.

[0021] The invention is now described in greater detail with reference to a preferred but not exclusive embodiment thereof, illustrated by way of nonlimiting example in the accompanying drawings, wherein:

Figure 1 is a schematic view of the steps of the method according to the invention;

Figure 2 is a perspective view of a blank obtained after a first step of the method according to the invention;

Figure 3 is a front view of the blank of Figure 2;

Figure 4 is a front view of a device that can be applied to an intermediate step of the method according to the invention;

Figure 5 is a perspective view of a blank obtained after a second step of the method according to the invention;

Figure 6 is a perspective view of a finished brick obtained by means of the method according to the invention;

Figure 7 is a perspective view of a wall during construction, constituted by bricks obtained by the method according to the invention;

Figure 8 is a schematic view of some final steps of the method in a first alternative embodiment of the invention;

Figure 9 is a perspective view of a finished brick obtained by the method in a second alternative embodiment of the invention;

Figure 10 is a perspective view of a wall constituted

partly by bricks obtained by the method according to the embodiment of Figure 1 and partly by bricks obtained by the method according to the embodiment of Figure 9.

[0022] With reference to the figures cited above, a brick of the type to which the present invention relates is manufactured starting from a powder 10 of clay, in this example of embodiment purified and ground red clay. The clay is mixed with steam in a mixing station 12 by mixing means 12a.

[0023] In a per se conventional manner, the mixture 14 thus provided is fed to an extruder 16, which shapes it in the form of a pug 18.

[0024] According to the invention, and as shown in detail in Figures 2 and 3, the pug 18 has at least one smooth face 18a obtained by way of shaping means.

[0025] In this embodiment, the smooth face 18a- is one of the larger faces of the pug 18 and the shaping means consist of a die 19 (shown schematically in Figure 4) which is shaped appropriately and is applied to the outlet of the extruder 16. The die 19 is provided with a substantially rectangular opening 19h, which has a profile that corresponds to the profile of the pug 18, with at least one smooth side 19a and the remaining sides 19b, 19c, 19d which have sets of teeth such as to generate, in a per se conventional manner, corresponding scoring lines on the other faces 18b, 18c and 18d of the pug 18.

[0026] In this embodiment, the pug 18 has a profile and dimensions that correspond to a standard building brick, e.g., 8 x 12 cm.

[0027] Furthermore, the pug 18 is longitudinally perforated for lightening, e.g., with a first row of three holes 20a adjacent to the smooth face 18a and a second row of three holes 20b adjacent to the opposite face 18b.

[0028] The holes 20a, 20b can have conventionally a rectangular profile that is rounded at the corners, and can be obtained by means of complementarily shaped plates (not shown) supported by the die, with technologies that are per se conventional in the field and therefore are not described here in detail.

[0029] In this embodiment, the distance L1 between the first row of holes 20a and the smooth face 18a, as well as the distance L2 between the first row of holes 20a and the second row of holes 20b, are greater than the distance L3 between the second row of holes 20b and the opposite face 18b and are preferably mutually identical.

[0030] By way of example, the distance L 1 = L2 can be equal to 15 mm, while the distance L3 can be equal to 8 mm.

[0031] Furthermore, the distance L4 between the holes 20a of the first row, as well as the distance L5 between the end holes of the first row and the smaller faces 18c, 18d that are adjacent thereto, are respectively greater than the distance L6 between the holes 20b of the second row and than the distance L7 between the end holes of the second row and the smaller faces 18c, 18d that are adjacent thereto.

[0032] Advantageously, the distance L4 is equal to the distance L5 and is, by way of example, equal to 15 mm, while the distance L6 is equal to the distance L7 and is, by way of example, equal to 8 mm.

[0033] As shown by the figures, therefore, adjacent to the glazed face the holes are smaller so as to increase the thickness of the material of the brick and make the latter stronger.

[0034] The extruded pug 18 is divided by cutting means 24 into segments of equal length, e.g., 24 cm. The cutting means 24 can consist advantageously of a steel wire guillotine that is conventionally used in the field. Each of the segments thus obtained constitutes a blank brick 26, which is shown in detail in Figure 5.

[0035] The bricks 26 are then transferred to a drying station 28, in which they are dried in a controlled manner. By way of example, the drying station 28 can operate by means of hot air, infrared heating, or other systems conventionally in use in the field.

[0036] At the end of the drying process, the bricks 26 are transferred to a finishing station 30, in which at least the scored walls 26b, 26c, 26d that are adjacent to the smooth wall 26a are mutually squared in a finishing station 30 by way of finishing means 30a, preferably milling means or abrasive means.

[0037] In this step, furthermore, a finishing smoothing is preferably provided on the smooth wall 26a as well.

[0038] Moreover, the edges that delimit the smooth face 26a are beveled in the finishing station 30, in this case also preferably by way of abrasive means. By way of example, a bevel 26f at 45° can be provided.

[0039] According to a first embodiment of the invention, the bricks 26 in output from the finishing station 30 are transferred to a coating station 32, in which a layer of glaze 33 is applied to the smooth wall 26a by way of coating means 32a (Figure 6).

[0040] In this example of embodiment it is possible to use a glaze based on glassy and colors of natural origin.

[0041] Among the many glazes suitable for the purpose, mention is made by way of example of clay-based glazes, crystalline glazes, salt-based glazes, as well as other glazes that are used conventionally in the field, which can have an opaque, satin, glossy, or other known kinds of finish.

[0042] The glazed bricks are then fired in a kiln 34 at a temperature comprised between 600 and 1350°C, preferably 1250°C, for a time comprised between 6 and 16 hours, preferably 12 hours.

[0043] Once they have cooled after firing, the bricks are ready for use and can be used to provide internal or external walls of buildings in a manner similar to traditional bricks, e.g., with a staggered stacking and fixing by means of conglomerate 35, for example an adhesive for tiles that has high adhesion and elasticity (Figure 7).

[0044] However, with respect to traditional solutions, the exposed surface of a wall formed by bricks according to the invention has both the appearance and the tech-

nical characteristics (in particular waterproofness and hardness) of a conventional tiled surface without requiring additional operations for plastering and tiling.

[0045] The increased thickness adjacent to the smooth wall 26a and between the two rows of holes gives the brick 26, as well as the walls composed thereby, a greater strength at the exposed surface. This characteristic also facilitates the fixing of wall-mounted supports by means of expansion plugs, since the expansion plug grips directly the brick instead of the tile and the underlying plaster, which, as known, are relatively fragile.

[0046] On the other hand, the reduced thickness on the rear wall facilitates the breaking of wall portions to insert electrical or hydraulic systems and the like.

[0047] In a first alternative embodiment of the invention, shown in the block diagram of Figure 8, after the finishing step 130 the bricks 126 are subjected to a first kiln firing 134' at a temperature comprised advantageously between 600 and 1000°C, preferably 800°C, for a time comprised between 6 and 16 hours, preferably 12 hours.

[0048] After first firing 134', the bricks 126 are subjected to glazing 132 and then subjected to a new kiln firing 134" at a temperature comprised advantageously between 800 and 1350°C, preferably 1250°C, for a time comprised between 6 and 16 hours, preferably 12 hours.

[0049] In a second alternative embodiment of the invention, a layer of engobe 233 (Figure 9) is applied to the smooth face 226a of the dried bricks 226, and then the bricks are fired in a kiln 234 at a temperature comprised between 600 and 1000°C, preferably 800°C, for a time comprised between 8 and 16 hours, preferably 12 hours.

[0050] Preferably, the layer of engobe 233 has a thickness comprised between 0.2 and 1.5 mm.

[0051] As an alternative to engobe it is possible to use simple white clay.

[0052] The brick 226 thus provided can be used both as an alternative to, and in association with, glazed bricks manufactured according to one of the first two embodiments described.

[0053] In particular, the brick 226 can be used to provide walls (or wall parts) that are perfectly smooth without requiring the application of multiple layers of plaster but by applying a common and ordinary skimming product, for example based on plaster, so as to fill the gaps between the bevels of adjacent bricks.

[0054] In particular, Figure 10 shows an example of a wall composed as follows:

- from the bottom to a height H, glazed bricks 26, e.g., according to the first embodiment, and
- from the height H upward, bricks coated with engobe 226, with subsequent application of a layer of a skimming product 236.

[0055] As shown clearly in Figure 9, the skimmed upper portion of the wall is flush with the lower portion having a tiled effect.

[0056] This solution, in addition to being welcome from an aesthetic standpoint, is advantageous also from the hygienic standpoint. It in fact allows to avoid the step that is normally present in traditional walls between the tiled lower region and the bare upper region, which is caused by the thickness of the tile and of the adhesive. This step, as is known, becomes an easy accumulation site for dust and can be difficult to clean depending on its height.

[0057] Some embodiments of the invention have been described, but of course the person skilled in the art can apply several modifications and variations within the scope of the claims.

[0058] For example, although only one face of the brick is flat and coated in the described embodiments, it might also be provided with two or three faces thus treated, so as to constitute dividing walls that are coated on both sides and/or provide corner wall portions.

[0059] Furthermore, although in the described embodiments the pug exits from the extrusion station with one face already smooth, smoothing might also be provided in a subsequent station, e.g., by abrasion or milling.

[0060] Moreover, instead of the classic staggered arrangement, the bricks might have a different arrangement, for example a herringbone arrangement, one which is aligned in a vertical direction, and others, in order to obtain particular ornamental effects.

[0061] Of course, the drying and firing times and temperatures provided here merely act as an indication and can vary considerably depending on the type of clay and glaze used.

[0062] In this regard, it is possible to use clay mixes of various kinds, e.g., sandstone clays, brick clays or secondary clays, marls or bentonite clays, and the like.

[0063] Moreover, after the treatment of the brick in the finishing station, the smooth wall can be treated with decorative effects in relief or other ornamental treatments such as e.g. screen printing techniques and the like.

[0064] The disclosures in Italian Patent Application no. 202015000056260 (UB2015U086578), from which this application claims priority, are incorporated herein by reference.

[0065] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A method for manufacturing bricks for applications in building, comprising the steps of:

   - mixing with steam a powder (10) of purified and milled clay by way of mixing means (12, 12a),

- shaping the resulting mixture (14) in the form of a pug (18) by way of extrusion means (16),
- dividing said pug (18) into segments (26) of equal length by way of cutting means (24),
- subjecting said segments (26) to controlled drying in a drying station (28),
- subjecting said segments (26) to firing in a kiln (34),

characterized in that it comprises the following steps:

- before dividing into segments (26), shaping said pug (18) with at least one smooth lateral face (18a) by way of shaping means (19), and
- before firing in a kiln (34), subjecting said segments (26) in output from the drying station (28) to finishing operations by way of finishing means (30, 30a) which are adapted to mutually square at least the side walls (26c, 26d) that are adjacent to the smooth wall (26a) that corresponds to the smooth face (18a) of the pug (18), and then applying a layer of coating material (33) on said smooth wall (26a) by way of coating means (32a).

2. The method according to claim 1, **characterized in that** said finishing operations further comprise a beveling of the edges (26f) that delimit said smooth wall (26a).

3. The method according to claim 1 or 2, **characterized in that** said finishing operations further comprise a finishing smoothing of said smooth wall (26a).

4. The method according to one of claims 1-3, **characterized in that** said shaping means consist of a die (19) that is applied to the outlet of said extrusion means (16) and has a substantially rectangular opening with at least one smooth side (19a) adapted to generate said smooth face (18a) and at least one toothed side (19b, 19c, 19d) that is adapted to generate a respective scored face (18b, 18c, 18d).

5. The method according to one of claims 1-4, **characterized in that** said pug (18) generated by said extrusion means (16) has a plurality of longitudinally extended holes (20a, 20b).

6. The method according to claim 5, **characterized in that** said pug has a first row of said holes (20a) extended adjacent to said smooth face (18a) and a second row of said holes (20b) extended adjacent to the opposite face (18b).

7. The method according to claim 6, **characterized in that** the distance (L1) between said first row of holes (20a) and said smooth face (18a) is greater than the distance (L3) between the second row of holes (20b) and said opposite face (18b).

8. The method according to claim 6 or 7, **characterized in that** the distance (L2) between said first row of holes (20a) and said second row of holes (20b) is greater then the distance (L3) between said second row of holes (20b) and said opposite face (18b).

9. The method according to one of claims 6-8, **characterized in that** the distance (L4) between the holes (20a) of said first row, as well as the distance (L5) between the end holes of the first row and the faces (18c, 18d) that are adjacent thereto, are respectively greater than the distance (L6) between the holes (20b) of the second row and than the distance (L7) between the end holes of the second row and the faces (18c, 18d) that are adjacent thereto.

10. The method according to one of claims 1-9, **characterized in that** said coating material comprises a glaze (33).

11. The method according to one of claims 1-10, **characterized in that** after said coating step (132) said segments (126) are subjected to a further firing in a kiln (134").

12. The method according to one of claims 1-11, **characterized in that** said coating material comprises a layer of engobe (233).

13. The method according to claim 12, **characterized in that** said layer of engobe (233) has a thickness comprised between 0.2 and 1 mm.

14. The method according to one of claims 1-13, **characterized in that** said coating material comprises a layer of white clay.

15. A wall, **characterized in that** it is composed of at least one row of bricks provided by means of the method according to one of claims 1-11, and at least one horizontal row of bricks according to one of claims 12-14.

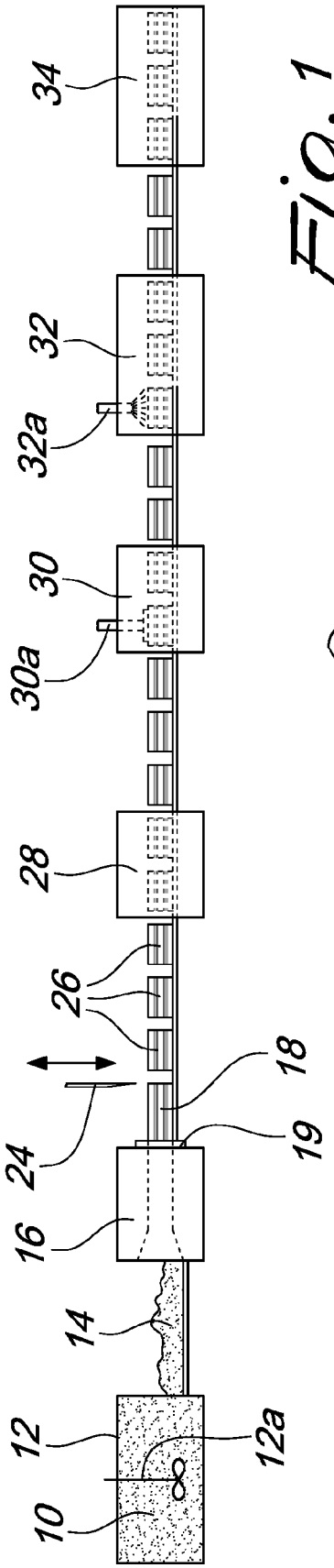

34
32
32a
30
30a
28
26
18
19
24
16
14
12
12a
10

Fig. 1

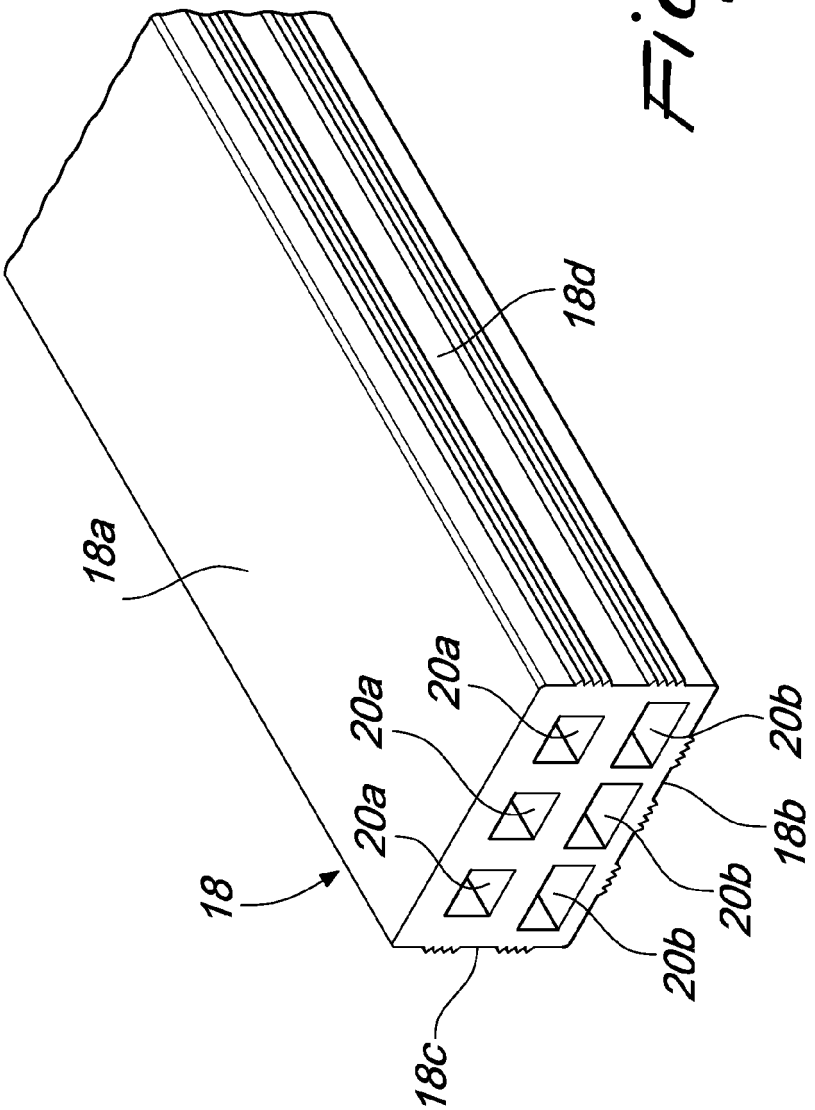
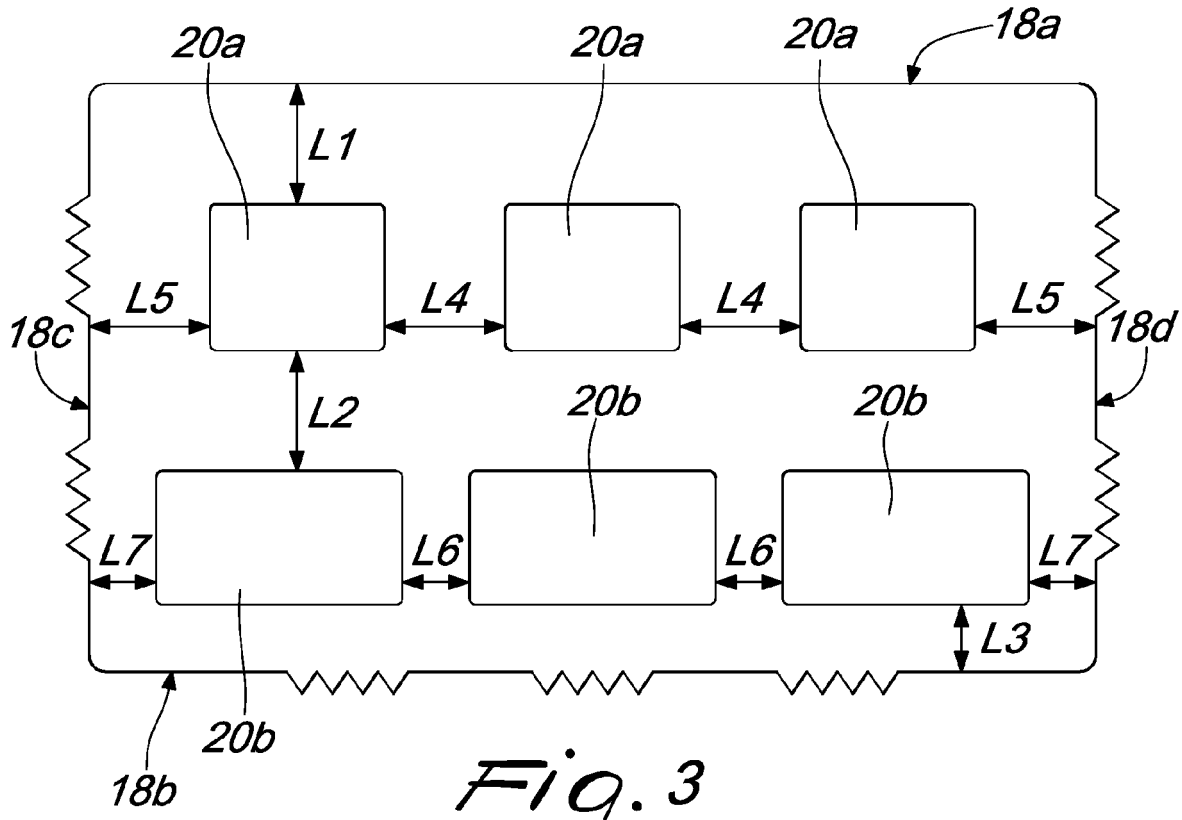

18d
18a
20a
20a
20a
20b
18b
20b
20b
18
18c

Fig. 2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20a
20a
18a
L1
L5
L4
L4
L5
18c
18d
L2
20b
20b
L7
L6
L6
L7
L3
20b
18b

Fig. 3

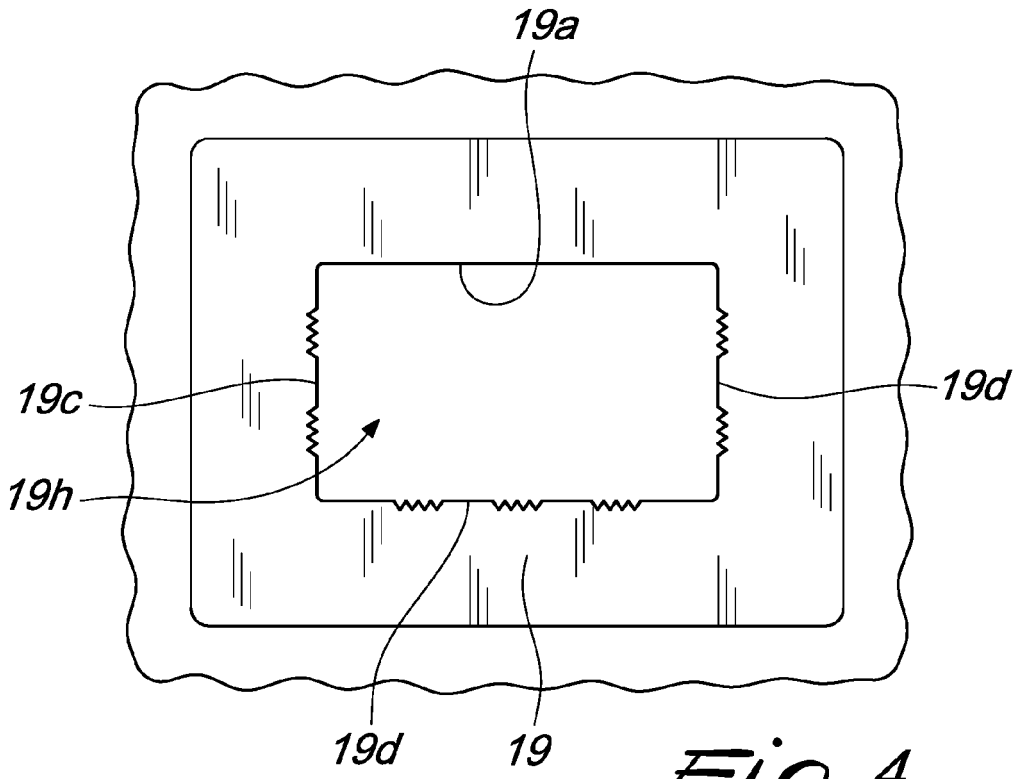
19a
19c
19d
19h
19d
19

Fig. 4

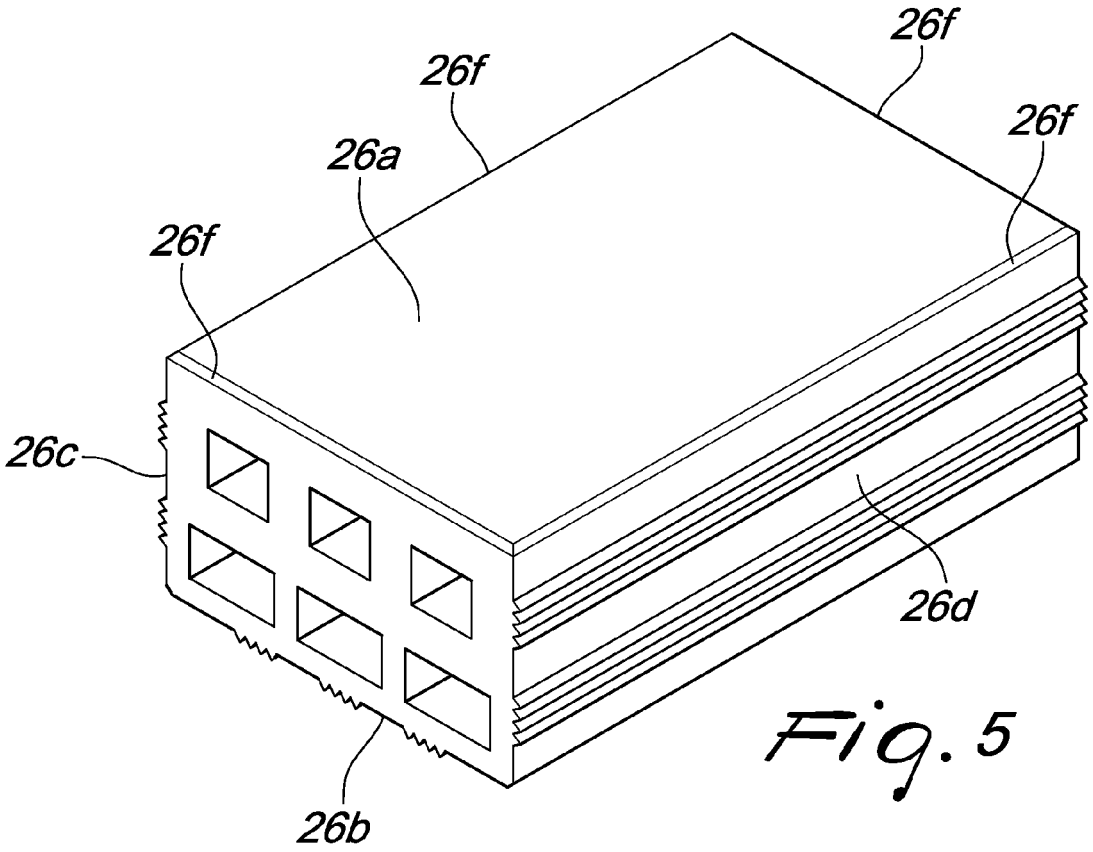

Fig. 5

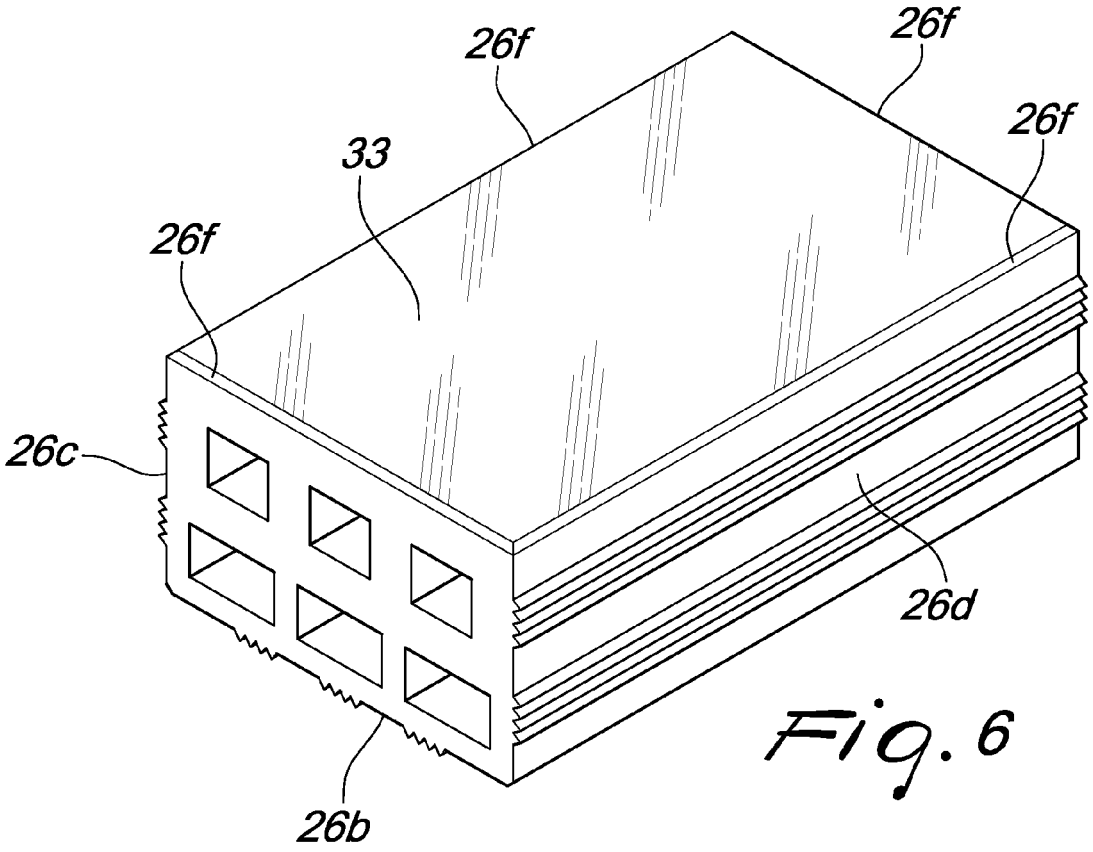

Fig. 6

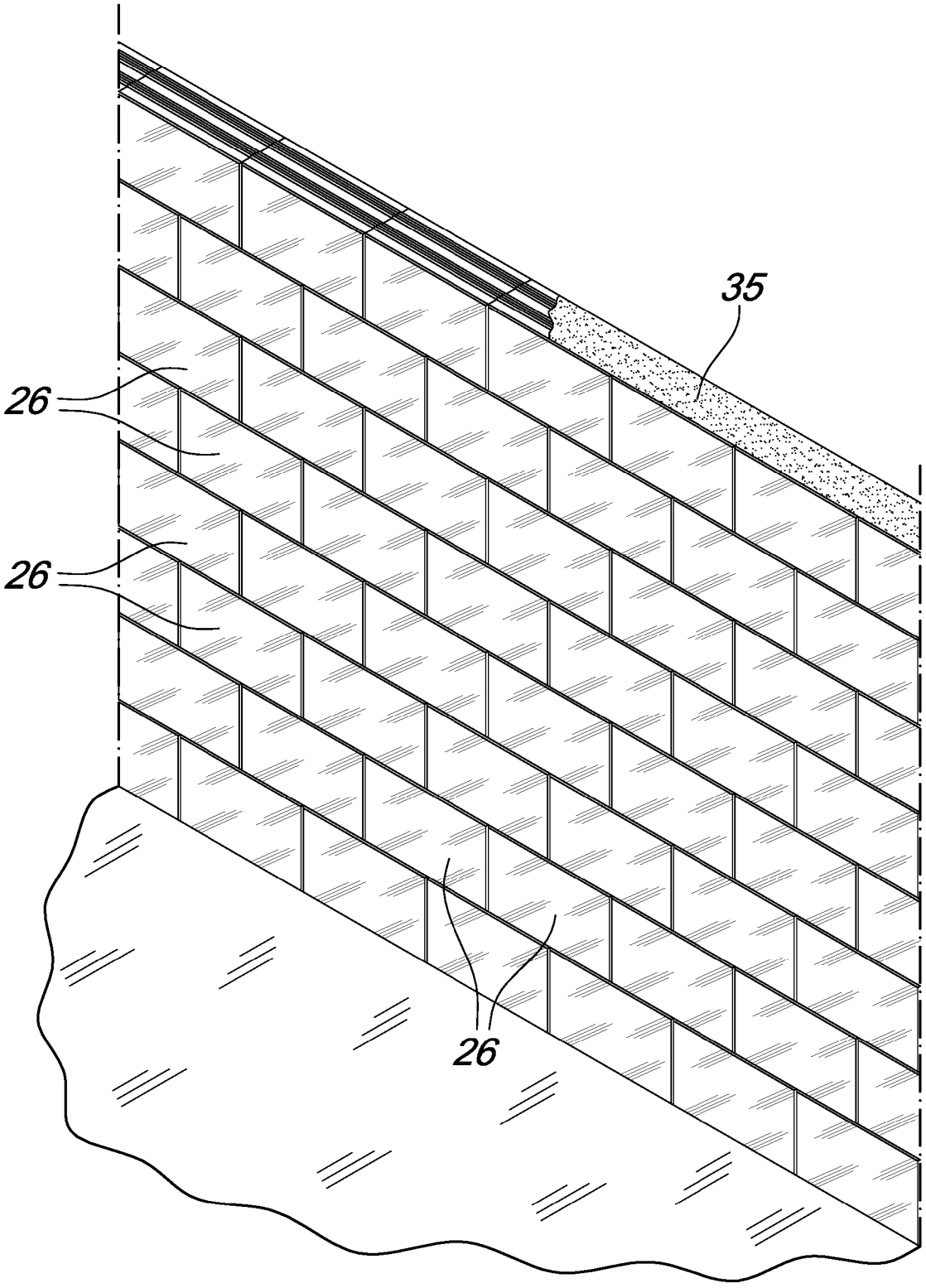

Fig. 7

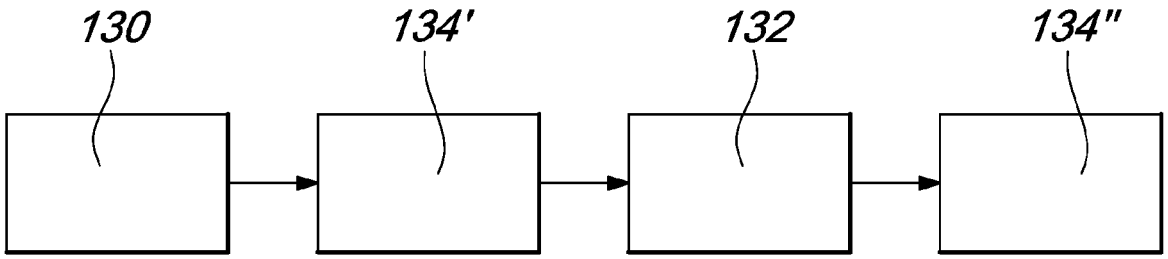

Fig. 8

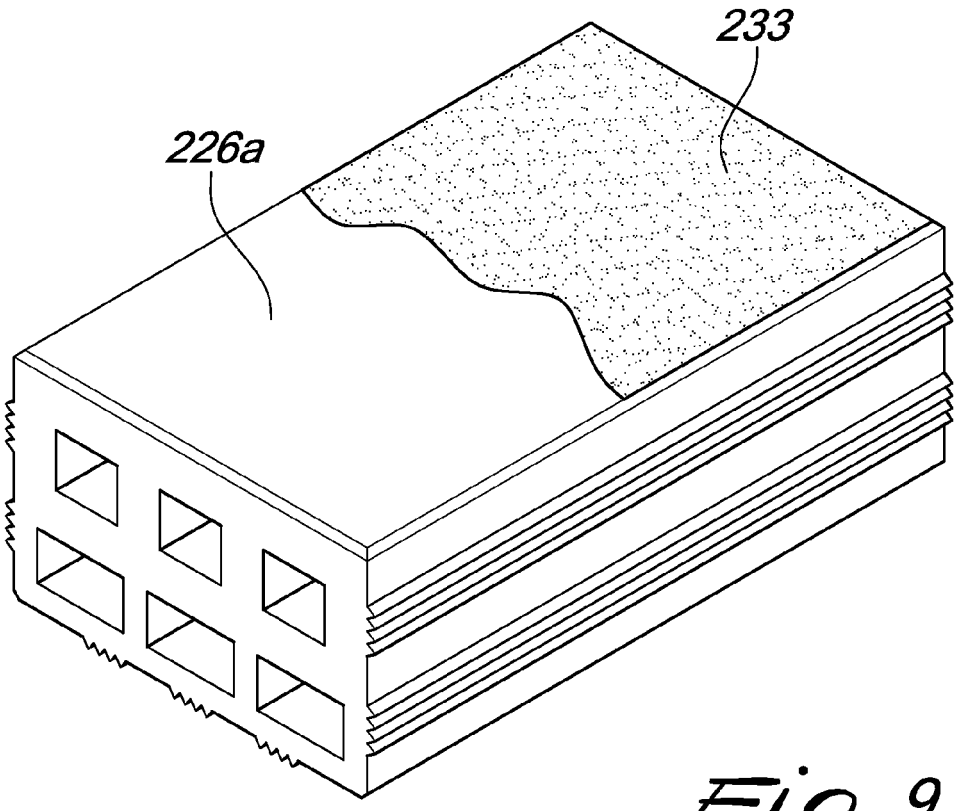

Fig. 9

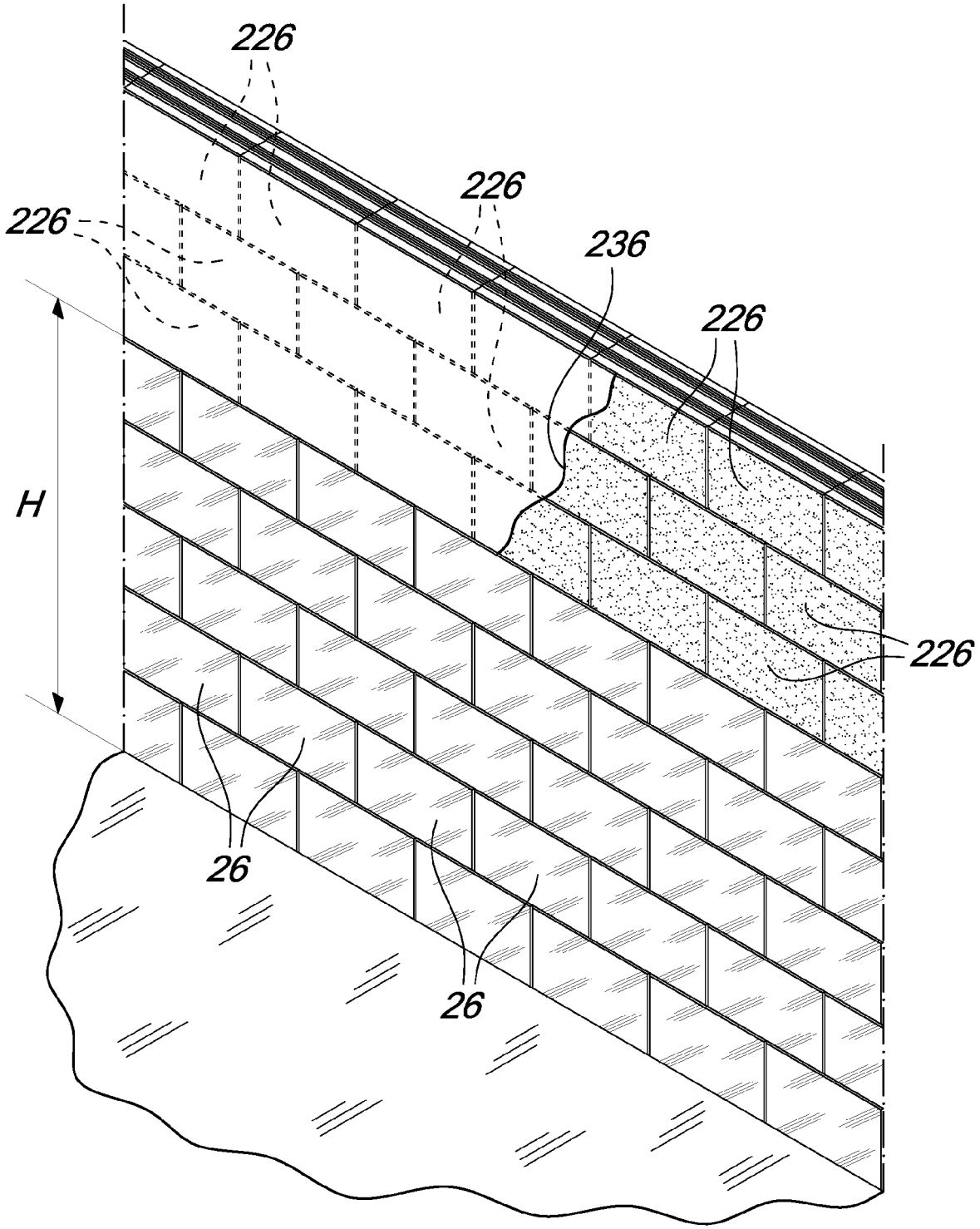

Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 16 18 2941

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 1 735 167 A (IVERY SIDNEY H) 12 November 1929 (1929-11-12)	15	INV. B28B3/26
Y	* page 2, lines 15-40 *	1-14	B28B7/00 B28B7/18
Y	EP 1 647 381 A2 (CO MA F S N C DI BALDELLI E AN [IT]) 19 April 2006 (2006-04-19) * figures 1,2 * * claim 1 *	1-14	B28B11/04 B28B11/08 B28B15/00 E04B2/14 E04B5/00
A	US 5 338 180 A (MAULE ALEXANDER [CA]) 16 August 1994 (1994-08-16) * figures 7-10 * * column 7, lines 13-21 *	1-15	C04B41/45
Y	US 1 569 665 A (MULLINS CHARLES E) 12 January 1926 (1926-01-12) * figures 1-4 * * claim 1 *	4	
Y	WO 2004/088056 A2 (OBSCHESTVO S OGRANICHENNOI OTV [RU]; ABRAMOV ANATOLIY KUZMICH [RU]; PE) 14 October 2004 (2004-10-14) * figure 1 * * abstract *	11	TECHNICAL FIELDS SEARCHED (IPC) B28B E04B E04C C04B
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 February 2017	Voltz, Eric

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 18 2941

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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10-02-2017

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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