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(54) ROOFING SYSTEM AND ROOFING TILE

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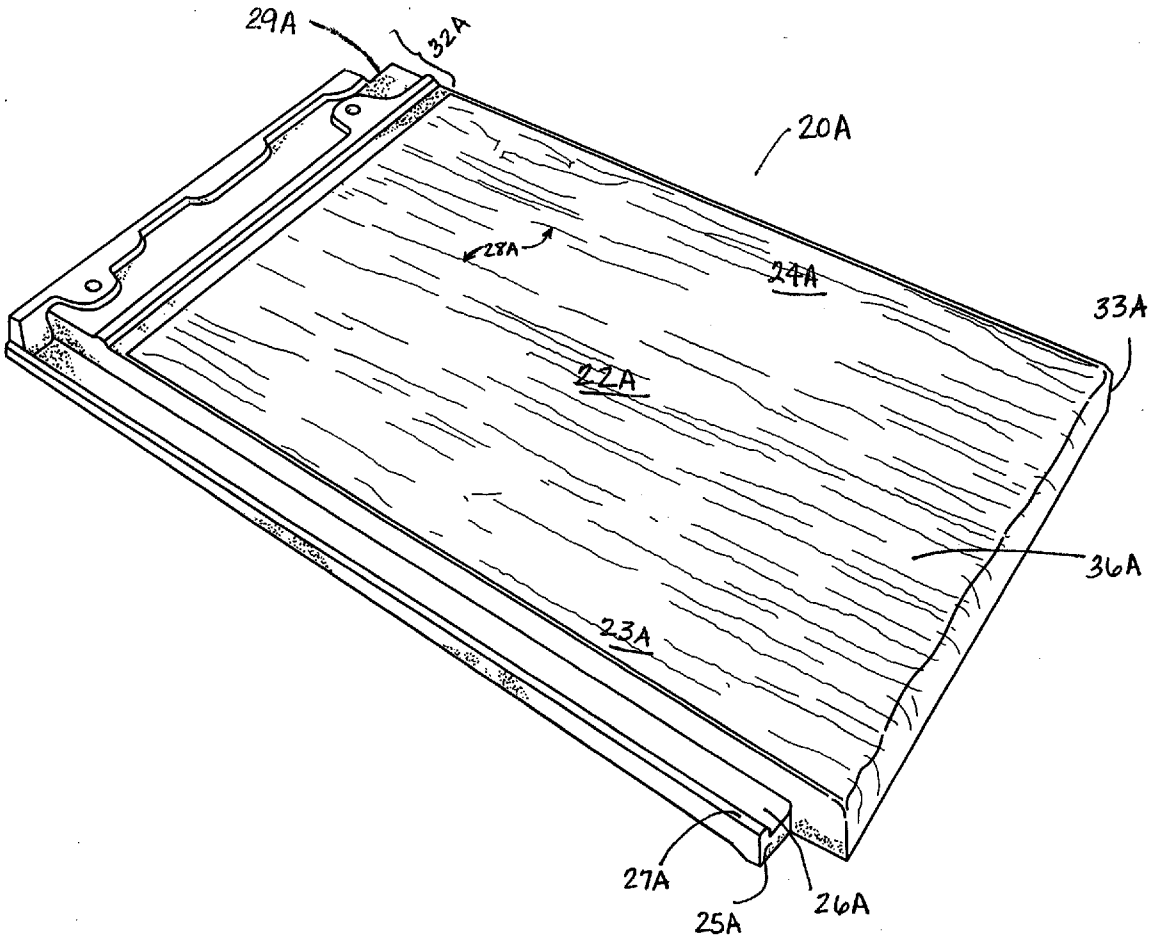
(52) **U.S. Cl.** **52/553**; 52/518

(57) **ABSTRACT**

The present invention provides an improved roofing tile and roofing tile system that simulates the appearance of wood shake and has an improved strength to weight ratio. One embodiment of the roofing tile system includes two unique tile profiles, an "A" profile and a "B" profile, wherein tiles having an "A" profile are alternately or randomly installed adjacent tiles having a "B" profile to simulate the appearance of wood shakes. In addition, each roofing tile is formed of a clay material and includes ribs that extend normally from a lower face of the tile, which improves the strength to weight ratio of each tile. Furthermore, each tile includes touch points that extend from the a face of the tile to engage receiving portions on a tile positioned vertically adjacent to the tile, which prevents the tiles from moving relative to each other.



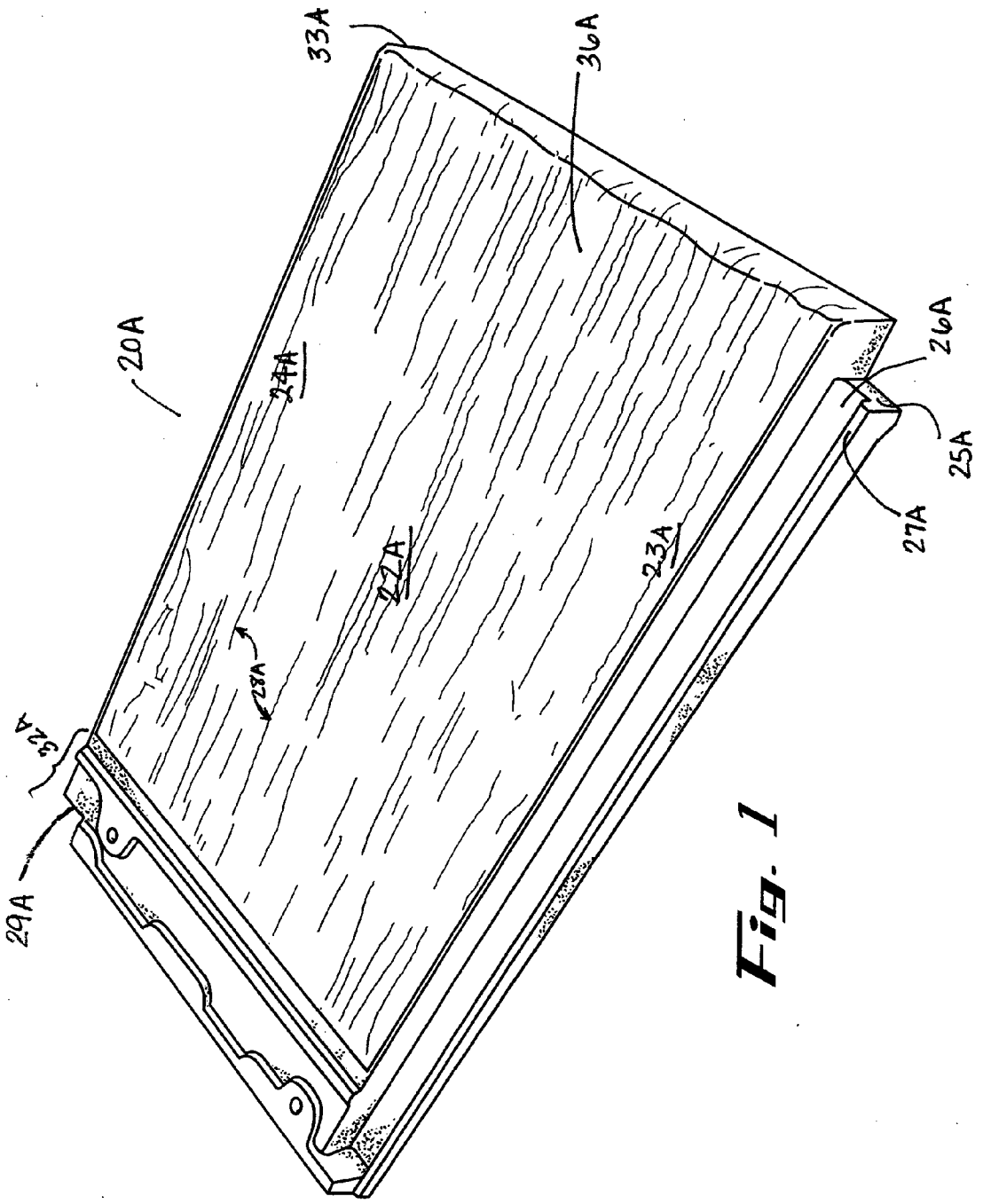


Fig. 1

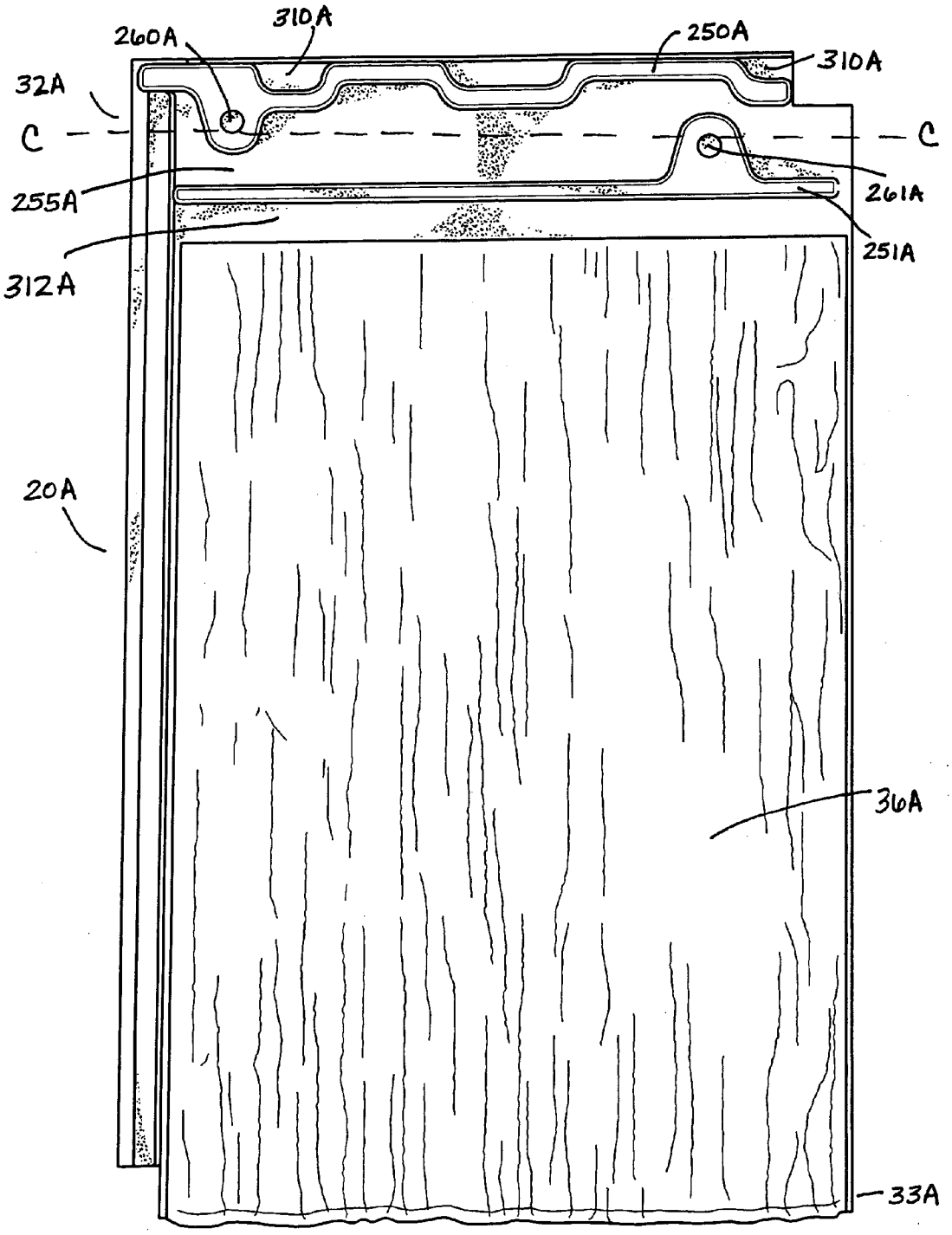


Fig. 2

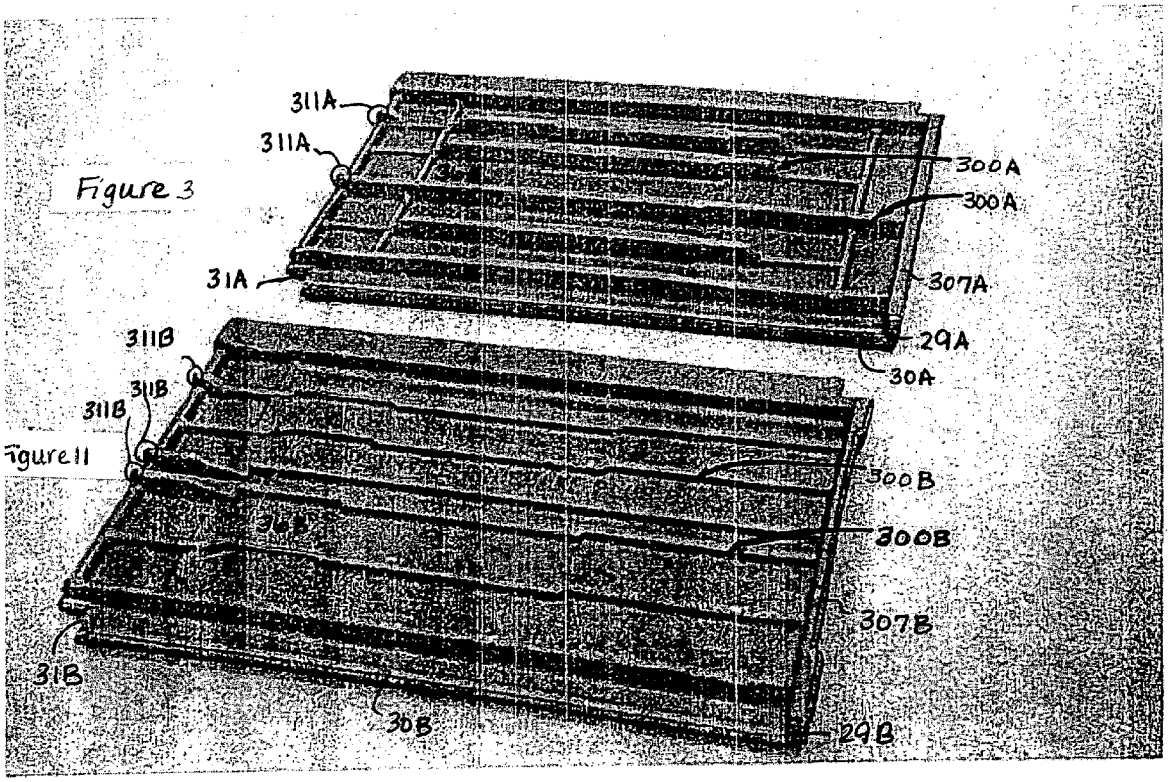


Figure 3

Figure 11

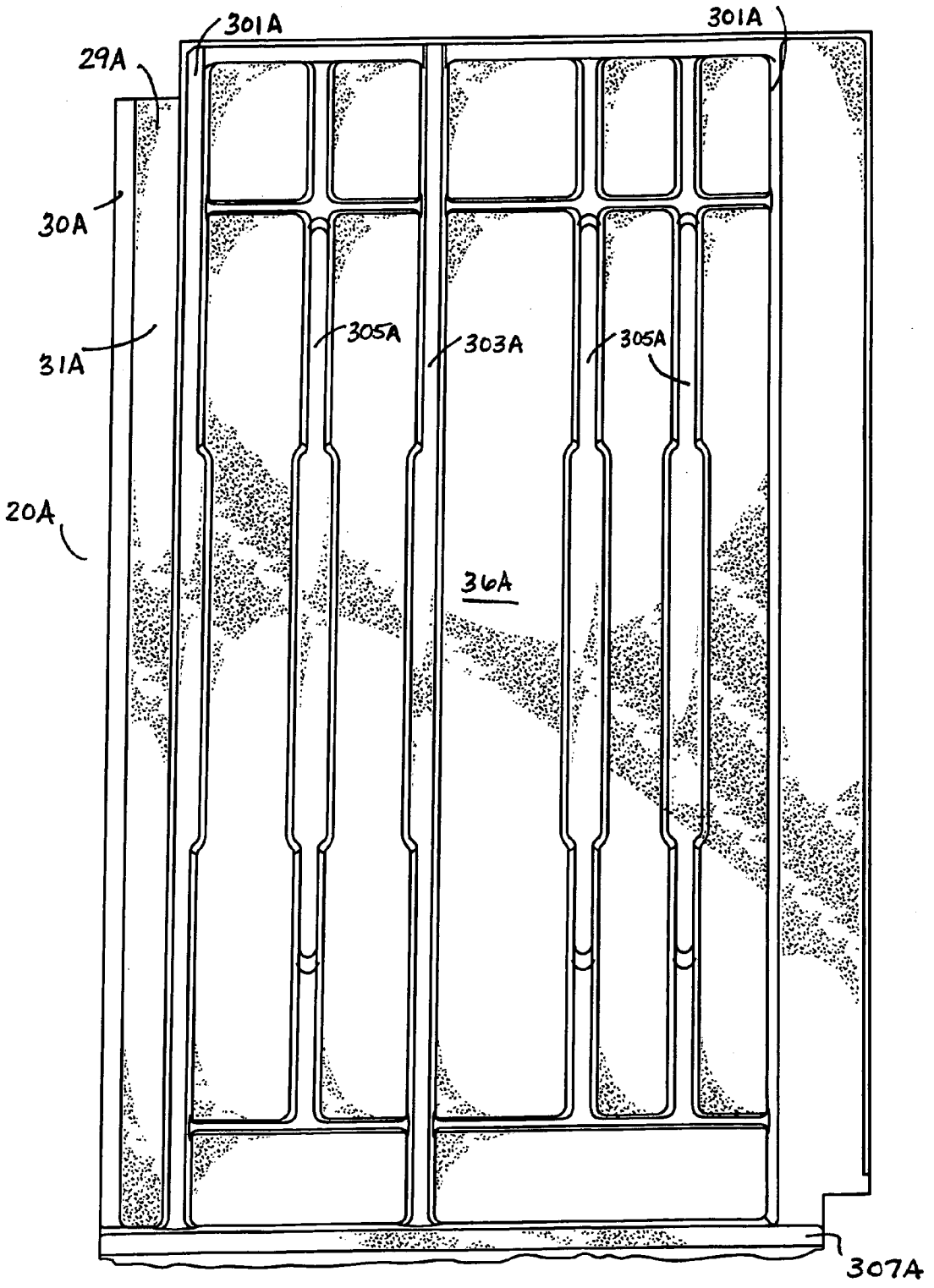


Fig. 4

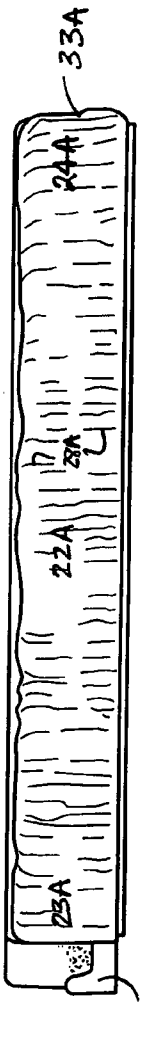


Fig. 5

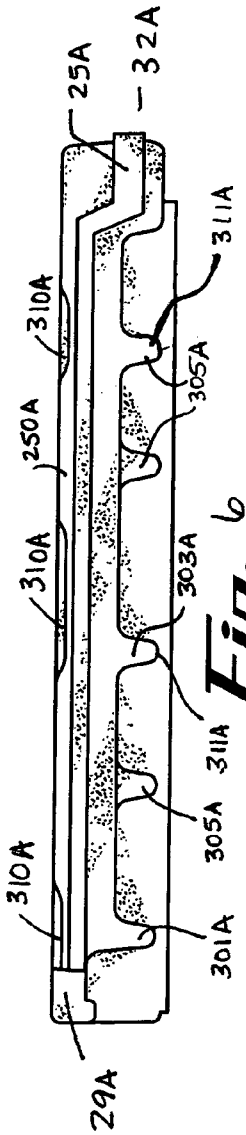


Fig. 6

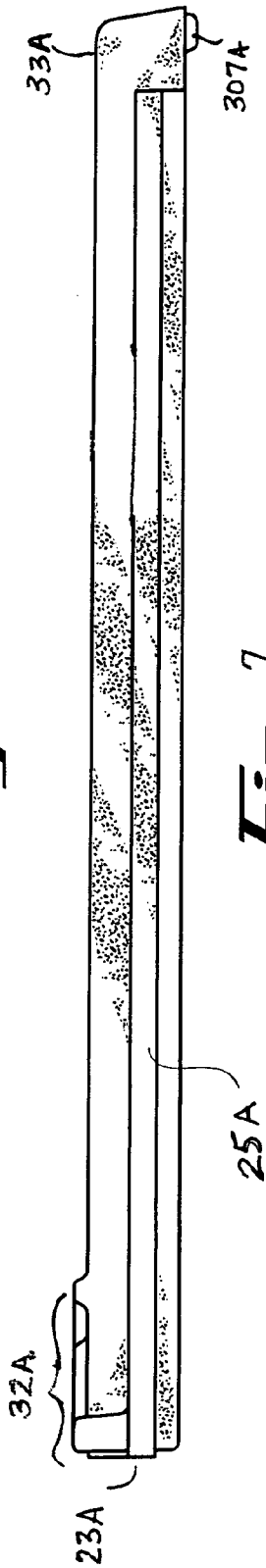


Fig. 7

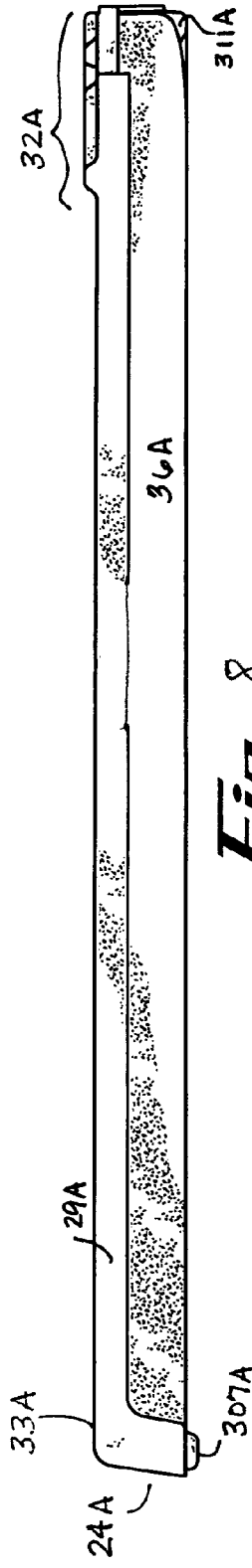


Fig. 8

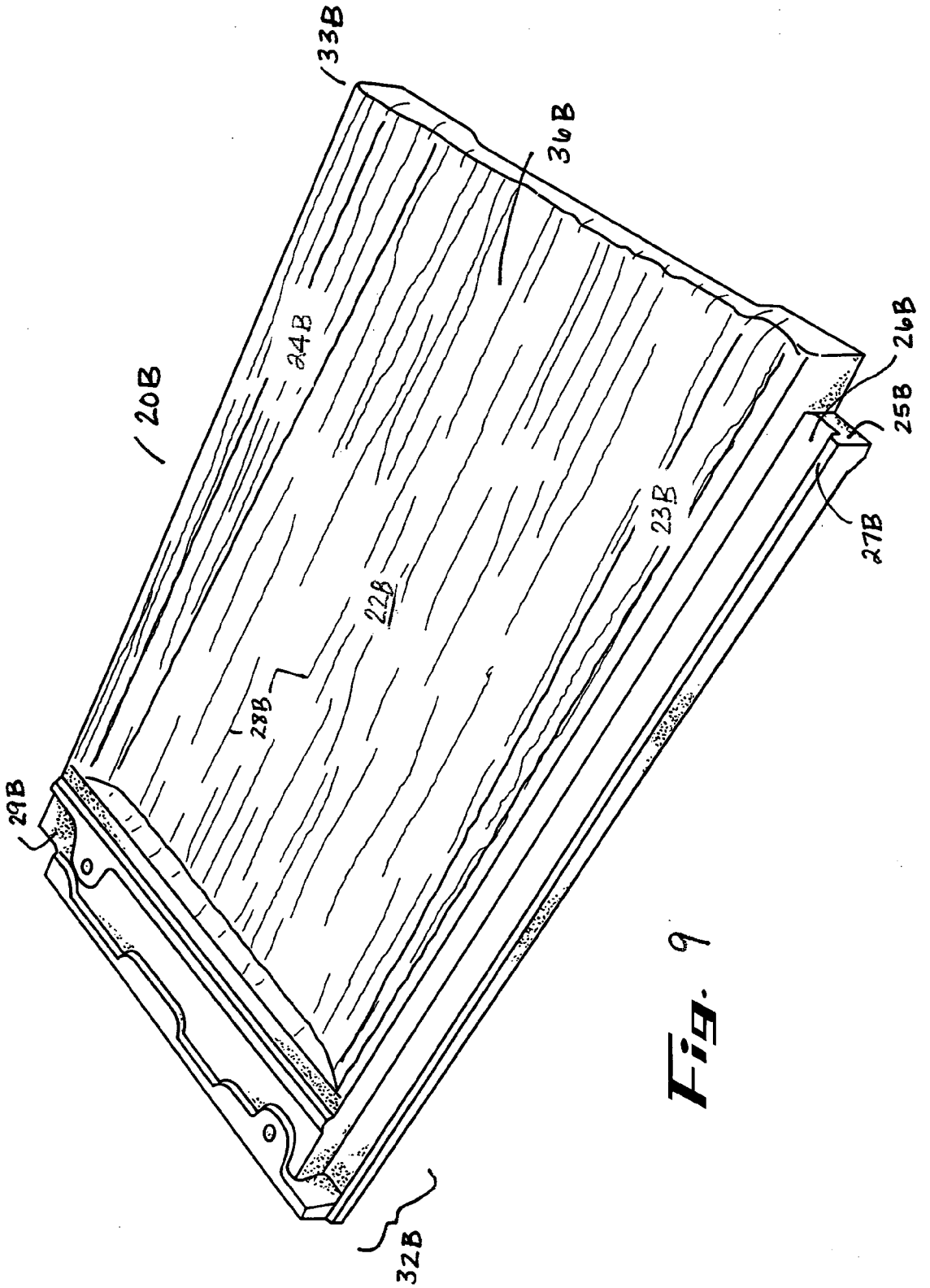


Fig. 9

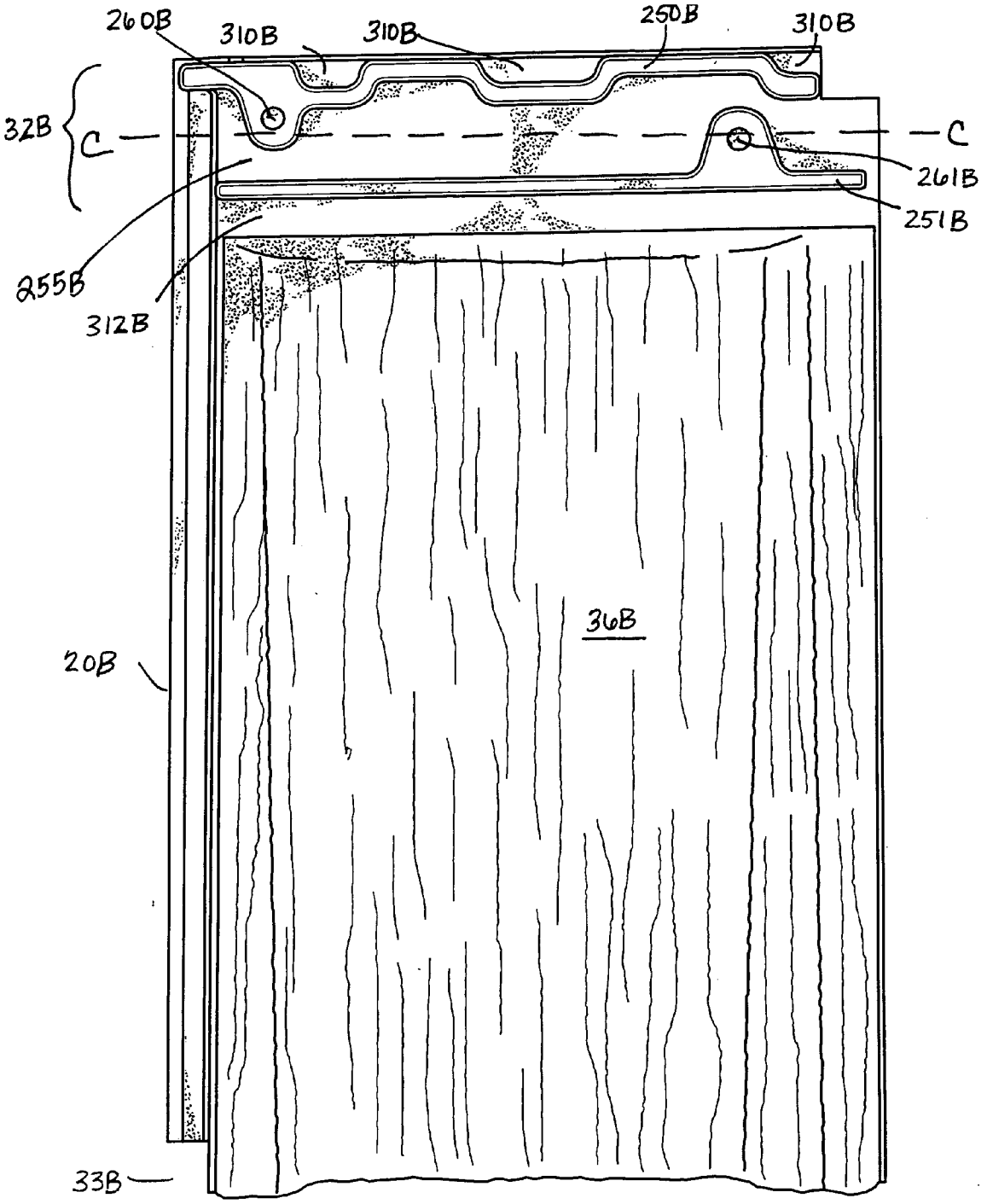

260B
310B
310B
250B
310B
32B
C
C
261B
251B
255B
312B
36B
20B
33B

Fig. 10

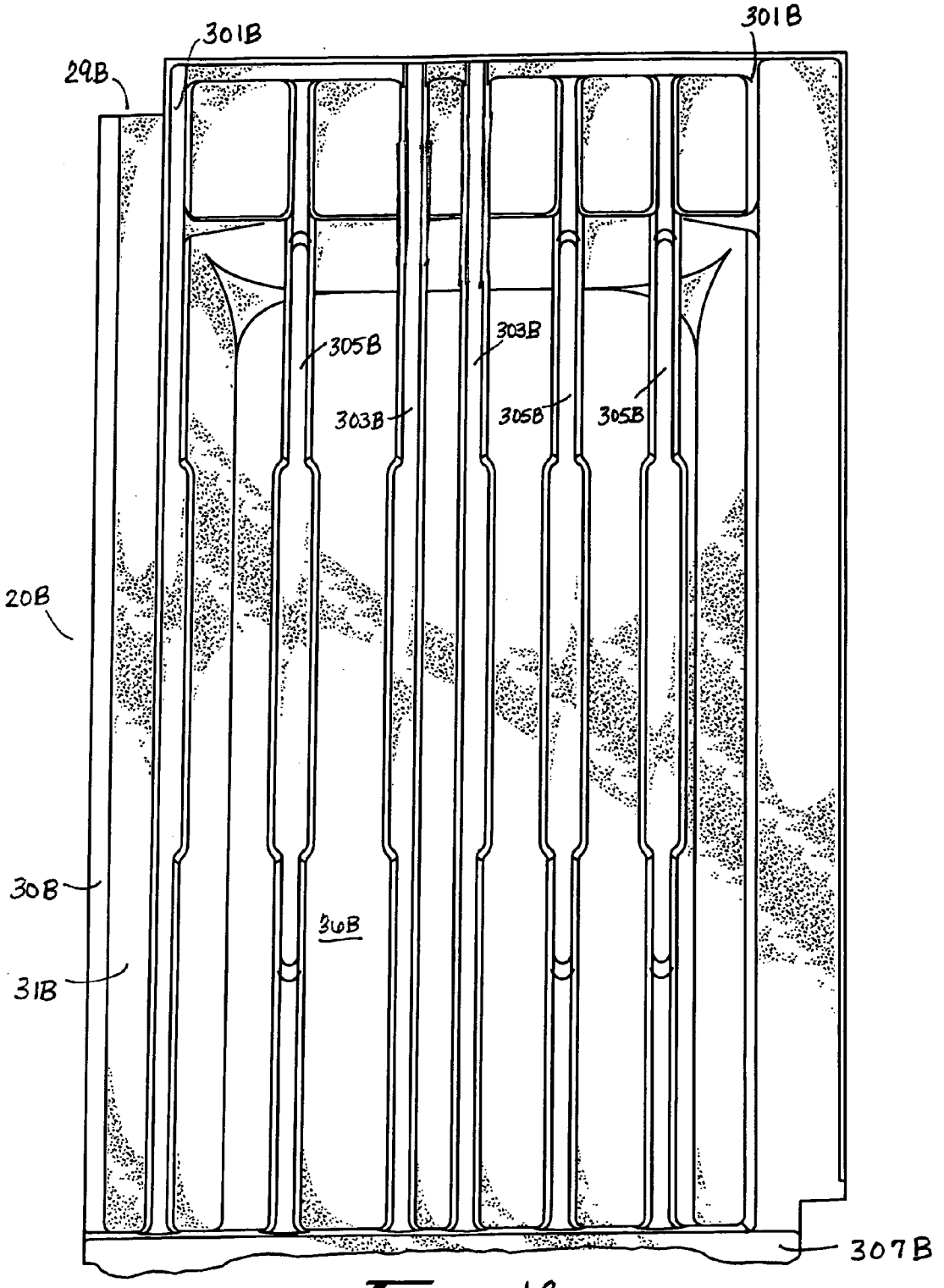


Fig. 12

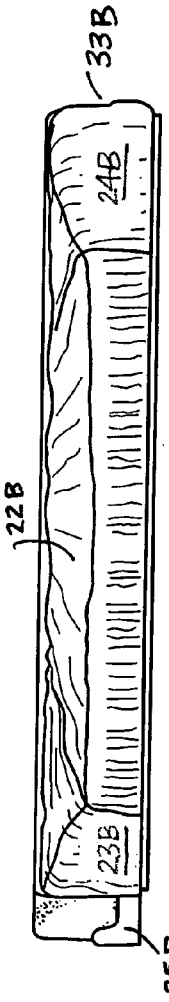


Fig. 13

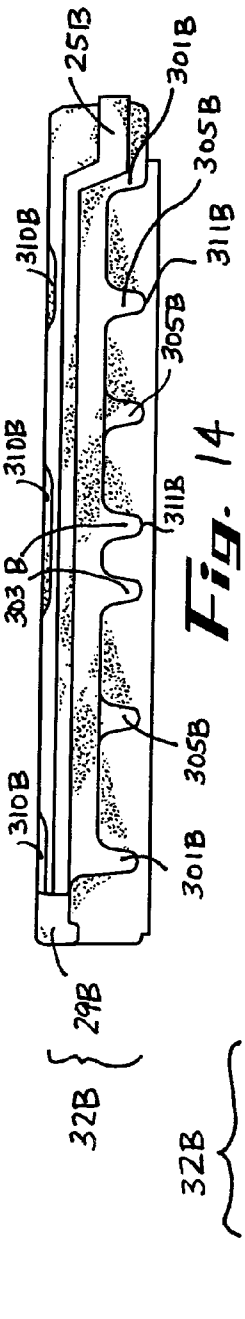


Fig. 14

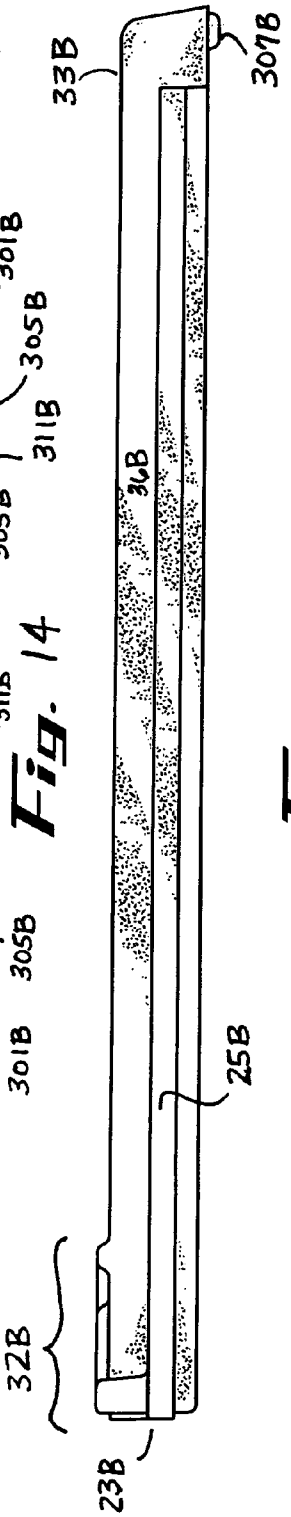


Fig. 15

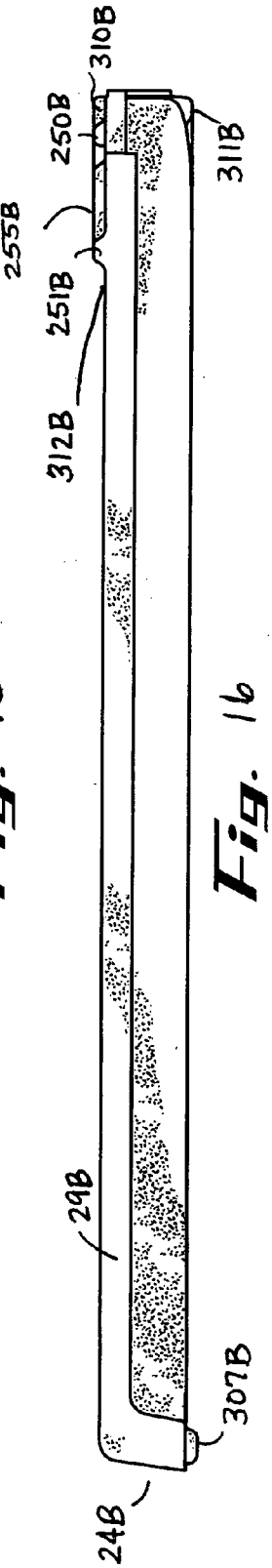


Fig. 16

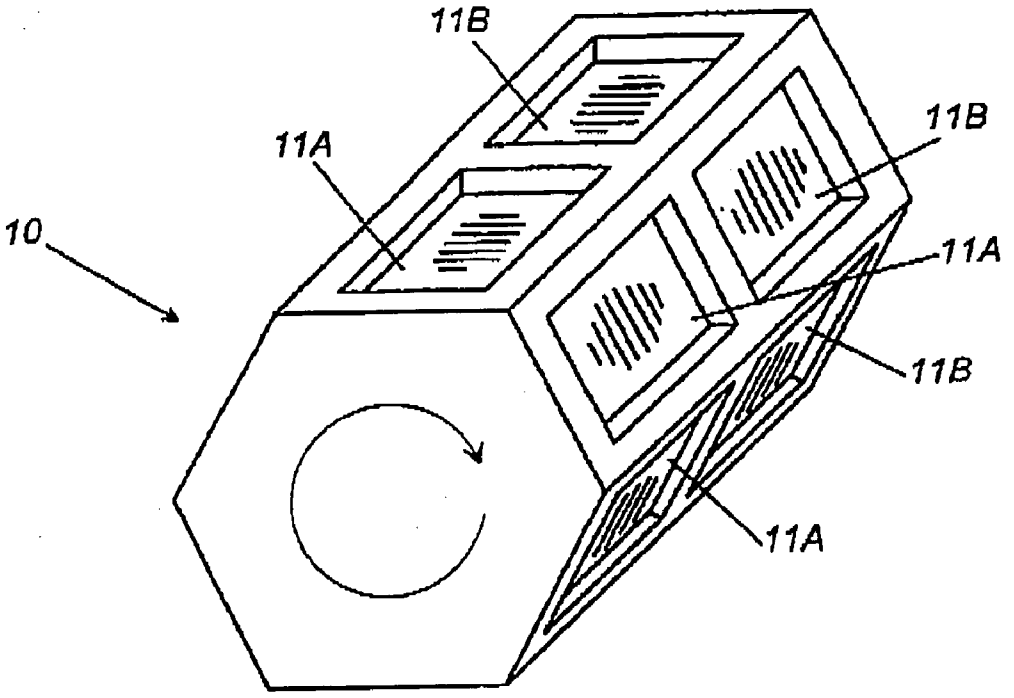


FIG. 17

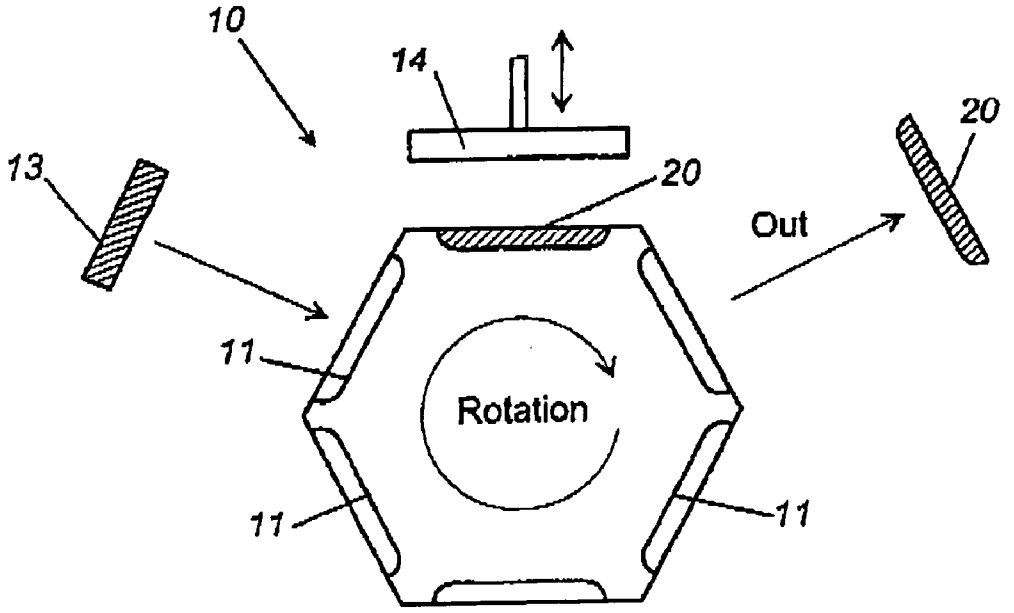


FIG. 18

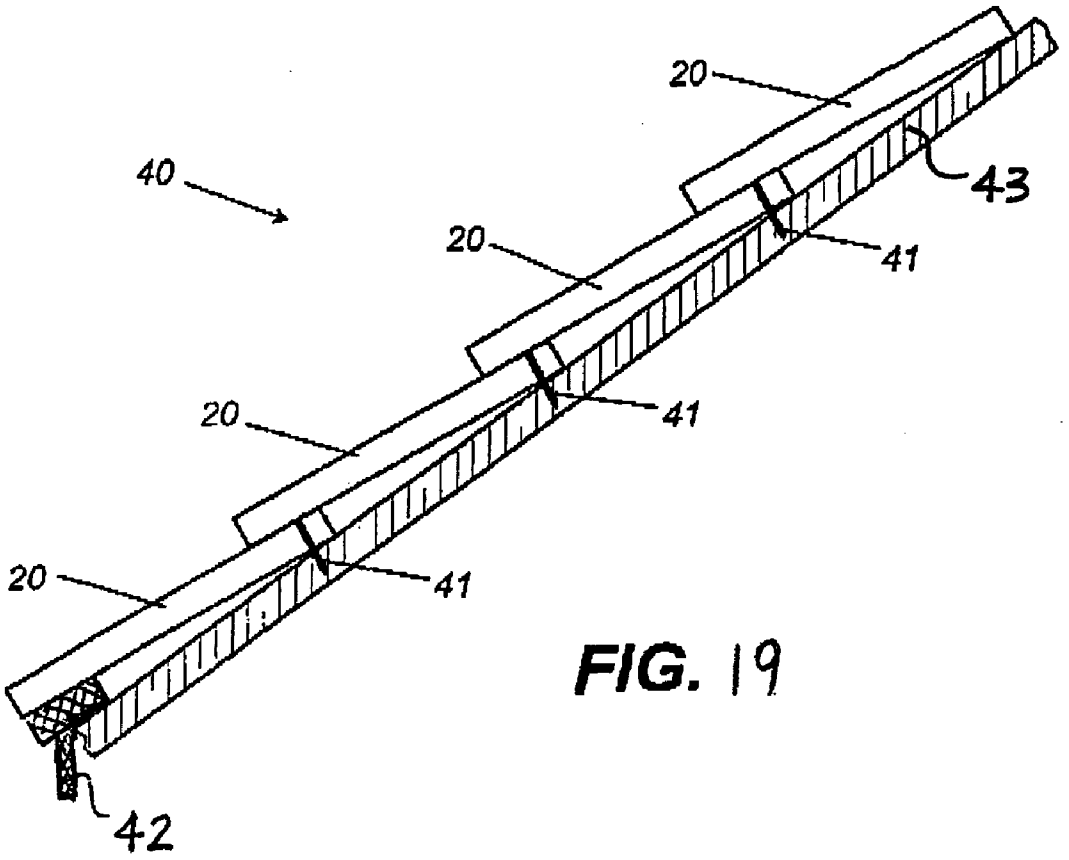


FIG. 19

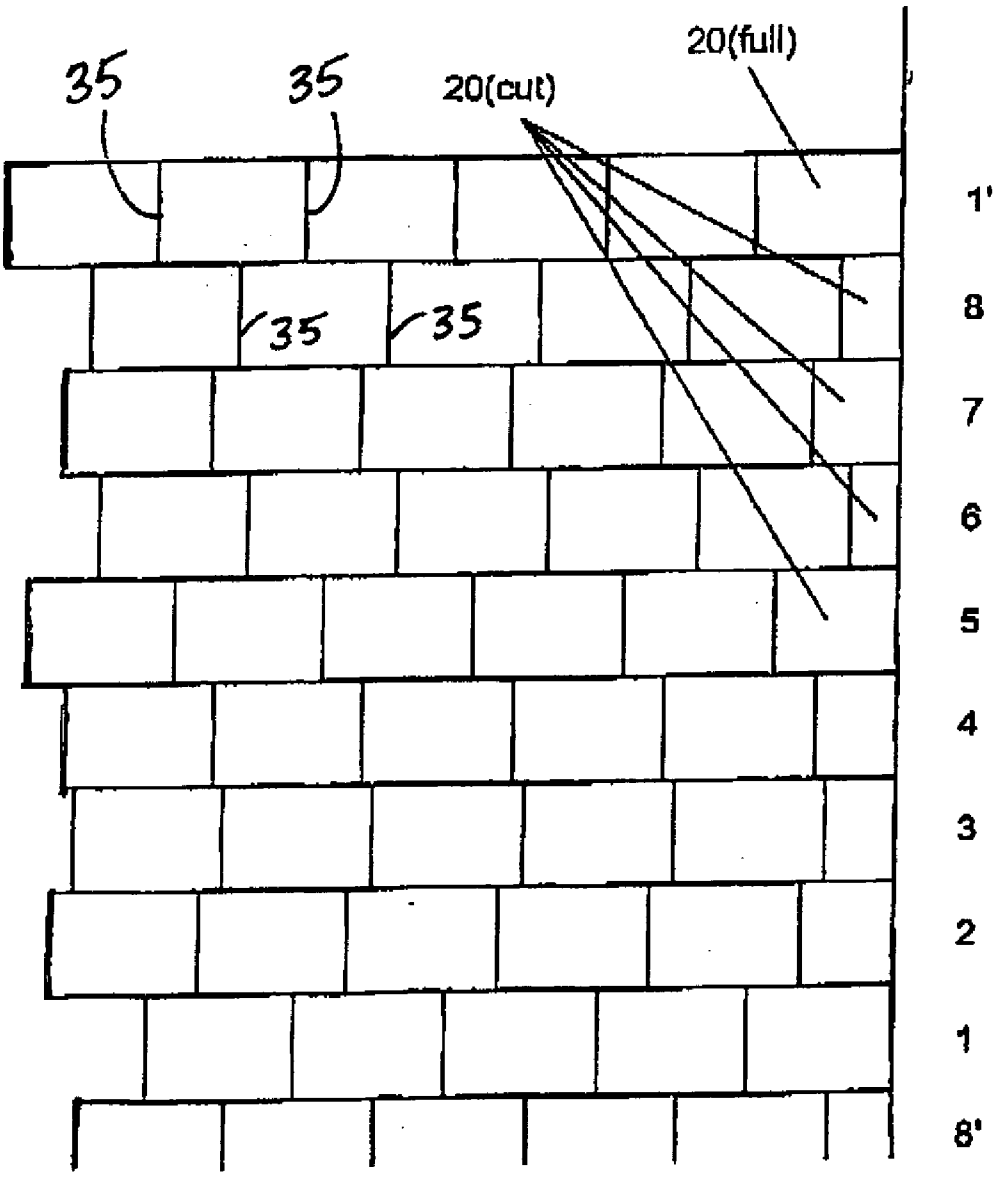


Figure 20

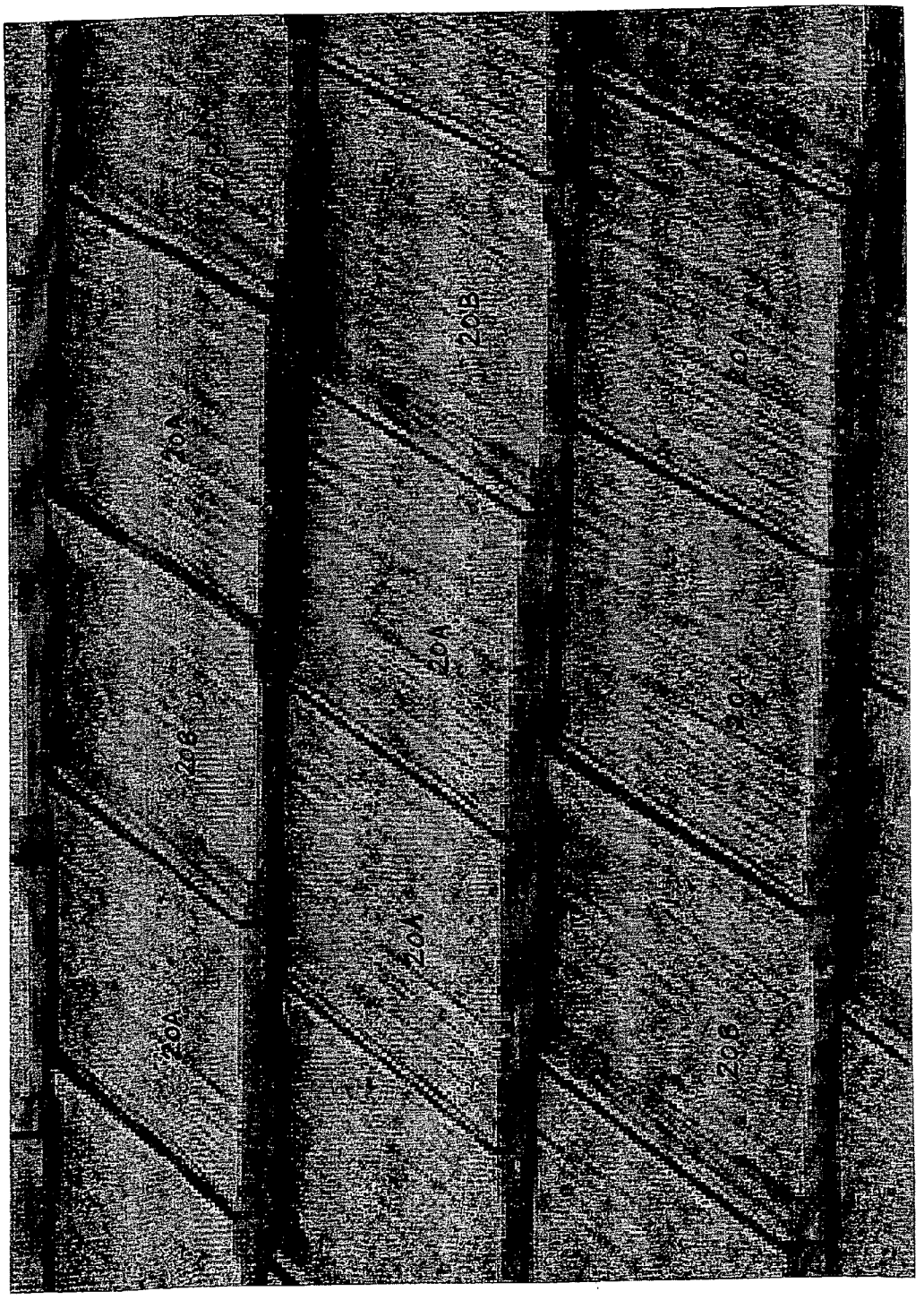


Figure 21

ROOFING SYSTEM AND ROOFING TILE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from provisional U.S. Application No. 60/573,708 entitled "Method and Apparatus for Manufacturing and Installing Improved Roofing Tiles," which was filed on May 20, 2004 and which is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] This invention relates in general to roofing, and particularly relates to the use of lightweight yet structurally sound clay material roofing tiles that simulate wood shake roofing.

BACKGROUND OF THE INVENTION

[0003] In the field of roofing, it is well known to use wood shakes as roofing elements. Typically, the wood shakes are installed in an overlapping manner to divert water. However, wood shakes have disadvantages, including their flammability and their tendency to leak after sufficient weathering. Nevertheless, consumers have shown a preference towards wood shakes due to their desirable appearance.

[0004] Roofing elements that simulate wood shakes and are comprised of nonflammable materials, such as concrete, metal, or clay (sometimes called "terracotta"), have become known. However, roofing elements made to date with these alternative materials present additional disadvantages. For example, roofing tiles made of concrete or clay tend to be heavy, weighing between 8 and 11 pounds per square foot, making them unsuitable for remodeling or re-roofing roofs that previously used lighter roofing elements, such as wood shakes or asphalt roofing tiles. In addition, previous attempts to reduce the weight of the concrete or clay tiles significantly have resulted in a reduction in the flexural strength of the tiles. Furthermore, known concrete and clay roofing tiles are categorized as a lower grade of building material because of their inability to provide adequate protection for severe climate weathering. For example, known tiles are typically characterized as having a Grade 1 Weathering Index of less than 500 (see ASTM C1167-96, Table 1).

[0005] As another example, metal pressed roofing tiles tend to be limited to shapes with identical contours on both the top and bottom surfaces. Further, tiles made with alternate materials, such as concrete and metal, have a tendency to rub against one another during shipping, causing unwanted scratching and chipping on the surfaces of the tiles.

[0006] Therefore, there is a need in the art to provide roofing elements that simulate wood shakes and have improved weathering capabilities and an improved strength to weight ratio.

SUMMARY OF THE INVENTION

[0007] The present invention overcomes deficiencies of the prior art by providing an improved roofing system and roofing tile that simulate the appearance of a wood shake roof and have improved weathering capabilities, an improved strength to weight ratio, and improved packing, or shipping, characteristics. One embodiment of the roofing tile system includes tiles having one or two unique profiles, an "A" profile and a "B" profile, that are alternately or randomly installed adjacent each other to simulate the appearance of wood shakes. Each tile having an "A" profile has a uniform cross-section throughout the body of the tile, and each tile having a "B" profile has a depressed center portion and two raised side portions throughout at least a portion of the body of the tile, wherein the two raised side portions have substantially the same cross-section as the tiles having an "A" profile.

[0008] In addition, each tile includes a plurality of ribs that extend from a lower face of the tile. By positioning the plurality of ribs on the lower face of the tile below portions of the tile that have reduced flexural strength, the weight of each tile is reduced while the strength of each tile is maintained. The width of each rib may also be varied along the length of the rib to provide additional strength to portions of the tile that have reduced flexural strength.

[0009] Furthermore, each tile includes upper touch points that prevent the tiles from moving relative to each other when vertically stacked together and lower touch points that provide a headlap alignment guide for the next-laid course in a roofing installation. The upper and lower touch points extend from the lower face of the tile and seat adjacent to upper and lower touch surfaces, respectively, on a tile positioned vertically adjacent to the tile.

[0010] Other features and advantages of the present invention will become apparent upon reading the following detailed description of exemplary embodiments of the invention when taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] **FIG. 1** is a perspective view of unique tile configurations **20**A according to one embodiment of the invention;

[0012] **FIG. 2** is a top view of the upper face of tile configuration **20**A of **FIG. 1**;

[0013] **FIG. 3** is a perspective view of a lower face of tile configuration **20**A of **FIG. 1**;

[0014] **FIG. 4** is a top view of the lower face of tile configuration **20**A of **FIG. 1**;

[0015] **FIG. 5** is an front view of tile configuration **20**A of **FIG. 1**;

[0016] **FIG. 6** is a end view of tile configuration **20**A of **FIG. 1**;

[0017] **FIG. 7** is a side view of the left side of tile configuration **20**A of **FIG. 1**;

[0018] **FIG. 8** is a side view of the right side of tile configuration **20**A of **FIG. 1**;

[0019] **FIG. 9** is a perspective view of unique tile configuration **20**B according to one embodiment of the invention;

[0020] **FIG. 10** is a top view of the upper face of tile configuration **20**B of **FIG. 9**;

[0021] **FIG. 11** is a perspective view of a lower face of tile configuration **20**B of **FIG. 9**;

[0022] **FIG. 12** is a top view of the lower face of tile configuration **20**B of **FIG. 9**;

[0023] **FIG. 13** is an front view of tile configuration **20**B of **FIG. 9**;

[0024] **FIG. 14** is a end view of tile configuration **20**B of **FIG. 9**;

[0025] **FIG. 15** is a side view of the left side of tile configuration **20**B of **FIG. 9**;

[0026] **FIG. 16** is a side view of the right side of tile configuration **20**B of **FIG. 9**;

[0027] **FIG. 17** is a perspective view of an exemplary rotating mold **10** that includes multiple tile-shaped cavities **11**A, **11**B for receiving clay;

[0028] **FIG. 18** is an end view of the mold **10** of **FIG. 17**, viewed along its axis of rotation and illustrating its interaction with a reciprocating top mold member **14**;

[0029] **FIG. 19** is a side view illustrating an exemplary installation of tiles atop a support surface **43**;

[0030] **FIG. 20** is a plan view illustrating an exemplary installation of tiles atop a support surface; and

[0031] **FIG. 21** is a perspective view of an exemplary installation of tiles atop a support surface.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0032] The present invention addresses the above needs and achieves other advantages by providing a roofing system that includes roofing tiles that have one of at least two profiles. In one embodiment, a portion of the tiles has an "A" profile, and a portion of the tiles has a "B" profile. When the tiles having an "A" profile are installed alternately or in a random fashion with tiles having a "B" profile, the tiles simulate the appearance of a wood shake roof, as shown in **FIG. 21**. The structures of each of the profiles according to one embodiment are described below in the section "Tile Structure," and exemplary methods of manufacturing the tiles and installing the tiles are described below in the sections "Method of Manufacturing the Tiles" and "Method of Installing the Tiles," respectively.

[0033] Tile Structure

[0034] **FIGS. 1 through 8** illustrate an embodiment of a singe roofing tile having an "A" profile. The "A" profile tile **20**A includes an upper face, a lower face, a "head" end **32**A, a "nose" end **33**A, and a body **36**A extending between the head end **32**A and nose end **33**A. As shown in **FIGS. 1, 2** and **6**, the upper face of the tile **20**A is substantially flat, with the exception of the simulated wood grain design on the body **36**A and the nose end **33**A. The simulated wood grain design gives each tile **20**A the appearance of a conventional wood shake member with natural variances. Further, as shown in **FIG. 5**, the gaps and shadows that are expected in a wood shake roof are maintained at the nose end **33**A of the tile **20**A, such that two overlapping tiles have irregular clearance.

[0035] The body **36**A includes a left portion **23**A, a right portion **24**A, and a center portion **22**A that extends between the left portion **23**A and the right portion **24**A, as illustrated in **FIG. 1**. The center portion **22**A has substantially the same elevation as the left and right portions **23**A, **24**A, resulting in a substantially uniform cross section through the body **36**A and extending towards the nose end **33**A. Further, the upper face of the nose end **33**A is level and has a slightly higher elevation than the head end **32**A of the tile **20**A, which is shown in **FIGS. 7 and 8**.

[0036] As shown in **FIGS. 2 and 6**, the head end **32**A includes two transverse ridges **250**A, **251**A that extend across the upper face of the tile **20**A. The ridges **250**A, **251**A lie along a substantially common transverse axis C. The lower ridge **251**A is substantially straight so as to provide a "straight edge" and stable support for tiles that are placed atop the lower ridge **251**A in the next-laid course. The portion of the tile **20**A between the lower ridge **251**A and the body **36**A defines a lower touch surface **312**A for receiving a lower touch point **307**A, **307**B located on the rear side of an above-stacked tile, which is discussed in more detail below in relation to **FIGS. 3 and 11**. The upper ridge **250**A jogs back and forth, defining upper touch surfaces **310**A for receiving upper touch points **311**A, **311**B located on the rear side of an above-stacked tile, which is discussed in more detail below in relation to **FIGS. 3 and 11**. In addition, the upper ridge **250**A provides a water barrier for preventing water from backing up behind the tile **20**A or from reaching behind the tile **20**A in the case of wind driven rain.

[0037] The upper **250**A and lower ridge **251**A further define an intermediate channel **255**A that provides a water channel for wind driven rain. The intermediate channel **255**A diverts the rain to the edges of the left side of the tile **20**A and into channel **26**A of engagement member **25**A or to the right side of the tile **20**A and off of downwardly directed ledge **30**A of engagement member **29**A. Channels **26**A, ledge **30**A, and engagement members **25**A, **29**A are discussed below in relation to **FIGS. 1, 4, 7**, and **8**.

[0038] In addition, apertures **260**A, **261**A for receiving fasteners are provided in the upper **250**A and lower ridges **251**A, respectively. Fasteners are engaged through the apertures **260**A, **261**A to secure the tile **20**A to the roof. As shown in **FIG. 2**, aperture **260**A is located in a portion of the upper ridge **250**A and aperture **261**A is located in a portion of the lower ridge **251**A. The additional cross sectional area of each ridge **250**A, **251**A provides more strength for the tile **20**A, reducing its tendency to split. Additionally, the ridges **250**A, **251**A provide a raised surface against which a nail or other suitable fastener can be driven.

[0039] As shown in **FIGS. 3 and 4**, the lower face of the tile **20**A includes a plurality of strategically placed structural ribs **300**A to provide lightweight yet structurally sound support for the tile **20**A. The ribs **300**A, which extend normally from the lower face of the body **36**A, include two edge ribs **301**A, one center rib **303**A, and three secondary ribs **305**A that extend along the length of the tile **20**A. The two edge ribs **301**A extend the length of the tile **20**A from the head end **32**A to the nose end **33**A to provide support for the edges of the tile **20**A, and the center rib **303**A extends the length of the tile **20**A from the head end **32**A to the nose end **33**A to provide support for the center portion **22**A. The three secondary ribs **305**A, which are shorter than the edge ribs **301**A and the center rib **303**A, extend lengthwise and adjacent the body **36**A of tile **20**A. Further, the three secondary ribs **305**A are interspaced between the edge ribs **301**A and the center rib **303**A to provide intermediate

support to the portions of the tile **20**A between the left **23**A and right portions **24**A and the center portion **22**A. Thus, by having a reduced length and being positioned between the edge ribs **301**A and the center rib **303**A, the secondary ribs **305**A provide additional strength for the tile **20**A between the edge **301**A and the center portions **301**A without adding unnecessary weight.

[**0040**] The ribs **301**A, **303**A, **305**A are substantially evenly spaced, providing superior strength when the tile **20**A is subjected to flexural strength testing or actual field conditions, such as exposing the tiles to foot traffic. In addition, the secondary ribs **305**A and the center structural rib **303**A vary in width such that the width of each rib **305**A, **303**A increases adjacent portions of the tile **20**A that have a reduced flexural strength. For example, as shown in **FIGS. 3 and 4**, the width of each rib **303**A, **305**A increases as the rib approaches the center of the body **36**A and decreases as the rib **305**A, **305**A approaches the head end **32**A and the nose end **33**A. As a further example, the width of each rib **303**A, **305**A may be increased if the rib **303**A, **305**A is adjacent an area of the tile that has a reduced cross-section. Varying the thickness of the ribs **303**A, **305**A further reduces the amount of material needed for structural support, which reduces the weight of the tile without compromising the flexural strength of the tile. For example, the embodiment of the tile **20**A described above can support the same load as most standard tiles, but has an installed weight of less than 6 pounds per square foot, which is about 40% lighter than most standard tiles.

[**0041**] The number and structure of the ribs may vary depending on the size, aesthetic design, and intended use of the tile. Accordingly, the concepts of varying the width and length of the ribs and strategically positioning the ribs to support the tile where the flexural strength may be compromised are within the scope of this invention.

[**0042**] In addition to the ability of the ribs **300**A to improve the flexural strength of the tiles, the secondary ribs **305**A further improve certain manufacturing characteristics. As may be understood, when the tiles **20**A are initially produced, they are not completely solidified, and can sag in certain instances, especially in locations that include unsupported spans. The secondary ribs **305**A, if they are supported, can provide support to prevent such sagging. Therefore, the secondary ribs **305**A provide support for an otherwise unsupported horizontal portion.

[**0043**] In addition to the ribs **300**A, the lower face of the tile **20**A further includes touch points **307**A, **311**A. Touch points **307**A, **311**A are protrusions that extend from the lower face of the tile **20**A. In the embodiment of the tile **20**A shown in **FIGS. 1 through 8**, upper touch points **311**A are adjacent to the head end **32**A, and one of the upper touch points **311**A is part of the ribs **300**A and one of the upper touch points **311**A is separate from the ribs **300**A. When tiles **20**A are stacked vertically adjacent one another, such as when being shipped from the manufacturer to the job site, the upper touch points **311**A of upper tile **20**A seat within the upper touch surfaces **310**A of lower tile **20**A. This configuration prevents movement of stacked tiles relative to one another, thereby preventing adjacent tiles from scratching or damaging each other. In addition, the upper touch points **311**A and upper touch surfaces **310**A reduce the height of vertical stack of tiles, which allows more tiles to be included in a shipment. Furthermore, the upper touch points **311**A are not visible once the tile **20**A is installed, thus maintaining the simulated appearance of wood shakes.

[**0044**] Lower touch point **307**A is positioned transverse across the nose end **33**A. When a tile **20**A is positioned in the next-laid horizontal course above a lower tile **20**A during installation, the lower touch point **307**A seats upon the lower touch surface **312**A of the lower tile **20**A. The lower touch point **307**A and the lower touch surface **312**A provide a headlap alignment guide for the roofing installers.

[**0045**] In other embodiments, all of the upper touch points **311**A can be part of the ribs **300**A, all of the upper touch points **311**A can be separate from the ribs **300**A, the lower touch point **307**A can comprise a plurality of protrusions that seat against the lower touch surface **312**A, or the tile **20**A can include one or more upper touch points **311**A.

[**0046**] To facilitate the mounting of tiles horizontally adjacent to one another, the tile **20**A also includes an upwardly facing, sidewardly extending engagement member **25**A and a downwardly facing, sidewardly extending engagement member **29**A, as shown in **FIGS. 1, 4, 7**, and **8**. Engagement member **25**A extends to the left of the left portion **23**A, defines a channel **26**A, and includes an upwardly directed ledge portion **27**A. Engagement member **29**A extends to the right of the right portion **24**A, defines a channel **31**A, and includes a downwardly directed ledge portion **30**A. Engagement member **25**A of a first tile mates with the engagement member **29**A of a second tile placed horizontally to the left of the first tile. The downwardly directed ledge portion **30**A of the second tile is received by the channel **26**A of the first tile. Additionally, the channel **26**A serves to divert water from the first and second tiles to the tile below the first and second tiles. Similarly, engagement member **29**A of the first tile mates with the engagement member **25**A of a third tile placed horizontally to the right of the first tile. The upwardly directed ledge portion **27**A of the third tile is received into the channel **31**A of the first tile. The channel **26**A of the third tile serves to divert water from the first and third tiles to the tile below the first and third tiles. As discussed below in relation to **FIGS. 9 and 12**, the engagement portion **29**A of tile **20**A can mate with an engagement portion **30**B of an adjacent tile having a "B" profile configuration. Similarly, the engagement portion **30**A of tile **20**A can mate with an engagement portion **29**B of an adjacent tile having a "B" profile. In an alternative embodiment, engagement member **25**A extends from the right portion **24**A and engagement member **29**A extends from the left portion **23**A. Thus, the embodiment of the tile described above has a Grade 1 Weathering Index of greater than 500 (see ASTM C1167-96, Table 1) due at least in part to the improved strength to weight ratio and the ability of the tile to channel water and debris.

[**0047**] **FIGS. 9 through 16** illustrate an embodiment of a single roofing tile having a "B" profile. Like the tile **20**A described above, the "B" profile tile **20**B includes an upper face, a lower face, a head end **32**B, a nose end **33**B, and a body **36**B. In addition, similar to the tile **20**A, the body **36**B and the nose end **33**B include a simulated wood grain design and the nose end **33**B further includes the gaps and shadows that are expected in a wood shake roof such that two overlapping tiles have irregular clearance, as shown in **FIG. 13**.

[0048] The body **36**B includes a left portion **23**B, a right portion **24**B, and a center portion **22**B. However, unlike the substantially flat upper face of tile **20**A, tile **20**B has a depressed center portion **22**B, as shown in **FIGS. 9 and 13**. The head end **32**B, the left portion **23**B, and the right portion **24**B slope downwardly towards the center portion **22**B such that the head end **32**B, the left portion **23**B, and the right portion **24**B are higher in elevation than the center portion **22**B, and the depressed center portion **22**B extends to the nose end **33**B of the tile **20**B. In addition, the left **23**B and right portions **24**B adjacent to the nose end **33**B have a slightly higher elevation than the head end **32**B, as shown in **FIGS. 15 and 16**.

[0049] Further, as shown in **FIG. 9**, the length of the **20**B tile from the head end **32**B to the nose end **33**B varies between the left **23**B and right portions **24**B and the center portion **22**B. In particular, the length of the center portion **22**B from the head end **32**B to the nose end **33**B is shorter than the length of the left **23**B and right portions **24**B from the head end **32**B to the nose end **33**B. In addition, the left **23**B and right portions **24**B of the tile **20**B extend to substantially the same length as the tile **20**A, and the elevation of the left portion **23**A and the right portion **24**A of the tile **20**A and the elevation of the left **23**B and right portions **24**B of the tile **20**B are substantially the same. Thus, the decreased elevation and reduced length of the center portion **22**B contrasted with the higher elevations and longer length of the left **23**A, **23**B and right portions **24**A, **24**B of the tile **20**A and **20**B creates the desired shadowing and appearance to simulate the overlapping of wood shakes. In addition, when tiles **20**A are placed on either side of a tile **20**B, a staggering effect is created. This staggering effect gives the impression that the center portion of the tile **20**B is one tile, the left portion of the tile **20**B and the tile **20**A to the left of the tile **20**B are one tile, and the right portion of the tile **20**B and the tile **20**A to the right of the tile **20**B are one tile.

[0050] As shown in **FIGS. 10 and 14**, tile **20**B further includes two transverse ridges **250**B, **251**B that extend across the head end **29**B of tile **20**B. These ridges **250**B, **251**B are similar to the transverse ridges **250**A, **251**A of the tile **20**A discussed above in relation to **FIG. 2**. The substantially similar arrangement of the transverse ridges **250**A, **250**B, **251**A, **251**B and the lower touch surface **312**A, **312**B facilitates the placement of the nose end **33**A, **33**B of tile **20**A, **20**B atop the head end **32**A, **32**B of tile **20**A, **20**B during installation. Thus, tiles **20**A and tiles **20**B are interchangeable in the installation, which provides a more rustic appearance and better simulates the appearance of a wood shake roof.

[0051] Like the tile **20**A, the tile **20**B includes an upwardly facing, sidewardly extending engagement member **25**B and a downwardly facing, sidewardly extending engagement member **29**B, as shown in **FIGS. 9, 12, 15**, and **16**. Engagement members **25**B and **29**B are configured similarly to engagement members **25**A and **29**A described above. In an exemplary installation in which the tile **20**A is laid to the right of the tile **20**B, engagement member **25**A mates with the engagement member **29**B. More specifically, the upwardly directed ledge portion **27**A of engagement portion **25**A is received into the channel **31**B of adjacent engagement member **29**B. Similarly, in an exemplary installation in which the tile **20**A is laid to the left of the tile **20**B, engagement member **29**A mates with engagement member **25**B. More specifically, the downwardly directed ledge portion **30**A of engagement member **29**A is received into the channel **26**B of adjacent engagement member **25**B.

[0052] As shown in **FIGS. 11 and 12**, the lower face of the tile **20**B includes a plurality of strategically placed structural ribs **300**B to provide lightweight yet structurally sound support for the tile **20**B. Two edge ribs **301**B extend along the length of the tile **20**B, similar to the nose rib **307**A and the edge ribs **301**A of the tile **20**A described above in relation to **FIG. 4**. However, the central ribs **303**B and the secondary ribs **305**B of the tile **20**B are configured differently than the corresponding ribs **303**A, **305**A of the tile **20**A due, at least in part, to the lower elevation of the center portion **22**B and the need to support the center portion **22**B and the transition areas between the center portion **22**B and the left **23**B and right portions **24**B and head end **32**B. For example, tile **20**B includes two center ribs **303**B that extend the full length of the tile **20**B, and the two center ribs **303**B increase in width under the center portion **22**B of the tile **20**B. In addition, three secondary ribs **305**B, which are shorter than center ribs **303**B, are spaced intermittently between the edge ribs **3011** and the center ribs **303**B adjacent the body **36**B. One of the secondary ribs **305**B is positioned near the elevation transition from the left portion **23**B to the center portion **22**B to support the transition, and one of the secondary ribs **305**B is positioned near the elevation transition from the right portion **24**B to the center portion **22**B. Furthermore, the center ribs **303**B and the secondary ribs **305**B of the tile **20**B are shorter than the corresponding ribs **303**A, **305**A of the tile **20**A because the center portion **22**B of the tile **20**B is shorter than the center portion **22**A of tile **20**A.

[0053] Furthermore, the tile **20**B includes touch points **307**B, **3111**B that extend from the lower face of the tile **20**B and engage upper touch surfaces **312**B, **310**B, respectively, of a tile **20**B stacked below the tile **20**B, such as the touch points **307**A, **311**A and touch surfaces **312**A, **310**A of tile **20**A described above in relation to **FIG. 3**. In the embodiment illustrated in **FIG. 11**, two of the upper touch points **3111**B are part of a rib **300**B, and one of the upper touch points **3111**B is separate from the ribs **300**B. However, the upper touch points **3111**B, like upper touch points **311**A, can all be separate from the ribs **300**B or can all be part of the ribs **300**B. In addition, the tile **20**B may include one or more touch points **307**B, **3111**B. Furthermore, in the embodiment shown in **FIGS. 2 and 10**, the touch surfaces **310**A, **310**B, **312**A, **312**B, and the touch points **311**A, **3111**B, **307**A, **307**B are in substantially similar positions, allowing the tiles **20**A, **20**B to be vertically stacked together or laid together in a random arrangement in each horizontal course while maintaining proper alignment of each course.

[0054] The Manufacturing Process

[0055] Reference is now made to **FIGS. 17 and 18**, which combine to illustrate an exemplary method of manufacturing tiles using raw, unmolded clay material to produce two similar tile forms suitable for kiln firing. A rotating mold **10** accepts clay bats **13** and forms them into tile shapes, such as those shapes described above. After being dried and kiln fired, these tiles can be installed in an overlapping manner as shown in **FIG. 19** atop an inclined support surface, such as support surface **43**.

[0056] A clay composition is extruded from a pugmill/extrusion machine in a column (not shown) and has a moisture content sufficient to provide adequate plasticity. The percentage of moisture content found to be acceptable in one embodiment is 17 to 19%. The extrusion process evacuates substantially all of the air from the clay mixture to discourage delamination. The column is then cut into short lengths to create the bats **13** for pressing.

[0057] The press structure includes a rotating drum **10** having a hexagonal cross-section and defining six outwardly directed drum faces. One "A" lower mold cavity **11**A and one "B" lower mold cavity **11**B are provided on each drum face, totaling twelve mold cavities, to provide an aesthetically pleasing variation on the installed appearance of the tiles, which is discussed above in relation to **FIGS. 1 and 9**. The net result is a 50—50 mix of tiles having an "A" profile and tiles having a "B" profile, such as those tiles **20**A and **20**B discussed above.

[0058] As shown in **FIG. 18**, the clay bats **13** enter the press and are deposited in the lower molds **11**A, **11**B when the molds **11**A, **11**B are in the 10 o'clock position. The drum **10** is configured to rotate about a substantially horizontal axis, such that upon drum rotation, the bats **13** are moved into the 12 o'clock position. While in the 12 o'clock position, a top mold member **14** comes down and presses the bats **13** into the shapes of the tiles **20**, and then withdraws upwardly. The drum **10** then rotates the pressed tile forms **20** to the 2 o'clock position, where a vacuum picker (not shown) moves in and simultaneously trims off the excess clay around the edges of the tiles **20** and punches nail holes as needed. It removes the tiles **20** from the drum face and deposits them on drying trays (not shown) that are passed under the picker on a synchronized conveyor.

[0059] The wet tiles, on their individual dryer trays, are then sent through a dryer where the moisture content is reduced to less than 4%. The dry "greenware" is then transported to the kiln for firing. The vitrified tiles **20**A, **20**B, as shown in **FIGS. 1 and 9**, are then placed directly into their shipping pallets. The combination of the touch points **311**A, **311**B and the transverse ridges **250**A, **250**B, **251**A, **251**B allows the tiles **20**A, **20**B to be stacked vertically relative to each other while preventing the tiles **20**A, **20**B from moving relative to each other, which prevents chipping and scratching of tiles **20**A, **20**B during shipping.

[0060] Furthermore, because tiles composed of clay may shrink when drying, tiles according to one embodiment of the invention are dimensioned to optimize the strength to weight ratio. The optimized dimensions allow the tiles to be manufactured with more tolerance for distortion while continuing to meet building code specifications for weight.

[0061] The Installation Process

[0062] Reference is now made to **FIGS. 19 through 21**, which combine to illustrate the tile installation process according to the present invention. The tiles **20**A, **20**B are typically installed horizontally in interlocked courses, with each horizontal course overlapping the one immediately below it. The overlap is typically about 2.25 inches, although other overlap lengths are contemplated without departing from the spirit and scope of the present invention. The lower ridge **251**A, **251**B and the adjacent lower touch surface **312**A, **312**B facilitate the proper alignment of the next-laid course. In addition, the ribs **300**A, **300**B extending from an upper tile **20**A, **20**B have a level resting surface on the lower ridge **251**A, **251**B of a lower tile **20**A, **20**B when installed, and the touch point **307**A, **307**B of the upper tile **20**A, **20**B seats on the lower touch surface **312**A, **312**B of the lower tile **20**A, **20**B. Additionally, having the ribs **300**A, **300**B of the upper tile **20**A, **20**B resting on the lower ridge **251**A, **251**B directs water to the exposed surface of the tile **20**A, **20**B below it, thus preventing the water from backing up behind the lower tile **20**A, **20**B.

[0063] The tiles are attached to a supporting surface **43** (such as plywood) by nails or other suitable fasteners engaged into apertures **260**A, **260**B, **261**A, **261**B. A common eave-riser metal drip edge **42** is used at the bottom of the roof to support the bottom horizontal course of tiles **20**A, **20**B.

[0064] As is shown in **FIG. 20**, the edge portions **35** of the tiles **20**A, **20**B are offset from the edge portions **35** of the tiles **20**A, **20**B below them to facilitate the diversion of water and debris. To size tiles **20**A, **20**B such that the edge portions **35** can be offset from those tiles **20**A, **20**B below them, installers may need to cut a tile **20**A, **20**B lengthwise. In one embodiment, the installers can cut between the two center primary ribs **303**B for tile **20**B or between the center primary rib **303**A and one of the secondary ribs **305**A for the tile **20**A. The rib design provides flexibility as to where the tiles **20**A, **20**B may be cut, which results in faster installation without compromising too much strength.

[0065] In an alternative embodiment (not shown), hip trim tiles are provided in varying widths. The hip trim tiles are used along the edge of the roof leading up to the ridge of the roof. Two configurations of hip trim tiles may be used according to one embodiment, a "C" configuration and a "D" configuration, wherein the "C" configuration hip trim tile has a width that is less than the width of the "D" configuration hip trim tile. Alternating the use of the "C" configuration hip trim tile and the "D" configuration hip trim tile with each horizontal course will result in the edge portions **35** of each course being offset from the course below or above it. The number of hip trim tile configurations may be greater than two, depending on the needs of the installation.

[0066] In addition to including hip trip tiles, one embodiment of the tiling system further includes hip trim starter tiles and ridge trim tiles. Hip trim starter tiles are used on the bottom course at the bottom corners of the roof. The hip trim starter tiles provide a clean finish for the bottom corners of the roof. Ridge trim tiles are installed along the ridge of the roof and overlap the horizontal course of tiles below them.

CONCLUSION

[0067] Therefore it may be seen that the present invention overcomes deficiencies in the prior art by providing roofing tiles which can be produced in mass quantities, yet have the appearance of traditional wood shakes with the structural properties of fired clay. In addition, by having one or more structural support ribs, the tiles have the strength of standard tiles, but weigh significantly less than standard tiles. Furthermore, the present invention provides touch points on each tile that engage receiving portions on a vertically adjacent tile for preventing the relative movement of tiles. While this invention has been described in specific detail

with reference to the disclosed embodiments, it will be understood that many variations and modifications may be affected within the spirit and scope of the invention as described in the appended claims.

That which is claimed:

1. A roofing tile made of clay material that simulates the appearance of a wood shake, said roofing tile comprising, said roofing tile further comprising:

a head end;

a nose end;

a body intermediate said head end and said nose end;

a wood grain design on an upper face of said roofing tile adjacent to said body and said nose end; and

a plurality of primary ribs extending substantially normally from a lower face of said roofing tile and extending along a length of said body from said head end to said nose end;

a plurality of secondary ribs extending substantially normally from a lower face of said roofing tile and extending along a length of said body, said secondary ribs having a length that is shorter than a length of said primary ribs;

wherein each of said ribs comprises at least one wide portion and at least one narrow portion, and said wide portion being positioned adjacent one or more portions of said tile having less flexural strength.

2. The roofing tile of claim 1 wherein said body includes:

a left side portion,

a right side portion, and

a center portion disposed intermediate said side portions,

wherein said center portion has a reduced cross-section from said side portions and wherein a first of said one or more ribs is positioned under a transition area between said left side portion and said center portion, a second of said ribs is positioned under a transition area between said right side portion and said center portion, and a third of said ribs is positioned under a transition area between said head end and said center portion.

3. A roofing tile system for simulating the appearance of a wood shake roof, said system comprising:

a first roofing tile having a first unique profile, said first roofing tile comprising:

a head end,

a nose end, and

a body,

wherein said nose end and said body have a substantially uniform cross-section and include a simulated wood grain design on an upper face of said first roofing tile; and

a second roofing tile having a second unique profile, said second unique profile being different than said first unique profile, said second roofing tile comprising:

a nose end,

a head end, and

a body, said body including a center portion intermediate a left side portion and a right side portion,

wherein said center portion has a reduced cross section than said side portions, and said side portions have substantially the same cross section as said body of said first roofing tile;

wherein said first tile is installed horizontally adjacent to said second tile.

4. The roofing tile system of claim 3 further comprising a plurality of said first roofing tiles and a plurality of said second roofing tiles, wherein said first roofing tiles are assembled horizontally adjacent to and in an alternating arrangement with said roofing second tiles.

5. The roofing tile system of claim 3 further comprising a plurality of said first roofing tiles and a plurality of said second roofing tiles, wherein said first roofing tiles are randomly assembled horizontally adjacent to said first roofing tiles and said second roofing tiles.

6. The roofing tile of claim 3 wherein said center portion of said second roofing tile has a shorter length than said side portions of said second roofing tile, and said side portions of said second roofing tile have substantially the same length as the body of said first roofing tile.

7. A roofing system comprising a plurality of roofing tiles, each of said tiles comprising:

a head end having an upper transverse ridge and a lower transverse ridge;

a nose end;

a first face comprising at least one first touch point adjacent said head end and at least one second touch point adjacent said nose end, said first and second touch points extending substantially normally from said first face; and

a second face, said second face being opposite said first face and said second face defining a first touch surfaces adjacent said upper transverse ridge and a second touch surface adjacent said lower transverse ridge;

wherein, said first touch point of a first tile is adapted for engaging said first touch surfaces of a second tile that is stacked vertically adjacent said first tile to prevent relative movement of said first tile and said second tile, and said second touch point of said first tile is adapted for engaging said second touch surface of said second tile positioned in a below laid-course to align the overlap of said nose end of said first tile with said head end of said second tile.

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