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**(54) Tile having a pattern and its manufacturing method**

Platte mit eingelegtem Ornament und Verfahren zur deren Herstellung

Carreau avec ornement incorporé et méthode pour sa fabrication

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## Description

### BACKGROUND OF THE INVENTION

#### Field of the Invention

[0001] The present invention relates to a nonglazed tile provided with a design of many colors or a colored pattern and its manufacturing method, particularly to a tile which is able to keep an initial distinct and vivid pattern even against long time abrasion and its manufacturing method. Such tiles may be laid on a floor of a bathroom, a lavatory or the like, sidewalks of a park, a shopping center or the like, etc. Such tiles may be also used for an interior or exterior wall material of a building or applied to tiling at stepped portions of stairs or roads, corners of gateposts or buildings, etc.

#### Description of Related Art

[0002] Conventionally, cement tiles, which are cheap, are generally used for tiles having a pattern that are laid on a sidewalk, a floor or the like while serving as an ornament, since such tiles need to be inexpensive. Each piece of tile is a plain colored tile of generally a rectangular shape fabricated by a colored body added with a kneaded pigment. Various colors of tiles are used in combination and joined to each other by a jointing cement.

[0003] In case one piece of rectangular tile needs to have a multicolored pattern, in general, colored tile pieces of different colors are separately made, thereafter the colored tile pieces of different colors and shapes are jointed by a cement at the time of laying.

[0004] There is a tile having a pattern with only a surface printed by a pigment.

[0005] However, with the method of making a pattern by a manner of arranging the rectangular plain colored tiles as the conventional tiles having a pattern, patterns to be formed are limited in simple patterns such as a diced pattern, now that a piece of floor tile is large, i.e. 200mm or 300mm square.

[0006] With the method of jointing the colored tile pieces by a cement at the time of laying, a white line of the jointing cement which is exposed after joining is easy to become dirty and unclear particularly in a floor, a pavement or the like. Moreover, if the jointed part is made into a line as narrow as possible, inadvantageously it is peeled off with time. With this method, a border of the colored tile pieces is also limited in a straight line or a curved line very similar to the straight line due to work convenience. In addition, as the colored tile pieces are separately made, a jointing work by the cement joining them each other is multiplied, then taking much time and labor in a laying work at a job site.

[0007] Furthermore, though the cement tile can be manufactured at low costs, since it does not experience burning, it is inferior to a burnt tile in luster or the like,

and is low in strength, particularly a surface strength thereby being abraded with time, e.g. when pedestrians pass thereon. Such a tile needs to be thick in order to assure a fixed strength, so that a transportation work efficiency is lowered.

[0008] The tile with the surface alone printed by an organic pigment is inadvantageously decolorated with time.

[0009] By the reasons mentioned above, burnt tiles are desirously used at a sidewalk of a shop street, a park or the like an appearance of which is thought important.

[0010] Some methods are used for giving a pattern to a nonglazing tile as a burnt tile. One method is to form flutes or irregularities. Other method is to disperse rock powders or colored tile powders to obtain a spotted pattern. However, these methods are not satisfactory in view of ornamentation. There is a tile provided with a baking pattern by printing or handwriting on a surface of a green body or a biscuit tile, too. However, the thickness of the pattern of this tile is about 0.1 to 0.3mm, so that the pattern is faded by abrasion or the tiles are possibly slippery thereby to need some caution in case of wet condition, with resultant limited applications.

[0011] In order to solve these problems, Japanese Patent Publication No. 50-20962 discloses a technique of manufacturing method of a multicolor tile in which a powdery pattern is embedded into a surface of a tile in a thickness of 3mm. As improved methods of the above technique, Japanese Patent Publication No 2-42323 shows a manufacturing method of ceramics provided with an inlaid ornamental surface, and Japanese Laid Open Patent Publication Nos. 2-239905 and 2-241703 respectively disclose techniques of manufacturing methods of inlaid tiles. These inlaying methods can obtain nonglazing tiles having a variety of patterns of a thickness of about 3mm, since they embed prepared patterns into bodies and sinter them.

[0012] As mentioned above, the inlaid tiles excel, as nonglazed tiles used for pavements or the like, in view of variety of patterns and thickness.

[0013] However, it is important for the inlaying method to control density and shrinkage degree of pattern materials, pellets and powders to be embedded as well as compression density of concaves of bodies receiving the embedded materials, in order to get tiles with a precise and elaborate boundary between the body and the pattern. Unless they are not controlled, gaps arise at the boundary. Generally, the inlaying method needs two or three times of pressing work, so that it has disadvantages of taking a lot of time and labor in making tiles and increasing production costs.

[0014] In the technique of Publication No. 2-241703, a base tile is preformed at such a pressure as maintaining its shape. Dents are formed at the same time and inlaying pellets are put and fitted into the dents. Otherwise, separately preformed base tile pellets and inlaying pellets are arranged in order while the base tile pellets are

kept flat, then they are pressed and formed as a whole. The inlaid tiles thus obtained have desired strength by burning, and has no gaps produced at the above mentioned boundary. Moreover, different colors of clay bodies rarely flow on pressing, so that it is possible to make clear the boundary between inlaid patterns and other areas.

[0015] However, the technique of Publication No. 2-241703 takes a lot of time and labor in making the base tiles having dents. In case the tile is given such a pattern as has a constant width of partition line at the boundary of the pattern, it is difficult to make the width of the partition line constant, so that it is unseemly in view of appearance.

[0016] As a manufacturing method of a body provided with a pattern of unfixed shapes of spots, Japanese Patent Publication No. 2-8883 discloses a tile having a bordered pattern of unfixed shapes of spots which is obtained by arranging and pressing to mold a lump of raw material dusted with color pigment powder or a lump of color raw material dusted with raw material powder in a press die. However, the technique is limited in the pattern of unfixed shapes, so that it is necessary to think out how to arrange the color raw material lump or the like in order to make a uniform pattern.

[0017] It is known to mix and knead two colors of clays and slice kneaded body, thereby making such a pattern as an ink flow. With tiles obtained by this technique, since the same color part goes through the tile in the thickness direction, the pattern is never vanished even if the surface is abraded. However, this technique is incapable of providing patterns other than the above ink flowing pattern. Moreover, the tiles are fabricated by hand, so that the technique is no good in workability.

[0018] Conventionally, in tiling a corner, angle tiles which are bent according to an angle of the corner are used. The angle tiles are manufactured generally by pressure forming of powder raw material. Specifically, its making method utilizes a press die which defines an angle shape of a pressing space between an upper mold and a lower mold of a V-section or an inverted V-section. The powder raw material added with a binder is disposed on a whole surface of both slopes of the lower mold and a top thereof. Then the material is pressingly formed between the upper and lower molds, thereafter being burned to obtain produce tiles. Such a technique is shown in Japanese Utility Model Publication No. 4-30011 or the like, for example.

[0019] Thus manufactured angle tiles have good appearance and sufficient corner strength, since they are formed into one body as a whole including the corner and have no joints. Still, a surface pattern is limited into a simple color pattern such as one color pattern or a spotted pattern.

[0020] In recent years, there arise needs for colorful tiles. Therefore, many kinds of tiles with various patterns have been proposed and used. For instance, in addition to the above Publication No. 2-42323, Japanese Patent

Publication No. 2-8883 discloses a tile having an unfixed pattern which is obtained by arranging and pressingly forming raw material lump of clay body dusted with color pigment powder in a press die.

[0021] However, as such various patterns are made by use of a plane die, the above methods are applicable to flat plate shaped tiles, but it is hard to apply to the above mentioned angle tiles which are manufactured by use of a press die with inclined die surfaces. Therefore, other methods are currently adopted to make up corners using tiles having the above color pattern. One method is to stick two tiles at right angles via an adhesive. Other one is to join two tiles at right angles via cement and connect them by use of angle members made of a metal, a synthetic resin or the like.

[0022] However, these methods need much labor in practising. Moreover, it is possible that a cutting plane is exposed to affect an appearance. There is a fear of abrasion in case of connecting through the cement. Thus, large improvement is to be achieved in manufacturing steps for tiling, durability, an appearance, etc. if angle tiles that has various patterns can be obtained. For that reason, such tiles have been desired in the industry for a long time.

[0023] In preamble of the enclosed patent claims 1 and 8 it is preceded from a manufacturing method of a tile having a pattern made by pressing and forming molding materials into one body and burning the body as shown in the printed publication EP-A-0 473 383.

[0024] This reference discloses a method for manufacturing the tile according to which an auxiliary mold is used which is inserted into the main mold in order to separate different granules. The die pattern material is firstly charged into the auxiliary mold. Subsequently, a base-course material for forming a base-course is charged and then the auxiliary mold is removed whereby the material charged is combined to form a ceramic-shaped article. The charge pattern and the base-course materials are pressed into a ceramic product and then this ceramic product is removed from the patterning and sintered into a ceramic-shaped article.

[0025] However, in order to effectively use a partition wall for dividing the inside space into a plurality of form cavities before the manufacturing of a ceramic tile, it is imperative that the diameter of each colored granule be such that the bulk colored granules exhibit sufficient "fluidity" to wholly fill each forming space while, at the same time, exhibiting sufficient "viscosity" to prevent overflowing into adjacent spaces.

[0026] If colored molding material is simply too fluid, i. e. liquid, the colored molding material will intrude into adjacent forming spaces despite the presence of the partition wall. This results in tiles with poorly defined or non-existent borderlines between the different colors comprising the pattern.

[0027] Furthermore, if the colored molding material has a too small diameter or is powdered, the fluidity of the bulk material will be insufficient and voids will result

when the material is placed in the forming spaces. The presence of such voids in finished tiles results in tiles exhibiting poorly defined borderlines and structural weaknesses at the point of the voids.

#### SUMMARY OF THE INVENTION

[0028] In view of the above, it is an object of the invention to provide a nonglazed tile having a pattern and a manufacturing method thereof that is capable of clearly making desired and various patterns by simple steps without any gaps at a boundary, that is free from fading or disappearing of the patterns and that prevents slip when it gets wet.

[0029] It is another object of the invention to provide a tile having a pattern and a manufacturing method thereof that has large abrasion resistance while having a fixed width of partition line at a boundary of the pattern and that is excellent in an appearance of the boundary of the pattern.

[0030] It is a still another object of the invention to provide a tile having a pattern and a manufacturing method thereof that can easily make such color patterns as are impossible in a common forming die for an angle tile and that has a sufficient corner strength and high quality in an appearance.

[0031] This object is solved by a manufacturing method according to claim 1 and a tile according to claim 8.

[0032] In accordance with one preferred mode of the invention, there is provided a tile having a pattern that is made by: disposing a plurality of molding materials of different colors into an inside space of a pressure forming die while dividing them from each other in a planar direction of the inside space while dividing them from each other in a planar direction of the inside space; pressing and forming integrally the molding materials into a molded body in the inside space; and burning the molded body.

[0033] Preferably, the molding materials are composed of different colors of colored granules filled in a divided manner in the inside space.

[0034] More preferably, a partition means is disposed in the inside space to divide the inside space into a plurality of forming spaces, wherein each color of the colored granules are filled in each of the forming spaces.

[0035] The colored granules are prepared by drying and granulating a raw material in a fixed diameter of 0,29 to 0,84 mm.

[0036] Preferably, the partition means is a partition wall made of a clay body into a predetermined moisture content, and the partition wall is pressed and formed integrally with the colored granules to make the molded body. body is made into an angle plate by disposing a pair of preformed bodies on opposite slopes of the lower mold, disposing a joining material between opposing end surfaces of the preformed bodies along a corner of

the lower mold, and pressing the preformed tile bodies and the joining material between the upper mold and the lower mold into one body.

[0037] In accordance with one preferred mode of the invention, there is provided a manufacturing method of a tile having a pattern, comprising: a molding material disposing step for disposing a plurality of molding materials of different colors into an inside space of a pressure forming die while dividing them from each other in a planar direction of the inside space; a pressure forming step for pressing and forming integrally the molding materials into a molded body in the inside space; and a burning step for burning the molded body.

[0038] According to claim 1 the molding materials are composed of different colors of colored granules; the molding material disposing step is a colored granule filling step for filling the plural colored granules in a divided manner in the inside space; and the molded body is made by pressing and forming integrally the colored granules in the inside space in the pressure forming step.

[0039] The method further comprises, before the colored granule filling step, a partition means disposing step for disposing a partition means in the inside space to divide the inside space into a plurality of forming spaces, each color of the colored granules being filled in each of the forming spaces.

[0040] The colored granules are prepared by drying and granulating a raw material in a fixed diameter of 0,29 to 0,84 mm.

[0041] Preferably, the partition means is a partition wall molded of a clay body into a predetermined moisture content in a partition wall forming step before the colored granule filling step, and the partition wall is pressed and formed integrally with the colored granules in the pressure forming step to make the molded body.

[0042] Further objects and advantages of the invention will be apparent from the following description, reference being had to the accompanying drawings, wherein preferred embodiments of the invention are clearly shown.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0043]

FIG. 1 is a plan view showing one example of a first embodiment of a tile having a pattern of the invention.

FIG. 2 is a flowchart showing manufacturing steps of the first embodiment of a tile having a pattern of the invention.

FIG. 3 is a perspective view of a partition plate used in manufacturing the first embodiment of a tile having a pattern of the invention.

FIG. 4 is a sectional view of a pressure forming die showing a state just after filling a color granule in a color granule filling step in FIG. 2.

FIG. 5 is a schematic view of a device for making a color granule used in the color granule filling step of FIG. 2.

FIG. 6 is a sectional view of the pressure forming die showing a state just after filling a lining granule in a lining granule filling step in FIG. 2.

FIG. 7(a) is a plan view showing a modification of the first embodiment of a tile having a pattern of the invention.

FIG. 7(b) is a plan view showing another modification of the first embodiment of a tile having a pattern of the invention.

FIG. 7(c) is a plan view showing still another modification of the first embodiment of a tile having a pattern of the invention.

FIG. 7(d) is a plan view showing still another modification of the first embodiment of a tile having a pattern of the invention.

FIG. 7(e) is a plan view showing still another modification of the first embodiment of a tile having a pattern of the invention.

FIG. 7(f) is a plan view showing still another modification of the first embodiment of a tile having a pattern of the invention.

FIG. 8 is a plan view showing an example of a second embodiment of a tile having a pattern of the invention.

FIG. 9 is a flowchart showing manufacturing steps of the second embodiment of a tile having a pattern of the invention.

FIG. 10 is a schematic drawing of a continuous molding machine used in a partition wall forming step of FIG. 9.

FIG. 11 is a perspective view showing an extruded product molded by the continuous molding machine of FIG. 10.

FIG. 12 is a perspective view of a partition wall obtained by cutting the extruded product of FIG. 10.

FIG. 13 is a perspective view showing a partition wall sticking sheet material obtained in a partition wall sticking step of FIG. 9.

FIG. 14 is a sectional view of a pressure forming die used in a colored granule filling step and a lining granule filling step of FIG. 9.

FIG. 15 is a plan view showing a filled state of colored granules of FIG. 14.

FIG. 16 is a sectional view showing a nonglazing tile burnt in a burning step of FIG. 9.

FIG. 17(a) is a plan view showing an example of a third embodiment of a tile having a pattern of the invention.

FIG. 17(b) is a plan view showing a modification of a third embodiment of a tile having a pattern of the invention.

FIG. 17(c) is a plan view showing a modification of a third embodiment of a tile having a pattern of the invention.

FIG. 17(d) is a plan view showing a modification of

a third embodiment of a tile having a pattern of the invention.

FIG. 17(e) is a plan view showing a modification of a third embodiment of a tile having a pattern of the invention.

FIG. 17(f) is a plan view showing a modification of a third embodiment of a tile having a pattern of the invention.

FIG. 18 is a schematic drawing showing diagrammatically a molding of a molded thin plate in manufacturing the third embodiment of a tile having a pattern of the invention.

FIG. 19 is a perspective view showing the molded thin plate of FIG. 18.

FIG. 20(a) is a schematic view showing a pressing die of a molded thin plate to be a partition wall of the tile having the pattern of FIG. 17(a).

FIG. 20(b) is a schematic view showing a pressing die of a molded thin plate to be a partition wall of the tile having the pattern of FIG. 17(c).

FIG. 20(c) is a schematic view showing a pressing die of a molded thin plate to be a partition wall of the tile having the pattern of FIG. 17(d).

FIG. 20(d) is a schematic view showing a pressing die of a molded thin plate to be an inside partition wall of the tile having the pattern of FIG. 17(e).

FIG. 20(e) is a schematic view showing a pressing die of a molded thin plate to be an outside partition wall of the tile having the pattern of FIG. 17(e).

FIG. 20(f) is a schematic view showing a pressing die of a molded thin plate to be a partition wall of the tile having the pattern of FIG. 17(f).

FIG. 21 is a plan view showing a filled state of colored granules in manufacturing the tile having the pattern of FIG. 17(e) among the third embodiment of tiles of the invention.

FIG. 22 is a sectional view showing a tile having a pattern after burning in manufacturing the tile having the pattern of FIG. 17(e) among the third embodiment of tiles of the invention.

FIG. 23(a) is a perspective view showing an appearance of an example of an angle tile having a colored pattern obtained by a fourth embodiment.

FIG. 23(b) is a perspective view showing an appearance of a modification of an angle tile having a colored pattern obtained by the fourth embodiment.

FIG. 23(c) is a perspective view showing an appearance of a modification of an angle tile having a colored pattern obtained by the fourth embodiment.

FIG. 24 is a flowchart showing manufacturing steps of the fourth embodiment of an angle tile of the invention.

FIG. 25 is a perspective view diagrammatically showing a plain tile pressing machine used in the fourth embodiment of the invention.

FIG. 26 is a perspective view showing a preformed

main plate body made by the plain tile pressing machine of FIG. 25.

FIG. 27 is a schematic drawing showing a bar pressing machine used in the fourth embodiment of the invention.

FIG. 28 is a perspective view showing a joining bar made by the bar pressing machine of FIG. 58.

FIG. 29 is an explanatory drawing of a used state of a pressing die of an angle tile pressing machine used in the fourth embodiment of the invention.

FIG. 30 is a flowchart showing manufacturing steps of the fifth embodiment of an angle tile of the invention.

FIG. 31 is a perspective view showing a preformed main plate body formed in a preformed tile body forming step of the fifth embodiment of the invention.

FIG. 32(a) is an explanatory drawing of a used state of a frame of a pressing die of an angle tile pressing machine used in the fifth embodiment of the invention.

FIG. 32(b) is an explanatory drawing of a used state of trimming metal fittings of a pressing die of an angle tile pressing machine used in the fifth embodiment of the invention.

FIG. 33 is an explanatory drawing of a used state of a pressing die of an angle tile pressing machine used in the sixth embodiment of the invention.

FIG. 34 is an explanatory drawing of a used state of a pressing die of an angle tile pressing machine used in the seventh embodiment of the invention.

FIG. 35(a) is an explanatory drawing showing a modified mode of an arranging manner of materials in an arranging step of a preformed tile boy and a joining bar in each of the fourth to seventh embodiments of the invention.

FIG. 35(b) is an explanatory drawing showing a modified mode of an arranging manner of materials in an arranging step of a preformed tile body and a joining bar in each of the fourth to seventh embodiments of the invention.

FIG. 35(c) is an explanatory drawing showing a modified mode of an arranging manner of materials in an arranging step of a preformed tile boy and joining granules in each of the fourth to seventh embodiments of the invention.

FIG. 35(d) is an explanatory drawing showing a modified mode of an arranging manner of materials in an arranging step of a preformed tile boy and joining granules in each of the fourth to seventh embodiments of the invention.

FIG. 35(e) is an explanatory drawing showing a modified mode of an arranging manner of materials in an arranging step of a preformed tile boy and joining granules in each of the fourth to seventh embodiments of the invention.

FIG. 35(f) is an explanatory drawing showing a modified mode of an arranging manner of materials

in an arranging step of a preformed tile boy and joining granules in each of the fourth to seventh embodiments of the invention.

FIG. 36 is a perspective view of a eighth embodiment of an angle tile of the invention.

FIG. 37 is a sectional view of a pressure forming machine showing a process of filling colored granules in a pressure forming die in a preformed tile body forming step.

FIG. 38 is a perspective view of a partition plate used in filling the colored granules in the pressure forming die in the preformed tile body forming step. FIG. 39(a) is a perspective view of a long preformed tile body formed in the preformed tile body forming step.

FIG. 39(b) is a perspective view of a short preformed tile body formed in the preformed tile body forming step.

FIG. 40 is a partial perspective view of a joining bar formed in a joining bar forming step.

FIG. 41 is a sectional view of an angle tile pressing die showing a state in a preformed tile body and joining bar disposing step.

FIG. 42 is a perspective view of an ninth embodiment of an angle tile of the invention.

FIG. 43 is a sectional view of a pressure forming machine showing a process of filling colored granules in a pressure forming die in a preformed tile body forming step.

FIG. 44 is a perspective view of a partition plate used in filling the colored granules in the pressure forming die in the preformed tile body forming step.

FIG. 45 is a perspective view of a preformed tile body formed in the preformed tile body forming step.

FIG. 46 is a sectional view of an angle tile pressing die showing a state in a preformed tile body and joining bar disposing step.

FIG. 47(a) is a perspective view showing a modification of slip preventing lugs.

FIG. 47(b) is a perspective view showing another modification of slip preventing lugs.

FIG. 47(c) is a perspective view showing still another modification of slip preventing lugs.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0044] Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, several preferred modes of the invention will be described hereafter.

#### [FIRST EMBODIMENT]

[0045] A first embodiment of the invention will be described hereunder referring to FIGs. 1 to 6.

[0046] Referring to FIG. 1, a tile having a pattern 81 is

a nonglazing tile of a dimension of 100mm square. The pattern is composed of a light black part 82 provided at an side part and a light red part 83 provided at an inside circular part. The light black part 82 and the light red part 83 are made of the same raw material but mixed with different pigments. They are burnt into one body. A lining layer is formed on a rear part (not shown) of the tile 81.

**[0047]** The tile 81 was manufactured as follows. FIG. 2 shows manufacturing steps.

**[0048]** First, in a partition plate disposing step S501, a partition plate 84 as a partition means shown in FIG. 3 is fabricated of a thin steel plate of a thickness of approximately 1mm in such a manner to correspond to the pattern of the tile 81. This partition plate 84 is composed of a center partition 85 and an outer wall 86 formed in one body. The center partition 85 is a ring plate shape with a height of 10 to 12mm and constitutes a border of multicolors. The outer wall 86 is a rectangular frame shape with the same height of 10 to 12mm and is contacted with an inside wall of a pressure forming die described later. A handle 87 is attached to an upper end of the partition plate 84. The outer wall 86 is provided for a purpose of holding the center plate 85 at a fixed position, but it may be omitted and only the inside center plate 85 may be disposed in the die according to a formed pattern. The thickness of the partition plate 84 is preferably made thin in order to make the border as distinct as possible. Still, if it is too thin, it would be easily deformed in works of its disposing and taking-out or filling of granules mentioned later. Thus, it is necessary to determine the thickness in consideration thereof. It is possible to chamfer a lower end of the partition plate 84 into a tapered shape.

**[0049]** After the partition plate 84 was fabricated, it was disposed on a bottom surface of a pressure forming die 91 shown in FIG. 4.

**[0050]** On the other hand, in a colored granule filling step S502, colored granules were prepared for forming a colored part. For the preparation of the colored granules, a tile body consisting of 50% feldspar, 20% china clay and 30% clay was added with 2% black pigment for kneading, 0.5% CMC and water. This tile body was then mixed and ground in a trommel 101 shown in FIG. 5 thereby to obtain a slip 102. Thereafter, it was pumped up to a spray drier 104 by a pump 103, and dried and granulated by the spray drier 104 to obtain the colored granules. This light black colored granules was stored in a storage/feed tank 105. Similarly, the above tile body was added with 3% of a red pigment for kneading thereby to obtain light red colored granules by a similar operation. The light red colored granules were stored in another storage/feed tank 106. These two kinds of granules had their moisture content regulated in about 7% by controlling drying condition. A raw material supplying means used in the colored granules filling step S502 may directly supply the raw material from a measuring means or supply them evenly over a fixed wide area by

a robot or the like.

**[0051]** After such preparation, the light black granules and the light red granules were filled into the pressure forming die 91 which had the partition plate 84 disposed therein. In this filling work, the light black granules were filled to a height of 7 to 8mm, by use of a feeder not shown, in an outer forming space 95 that was surrounded by the center partition 85 and the outer wall 86 of the partition plate 84, among a forming space 10 to 12mm deep defined by a lower mold 93 and a side mold 94, while an upper mold 92 was kept raised in the pressure forming die 91 of FIG. 4. At this time, care was taken of so that the light black granules did not intrude into an inner forming space 96. When they intruded, they were sucked and eliminated.

**[0052]** Next, the light red granules were filled into the inner forming space 96 to a height of 7 to 8mm in the same manner as the light black granules. Here, the light red granules may reversely be filled prior to filling of the light black granules, or they may be filled at the same time.

**[0053]** After the colored granules were filled, in a partition plate removing step S503, the partition plate 84 were removed by taking the handle 87 which was attached to the upper end of the outer wall 86. Thereby, the light black granules and the light red granules overflowed the border to each other and were mixed in a very small amount. If the colored granules overflow to each other and are mixed, a joining strength is improved between the different colored granules, though the border is made slightly indistinct.

**[0054]** In a lining granule filling step S504, on the other hand, lining granules as uncolored body grains were prepared in the same manner as the colored granules, by use of the same tile body as that of the light black and red granules, without any pigment added. They were stored in a storage/feed tank 107. Then as shown in FIG. 6, the lining granules were filled into a lining granule forming space 97 which was defined over the filled light black and red granules, to the same height as an upper surface of the side mold 94.

**[0055]** Next, in a pressure forming step S505, each kind of the colored granules and the lining granules in the pressure forming die 91 were pressed and molded at a pressure of 100kg/cm<sup>2</sup>. At this time, though not shown illustratively, if a pressing surface of a bottom part of the upper mold 92 is given concaves and convexes of a fixed width, it is possible to form concavo-convex ribs or protrusions for heightening an adhering strength at the same time on the rear surface of the tile 81.

**[0056]** Thereafter, in a burning step S506, a block which was molded in the pressure forming step S505 was turned over, and burnt under a condition of a burning temperature of 1250°C and a burning time of 30 hours. The 6 to 7mm thick nonglazing tile 81 was obtained, by burning, as shown in FIG. 1 which had a pattern of the light black part 82 and the light red part 83

at the front side while lined by uncolored porcelain at the rear side.

**[0057]** As mentioned above, this embodiment of the tile is obtained by: disposing the partition plate 84 in the pressure forming die 91; then filling the light black granules and the light red granules respectively in the outer forming space 95 and the inner forming space 96 both defined by the partition plate 84; removing the partition plate 84 and then filling the lining granules over the filled colored granules; pressing and molding them into one body; and burning them.

**[0058]** According to this embodiment, since the partition plate 84 is disposed beforehand in the pressure forming die 91 so as to fill the colored granules in the forming spaces 95, 96 and the lining granules are filled and pressed after removal of the partition plate 84, it is possible to easily form a multicolored pattern and improve a joining property between the light black granules and the light red granules, thereby preventing the border part from being peeled off and cracked, though the border line is made slightly indistinct if a very small amount of the colored granules overflow the border at the time of pressing.

**[0059]** Moreover, the pattern is never faded or vanished, thus exhibiting the same pattern as the initial one, even if the tile surface is abraded with long time of use.

**[0060]** Furthermore, the lining granules are joined to both the colored granules so as to also enlarge the joining strength between them. The lining granules are filled in each forming space so as to flat a filled surface of the colored granules that is apt to become irregular, thereby making it easy to standardize the tile thickness.

**[0061]** In addition, since both the colored granules and the lining granules are filled, pressed and thereafter burnt, it is possible to improve an overall strength and a surface hardness, thereby preventing abrasion of the tile surface.

**[0062]** Moreover, both the colored granules dried are good in fluidity in filling, and easy to handle or suitable for mass production.

**[0063]** While the above embodiment uses the uncolored lining granules in addition to the two colored granules, one of the colored granules may be used for the liner. That is, after one of the two colored granules are filled in one of the forming spaces 95, 96, the other colored granules are filled wholly up to the lining granule forming space 97. This make material control easy. Moreover, the lining granules may be obtained by granulating sewage disposal waste soil, waste tile material or the like. In this case, it is possible to manufacture the tile at low costs, which will serve for waste disposal and contribute to recycle of resources.

**[0064]** The above embodiment of the manufacturing method of the tile having the pattern is composed of: the partition plate disposing step S501 for disposing the partition plate 84 in the pressure forming die 91; the colored granule filling step S502 for filling the light black granules and the light red granules respectively in the

outer forming space 95 and the inner forming space 96 both defined by the partition plate 84 after disposing the partition plate 84; the partition plate removing step S503 for removing the partition plate 84 out of the pressure forming die 91 after filling the colored granules; the lining granule filling step S504 for filling the lining granules over both the filled colored granules; the pressure forming step S505 for pressing and forming the colored granules and the lining granules in the pressure forming die 91 into one body after filling both the colored granules and the lining granules in the pressure forming die 91; and the burning step S506 for burning the block molded in the pressure forming die 91.

**[0065]** According to the above method, since the colored granules are filled in the forming spaces 95, 96 after disposing the partition plate 84 in the pressure forming die 91 and then the lining granules are filled therein, the pattern of the tile can be made with an easy operation, and different colors of granules can be filled simultaneously.

**[0066]** Here, the colored granules used in manufacturing the present embodiment of the tile are preferably obtained by: using the same materials as ordinary tiles like feldspar, china clay, kaolin, clay, etc.; adding coloring pigments, organic caking agent, water thereto; mixing and grinding them into slip by a trommel or the like; and pelletizing them into a fixed moisture content by a spray drier or the like. The particle diameter is preferably 20-50 meshes. Moreover, the colored granules may be used in a powdered state without pelletizing process. Still, the pelletized granules of a fixed moisture content are good in workability and suitable for mass production. This is because advantageously they have no irregular color and are unsticky and spread entirely over the pressure forming die 91.

**[0067]** The coloring pigment may be such pigments for kneading as chromium oxide, iron oxide and Mn-Al pink, in addition to such natural pigments as chromite and loess. Preferably, an adding amount thereof is generally two to three percent.

**[0068]** Moreover, it is best for the lining granules to use the same granulated grains as the colored granules in view of a joining strength and a shrinkage percentage, since one object of the invention is to reinforce the joined part of the colored granules of the tile surface corresponding to the partition plate 84 and prevent its crazing. However, since the lining granules do not appear on the tile in a normal use, other material may be utilized as long as the joining strength and the shrinkage percentage can be regulated. For example, it is possible to use a material that is obtained by mixing refuses, such as crashed fine powders of tile waste and dried waste soil powder of sewage disposal, as a main material with silica or the like, and adjusting a melting point and a shrinkage percentage. This makes recycle of resources possible.

**[0069]** It is preferable to use a cellulose ether such as MC (methyl cellulose), CMC (carboxymethyl cellulose



sodium), ethyl cellulose and benzyl cellulose, or a synthetic resin.

**[0070]** The firing or burning after pressure molding may be performed correspondingly to a manufacturing condition of general nonglazing tiles. Here, it is possible to give luster to the fired tile by properly polishing its surface.

**[0071]** While, in the above embodiment, the lining granules are filled together with the colored granules, it is possible to eliminate the filling of the lining granules. In case of eliminating the filling of the lining granules, material control is made easy, and manufacturing steps are simplified.

**[0072]** While, in the above embodiment, the lining granules are filled over the colored granules after filling of the colored ones, the order of filling work may be changed. Namely, the colored granules may be filled over the lining granules after filling the lining granules. In this case, the partition plate 84 is to be disposed on the lining granules which were filled beforehand in the pressure forming die 91. Accordingly, it is unnecessary to closely contact the lower end of the partition plate 84 with the surface of the pressure forming die 91 in a uniform manner, so that the partition plate 84 may be fabricated without special care for accuracy at the lower end.

**[0073]** While the above embodiment of the tile 81 has the pattern that a circle is formed in a square frame, desired patterns may be given to various shapes of tiles, such as a rectangular tile 81a shown in FIG. 7(a), a rectangular tile 81b shown in FIG. 7(b), a rectangular tile 81c shown in FIG. 7(c), a rectangular tile 81d shown in FIG. 7(d), a hexagonal tile shown in FIG. 7(e), and a circular tile 81f shown in FIG. 7(f). For example, in the tile 81c of FIG. 7(c), a pattern is defined by a white part and a spotted part that is made of a body with blue granules dispersed. The tile 81d of FIG. 7(d) has a pattern defined by three colors.

**[0074]** The partition plate may make its pattern forming lower end or all the part thinner or thicker than the above embodiment. Thinner one prevents breakage of the pattern in removing the partition plate. Thicker one makes an outline of the pattern indistinct thereby exhibiting a unique appearance. Moreover, it is possible to use part of a pressure forming die as a substitute for an outer wall of a partition plate, which forms an outer part of a tile, so as to eliminate the outer wall and simplify its construction.

## [SECOND EMBODIMENT]

**[0075]** A second embodiment will be described hereunder referring to FIGs. 8 to 16.

**[0076]** Referring to FIG. 8, a tile having a pattern 111 is a nonglazing tile of a dimension of 200mm square. The pattern is formed by an outer light black part 113 and an inner light red part 114 with a white ring part 112 of a constant width of 6mm bordering them. All of these white ring part 112, light black part 113 and light red

part 114 are made of the same raw material and burnt into one body. However, they have respectively different pigments mixed therein and show different colors. A lining layer is formed on a rear side thereof (not shown).

**[0077]** Manufacturing steps of the tile 111 is described hereafter referring to FIG. 9.

**[0078]** First, in a partition wall forming step S511, a tile body consisting of 50% feldspar, 20% china clay and 30% clay was added with 10% zirconium silicate, namely superfine powders of zircon as a white pigment, 1% CMC and 25% water. Then, they were put into and mixed in a mixer 122 of a continuous molding machine 121 which was composed of the mixer 122, a kneader 123 and an extruder 124, and sufficiently kneaded by the kneader 123 thereby preparing a clay body for a partition wall 132. Thereafter, a cylindrical molded body 131 shown in FIG. 11 was obtained through a mouth-piece 125 by use of the extruder 124. Next, this cylindrical molded body 131 was cut into a 15mm length, and dried a predetermined time at a temperature not more than 200°C by a drier. Thus, most of moisture of the cylindrical molded body 131 was evaporated thereby to obtain the ring partition wall 132 shown in FIG. 12 which has 7% moisture content and an outer diameter of 200mm and a thickness of 6mm.

**[0079]** Next, in a partition wall sticking step S512, an organic adhesive known in the art was coated on one cut surface of the partition wall 132 as a partition means obtained in the step S511. Such a partition wall 132 was put on and stuck to a predetermined position of a sheet material 133 of Japanese paper which is the same dimension as an inside dimension of a bottom surface of a pressure forming die 91, which was similar to that of the first embodiment. Then, the sheet material 133 with the partition wall 132 stuck thereto, as shown in FIG. 13, was laid on the bottom surface of the pressure forming die. Here, an inner dimension of the pressure forming die 91 was 210mm square.

**[0080]** On the other hand, in a colored granule filling step S513, colored granules for forming a colored part were prepared, separately from the partition wall 132. The preparation of the colored granules was carried out in the same manner as the first embodiment, by use of the device shown in FIG. 5.

**[0081]** After such preparation, light black granules and light red granules were filled in the pressure forming die 91 that accommodated the sheet material 133 with the partition wall 132 stuck thereto. In this filling work, the upper mold 92 of the pressure forming die 91 was kept raised as shown in FIG. 14. Then, the light black granules were filled, by use of a feeder (not shown), into the outer forming space 95 which was surrounded by the pressure forming die 91, the ring partition wall 132 and the underlying sheet material 133, among the forming spaces defined by the lower mold 93 and the side mold 94, up to such a height as an upper end of the partition wall 132 was not hidden. At this time, a care was paid for so that the light black granules did not overflow into

the inner forming space 96 formed by the partition wall 132 and the sheet material 133. Any ones which were erroneously overflowed thereinto were sucked and eliminated.

[0082] Next, the light red granules were filled into the inner forming space 96 up to such a height as the upper end of the partition wall 132 was not hidden, as in the light black granules. A state after filling is shown in FIG. 15. Regarding the filling works of the light black and red granules, contrary to the above, the red ones may be filled first as in the first embodiment, or both of them may be filled at the same time.

[0083] After the light black and red granules were filled in the forming spaces 95, 96 of the pressure forming die 91, in a lining granule filling step S514, lining granules as uncolored body grains were prepared in the same manner as the first embodiment, and stored in the storage/feed tank 107 for the lining granules shown in FIG. 5. Then, these lining granules were filled into the lining granule forming space 97 from over the already filled light black and red granules up to a height twice that of the partition wall 132, namely a height of 25 to 30mm.

[0084] Next, in a pressure forming step S515, each color of granules and the lining granules in the pressure forming die 91 were pressed and formed at a pressure of 100kg/cm<sup>2</sup>.

[0085] Thereafter, in a burning step S516, a block formed in the pressure forming step S515 was turned over, and burnt under a condition of a burning temperature of 1250°C and a burning time of 30 hours. A non-glazing tile 111 of a section shown in FIG. 16 was obtained by burning. As to an appearance, the tile 111 has its front side design surface formed with a pattern which is composed of an inner light black part 113, an outer light red part 114 and a white ring part 112 bordering them, and its rear side lined by the uncolored porcelain, as shown in FIG. 8.

[0086] Here, the sheet material 133 of Japanese paper is burnt out by high temperature heat in the above burning. A plastic sheet or the like may be used as the sheet material 133. However, a common European paper needs some attention since residue is left after burning.

[0087] As mentioned above, the second embodiment of the tile is obtained by: forming the partition wall 132 of a fixed moisture content from a clay body and disposing it in the pressure molding die 91; then filling the light black granules and the light red granules in the outer forming space 95 and the inner forming space 96 both defined by the partition wall 132; thereafter filling the lining granules over the filled colored granules to press and mold into one body; and burning them.

[0088] According to this embodiment, since the partition wall 132 is disposed beforehand in the pressure forming die 91 so as to define the forming spaces 95, 96 for the colored granules, the partition wall 132 functions as a shielding wall in the pressing step. Thus, it is prevented that the colored granules overflow the border,

thereby making the pattern distinct. Moreover, since the lining granules are filled over the colored granules and pressed integrally therewith, the border part between the partition wall 132 and the colored granules is given a sufficient joining strength. As a result, the border part of the pattern can be restrained from cracking or the like. Moreover, since the colored granules and the lining granules are filled, pressed and molded, and fired thereafter, an overall strength and a surface hardness are improved. Thereby, the tile is prevented from abrasion at the surface as well as dirt or stain at the border part.

[0089] In addition, since multicolored patterns can be provided on one piece of tile, many kinds of patternings can be realized, though conventional technique is only capable of forming such a simple pattern as a diced pattern in spite of a trend of these days in which a size of one tile piece has been becoming larger such as 200mm square or 300mm square.

[0090] Here, the lining granules may be the same color as that of one of the colored granules as in the first embodiment. The lining granules may be obtained by granulating sewage disposal waste soil, waste tile material or the like.

[0091] The above second embodiment of the manufacturing method of the tile having the pattern is composed of: the partition wall forming step S511 for forming the partition wall 132 of a predetermined moisture content from a clay body; the partition wall sticking step S512 for sticking the formed partition wall 132 to the sheet material 133 of the same dimension as that of the bottom surface in the pressure forming die 91 while being standed; the colored granule filling step S513 for disposing the sheet material 133, to which the partition wall 132 has been stuck, in the pressure forming die 91 and filling the light black granules and the light red granules respectively in the outer forming space 95 and the inner forming space 96 both defined by the partition wall 132; the lining granule filling step S514 for filling the lining granules over the partition wall 132 and the upper surface of both the filled colored granules; the pressure forming step S515 for pressing and forming the partition wall 132, the colored granules and the lining granules in the pressure forming die 91 into one body; and the burning step S516 for burning the pressed and formed block and burning out the sheet material 133 by the heat.

[0092] According to the above method, since the colored granules and the lining granules are filled in the forming spaces 95, 96, 97 after disposing the partition wall 132 in the pressure forming die 91, a desired distinct pattern can be given to the tile with an easy operation, and different colors of granules can be filled simultaneously. Since each color of the granules that has been dried into a fixed moisture content has a good fluidity at the time of filling, so that they are easy to handle and suitable for mass production.

[0093] Furthermore, since the sheet material 133 that is as large as the bottom surface of the pressure forming die 91 is disposed in the pressure forming die 91,

while having the molded partition wall 132 stuck in a stand state thereto, the colored granules are blocked by the sheet material 132 from going over the border part in the die 91 at the time of pressing. Thus, the border part of the pattern can be more distinct. Inasmuch as the sheet material 133 for sticking the partition wall 132 is made of Japanese paper as a combusting material, it is burnt out at the time of burning after pressing, so that it never affects an appearance of tile surface nor material property of the tile after burning.

### [THIRD EMBODIMENT]

**[0094]** Next, a third embodiment of the invention will be described referring to FIGs. 17(a) to 22.

**[0095]** The third embodiment shows tiles of relatively small dimension such as 100mm square or 150mm square while having patterns illustrated in FIG. 17(a) to FIG. 17(f).

**[0096]** FIG. 17(a) to FIG. 17(f) show six kinds of tiles 141a, 141b, 141c, 141d, 141e, 141f respectively having different patterns. The tiles 141a-141f are nonglazing tiles of approximately 100mm square or an outer dimension smaller than that of the tile 111 in the second embodiment. The tiles 141a, 141b, 141c, 141d, 141f have patterns that dark brown parts 143a, 143b, 143c, 143d, 143f and green parts 144a, 144b, 144c, 144d, 144f are disposed at opposite sides of white border part 142a, 142b, 142c, 142d, 142f. The tile 141e has a pattern that a dark brown part 143e, a green part 144e or a yellow part 145e are disposed at opposite sides of a white border part 142e. The white border part 142a-142f is approximately 3mm wide which is narrower than the white ring part 112 approximately 7mm wide in the second embodiment, since the tile 141a-141f has a smaller outer dimension.

**[0097]** Hereunder, manufacturing steps of the third embodiment of a tile will be described referring to the tile 141e of FIG. 17(e) as an example.

**[0098]** Regarding the third embodiment of the tile 141a-141f, the white border part 142a-142f that has a small width of about 3mm is preferably formed by use of a pressing die, in order to make its handling in the following steps easier.

**[0099]** The third embodiment is the same as the second embodiment in other operations such as preparation of colored granules and lining granules, their filling into a pressure forming die, pressing and forming, and burning.

**[0100]** First, a tile body consisting of 50% feldspar, 20% china clay and 30% clay was added with 5% titanium oxide, 1% CMC and 25% water. Then, they were mixed and kneaded into a clay body 151, and the clay body 151 was molded by a double stage mill 152 shown in FIG. 18 thereby to obtain a molded thin plate 153 250mm wide, 3mm thick and 1000mm long as shown in FIG. 19.

**[0101]** Thereafter, a little amount of titanium white was

sprinkled over a surface of the molded thin plate 153 that had been laid on a base. Then, such molded thin plate 153 was cut, along longitudinally extending cutting lines shown by two-dotted chain lines in FIG. 19, into 7mm wide strips. These strips were gently wound.

**[0102]** A white molded strip cut into 7mm width had its one end positioned at one end of a lower mold 163d, 163e while an upper mold 162d, 162e was kept raised. A pressing die 161d, 161e was used for fabricating the tile 141e of 100mm square as shown in FIG. 20(d) and FIG. 20(e). Then, the upper mold 162d, 162e was lowered to press the strip. Thereafter, the white molded strip had its other end cut off, if such end was out of the pressing die 161d, 161e. The tile 141e of FIG. 17(e) is manufactured by use of two smaller white strips and two larger white strips, which are pressingly molded by the pressing die 161d of FIG. 20(d) and the pressing die 161e of FIG. 20(e), respectively.

**[0103]** The tile 141a of FIG. 17(a) can be fabricated by use of a white molded strip formed by a pressing die 161a of FIG. 20(a). The tile 141c of FIG. 17(c) can be fabricated by use of two white molded strips formed by a pressing die 161b of FIG. 20(b). The tile 141d of FIG. 17(d) can be fabricated by use of two white molded strips formed by a pressing die 161c of FIG. 20(c). The tile 141f of FIG. 17(f) can be fabricated by use of four white molded strips formed by a pressing die 161f of FIG. 20(f).

**[0104]** The white strips molded by the pressing die 161d of FIG. 20(d) and the pressing die 161e of FIG. 20(e) were dried at a temperature of not more than 200°C into 7% moisture content. Two small strips and two large strips were used and mutually joined by coating an organic adhesive on a joint surface, thereby forming one partition wall 171 shown in FIG. 21.

**[0105]** Next, an organic adhesive was coated on a bottom surface of the partition wall 171, and the partition wall 171 was stuck to such a sheet material as a Japanese paper or a plastic sheet, and disposed in a pressure forming die.

**[0106]** On the other hand, in addition to the above operation, three tile bodies each consisting of 50% feldspar, 20% china clay and 30% clay were added respectively and separately with kneading pigments of dark brown, green and yellow. CMC and water were further added to each tile body. Then, each of them was mixed, crashed and made into a slip by the same operations as each color of granules in the second embodiment, and dried and pelletized by the spray drier 104. Thereby, brown colored granules, green colored granules and yellow colored granules were prepared.

**[0107]** Thereafter, the three colors of the granules prepared beforehand as above were filled one by one into forming spaces defined by the pressure forming die, the partition wall 171 and the sheet material, from the inside to the outside. Then, uncolored lining granules were filled over these three colored granules. FIG. 21 shows their filling state in the pressure forming die. In FIG. 21,

the innermost is yellow granules, the center is green granules, and the outermost is dark brown granules.

[0108] After this, they were pressed and formed into a block by the same operation as the second embodiment. Such a pressed block was fired to obtain the tile 141e approximately 10mm thick shown in FIG. 17(e) and FIG. 22.

[0109] That is, the third embodiment is different from the second embodiment in the forming process of the partition wall.

[0110] Here, in the second and third embodiments, a partition wall may be obtained by: using the same raw material as that of common tiles such as feldspar, china clay, kaolin, clay or the like; adding thereto a pigment, an organic caking agent and water to prepare a kneaded clay body; forming the clay body by means of extrusion, roller molding or the like; cutting it into a constant width; and drying it into a predetermined moisture content. The moisture content is preferably a value substantially the same as that of the colored granules, and more preferably 6 to 8% from experience. It is possible to use similar materials to those of the first embodiment, as colored granules, lining granules, pigments, and organic caking agents. The burning work may be done according to a manufacturing condition of general non-glazing tiles, as in the first embodiment.

[0111] While, in the second and third embodiment, the partition wall is disposed in the pressure forming die after being stuck to the sheet material like a Japanese paper or a plastic sheet, and then the colored granules are filled into the pressure forming die, other modifications are possible. For instance, the partition wall may be disposed directly in the pressure forming die without use of the sheet material. However, it may be caused in this case that the colored granules flow into between the partition wall and the bottom surface of the die thereby to make the pattern of the border part slightly indistinct, at the time of filling the colored granules in the die. Therefore, it is preferable to use the sheet material in case there is a problem in a finished article due to a grain diameter and fluidity of filled colored granules, a degree of flatness of the bottom surface of the partition wall or the like.

[0112] While the above embodiments of the partition walls are made into a constant width of 3mm or 7mm, other shapes may be adopted. For example, it may have a width change such as an expanded part provided at some position. In this case, it is possible to give a different feeling to the pattern compared with that of each of the above embodiments.

[0113] Moreover, in the above embodiments, each of the partition walls may make its surface roughness of a side wall coarse or into a concavo-convex surface or formed with an undercut. In this case, it is possible to make the joining strength larger between the partition wall and the colored granules, thereby restraining more effectively cracks or crazes from being caused at the joined surface.

[0114] In addition, the above second and third embodiments of the partition walls may be the same color as one of the colored granules thereby to obtain a pattern with a border line having no width.

[0115] FIGs. 23(a) to 23(c) illustrate respectively examples of angle tiles having various colored patterns. The angle tile 260, 270, 280, 290 only as an example of these embodiments is composed of long and short tiles joined by a rectangular corner 263, 273, 283, 293. They may be used for stepped parts of stairs or roads or the like. In the following description, the long tile is called a main plate 261, 271, 281, 291. The short one is called a bent plate 262, 272, 282, 292.

[0116] In FIG. 23(a), the main plate 261 of the tile 260 has two pairs of triangle parts of different colors while each pair shows symmetry. The bent plate 262 is the same color as that of the adjacent triangle. In FIG. 23(b), the main plate 271 of the tile 270 has a pair of symmetrically arranged semicircular parts and other parts of different colors. The bent plate 272 is the same color as that of the other parts. In FIG. 23(c), the main plate 291 of the tile 290 has the same color arrangement as that of the tile of FIG. 23(a). The bent plate 292 has a color arrangement corresponding to a half of the above color arrangement. These are the appearances of the tiles in each embodiment.

#### [Fourth Embodiment]

[0117] The fourth embodiment will be described referring to FIGs. 24 to 29, taking the angle tile 260 as an example.

[0118] In FIG. 23(a), the angle tile 260 has the main plate 261 and the bent plate 262 formed at both sides of the corner 263. The main plate 261 has one pair of triangles provided with light blue spots on a white background and the other pair provided with light gray spots on a black background. The bent plate 262 has light blue spots on a white background like the one triangle pair of the main plate 261.

[0119] This angle tile 260 was manufactured according to a process of FIG. 24 by use of the following device.

[0120] FIG. 25 shows a plate tile press machine 410 used in a preformed tile body forming step S551. FIG. 26 shows a preformed tile body 300 made by this plate tile press machine 400. This preformed tile body includes a preformed main plate body 301 forming the main plate 261 and a preformed bent plate body 302 forming the bent plate 262. Each preformed tile body 301, 302 has a trimmed part 304. FIG. 27 shows a bar press machine 420 used in a joining bar forming step S552 of FIG. 24. FIG. 28 shows a joining bar 303 formed by the bar press machine 420 of FIG. 28. FIG. 29 shows a press die in an angle tile pressing machine used in an angle tile body forming step S554, a lower mold 431 and an upper mold 432 thereof.

[0121] To begin with, in a preformed tile body forming

step, colored granules used for preparing the preformed tile body 300 were prepared as follows. A crashed mix raw material consisting of 50% feldspar, 20% china clay, 10% kaolin and 20% clay was used herein. Three kinds of colored crashed mix raw materials were prepared: a first material adding 5% black pigment (belonging to a group of  $\text{CoO}$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{Fe}_2\text{O}_3$ ) to the above crashed mix raw material; a second material adding 5% blue pigment (belonging to a group of  $\text{ZrSiO}_4(\text{V})$ ); and a third material without any pigment added. Water was added to each kind of these materials. They were then mixed and ground by a trommel or the like into a slip, and granulated by a spray drier into granules of a fixed moisture content (granule diameter of about  $70\mu\text{m}$ ). Thus, black, blue and uncolored (white) granules were prepared. The preformed tile body 300 was prepared using these colored granules (including white ones) as mentioned below.

**[0122]** First, a partition plate (not shown) was disposed diagonally in a forming space 412 (103mm wide, 120mm long and 13mm deep) of the lower mold 411 of the plate tile press machine 410 shown in FIG. 25. Thus, the forming space 412 was divided into four isosceles right triangles. Then, a mixture of the uncolored or white granules and the blue granules was filled in the facing one pair of the triangle spaces. A mixture of the white granules and the black granules was filled in the other pair of the triangle spaces. Thereafter, the partition plate was removed, and the granules were pressed by the plate tile press machine 410 to make the preformed main plate tile body 301 having a colored pattern shown in FIG. 26. A mixture of the white granules and the blue granules was filled in the forming space 412 (103mm long, 55mm wide and 13mm thick) of the lower mold 411. They were similarly pressed to obtain the preformed bent plate body 302. The pressing was carried out at a pressure of  $200\text{kg}/\text{cm}^2$ .

**[0123]** As mentioned above, the trimmed part 304 is provided in a length of about 20mm on a part unnecessary in a finished tile or outside ends of the preformed main plate body 301 and the preformed bent plate body 302. This trimmed part 304 is cut off in a following step. Therefore, uncolored or white granules were filled at a part corresponding to the trimmed part 304. Accordingly, in forming the preformed main plate body 301, the partition plate was diagonally disposed only in a square part (103mm square) of the forming space 412 while excepting a part for forming the trimmed part 304 (about 20mm wide).

**[0124]** Next, in a joining bar forming step S552, a joining bar 303 was formed. This joining bar 303 had a cross section of 13mm square and a length of 103mm and was made by filling a mixture of the white granules and the blue granules used in forming the preformed tile body in the bar press machine 420 shown in FIG. 27, and pressing it. FIG. 28 shows thus obtained joining bar 303 which has a pattern of light blue spots scattered on a white background.

**[0125]** In a preformed tile body and joining bar disposing step S553, two kinds of preformed tile bodies 301 and 302 obtained in the step S551 and the joining bar 303 obtained in the step S552 were respectively disposed in the lower mold 431 of the press die 430 of the angle tile pressing machine which molded an angle product. Specifically, the joining bar 303 was disposed along a lowermost rectangular corner of the V-shaped lower mold 431. At this time, since the corner of the joining bar 303 and the corner of the lower mold 431 are rectangular, respectively, the joining bar 303 can be disposed in close contact therewith. Next, the preformed main plate body 301 and the preformed bent plate body 302 were disposed at both sides of the joining bar 303 on both slopes of the lower mold 431. Here, they were disposed so that one end or the side of the trimmed part 304 was positioned outside and that the other end surface was touched vertically with the joining bar 303. At this time, a size of one part, for the main plate, of the lower mold 431 is 105mm wide, 120mm long and 13mm deep. A size of the other part, for the bent plate, of the lower mold 431 is 105mm long, 55mm wide and 13mm deep. Uncolored granules were filled in contact surfaces between the preformed tile bodies 301 and 302 and the joining bar 303 in a small amount, and also in a gap at contact parts between the preformed tile bodies 301 and 302 and the upper mold 432 in a thickness of the preformed tile body. FIG. 29 shows the state of each material on the lower mold 431.

**[0126]** In an angle tile body forming step S554, the reversed V-shaped upper mold 432 corresponding to the shape of the lower mold 431 was pressed against the materials on the lower mold 431 at a pressure of  $300\text{kg}/\text{cm}^2$ . Thus, the materials were integrally pressed and the angle tile body was obtained. The angle tile body was taken out by pulling up the upper mold 432 and pushed up the lower mold 431 up to a take-up level.

**[0127]** As mentioned above, the trimmed parts 304 approximately 20mm wide were provided on both ends of the angle tile body or unnecessary parts for finished tiles. These trimmed parts 304 were removed by cutting by a cutter along cutting lines shown in FIG. 29. Since the angle tile body is a pressed body molded by a sufficient pressing force, it has enough strength to bear any works by hand to a sufficient degree, unless it is intended to destroy it.

**[0128]** In a burning step S555, the angle tile bodies obtained in the step S554 were arranged in a chamotte sagger at appropriate intervals therebetween. They were burned four hours at a temperature of  $1200^\circ\text{C}$  and sintered.

**[0129]** Thus, the angle tile 260 was obtained. As shown in FIG. 23(a), this tile 260 has the main plate 261 100mm wide, 100mm long and 10mm thick and the bent plate 262 100mm long, 50mm wide and 10mm thick at opposite sides of the rectangular corner 263. The main plate 261 is diagonally divided into two pairs of triangles one pair of which has the light blue spotted pattern on

the white background and the other pair of which has light gray spotted pattern on the black background. The bent plate 262 has the light blue spotted pattern on the white background which is the same as the pattern of the adjacent part of the main plate 261.

[0130] As mentioned above, this embodiment of the angle tile 260 is made by: disposing the plate shaped preformed tile bodies 301 and 302 having the spotted pattern respectively on the opposite slopes of the lower mold 431 of V-section; disposing the joining bar 303 of the same material as the preformed tile body 301, 302 between the facing end surfaces of the preformed tile bodies 301 and 302 along the edge of the lower mold 431; and pressing them between the lower mold 431 and the upper mold 432 into one body, and then burning them.

[0131] According to the present embodiment, since the plate shaped preformed tile bodies 301 and 302 are given colored patterns on their surfaces beforehand, such patterns appear on the surface of the angle tile as they are, so that it is possible to obtain the above mentioned patterns that would be difficult to provide in conventional molds for angle tiles. Moreover, since the preformed tile bodies 301, 302 are joined by the joining bar 303 of the same material into the angle molded body without any joint line, so that the finished tile has a good appearance and sufficient corner strength.

[0132] The manufacturing method of the angle tile comprises: the preformed tile body forming step S551 for forming the plate shaped preformed tile bodies 301, 302 having the colored spotted pattern on their surfaces; the joining bar forming step S552 for forming the joining bar 303 of the same material as the preformed tile body 301, 302; the preformed tile body and joining bar disposing step S553 for disposing the preformed tile bodies 301, 302 respectively on the opposite slopes of the lower mold 431 of V-section and the joining bar 303 between the end surfaces of the preformed tile bodies 301, 302 along the edge of the lower mold 431; the angle tile body forming step S554 for pressing the preformed tile bodies 301, 302 and the joining bar 303 between the lower mold 431 and the upper mold 432 to form the angle tile body as one body; and the burning step S555 for burning the angle tile body.

[0133] According to this embodiment, the angle tile having the colored spotted pattern can be obtained by the simple steps from the step S551 to the step S555.

#### [Fifth EMBODIMENT]

[0134] The fifth embodiment of the invention will be described referring to FIGs. 30 to 32(b), taking the angle tile 270 of FIG. 23(b) as an example.

[0135] In FIG. 23(b), the angle tile 270 has the main plate 271 and the bent plate 272 at both sides of the rectangular corner 273. The main plate 271 has a pattern composed of a pair of semicircles, one of which is yellow and the other of which is green, and the other parts

which is white. The bent plate 272 has a pattern of the same white color as the adjacent part of the main plate 271.

[0136] This angle tile 270 was manufactured as follows.

[0137] FIG. 31 shows a preformed tile body 311 formed in a preformed tile body forming steps S561. FIG. 32 shows an aluminium frame 435 of the press die 430 of the angle tile pressing machine used in the angle tile body forming step S554. The frame 435 defines guide walls in filling joining granules at the edge of the lower mold 431 of V-section. A pair of trimming metal fittings 436, 437 are disposed at such positions as trimmed parts are to be provided on each end of the preformed tile bodies 311, 312 which are placed on the slopes of the lower mold 431. The fittings 436 is situated against the outside end of the preformed main plate body 311. The other fittings 437 is situated against the outside end of the preformed bent plate body 312.

[0138] First, in the preformed tile body forming step S561, three kinds of colored crashed mix raw materials were prepared from the same uncolored crashed mix raw material as the fourth embodiment: first colored materials obtained by adding 5% yellow pigment (titan yellow) to the uncolored material; second colored material obtained by adding 5% green pigment (chromium oxide) to the uncolored material; and the uncolored crashed mix raw material as it is though it is called a colored crashed mix raw material herein for convenience sake. Each of them was added with water and granulated into particles of about 70 $\mu$ m diameter, thereby preparing three kinds of colored granules or yellow, green and uncolored (white) granules.

[0139] Then, in the preformed tile body forming step S561, two partition plates (not shown) were disposed in the forming space 412 of the lower mold 411 of the plate tile press machine 410. Each partition plate is semicircular and has a diameter equal to a length of a side of the forming space 412. Thus, the partition plates divided the forming space 412 into three spaces (two semicircular spaces and the rest). The yellow granules and the green granules were filled respectively in the two semicircular spaces and the white granules were filled in the rest of the space. Then, the partition walls were removed and the colored granules were pressed by the plate tile press machine 410 to form the preformed main tile body 311. On the other hand, using another plate tile press machine which was substantially the same construction as the press machine 410 but different in size and had a lower die and a forming space, the preformed bent plate body 312 was prepared. For convenience sake, the press die and its elements are given the same reference numerals as those of the press die 410. Namely, the white granules were filled in all the forming space 412 and pressed similarly to the above thereby forming the preformed bent plate body 312. FIG. 31 shows the preformed tile body 311 molded as above. Here, the size of the forming space

412 for the preformed main plate body 311 was 308mm wide, 308mm long and 25mm deep. The size of the forming space 412 for the preformed bent plate body 312 was 308mm long, 35mm wide and 25mm deep. The pressure was 200kg/cm<sup>2</sup>.

[0140] In the fourth embodiment, the trimmed part 304 is formed at the end of each preformed tile body 301, 302, and the forming space 412 includes a space for such trimmed part. However, in this embodiment, as mentioned below, the trimming metal fittings 436, 437 of substantially a similar shape to the trimmed part 304 is placed in molding the angle tile body. Thus, the forming space 412 in this embodiment includes no space for such trimmed part.

[0141] Next, in a joining granule forming step S562, joining granules were prepared by adding 1% CMC to the white granules, which were used in forming the preformed tile body 311, 312.

[0142] Then, in a preformed tile body and joining granule disposing step S563, each preformed tile body 311, 312 and the joining granules were disposed on the lower mold 431 of V-section. Specifically, the aluminium frame 435 (305mm long, 50mm high and 30mm wide) for guiding the joining granules as packed material was disposed in the lower mold 431 so that its opening was contacted with the edged area of the lower mold 431. Thereafter, the joining granules were put into the frame 435. Then, as shown in FIG. 32(a), the preformed main plate body 311 and the preformed bent plate body 312 were disposed in the lower mold 431 so that they were contacted to the frame 435. Then, the frame 435 was removed, and simultaneously, each preformed tile body 311, 312 was pushed toward the edge of the lower mold 431 (in a direction of arrow of FIG. 32(b)) along the slope thereof, thereby making the preformed tile bodies 311, 312 nearer. Next, the trimming metal fittings 436, 437 were placed so as to touch the ends of the preformed tile bodies 311, 312 in such positions as the trimmed parts were placed. FIG. 32(b) shows a state obtained by the above operation. At this time, as shown in FIG. 32(b), the joining granules were densely packed in a bar shaped space of 25mm square section which was defined by the end surfaces of the two preformed tile bodies 311, 312. Moreover, the rest of the joining granules buried an inside part defined by touching edges of the two preformed tile bodies 311, 312.

[0143] Then, in an angle tile body forming step S564, the upper mold of reversed V-section corresponding to the section of the lower mold 431 is pressed against the lower mold 431 at a pressure of 400kg/cm<sup>2</sup>, thereby obtaining an angle tile body without any cutting works needed. Since the thickness of the trimming metal fittings 436, 437 as an alternate of the trimmed part is set into 80% that of each preformed tile body 311, 312, they never hinders the pressing work of the angle tile body into one body.

[0144] Thereafter, in a burning step S565, as in the twelfth embodiment, the angle tile body was burned to

obtain the angle tile 270. The angle tile 270 has the main plate 271 300mm wide, 300mm long and 20mm thick and the bent plate 272 300mm long, 50mm wide and 20mm thick at opposite sides of the rectangular corner 273 shown in FIG. 23(b). The main plate 271 has a pattern composed of a pair of symmetrically arranged semicircles, one of which is yellow and the other of which is green, and the rest part which is white. The bent plate 272 has a pattern of white color which is the same as the adjacent part of the main plate 271.

[0145] As mentioned above, this embodiment of the angle tile 270 is made by: disposing the plate like preformed tile bodies 311, 312 having colored patterns thereon on both the slopes of the lower mold 431 of V-section; disposing the joining granules of the same material between the end surfaces of the preformed tile bodies 311, 312 along the lowermost corner of the lower mold 431; and pressing them between the upper mold 432 and the lower mold 431 into one body, and burning it.

[0146] According to this embodiment, as in the fourth embodiment, it is possible to provide an angle tile which has a colored pattern and a good appearance.

[0147] The manufacturing method of the angle tile in this embodiment comprises: the preformed tile body forming step S561 for forming the plate shaped preformed tile bodies 311, 312 having the colored patterns thereon; the joining granules forming step S562 for forming the joining granules which are the same material as those of the preformed tile body 311, 312; the preformed tile body and joining granule disposing step S563 for disposing the preformed tile bodies 311, 312 on both the slopes of the lower mold 431 and the joining granules between the end surfaces of the preformed tile bodies 311, 312 along the corner of the lower mold 431; the angle tile body forming step S564 for pressing the preformed tile bodies 311, 312 and the joining granules between the upper mold 432 and the lower mold 431 to form the angle tile body; and the burning step S565 for burning the angle tile body.

[0148] According to this embodiment, it is possible to provide an angle tile having a colored pattern with simple steps. Moreover, in this embodiment, since the trimming metal fittings are used, there is no need to provide the trimmed part on the preformed tile body.

#### [Sixth EMBODIMENT]

[0149] The sixth embodiment of the invention will be described referring to FIG. 33, taking the angle tile 290 of FIG. 23(c) as an example.

[0150] In FIG. 23(c), the angle tile 290 has the main plate 291 and the bent plate 292 at both sides of the rectangular corner 293. The main plate 291 has the same pattern as that of the angle tile 260 of FIG. 23(a). The bent tile 292 has a pattern similar to that of the main plate 291 (a pattern obtained by cutting the pattern of the preformed main plate body 301 in half). The pat-

terns on the main plate 291 and the bent plate 292 are continuously provided.

[0151] This angle tile 290 was manufactured as below according to steps similar to those of the fifth embodiment.

[0152] First, in a preformed tile body forming step S561, a preformed main plate body 301 was made by use of the plate tile press machine 410 used in the fourth embodiment. A preformed bent tile body 332 was made by use of a partition plate (not shown) so that the pattern became a pattern obtained by cutting the pattern of the preformed main plate body 301 in half. The thickness of the preformed tile bodies 301, 332 was 10mm.

[0153] In a joining granule forming step S562, joining granules were prepared by adding 1% CMC to the black granules used in forming the preformed tile body 301, 332.

[0154] Next, in a preformed tile body and joining granule disposing step S563, the preformed tile bodies 301, 332 and the joining granules were disposed on the lower mold 431 of V-section, as in the thirteenth embodiment. However, in this embodiment, the black granules were filled by use of the aluminium frame 435 103mm long, 20mm high and 10mm wide. Moreover, the black granules were disposed as a lining material over the preformed tile bodies 301, 332 in a uniform thickness of 6mm.

[0155] Then, in an angle tile body forming step S564, as shown in FIG. 33, the materials on the lower mold 431 were pressed by the upper mold 432 to form an angle tile body. The thickness of the angle tile body was 13mm.

[0156] Thereafter, via similar steps to those of the fifth embodiment, the angle tile 290 was obtained as shown in FIG. 23(c). The angle tile 290 has the main plate 291 and the bent plate 292 of the same dimension as those of the fourth embodiment. The main plate 291 has the same pattern as that of the main plate 261 of the fourth embodiment. The bent plate 292 has the pattern similar to that of the main plate 291 (the pattern cutting the pattern of the main plate 291 in half). The patterns of the main plate 291 and the bent plate 292 are continuously provided.

[0157] As mentioned above, the present embodiment of the tile 290 is made by: disposing the preformed tile bodies 301, 332 having the colored pattern respectively on the opposite slopes of the lower mold 431 of V-section; disposing the joining granules of the same material between the end surfaces of these preformed tile bodies 301, 332 along the corner of the lower mold 431; and pressing them by the upper mold 432 into one body and burning it.

[0158] The manufacturing method of the present embodiment of the tile comprises: the preformed tile body forming step S561 for forming the plate shaped preformed tile bodies 301, 332 having the colored pattern thereon; the joining granules forming step S562 for

forming the joining granules of the same material as that of the preformed tile body 301, 332; the preformed tile body and joining granule disposing step S563 for disposing the preformed tile bodies 301, 332 on the opposite slopes of the lower mold 431 of V-section and the joining granules between the end surfaces of the preformed tile bodies along the edge of the lower mold 431; the angle tile body forming step S564 for pressing the preformed tile bodies 301, 332 and the joining granules between the lower mold 431 and the upper mold 432 into one body thereby obtaining the angle tile body; the burning step S565 for burning the angle tile body.

[0159] Accordingly, it is possible to provide an angle tile having a colored pattern and a good appearance as in the fourth embodiment. It is also possible to provide an angle tile reinforced by lining, since the granules are used as a lining material.

#### [SEVENTH EMBODIMENT]

[0160] The angle tile 260 of FIG. 23(a) may be manufactured as follows. Such modification will be described referring to FIG. 34.

[0161] This angle tile 260 was manufactured as below according to the steps of the fifth embodiment.

[0162] First, in the preformed tile body forming step S561, only a preformed main plate body 301 was formed as in the fourth embodiment.

[0163] Then, in the joining granule forming step S562, joining granules were prepared by adding 1% CMC to the mixture of the white granules and the blue granules which were used in manufacturing the preformed main plate body 301.

[0164] Next, in the preformed tile body and joining granule disposing step S563, the preformed tile body 301 was disposed on one slope of the lower mold 431 of V-section. On the other hand, the joining granules were disposed and filled on the other slope of the lower mold 431 as well as the corner of the lower mold 431, as shown in FIG. 34. This filled layer of the joining granules had a thickness twice that of the preformed main plate body 301. Particularly, the joining granules were filled over the corner of the lower mold 431 up to a maximum thickness of 10mm.

[0165] Then, in the angle tile body forming step S564, the upper mold 432 of reversed V-section corresponding to the section of the lower mold 431 was pressed against the lower mold 431 to form an angle tile body. Trimmed parts 304 were cut off as in the fourth embodiment.

[0166] The burning step S565 was carried out under the same condition as the fourth embodiment, thereby obtaining the angle tile 260 shown in FIG. 23(a) as in the fourth embodiment.

[0167] As mentioned above, this modification of the angle tile is made by: disposing the plate shaped preformed tile body 301 having the colored pattern on the one slope of the lower mold 431 and the joining gran-



ules of the same material as that of the preformed tile body 301 on the other slope and the corner of the lower mold 431; and pressing them by the upper mold 432 into one body and burning it.

[0168] The manufacturing method of this modification comprises: the preformed tile body forming step S561 for forming the plate shaped preformed tile body 301 having the colored pattern; the joining granule forming step S562 for forming the joining granules of the same material as that of the preformed tile body 301; the preformed tile body and joining granule disposing step S563 for disposing the preformed tile body 301 on one slope of the lower mold 431 of V-section and the joining granules on the other slope and the corner of the lower mold 431; the angle tile body forming step S564 for pressing the preformed tile body 301 and the joining granules between the lower mold 431 and the upper mold 432 into one body, thereby forming the angle tile body; and the burning step S565 for burning the angle tile body.

[0169] According to this modification, the same advantages can be obtained, too, as in the fourth embodiment.

[0170] In the above embodiments, the disposing works of the materials in the preformed tile body and joining bar disposing step S553 and the preformed tile body and joining granule disposing step S563 may be carried out as follows.

[0171] FIGs. 35(a) and 35(b) respectively show the case in which a joining bar is used. Specifically, FIG. 35(a) shows the case in which lining powders were disposed over a contact portion or border line of two preformed tile bodies 340 and the joining bar 343. FIG. 35(b) shows the case in which lining powders were disposed in a uniform thickness over all the two preformed tile bodies 340. Such angle tile has a corner made stronger.

[0172] FIGs. 35(c), 35(d) and 35(e) respectively show the case in which joining granules are used. Specifically, FIG. 35(c) shows the case in which the joining granules were disposed as a lining material over the facing ends of the two preformed tile bodies 340, in addition to being filled therebetween. FIGs. 35(d) and 35(e) respectively show the case in which an inside end of a preformed tile body 340 is slanted so as to facilitate filling the joining granules between end surfaces of the preformed tile bodies 340. More in detail, FIG. 35(d) shows the case in which the joining granules were filled as a lining material over the facing inside end surfaces thereof. FIG. 35(e) shows the case in which the joining granules were filled over all the preformed tile bodies 340 as a liner.

[0173] FIG. 35(f) shows the case in which the preformed tile body 340 was disposed on one slope of the lower mold 431 and the lining powders were disposed on the other slope and the corner of the lower mold 431, over the preformed tile body 340 and the joined part of the preformed tile body 340 and the lining powders.

[0174] In the fourth to seventh embodiments, the pre-

formed tile body may be any other forms so long as it is plate shaped. The pattern on its surface may be desirously changed, and if desired, it may be a plain pattern of one color. This preformed tile body may be formed by pressing a powder material or a clay body, for example, as in generally known tiles. In this case, it is preferable to set a pressure in pressing into a relatively low value. Thereby, the preformed tile body is further compressed when finally being pressed into an angle shape, so as to be strongly joined to the joining bar or granules. However, it is not preferable to mold it at an excessively low pressure, since the obtained colored pattern change in pressing it into the angle shape. Generally, it is preferable to set the pressure in forming the preformed tile body into one half to two thirds of a pressure in making finally the angle tile body. The pressure in pressing it into the angle shape is equal to a pressure for pressing common tiles or angle tiles. Preferably, the preformed tile body is formed into a width a little smaller than that of the lower mold so as to facilitate its disposing on the lower mold.

[0175] The joining bar and the joining granules are joined integrally with the preformed tile body to define the corner of the angle tile, so that they may be made of any material inasmuch as it has the same quality as that of the preformed tile body. "The same quality" means that the material is substantially the same in terms of composition so that there arise no remarkable differences in sintering temperature or the like. Preferably, the joining bar or granules have the same composition, including the component of the pigment, as that of the preformed tile body so that the colored pattern of the angle tile is made continuous including the corner. It is preferable to add an adhesive to these joining bar or granules so as to improve a joining property at the time of pressure forming with the preformed tile body as well as to prevent cracks at the time of burning. A cellulose ether like CMC or a synthetic resin or the like may be used.

[0176] The joining bar of such material may be formed by any desired method like extruding of a clay body or pressure forming of powders or the like. It is preferable to make its density approximately the same as that of the preformed tile body in view of uniformity of the angle tile when it is finished. Therefore, it is most preferable to form it by a method and under a condition similar to those of the preformed tile body. The joining bar needs to have such a section as to be filled as close as possible between the end surfaces of the preformed tile bodies on the slopes of the lower mold.

[0177] A normal powder material may be used as it is for the joining granules. However, it is advantageous to use a material in the form of pelletized granules. These granules can be made by adding water to a powder material, mixing and crushing it by a trommel or the like into a slip, and then pelletizing it into granules of a predetermined moisture content by a spray drier or the like. Since the granules are nonsticky and smooth, it

improves workability. Moreover, the granules can flow easily to be filled over all between the end surfaces of the preformed tile bodies which are disposed on the opposite surfaces of the lower mold. In case the preformed tile body is made by pressure forming of a powder material, the joining granules may be the same as the powder material. The joining granules can be auxil-

**[0178]** While the preformed tile body and the joining bar or granules are disposed on the lower mold of the press die which defines a pressure forming space of angle shape, the lower mold may be a V-section or a reversed V-section. In case the lower mold is a reversed V-section, it is not preferable to use the joining granules. In case of providing an angle tile of relatively large size, the lower mold is preferably a V-section. A lining powder material may be further disposed on these materials on the lower mold. This provides an angle tile reinforced by the liner.

**[0179]** While, the angle tile and its manufacturing method of the fourth to seventh embodiments were described, mainly taking as an example the angle tile composed of short and long tiles joined integrally by the rectangular corner, other modifications are possible. For example, The tiles joined by the corner may have the same length or other desired lengths. The corner may have a desired angle other than the right angle or may be curved.

**[0180]** The device used in the fourth to seventh embodiments is not limited to the above described one. Any type of device which has been already used in a ceramic industry or the like may be chosen for the use. Or some change to the conventional device is possible.

#### [EIGHT EMBODIMENT]

**[0181]** An eight embodiment of the invention will be described referring to FIGs. 36 to 41. A tile of this embodiment is also applicable to stepped parts of stairs or roads.

**[0182]** In FIG. 36, An angle tile 601 has a pair of plate tiles 602a, 602b and a corner 603 joining them at right angle. This tile 601 is used at the stepped part while putting the long plate tile 602a horizontally and the short plate tile 602b vertically. The corner 603 has a surface that is gently curved. The plate tiles 602a, 602b and the corner 603 have their surfaces uniformly colored as a whole. In this embodiment, the angle tile 601 has a spotted pattern of a light tone that green granules are scattered on a white background in a spotted manner.

**[0183]** In this embodiment of the angle tile 601, a colored pattern 604 for distinguishing the corner is provided on the surface of each plate tile 602a, 602b. As shown in FIG. 71, a long strip of colored pattern extends in a width direction of the tile near the corner 603, in the plate tile 602a. Short strips of colored pattern extend at

right angle to the corner 603 and are disposed in parallel in the width direction of the tile, in the plate tile 602b. These patterns are colored into dark brown. These colored patterns 604 go through the tile in its thickness direction, so that they are never faded nor vanished if the tile is abraded.

**[0184]** In case of tiling the stepped parts of the stairs or the roads using the angle tiles 601, the colored patterns 604 are arranged along a corner of the stepped part, thereby defining a marking for distinguishing the corner from a flat part in terms of color difference. Thus, such colored patterns 604 attract attention of walkers, so that the walkers can be kept away from danger such as stumbling or the like when they go up and down the stepped parts like stairs, thereby improving safety in such going up and down.

**[0185]** This embodiment of the angle tile 601 is manufactured by a similar manufacturing method to that of the fourth embodiment, in accordance with the process shown in FIG. 24.

#### [PREFORMED TILE BODY FORMING STEP]

**[0186]** In this embodiment, a preformed tile body is pressingly formed by use of a pressure forming machine 610 shown in FIG. 37 and a partition plate 620 shown in FIG. 38. The pressure forming machine 610 is composed of a pressure forming die 611, a vertically movable lower mold 612, a vertically movable upper mold 613 and a fixed frame 614.

**[0187]** The partition plate 620 is composed of a square outer frame 621, a partition wall 622 disposed inside thereof and joints 623 joining the partition wall 622 to the outer frame 621. The outer frame 621 is made into such a shape as to be fitted in the pressure forming die 611 without clearance. The joint 623 is made by a plate. A lower end of the joint 623 does not reach a lower end of the outer frame 621 and the partition wall 622. This partition wall 622 may be modified in various forms according to a desired pattern. Depending on a form of the pattern, at least one of the outer frame 621 and the partition wall 622 may be omitted, and the partition plate 620 may be composed of the partition wall 622 and the outer frame 621 or the joints 623. The partition plate 620 may be composed of only the partition wall 622.

**[0188]** The partition plate 620 may be formed by molding a synthetic resin, for example.

**[0189]** Such partition plate 620 was disposed in the pressure forming die 611. As shown in FIG. 37, colored granules 615a, 615b of different colors were filled respectively in forming spaces up to substantially the same height. In this filling, a proper hopper was used, since openings of the partition plate 620 were small.

**[0190]** The colored granules as a tile forming material were prepared as follows. Namely, three kinds of crushed mix raw materials were prepared: a first material obtained by adding 5% white pigment (zircon) to a

base crushed mix raw material consisting of 50% feldspar, 20% china clay and 30% kaolin; a second material obtained by adding 2% green pigment (chromium oxide) to the base crushed mix raw material; a third material obtained by adding 2% dark brown pigment (red oxide) to the base material. These materials were mixed further with 0.5% CMC and water, and mixed in a trommel into a slip. This slip was fed to a spray drier to be granulated and dried. Thus, there were provided white, green and dark brown granules which had an average grain diameter of 500 $\mu$ m and a moisture content of about 6%. Similarly, uncolored granules were prepared which had no pigments.

[0191] A mixture of 70% white granules and 30% green granules were used for the colored granules 615a which formed a whole surface of the tile. The dark brown granules were used for the colored granules 615b filled into the partition wall 622.

[0192] Thereafter, the partition wall was raised and removed out of the pressure forming die 611. Then, the colored granules 615a, 615b were gently pressed to make their surface flat. The uncolored granules were further filled as a lining material over the colored granules.

[0193] The granules in the pressure forming die 611 were pressed and molded into one body between the lower mold 612 and the upper mold 613 at a pressure of 200kg/cm<sup>2</sup>. Next, a preformed tile body which was obtained by this pressure forming was taken out by pulling up the upper mold 613 and pushing up the lower mold 612 up to a take-up level.

[0194] Thus obtained plate shaped preformed tile body 606 is composed of a surface layer 606a made of the mixture of colored granules 615a, a colored pattern 606b made of the colored granules 615b and a lining layer 606c made of the uncolored granules, as shown in FIG. 39(a).

[0195] A short preformed tile body 606 was fabricated by use of the same material as the preformed tile body 606 of FIG. 39(a) and a similar method thereto.

[0196] The preformed tile body 606 of FIG. 39(b) has a length of one half of the length of the one 606 of FIG. 39(a), and forms the short plate tile 602b of the tile 601 of FIG. 36. A partition plate 620 used in making the short preformed tile body 606 has three partition walls 622 corresponding to the colored patterns 606b. While the short preformed tile body 606 was fabricated by a pressure forming die of a dimension corresponding to a dimension thereof, the pressure forming die 611 for making the long preformed tile body 606 can be used as it is. In this case, the short preformed tile body 606 is obtained by cutting the long preformed tile body 606 in half.

#### [JOINING BAR FORMING STEP]

[0197] A joining bar 607 was fabricated by use of the mixture of colored granules consisting of 70% white

granules and 30% green granules which were used for making the surface layer 606a of the preformed tile body 606.

[0198] As shown in FIG. 40, the joining bar 607 has such a section as a bottom of an isosceles right triangle is formed into an arc. This section is substantially equal to a section of a space that is defined between end surfaces of a pair of preformed tile bodies when they are disposed respectively on opposite slopes of a lower mold of an angle tile press die described later. A length of the joining bar 607 is substantially equal to a width of the preformed tile body 606.

[0199] The joining bar 607 was pressed and formed at a pressure of about 100kg/cm<sup>2</sup> by use of a pressure forming die of a shape corresponding thereto. This pressure is lower than a pressure in pressing the preformed tile body, so that the joining bar 607 has relatively a little larger dimension.

#### [PREFORMED TILE BODY AND JOINING BAR DISPOSING STEP]

[0200] The short and long pair of preformed tile bodies 606 and the joining bar 607 were disposed on the lower mold of the angle tile press die.

[0201] As shown in FIG. 41, an angle tile press die 630 is composed of a lower mold 631 of reversed V-section and an upper mold 632 of V-section.

[0202] The short and long preformed tile bodies 606 were disposed respectively on opposite slopes of the lower mold 631 while having the colored patterns 606b faced upside and placed near a peak of the lower mold 631. The joining bar 607 was disposed between the preformed tile bodies 606 along the peak of the lower mold 631. Trimming metal fittings 640 define a forming space over the lower mold 631 correspondingly to a shape of an angle tile to be fabricated.

[0203] In this step, if there is made a gap or clearance between the joining bar 607 and the preformed tile bodies 606, granules used for forming the joining bar 607 are preferably filled in such a gap.

#### [ANGLE TILE BODY FORMING STEP]

[0204] The preformed tile bodies 606 and the joining bar 607 were pressed into one body between the lower mold 631 and the upper mold 632 to form an angle tile body. A pressure in this pressing is approximately the same level as the pressing of common tiles or angle tiles, but made higher than pressures in pressing the preformed tile body and the joining bar. In this pressing, the preformed tile bodies 606 and the joining bar 607 were further compressed to be joined integrally. In this embodiment, the pressure forming was carried out at a pressure of 400kg/cm<sup>2</sup> to make the angle tile body as one body without any joint line.

## [BURNING STEP]

[0205] The angle tile bodies were put in a chamotte sagger with a distance therebetween, and burned and sintered in a shuttle kiln under a condition of a burning temperature of 1250°C and a burning time of 30 hours, thereby making angle tiles as finished products.

[0206] Thus, the angle tile 601 shown in FIG. 36 was obtained.

[0207] While, in this embodiment, the joining bar 607 is the same color as the surface layer 606a of the preformed tile body 606, it may be a different color so as to define a colored pattern at the corner of the angle tile for distinguishing it. While, in this embodiment, the surface layer 606a of the preformed tile body 606 has only the spotted pattern, a variety of patterns may be provided on the surface of the tile by use of a plurality of colors of granules and a partition plate according to a color arrangement.

## [NINTH EMBODIMENT]

[0208] A ninth embodiment of the invention will be described referring to FIGs. 42 to 46.

[0209] As shown in FIG. 42, an angle tile 701 of this embodiment is composed of a long and short pair of plate tiles 702a, 702b and a corner 703 joining them at right angle, as in the seventeenth embodiment of the angle tile 601. Colored patterns 704 for distinguishing the corner are provided respectively on the plate tiles 702a, 702b. The colored pattern 704 of the long plate tile 702a has a relatively large width and is formed successively from one end to the other end in the width direction of the tile. These plate tiles 702a, 702b and the corner 703 have their surfaces colored uniformly and provided with a spotted pattern of light whitish gray tone that light black granules are scattered to make spots on a white background. On the other hand, the colored pattern 704 is a spotted one of a similar color tone to the above color tone, but is made a spotted pattern of relatively dark tone that the light black granules are mixed in larger amount on a white background, thereby being distinguishable by a difference of lightness of the colors.

[0210] In this embodiment, a protruded area 708 is further formed on the colored pattern 704 of the long plate tile 702a in order to prevent slip. In the illustrated example, the protruded area 708 has a plurality of ribs each of which continuously extends in the width direction of the tile and which have a cross section of a saw shape as a whole. The corner 703 has a curved shape which is bulged out of the surface of the plate tiles 702a, 702b. This bulged corner 703 is provided with a plurality of grooves 709a for drainage along a curved surface thereof. These grooves 709a are continuous respectively with grooves 709b which are formed on the ribs of the protruded area 708.

[0211] Since the present embodiment of the angle tile 701 has the protruded area 708 for preventing slippage,

it is possible to assure more safety in going up and down stepped parts. Moreover, shade by the protruded area 708 makes the colored pattern 704 more conspicuous, thereby facilitating the corner distinguishing effects of the colored pattern 704. Since the corner 703 is curved and bulged from the surface of the tile plates 702a, 702b, it enlarges the corner strength of the angle tile. Moreover, the bulged curved shape of the corner 703 itself can give distinguishing effects of the corner. Since the grooves 709a for drainage are formed on the bulged corner 703, they drain water on the plate tile 702a in cooperation with the grooves 709b of the plate tile 702a. These grooves 709a, 709b also enlarge the distinguishing effects of the corner due to their concavo-convex shapes.

[0212] Next, a manufacturing method of the angle tile in the ninth embodiment of the invention will be described according to the process shown in FIG. 30. It is basically the same as the manufacturing steps of the eighth embodiment, except the joining bar is substituted by joining granules.

## [PREFORMED TILE BODY FORMING STEP]

[0213] A preformed tile body was prepared by pressingly forming colored granules as a tile material, as in the preformed tile body forming step of the eighth embodiment.

[0214] FIG. 43 shows a pressure forming machine 710 used in the pressing work. The pressure forming machine 710 is composed of a pressure forming die 711, a vertically movable lower mold 712, a vertically movable upper mold 713 and a fixed frame 714.

[0215] This pressure forming machine 710 is different from the pressure forming machine 610 of FIG. 37 in that a concavo-convex mold surface 715 is provided on an upper surface of the lower mold 712 or a bottom surface of the pressure forming die 711. The concavo-convex mold surface 715 serves to form ribs for preventing slippage on a tile surface. In this embodiment, the mold surface 715 has three lines of crests extending from one lateral end to the other lateral end of the pressure forming die 711. The mold surface 715 is arranged near one longitudinal end of the pressure forming die 711. The mold surface 715 is further provided with projections (not shown) at bottoms between the crests in order to form grooves for drainage. The mold surface 715 is structured in an exchangeable manner on a main body of the lower mold 712.

[0216] A partition plate 720 shown in FIG. 44 was used in filling the colored granules as a tile material into the pressure forming die 711, as in the eighth embodiment. The partition plate 720 is composed of an outer frame 721 and two partition walls 722, and divided into three spaces by the two partition walls 722. The space defined between the two partition walls 722 has its width and position determined so as to accommodate the concavo-convex mold surface 715 therein.

[0217] The partition plate 720 was disposed in the pressure forming die 711. Then, colored granules 705a were filled into the two outside spaces each defined between the outer frame 722 and the partition walls 722, as shown in FIG. 43. Colored granules 705b were filled in the center space defined between the two partition walls 722. The two kinds of colored granules 705a, 705b were filled up to substantially the same height. Next, the partition plate 720 was taken up and removed out of the pressure forming die 711. Thereafter, the colored granules 705a, 705b were gently pressed so as to make their surfaces even. Then, lining granules were further filled over them.

[0218] The colored granules 705a, 705b were prepared as follows, in the same manner as those of the eighth embodiment. Namely, a base crushed mix raw material consisting of 50% feldspar, 20% china clay and 30% kaolin was added with 5% white pigment (zircon) as a coloring pigment. They were further added with 0.5% CMC and water and mixed in a trommel into a slip. This slip was put into a spray drier and granulated and dried. Thus, white granules of an average particle diameter of about 400 $\mu$ m were prepared. Similarly, 2% black pigment (chromite) was mixed in the above base material to prepare light black granules of an average particle diameter of about 700 $\mu$ m. Moreover, lining granules were prepared with no pigments added into an average particle diameter of about 500 $\mu$ m. Each kind of the granules has a moisture content of about 6%.

[0219] The colored granules 705a were composed of 80% white granules and 20% light black granules. The colored granules 705b were composed of 60% white granules and 40% light black granules.

[0220] The colored granules 705a, 705b and the lining granules were pressed and molded into one body in the pressure forming die at a pressure of 200kg/cm<sup>2</sup> between the lower mold 712 and the upper mold 713, as in the seventeenth embodiment.

[0221] Thus obtained preformed tile body 706 has a surface layer 706a made of the mixed colored granules 705a, a colored part 706b made of the colored granules 705b and a lining layer 706c made of the lining granules, as shown in FIG. 45. The colored part 706b has a protruded area 706d for preventing slippage formed by the mold surface 715 of the pressure forming die 711. The colored part 706b is further provided with grooves 706e for drainage.

[0222] On the other hand, there was prepared a short preformed tile body constituting the short plate tile 702b in the angle tile 701 of FIG. 42. Here, the short preformed tile body has a structure corresponding to that of the long one 706 of FIG. 45, so the same reference numerals as the long preformed tile body 706 will be attached to the corresponding parts for convenience sake (see FIG. 46). The short preformed tile body was fabricated in the same manner as that of the preformed tile body 606 of FIG. 23(b). Still, a surface layer 706a was made of mixed colored granules of 80% white gran-

ules and 20% light black granules, and colored parts 706b were made of mixed colored granules of 60% white granules and 40% light black granules.

#### [JOINING GRANULE FORMING STEP]

[0223] The mixed colored granules of 80% white granules and 20% light black granules which were used in fabricating the preformed tile body 706 and the surface layer 706a were used for joining granules as they were.

#### [PREFORMED TILE BODY AND JOINING GRANULE DISPOSING STEP]

[0224] The long and short preformed tile bodies 706 and the joining granules were disposed on a lower mold of an angle tile press die.

[0225] In FIG. 46, an angle tile press die 730 is composed of a lower mold 731 of V-section and an upper mold 732 of reversed V-section.

[0226] The lower mold 731 has a mold surface 733 that is the same shape as that of the concavo-convex mold surface 715 of the pressure forming die 711. This concavo-convex mold surface 733 has ribs which correspond to the slip preventing protruded area 706d of the long preformed tile body 706. Thus, it prevents the protruded area 706d from deforming at the time of pressing step. Compressed deformation of the preformed tile body 706 is not very large in pressing, so that such a concavo-convex mold surface 733 is not always necessary depending on a shape of the protruded area 706d. While, in this embodiment, the mold surface 733 is integrally formed on a surface of the lower mold 731, it may be in such a form as to pack dents of the protruded pattern 706 and define a flat surface.

[0227] A lowermost edge part or a bottom 734 of the lower mold 731 has a cross section that is curved and bulged downward. Protrusions 735 are provided along a curved surface of the bottom 734 so as to form the grooves 709a for drainage. Though not shown in FIG. 46, one of the slopes of the lower mold 731 has protrusions formed continuously with the protrusions 735. These protrusions (not shown) have a shape corresponding to that of the draining grooves 706e of the long preformed tile body 706 and fitted therein. These protrusions (not shown) are provided principally for preventing the joining granules from intruding into the draining grooves 706e. Therefore, these protrusions need not be formed over all the full length of the groove 706e.

[0228] As shown in FIG. 46, a pair of long and short preformed tile bodies 706 were disposed on the opposite surfaces of the lower mold 731 while their colored surface situated downward. Then, the joining granules were filled between the end surfaces of the preformed tile bodies 706 along the bottom 734 of the lower mold 731.

[0229] In this filling the joining granules, the short preformed tile body 706 was moved upward a little along

the slope of the lower mold 731 while the end metal fittings 640 was removed. Then, the joining granules were thrown into between the preformed tile bodies 706 through a hopper or a similar frame. Thereafter, the short preformed tile body 706 was pushed downward along the slope of the lower mold 731. The joining granules were disposed in an excessive amount over the bottom 734 of the lower mold 731, taking compression in pressing into account.

#### [ANGLE TILE BODY FORMING STEP, BURNING STEP]

[0230] An angle tile body forming step and a burning step are just the same as the eighth embodiment.

[0231] Thus, the angle tile 701 shown in FIG. 42 was obtained. The angle tile 701 has the colored pattern 704 formed up to a sufficient depth in the thickness direction thereof and made into one body with the other part thereof. Accordingly, if the tile is abraded strongly, the colored pattern 704 is never vanished nor peeled off.

[0232] In this embodiment, the colored granules for the surface layer 706a of the preformed tile body 706 are used for the joining granules as they are so that the same color is given to the area from the corner to the plate tiles of the tile. However, the joining granules may be a different color tone from that of the colored granules, so that a corner distinguishing colored pattern is provided on the corner of the tile. While, in this embodiment, the surface layer 706a of the preformed tile body 706 is given a simple spotted pattern, plural colors of granules and an appropriate partition plate may be used so that various patterns are formed on the tile surface.

[0233] This embodiment provides an angle tile having a thick corner distinguishing colored pattern, that is difficult to obtain in conventional angle tile press dies, and slip preventing protrusions.

[0234] While, in this embodiment, the slip preventing protruded area 708 is formed into a section of a saw, it may have any other shapes. Some modifications will be shown in FIGs. 47(a) to 47(c). FIG. 47(a) illustrates a slip preventing protruded area 801 which has rectangular protrusions provided in two rows, while each row being arranged along a width direction of a tile. The protrusions of one row are positioned diagonally to those of the other row. FIG. 47(b) illustrates a slip preventing protruded area 802 which has circular protrusions provided in two rows, while each row being arranged along a width direction of a tile. The protrusions of one row are diagonally disposed to those of the other row. FIG. 47(c) shows a slip preventing protruded pattern 803 which has grooves of V-section provided laterally and longitudinally of a tile, thereby forming concaves and convexes.

#### Claims

1. A manufacturing method of a tile having a pattern,

comprising the steps of pressing and forming molding materials into one body, and burning the body, comprising:

a molding material disposing step for disposing a plurality of molding materials (186, 193, 239a, 239b, 253, 615a, 615b, 705a, 705b) of different colors as the materials into an inside space (95, 96, 412) of a pressure forming die (91, 187, 240, 611, 711) while dividing them from each other in a planar direction of the inside space;

a pressure forming step as the pressing and forming step for pressing and forming integrally the molding materials into a molded body as the body in the inside space; and

a burning step as the burning step for burning the molded body, wherein

the molding materials are composed of different colors of colored granules;

the molding material disposing step is a colored granule filling step for filling the plural colored granules in a divided manner in the inside space (95, 96); and

further comprising, before the colored granule filling step, a partition means disposing step for disposing a partition means (84, 132) in the inside space to divide the inside space into a plurality of forming spaces (95, 96), each color of the colored granules being filled in each of the forming spaces;

characterized in that

the colored granules are prepared by drying and granulating a raw material in a fixed diameter of 0.29 - 0.84 mm so that the colored granules wholly fill each one of the forming spaces while being prevented from intruding into an adjacent forming space by the partition means.

2. A method according to claim 1, characterized in that the burning step is performed for 4 to 30 hours at a temperature of 1250° C.

3. A method according to claim 1, characterized in that

the molding material disposing step comprises a further filling step of lining granules over the colored granules in the inside space.

4. A method according to claim 3, characterized in that the partition means is a partition plate (84) that is taken out from the pressure forming die (91) in a partition plate removing step before the lining granule filling step.

5. A method according to claim 3, characterized in that the partition means is a parti-

tion wall (132) molded of a clay body having a predetermined moisture content in a partition wall forming step before the colored granule filling step and the partition wall is pressed and formed integrally with the colored granules and the lining granules in the pressure forming step to make the molded body.

6. A method according to claim 3, characterized by further comprising,

between the colored granule filling step and the pressure forming step, the lining granule filling step for filling lining granule over the colored granules and the partition wall (132) in the inside space.

7. A method according to claim 1, characterized by further comprising,

between the partition wall forming step and the colored granule filling step, a partition wall sticking step for sticking a sheet material (133) to the partition wall (132), the sheet material being disposed in the inside space together with the partition wall in the partition means disposing step.

8. A tile having a pattern made by a manufacturing method according to claim 1 and consisting of molding materials which are composed of different colors of colored granules characterized in that

the colored granules have a fixed diameter of 0.29 - 0.84 mm.

#### Patentansprüche

1. Herstellverfahren einer mit einem Muster versehenen Fliese, Kachel oder Platte, das die Schritte des Pressens und Formens von Formmaterialien zu einem Körper und des Brennens des Körpers aufweist, mit

einem Formmaterialanordnungsschritt zum Anordnen einer Vielzahl von Formmaterialien (186, 193, 239a, 239b, 253, 615a, 615b, 705a, 705b) unterschiedlicher Farben in einem Innenraum (95, 96, 412) einer Preßformmatrize (91, 187, 240, 611, 711), während die Materialien in einer planaren Richtung des Innenraumes voneinander getrennt werden;

einem Preßformschritt zum Pressen und einstückigen Formen der Formmaterialien zu einem Formkörper im Innenraum; und

einem Brennschritt zum Brennen des Formkörpers, wobei

die Formmaterialien aus farbigen Granulaten unterschiedlicher Farben bestehen;

es sich bei dem Formmaterialanordnungsschritt um einen Farbgranulateinfüllschritt zum Einfüllen der mehreren Farbgranulate in einer voneinander getrennten Weise in den Innenraum (95, 96) handelt; und

das Verfahren des weiteren vor dem Farbgranulateinfüllschritt einen Trenneinrichtungsanordnungsschritt zum Anordnen einer Trenneinrichtung (84, 132) im Innenraum umfaßt, um den Innenraum in eine Vielzahl von Formräumen (95, 96) aufzuteilen, wobei ein Farbgranulat in einen jeweiligen Formraum eingefüllt wird; dadurch gekennzeichnet, daß

die Farbgranulate durch Trocknen und Granulieren eines Rohmaterials auf einen festen Durchmesser von 0,29-0,84 mm hergestellt werden, so daß die Farbgranulate jeden Formraum vollständig ausfüllen, während ein Eindringen in einen benachbarten Formraum über die Trenneinrichtung verhindert wird.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Brennschritt über 4 bis 30 h bei einer Temperatur von 1250 °C durchgeführt wird.

3. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Formmaterialanordnungsschritt einen weiteren Einfüllschritt eines Belaggranulates über die Farbgranulate im Innenraum umfaßt.

4. Verfahren nach Anspruch 3, dadurch gekennzeichnet, daß die Trenneinrichtung eine Trennplatte (84) ist, die in einem Trennplattenentfernungsschritt vor dem Belaggranulateinfüllschritt aus der Preßformmatrize (91) herausgenommen wird.

5. Verfahren nach Anspruch 3, dadurch gekennzeichnet, daß die Trenneinrichtung eine Trennwand (132) ist, die in einem Trennwandformschritt vor dem Farbgranulateinfüllschritt aus einem Tonkörper mit einem vorgegebenen Feuchtigkeitsgehalt geformt wird, und daß die Trennwand im Preßformschritt gepreßt und einstückig mit den Farbgranulaten und dem Belaggranulat geformt wird, um den Formkörper herzustellen.

6. Verfahren nach Anspruch 3, dadurch gekennzeichnet, daß es des weiteren zwischen dem Granulateinfüllschritt und dem Preßformschritt einen

Belaggranulateinfüllschritt zum Einfüllen eines Belaggranulates über die Farbgranulate und die Trennwand (132) im Innenraum umfaßt.

7. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß es des weiteren zwischen dem Trennwandformschritt und dem Farbgranulateinfüllschritt einen Trennwandbefestigungsschritt zum Befestigen eines Lagenmaterials (133) an der Trennwand (132) aufweist, wobei das Lagenmaterial zusammen mit der Trennwand im Trenneinrichtungsanordnungsschritt im Innenraum angeordnet wird. 5 10
8. Mit einem Muster versehene Fliese, hergestellt durch ein Herstellverfahren nach Anspruch 1 und bestehend aus Formmaterialien, die aus Granulaten unterschiedlicher Farben bestehen, dadurch gekennzeichnet, daß die Farbgranulate einen festen Durchmesser von 0,29-0,84 mm besitzen. 15 20

## Revendications

1. Procédé de fabrication d'un carreau ayant un motif, comprenant des étapes de compression et de mise en forme de matériaux de moulage sous forme d'un corps, et de cuisson du corps, le procédé comprenant : 25
- une étape de disposition de matériaux de moulage destinée à disposer plusieurs matériaux de moulage (186, 193, 239a, 239b, 253, 615a, 615b, 705a, 705b) de différentes couleurs comme matériaux dans un espace interne (95, 96, 412) d'un moule de mise en forme sous pression (91, 187, 240, 611, 711) avec séparation des matériaux les uns des autres dans une direction plane de l'espace interne, 30
- une étape de mise en forme sous pression constituant l'étape d'application de pression et de mise en forme afin que les matériaux de moulage soient rendus solidaires sous forme d'un corps moulé constituant le corps placé dans l'espace interne, et 40
- une étape de cuisson, utilisée comme étape de cuisson du corps moulé, dans lequel 45
- les matériaux de moulage sont composés de différentes couleurs de granulés colorés, l'étape de disposition d'un matériau de moulage est une étape de remplissage par des granulés colorés destinés à remplir l'espace interne (95, 96) de plusieurs granulés colorés sous forme divisée, et 50
- le procédé comprenant en outre, avant l'étape de remplissage de granulés colorés, une étape de disposition d'un dispositif de cloisonnement destinée à placer un dispositif de cloisonnement (84, 132) dans l'espace interne afin que 55
- celui-ci soit séparé en plusieurs espaces de mise en forme (95, 96), les granulés colorés de chaque couleur étant chargés dans chacun des espaces de mise en forme, caractérisé en ce que 60
- les granulés colorés sont préparés par séchage et granulation de matières premières avec un diamètre fixe compris entre 0,29 et 0,84 mm, afin que les granulés colorés remplissent entièrement chacun des espaces de mise en forme sans pouvoir pénétrer dans un espace adjacent de mise en forme du fait de la présence du dispositif de cloisonnement.
2. Procédé selon la revendication 1, caractérisé en ce que l'étape de cuisson est réalisée pendant une période de 4 à 30 h à une température de 1 250 °C.
3. Procédé selon la revendication 1, caractérisé en ce que l'étape de disposition des matériaux de moulage comprend une étape supplémentaire de remplissage par des granulés de revêtement disposés sur les granulés colorés placés dans l'espace interne.
4. Procédé selon la revendication 3, caractérisé en ce que le dispositif de cloisonnement est une plaque (84) de cloisonnement qui est extraite du moule (91) de mise en forme sous pression dans une étape d'extraction de la plaque de cloisonnement avant l'étape de remplissage par les granulés de revêtement.
5. Procédé selon la revendication 3, caractérisé en ce que le dispositif de cloisonnement est une paroi (132) de cloisonnement moulée en un corps d'argile ayant une teneur prédéterminée en humidité, dans une étape de mise en forme de paroi de cloisonnement avant l'étape de remplissage par les granulés colorés, et la paroi de cloisonnement est comprimée et mise en forme afin qu'elle soit solidaire des granulés colorés et des granulés de revêtement dans une étape de mise en forme par compression utilisée pour la fabrication du corps moulé.
6. Procédé selon la revendication 3, caractérisé en ce qu'il comprend en outre, entre l'étape de remplissage par les granulés colorés et l'étape de mise en forme par compression, une étape de remplissage par des granulés de revêtement destinée à charger les granulés de revêtement sur les granulés colorés et la paroi de cloisonnement (132) dans l'espace interne.
7. Procédé selon la revendication 1, caractérisé en ce qu'il comporte en outre, entre l'étape de mise en forme de la paroi de cloisonnement et l'étape de



remplissage par les granulés colorés, une étape de collage de la paroi de cloisonnement dans laquelle un matériau en feuille (133) est collé à la paroi de cloisonnement (132), le matériau en feuille étant placé dans l'espace interne avec la paroi de cloisonnement dans l'étape de mise en place du dispositif de cloisonnement.

8. Carreau ayant un motif, fabriqué par un procédé de fabrication selon la revendication 1, constitué de matériaux de moulage qui sont composés de granulés colorés de différentes couleurs, caractérisé en ce que les granulés colorés ont un diamètre fixe compris entre 0,29 et 0,84 mm.

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FIG.1

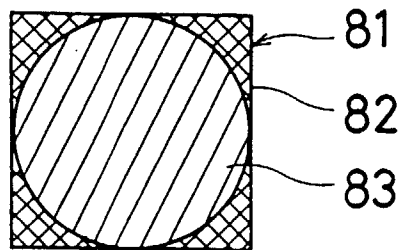


FIG. 2

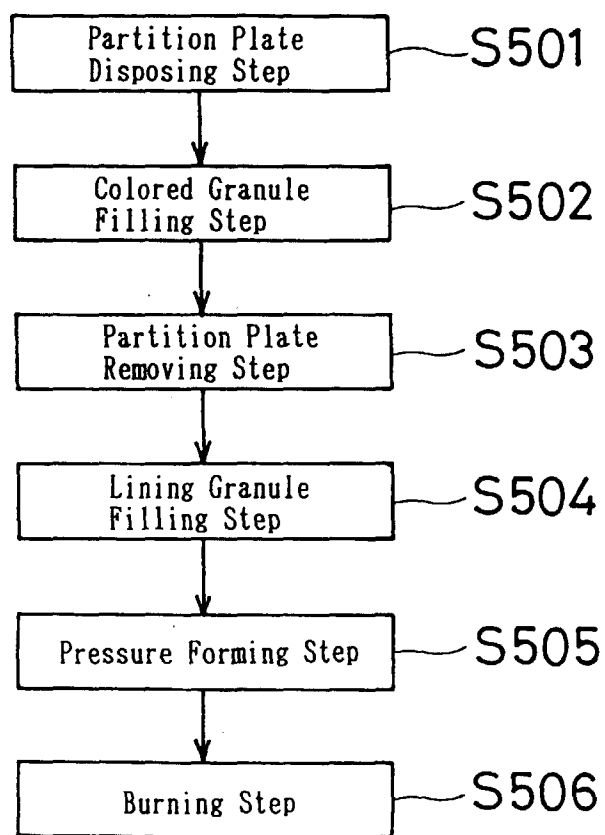


FIG. 3

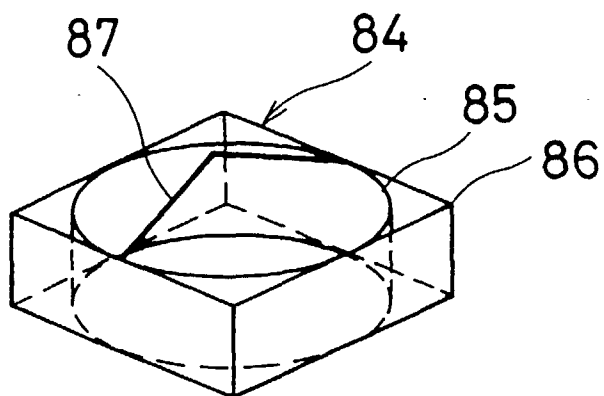


FIG. 4

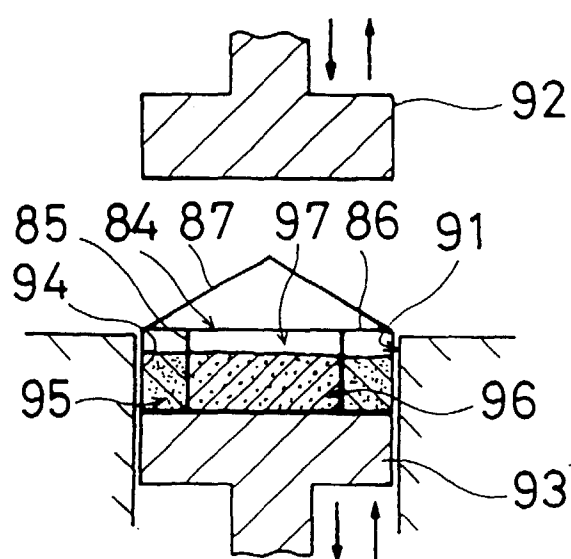


FIG. 5

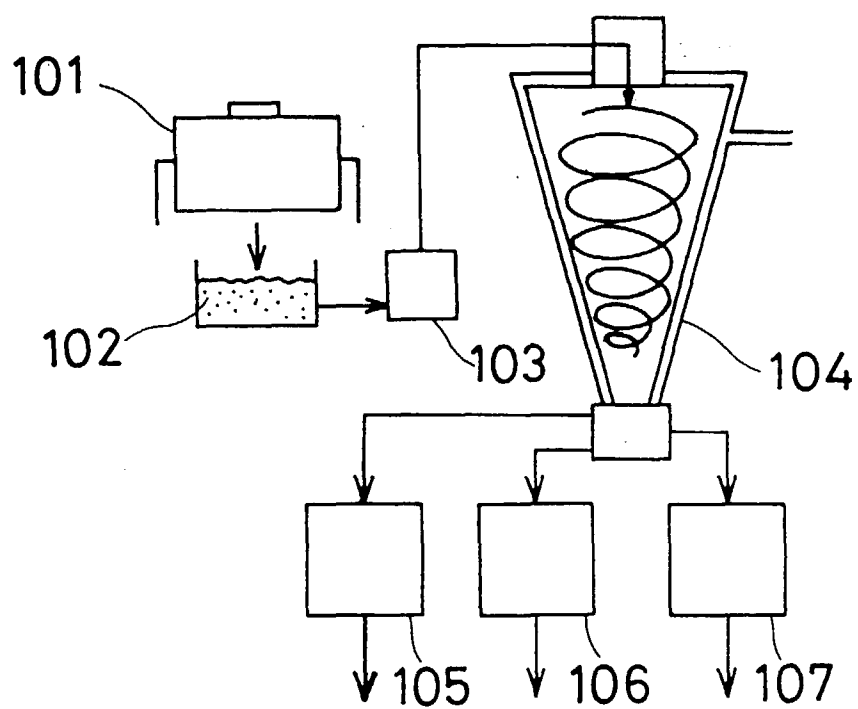


FIG.6

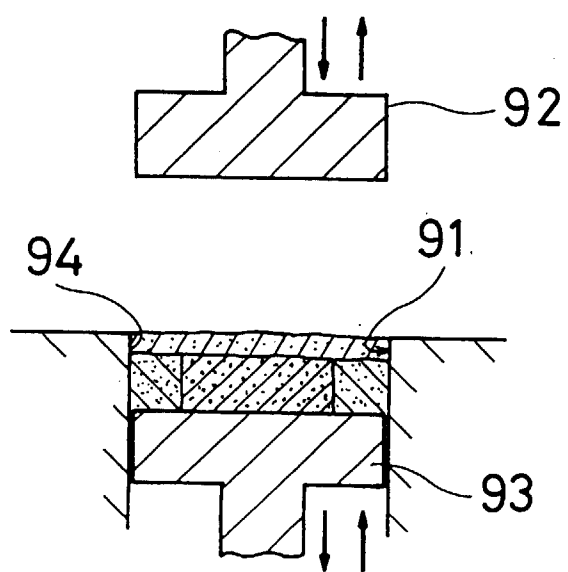


FIG.7a

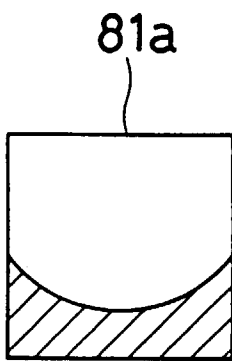


FIG.7b

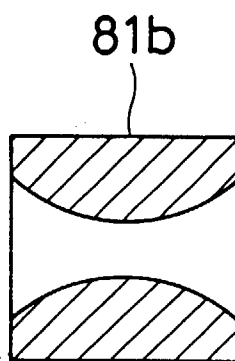


FIG.7c

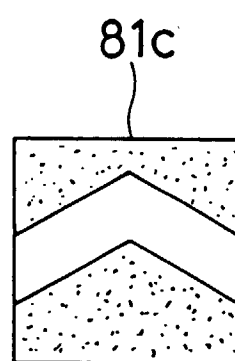


FIG.7d

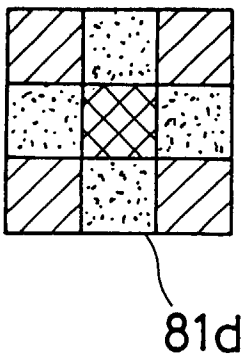


FIG.7e

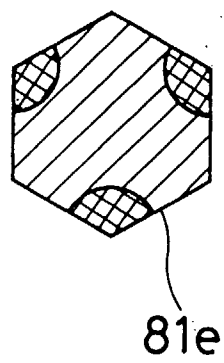


FIG.7f

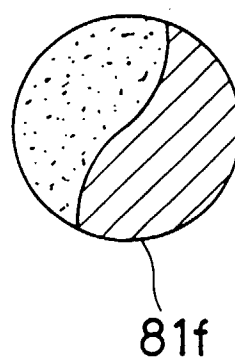


FIG. 8

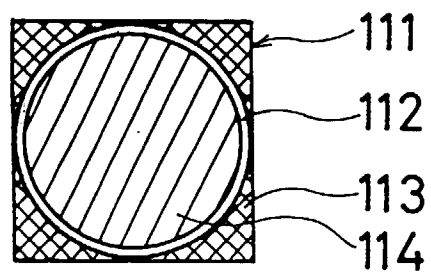




FIG. 9

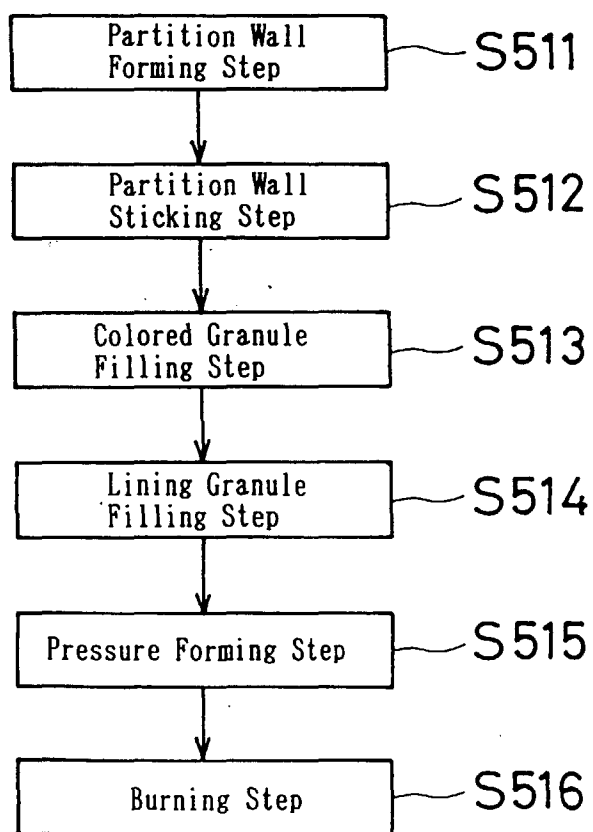


FIG.10

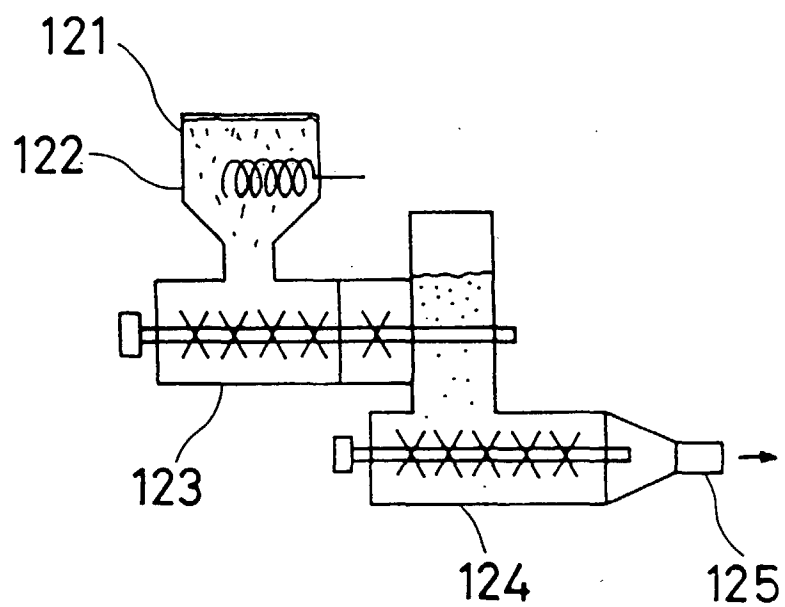


FIG.11

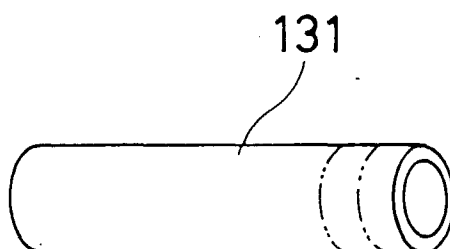


FIG.12

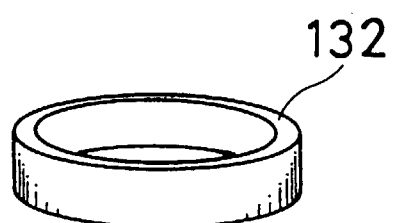


FIG.13

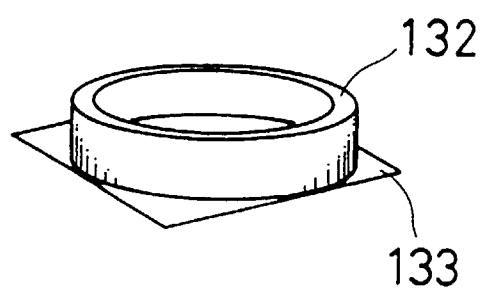


FIG.14

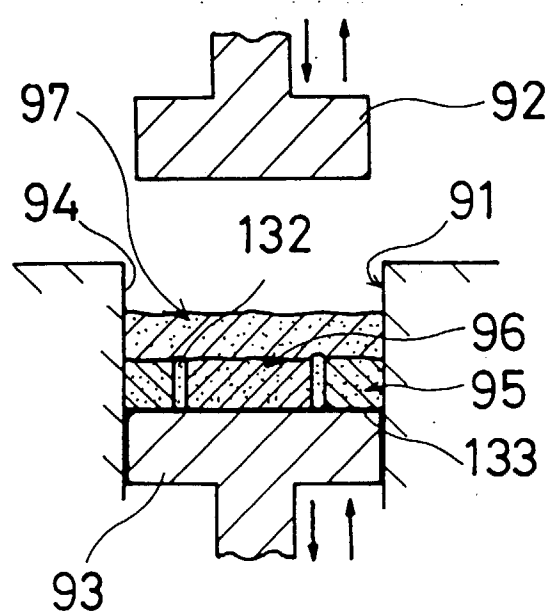


FIG.15

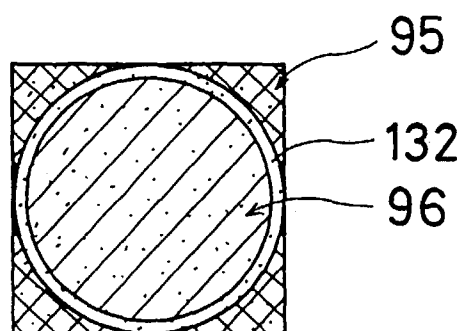


FIG.16

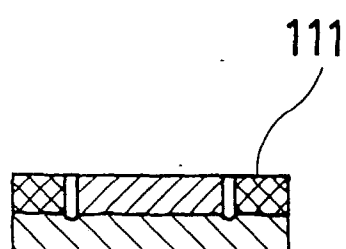


FIG.17a

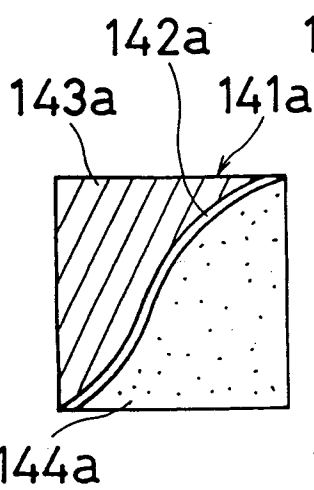


FIG.17b

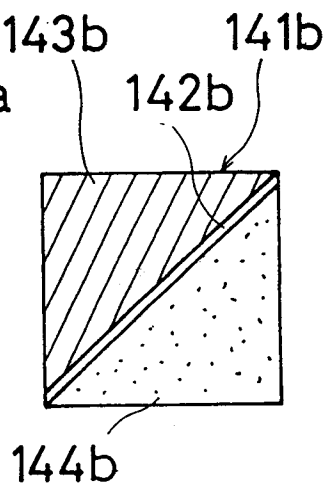


FIG.17c

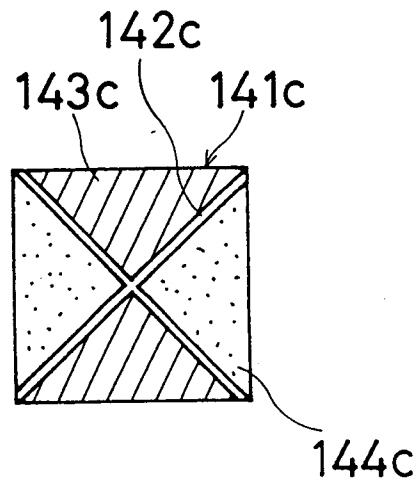


FIG.17d

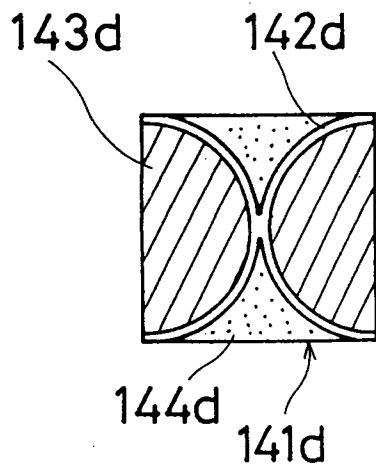


FIG.17e

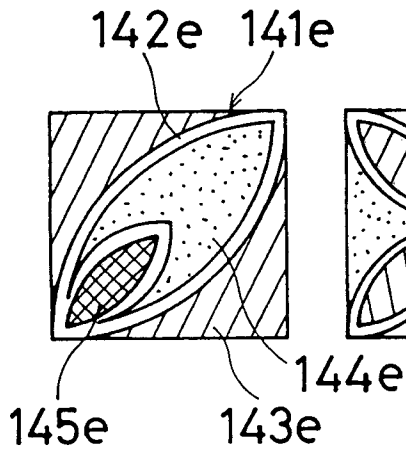


FIG.17f

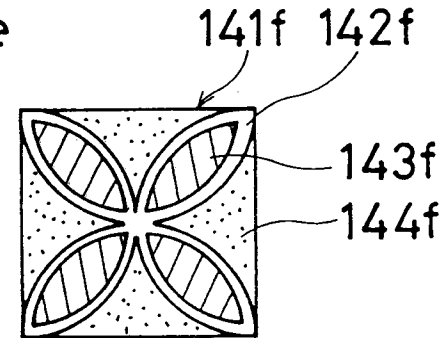


FIG.18

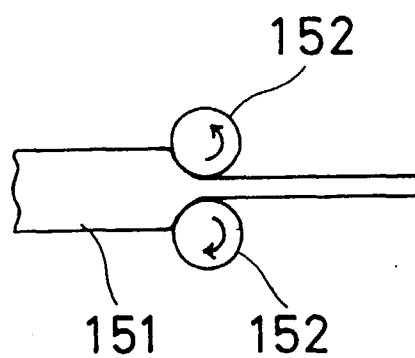
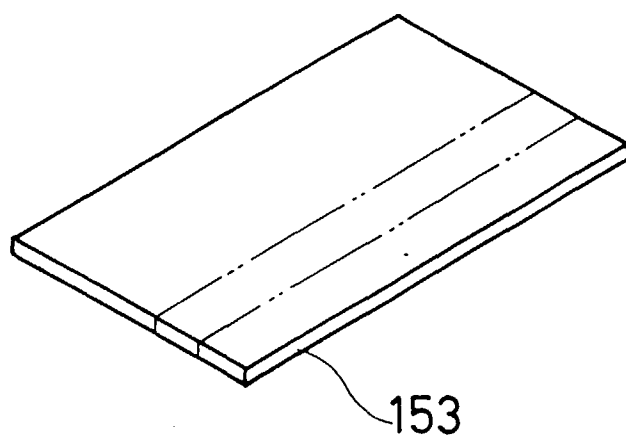


FIG.19



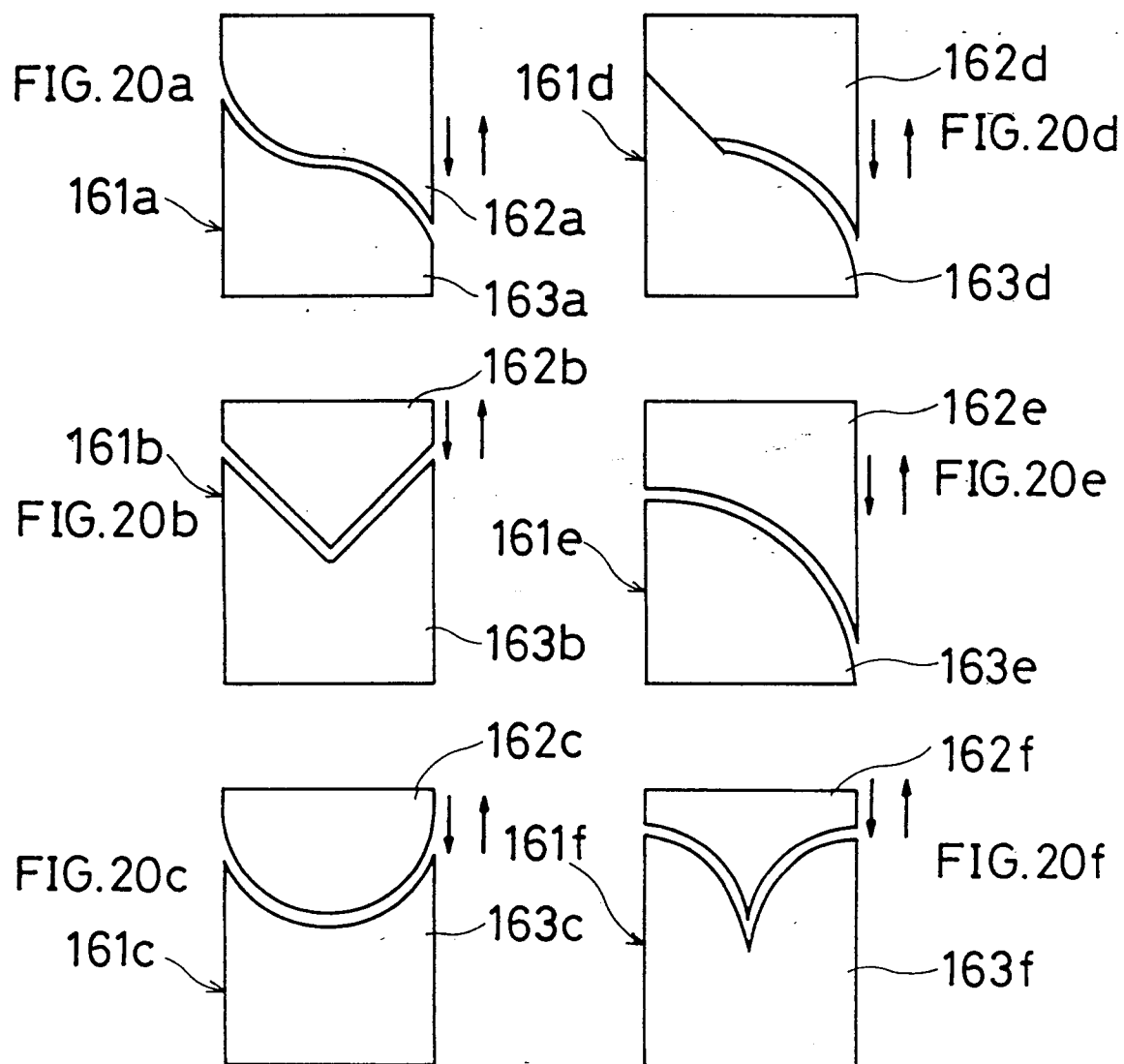




FIG. 21

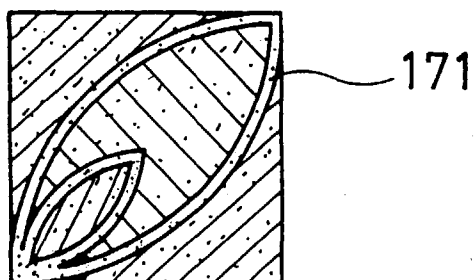


FIG. 22

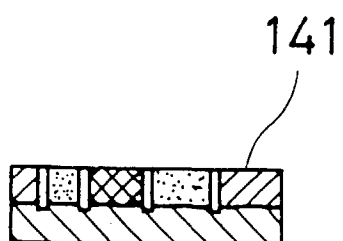


FIG. 23a

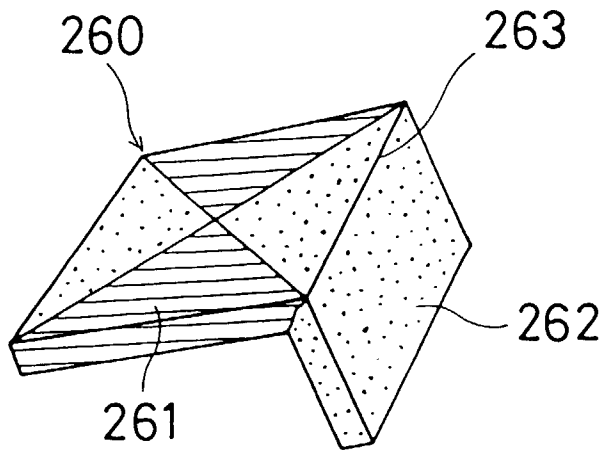


FIG. 23b

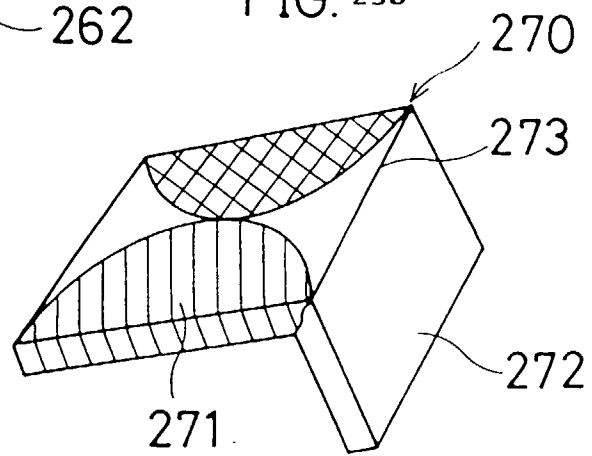


FIG. 23c

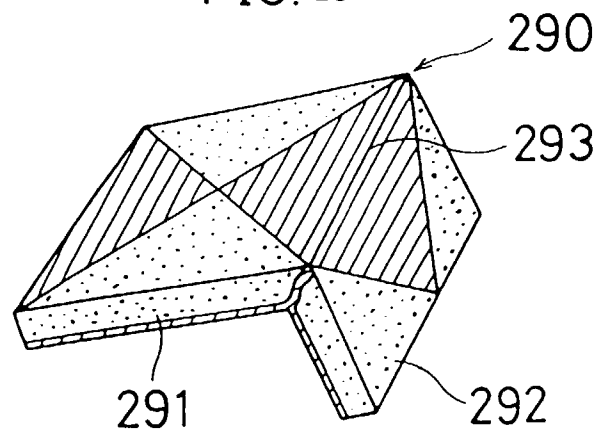


FIG. 24

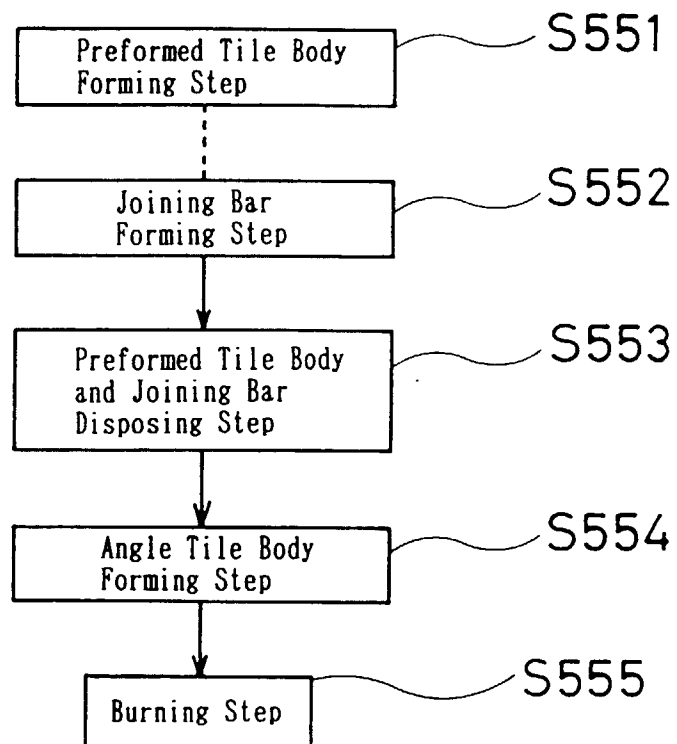


FIG. 25

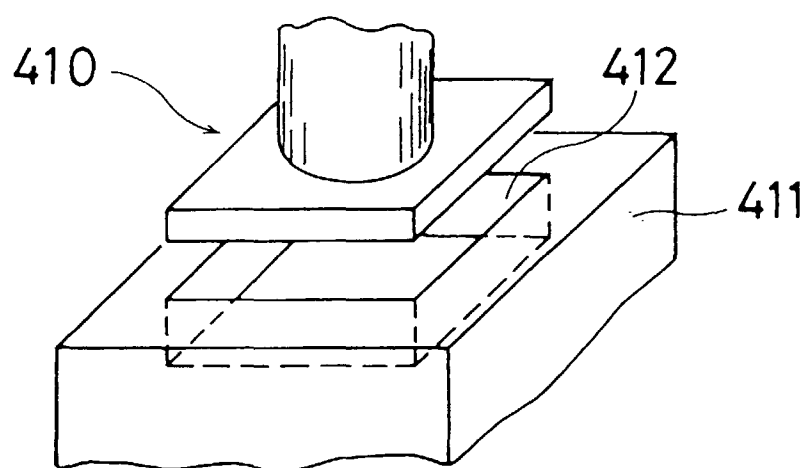


FIG. 26

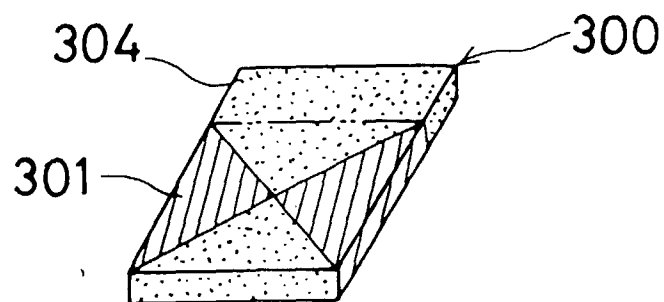


FIG. 27

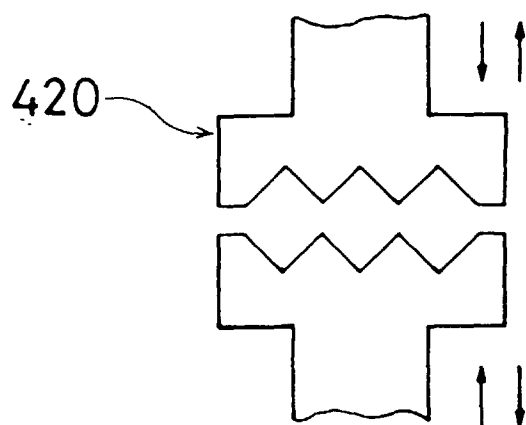


FIG. 28

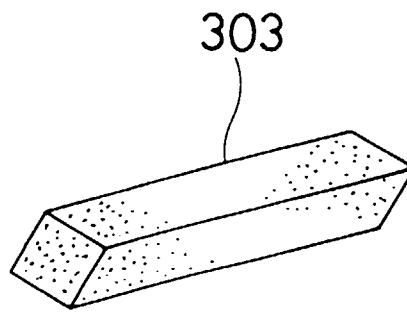


FIG. 29

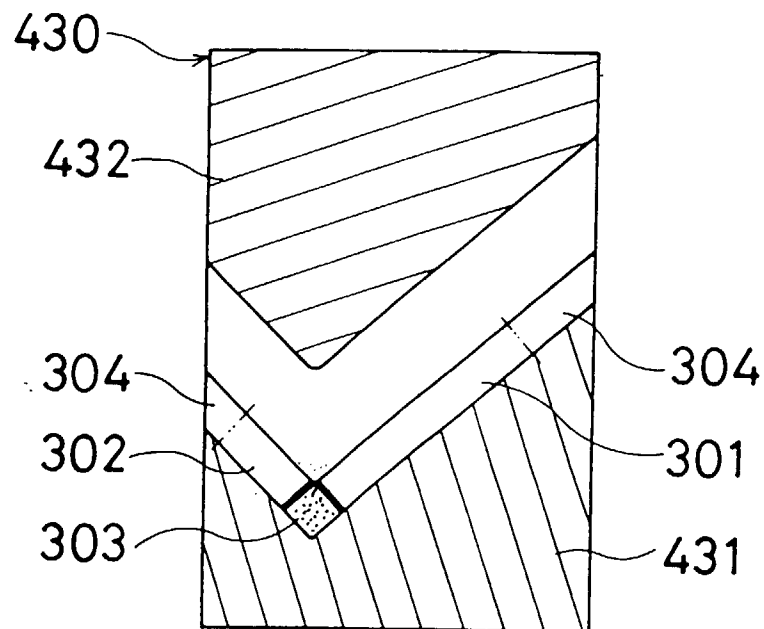


FIG. 30

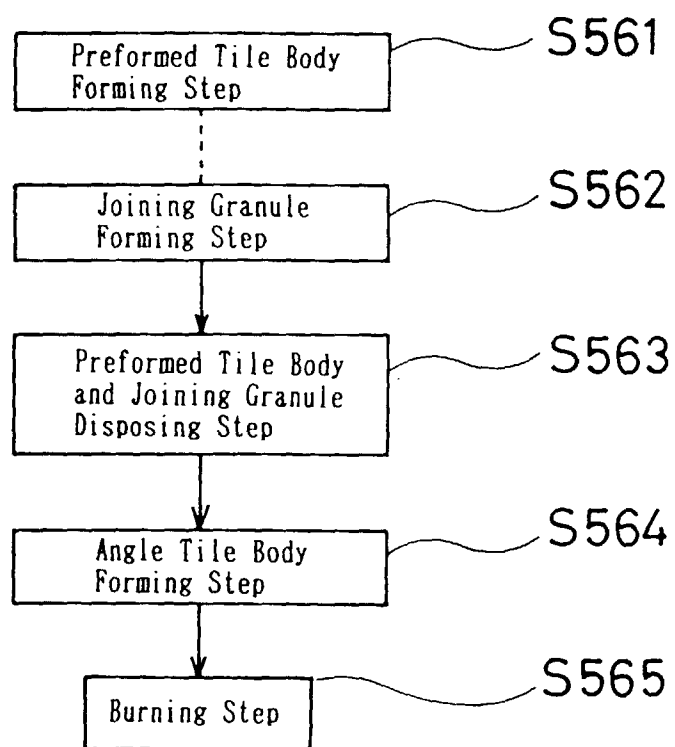


FIG. 31

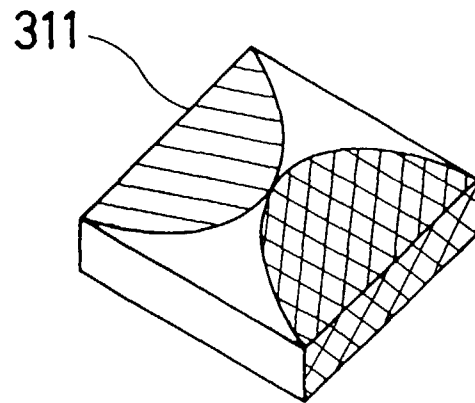


FIG. 32a

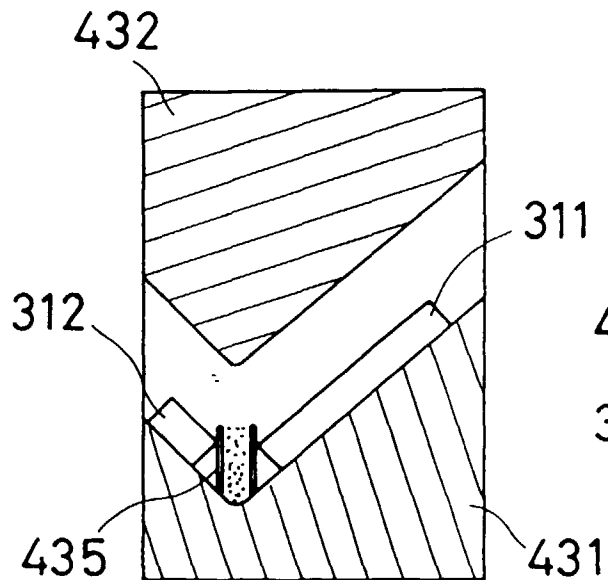


FIG. 32b

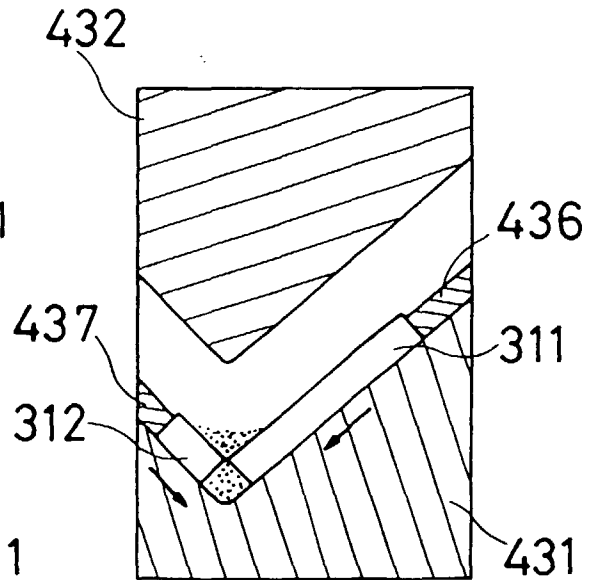




FIG. 33

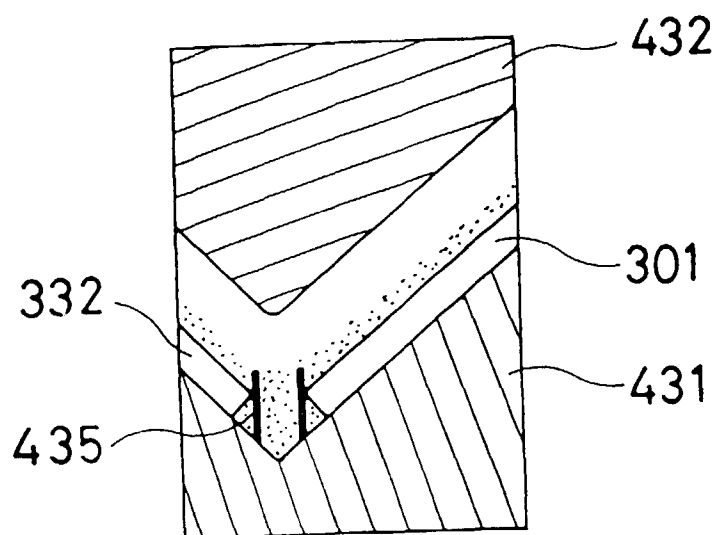


FIG. 34

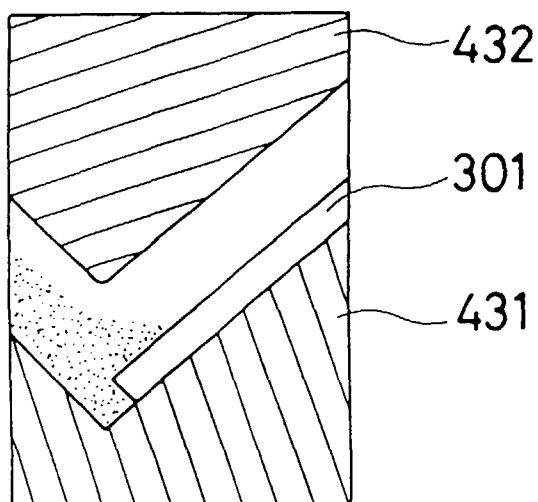


FIG. 35a

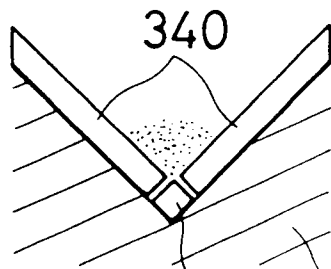


FIG. 35d

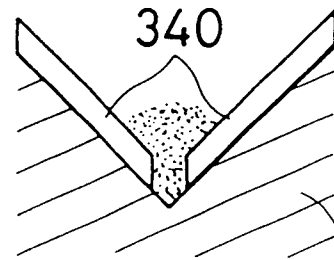


FIG. 35b

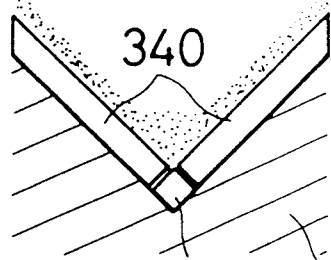


FIG. 35e

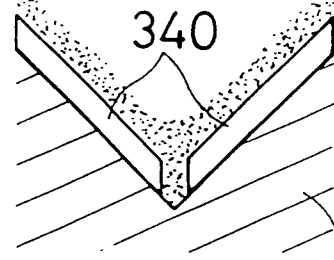


FIG. 35c

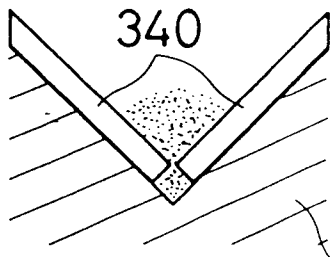


FIG. 35f

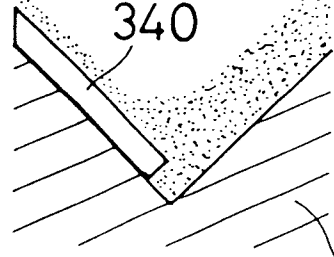


FIG. 36

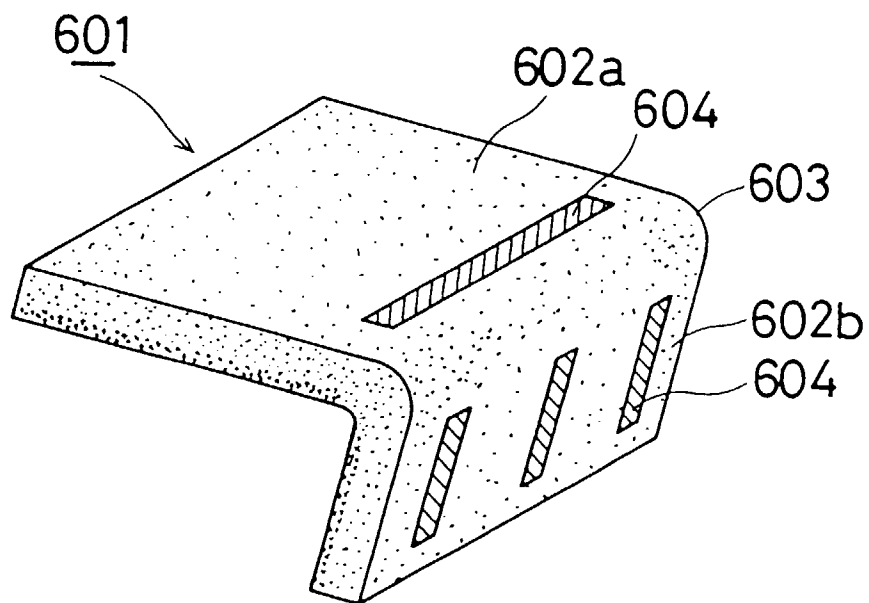


FIG. 37

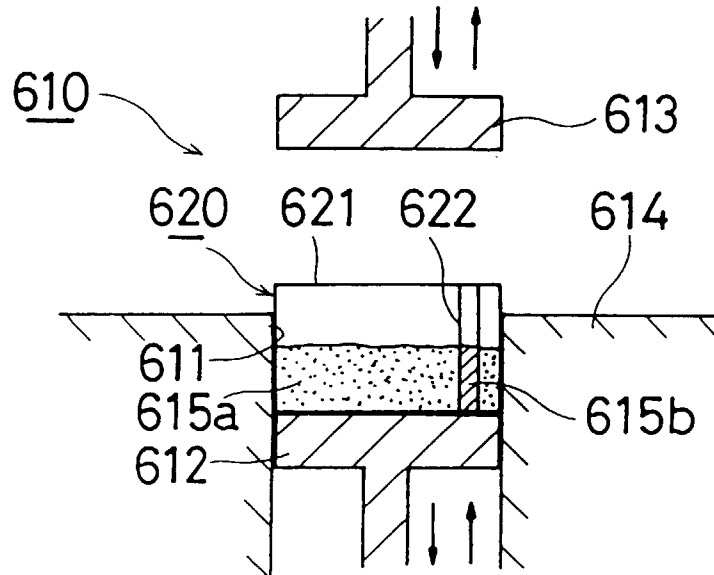


FIG. 38

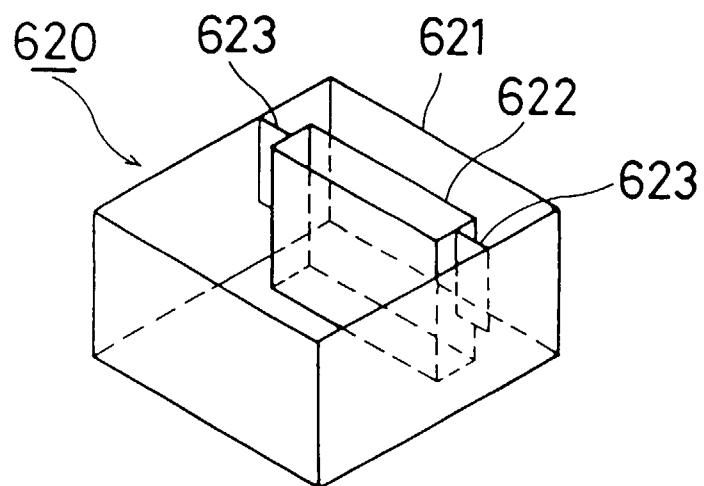


FIG. 39a

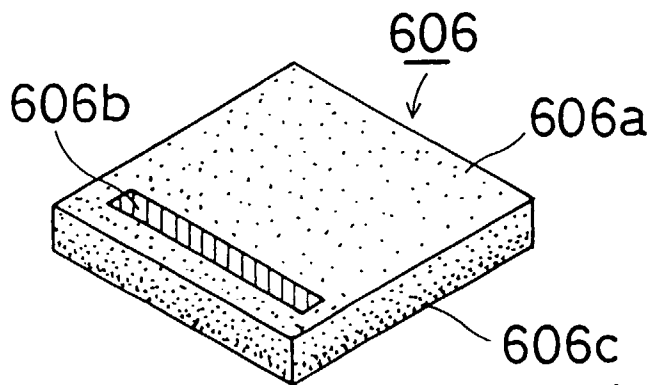


FIG. 39b

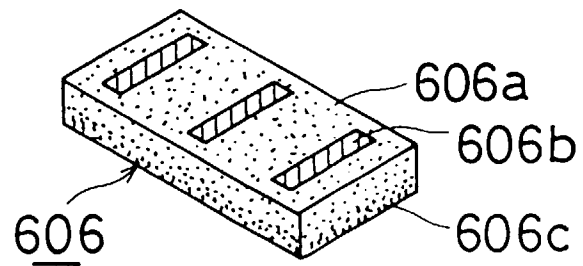


FIG. 40

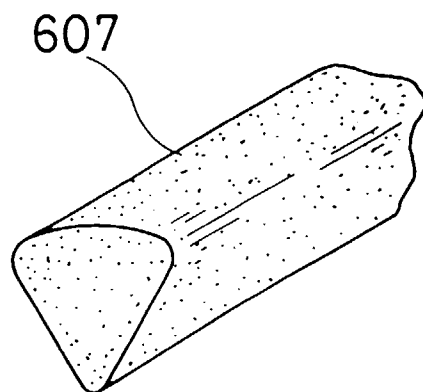


FIG. 41

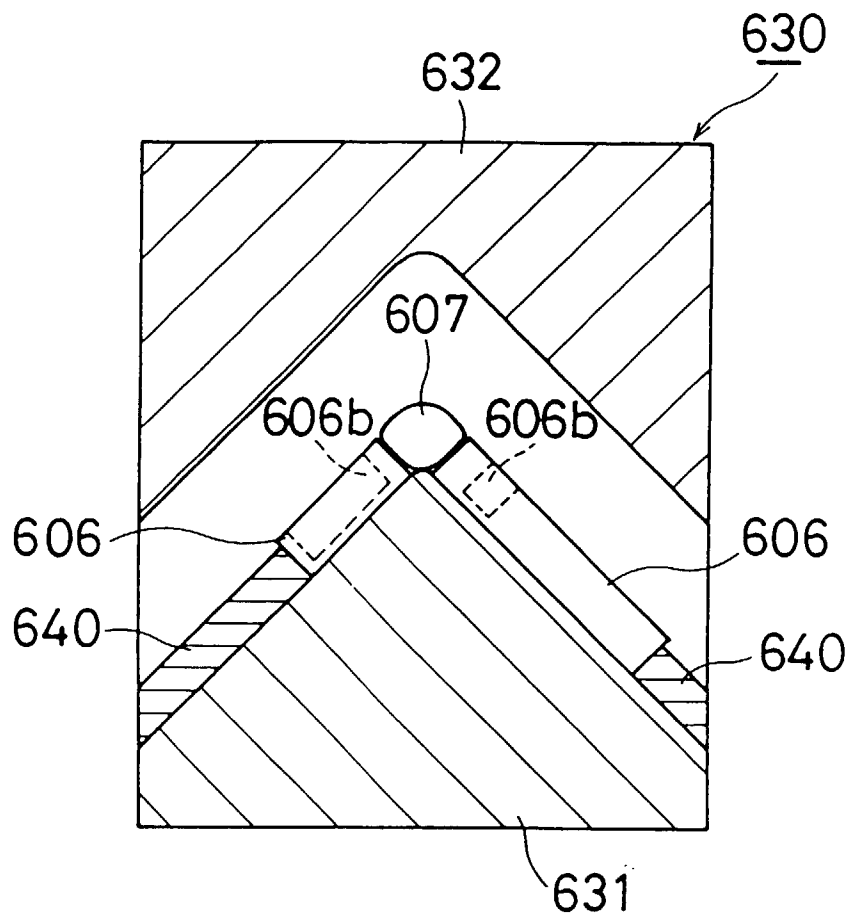


FIG. 42

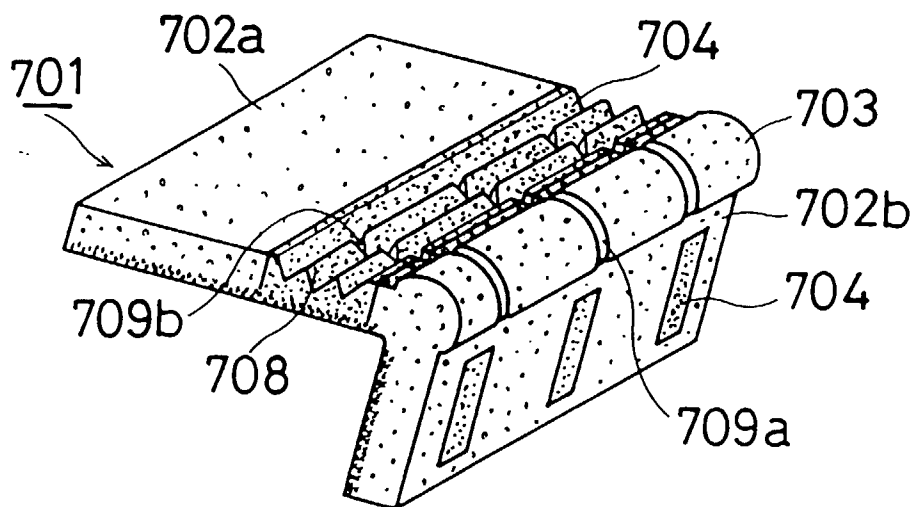


FIG. 43

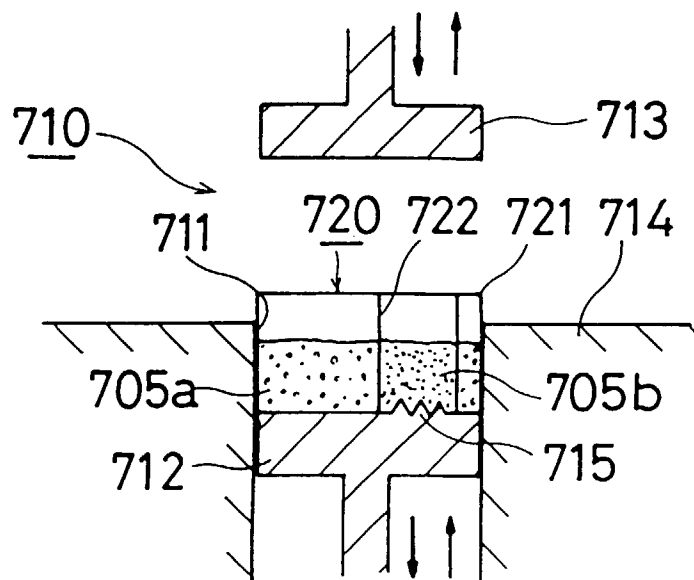


FIG. 44

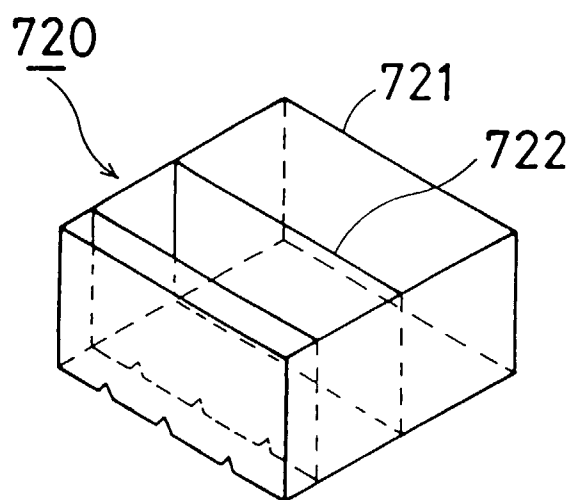


FIG. 45

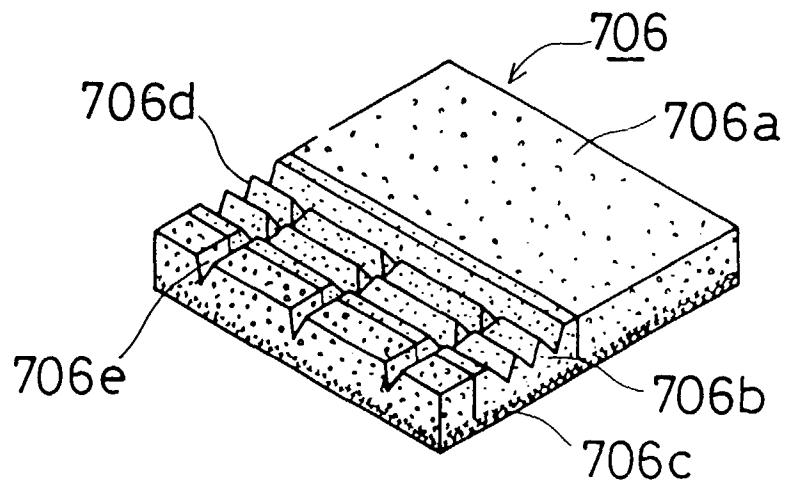


FIG. 46

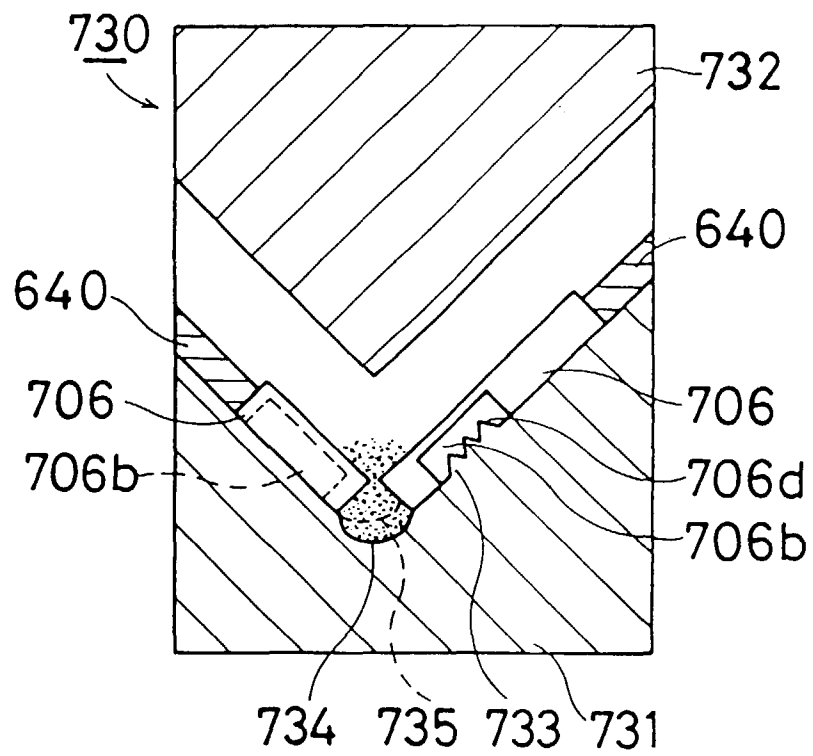




FIG. 47a

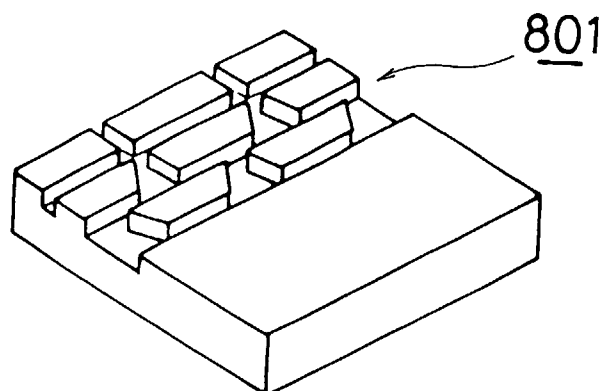


FIG. 47b

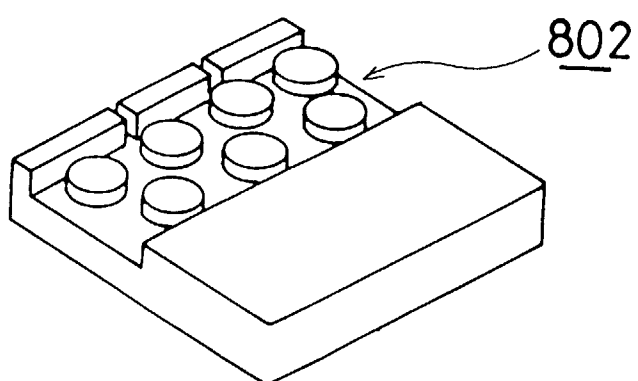


FIG. 47c

