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(54) **PAVING SYSTEM**

(71) Applicant: **PAVESTONE, LLC**, Atlanta, GA (US)

(72) Inventor: **William H. Karau**, Southlake, TX (US)

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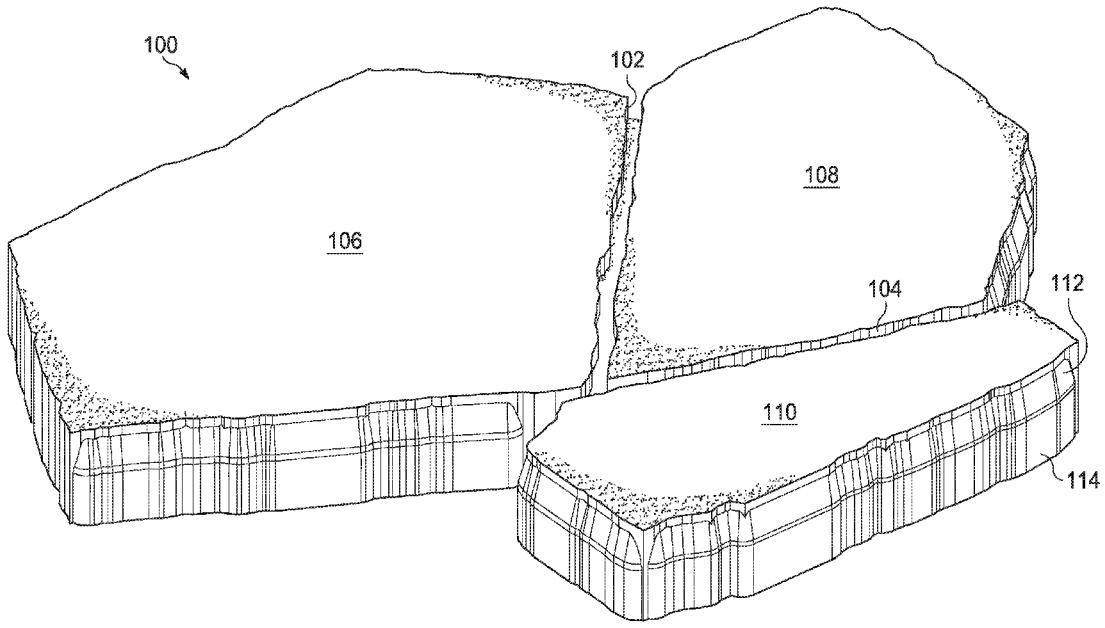
(57) **ABSTRACT**

A paving system is disclosed that includes a first paving stone having a virtual perimeter outline and a plurality of first physical sides, the virtual perimeter outline having a plurality of segments, where each segment of the plurality of segments corresponds to two or more of the first physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent first physical sides by a predetermined distance. A second paving stone having the virtual perimeter outline and a plurality of second physical sides, where each segment of the plurality of segments corresponds to two or more of the second physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent second physical sides by a predetermined distance. The plurality of first physical sides is different from the plurality of second physical sides.



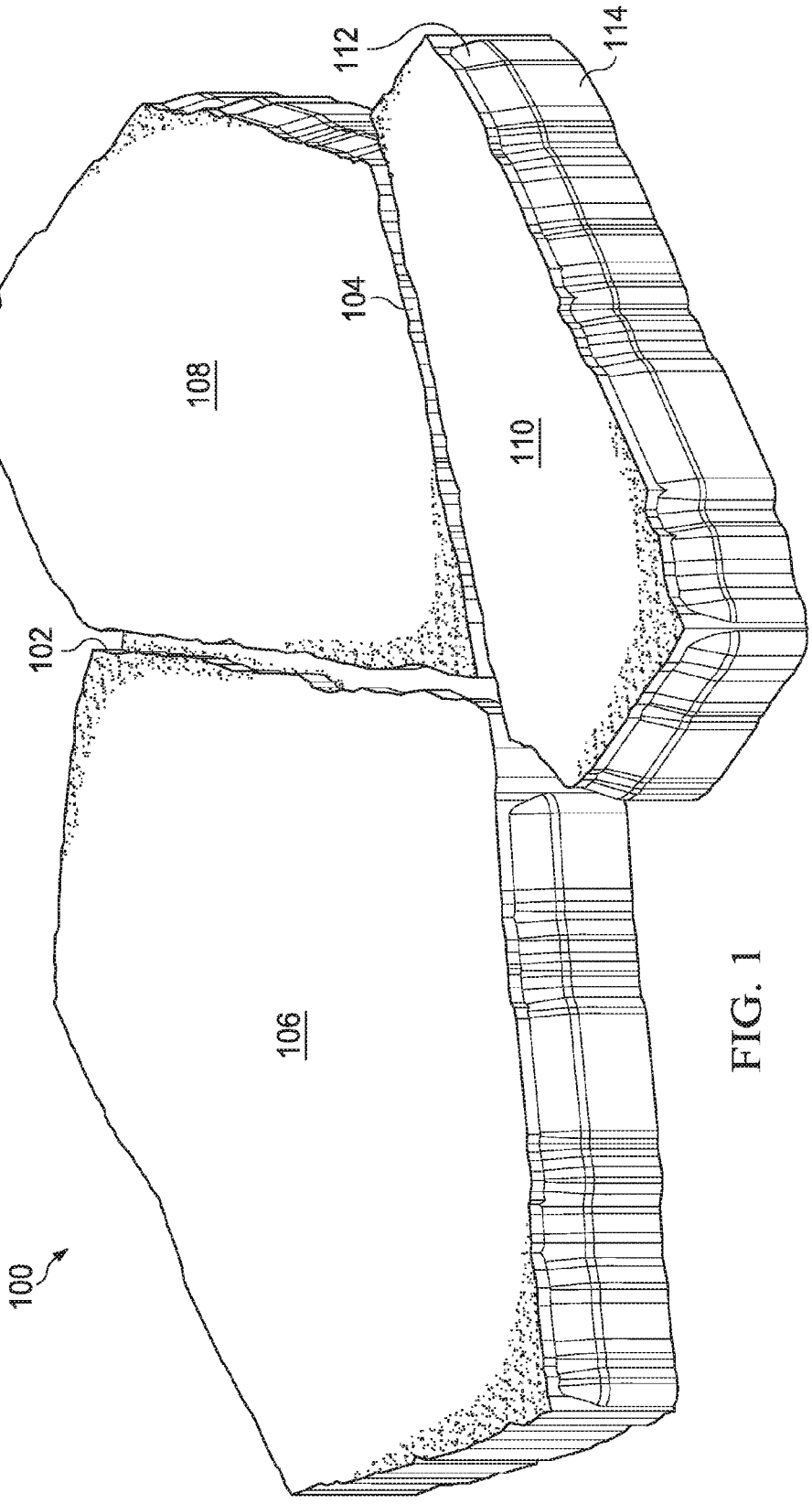


FIG. 1

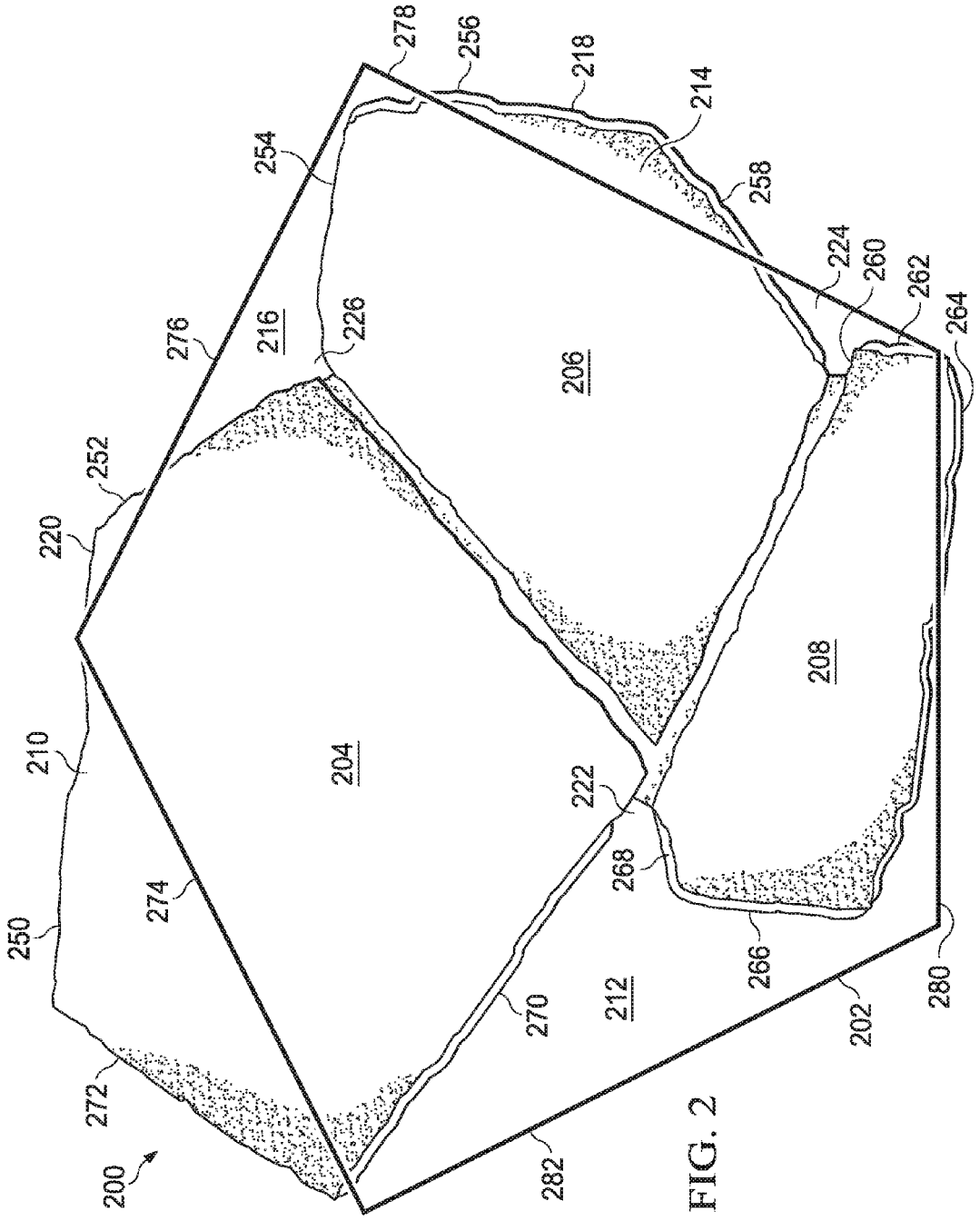

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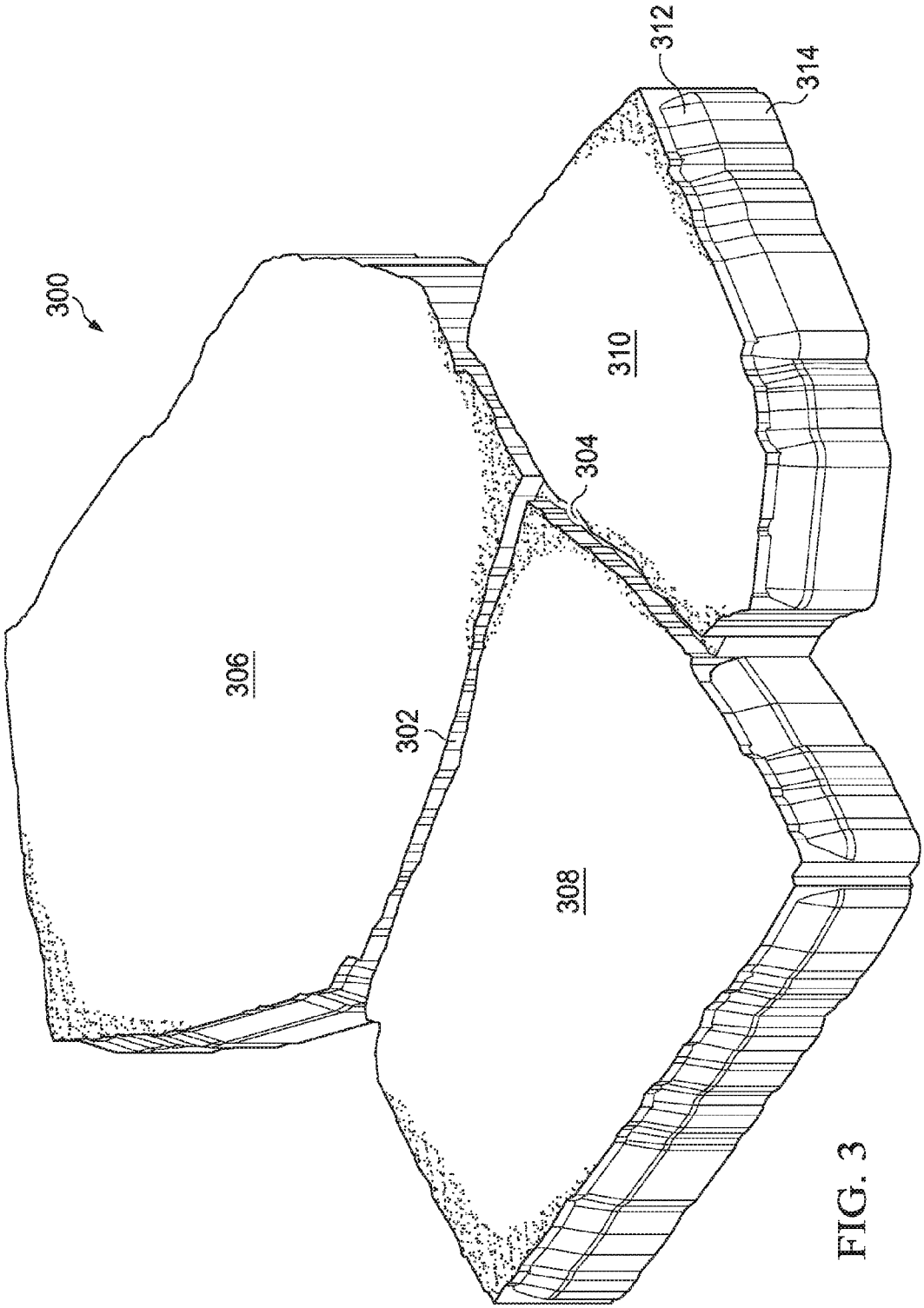
FIG. 2



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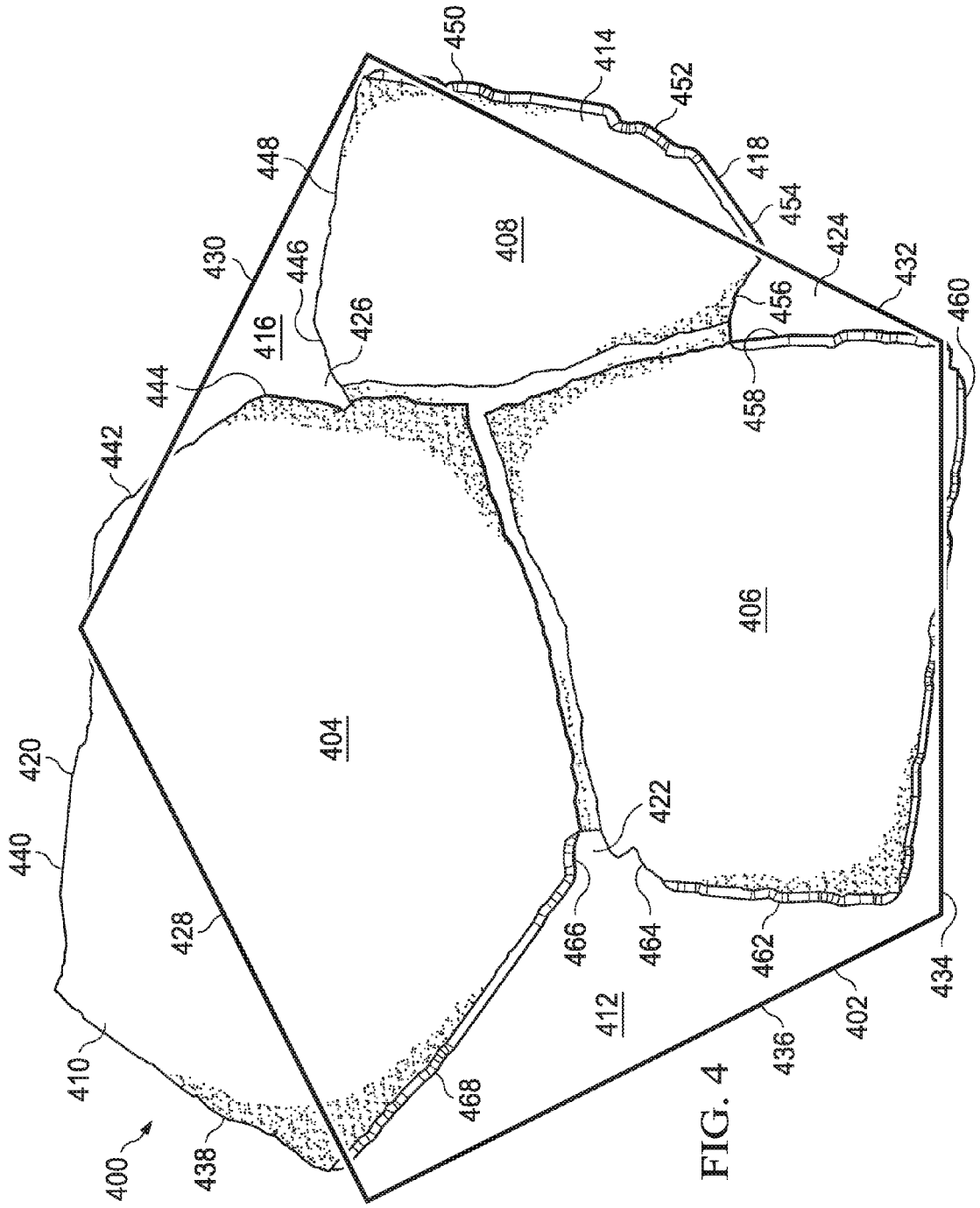
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FIG. 4

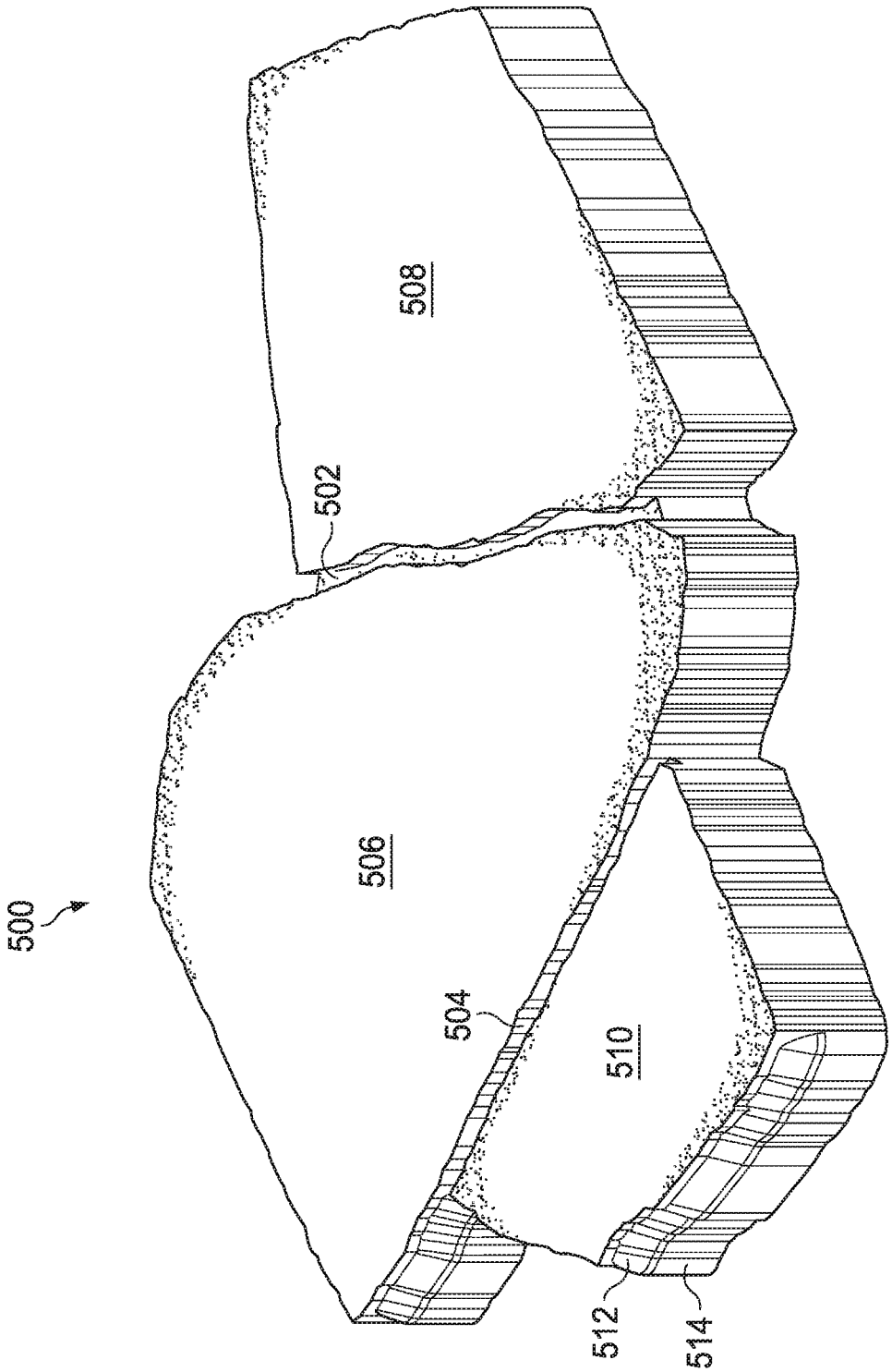

FIG. 5

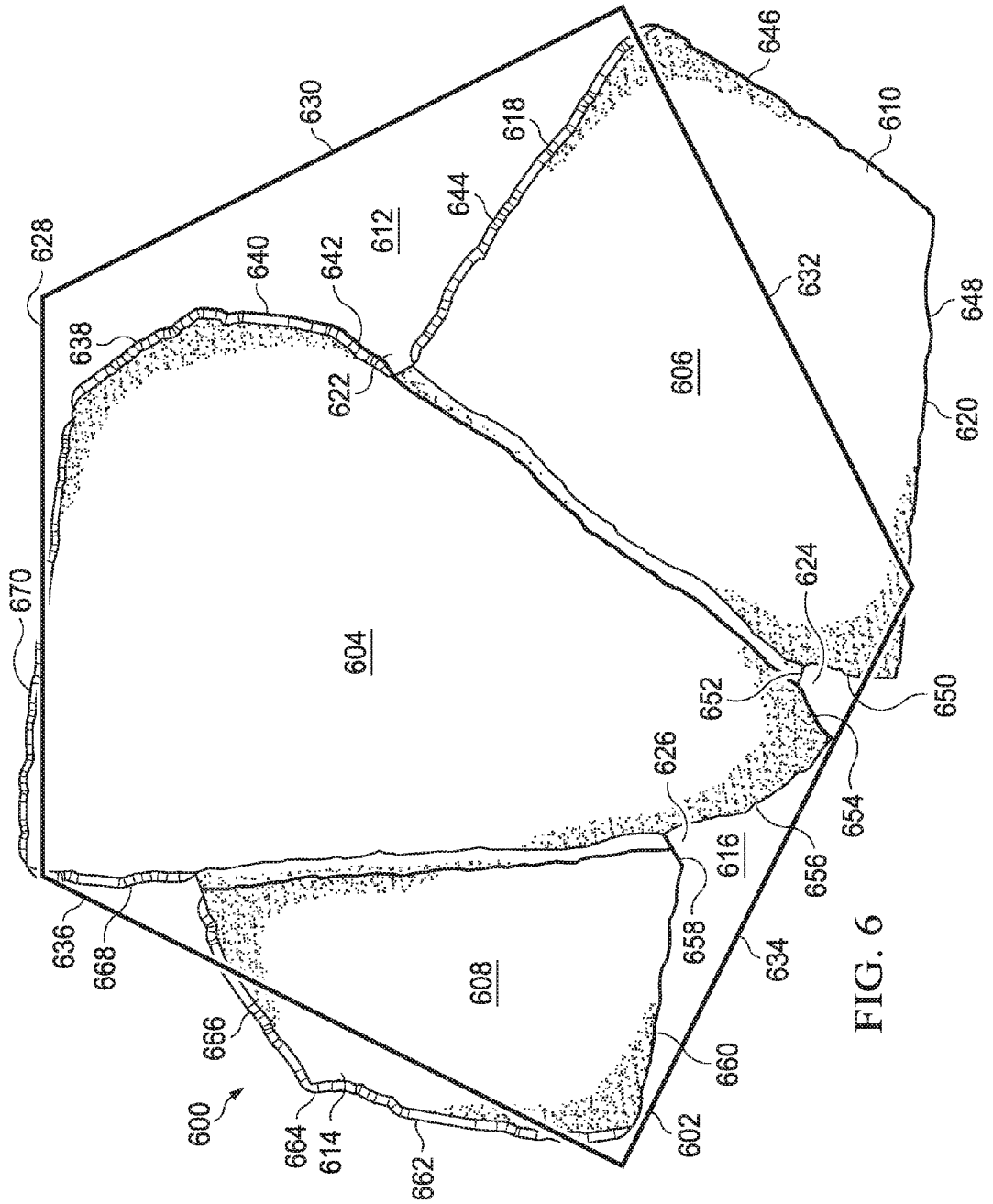
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FIG. 6

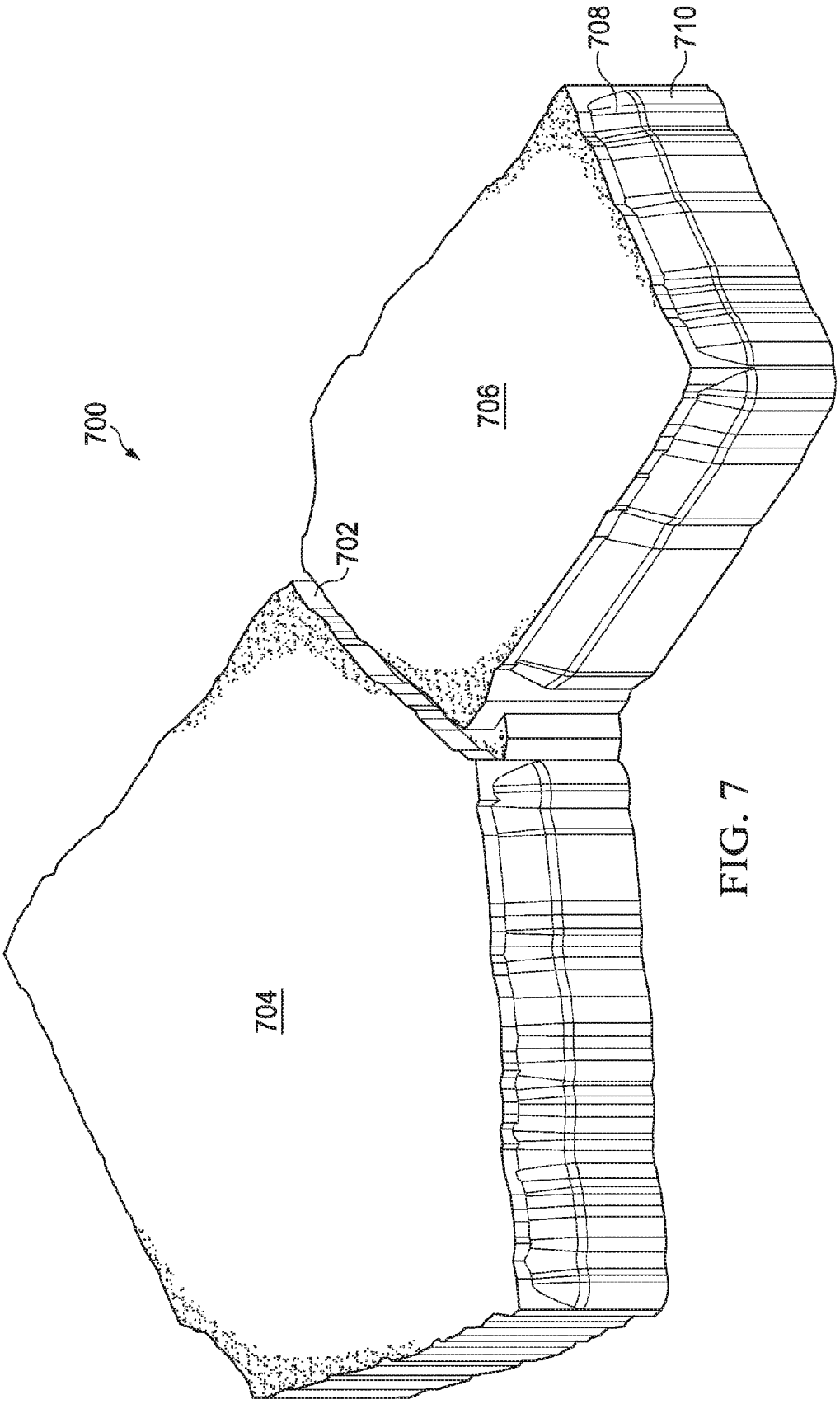

FIG. 7

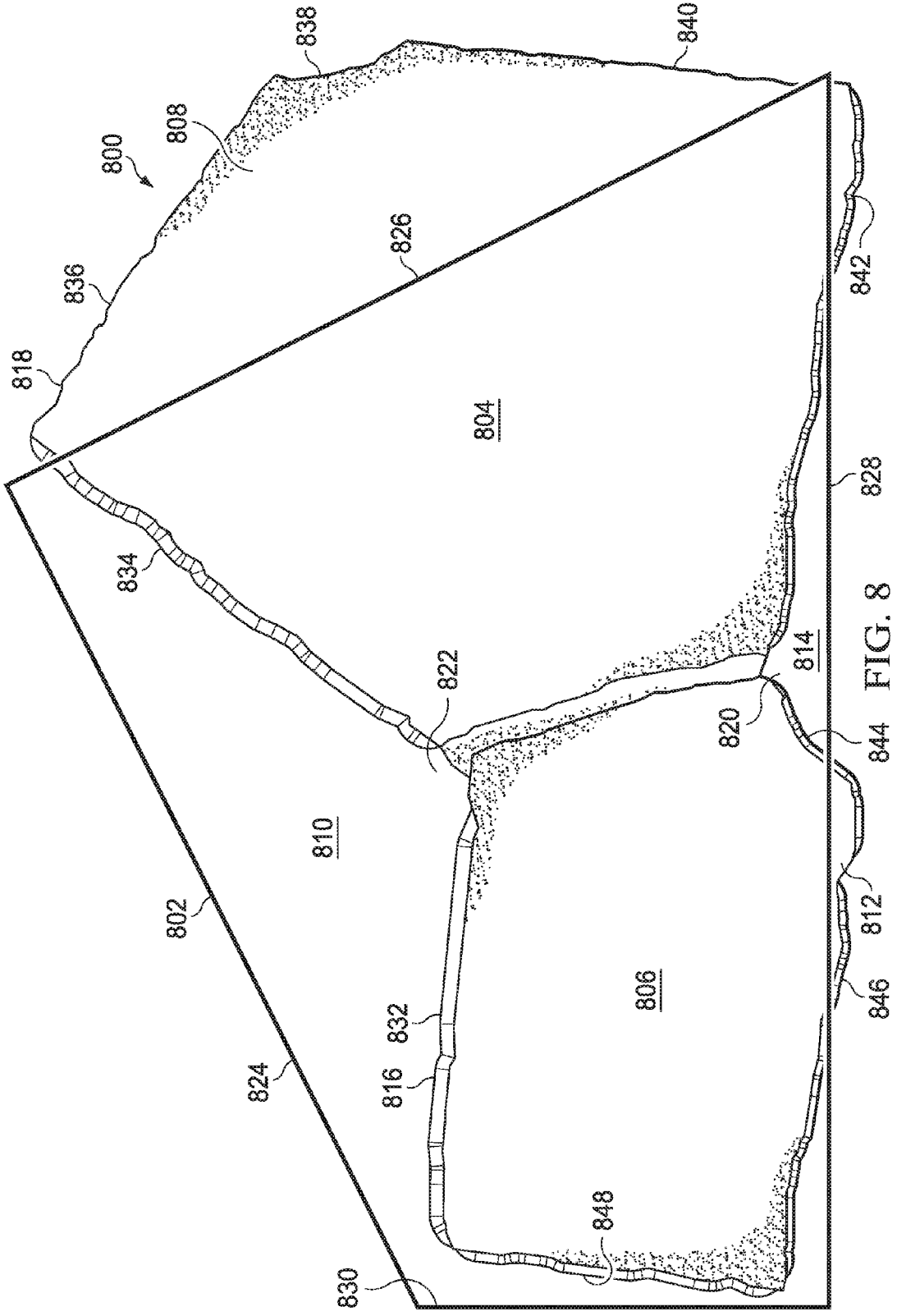
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FIG. 8

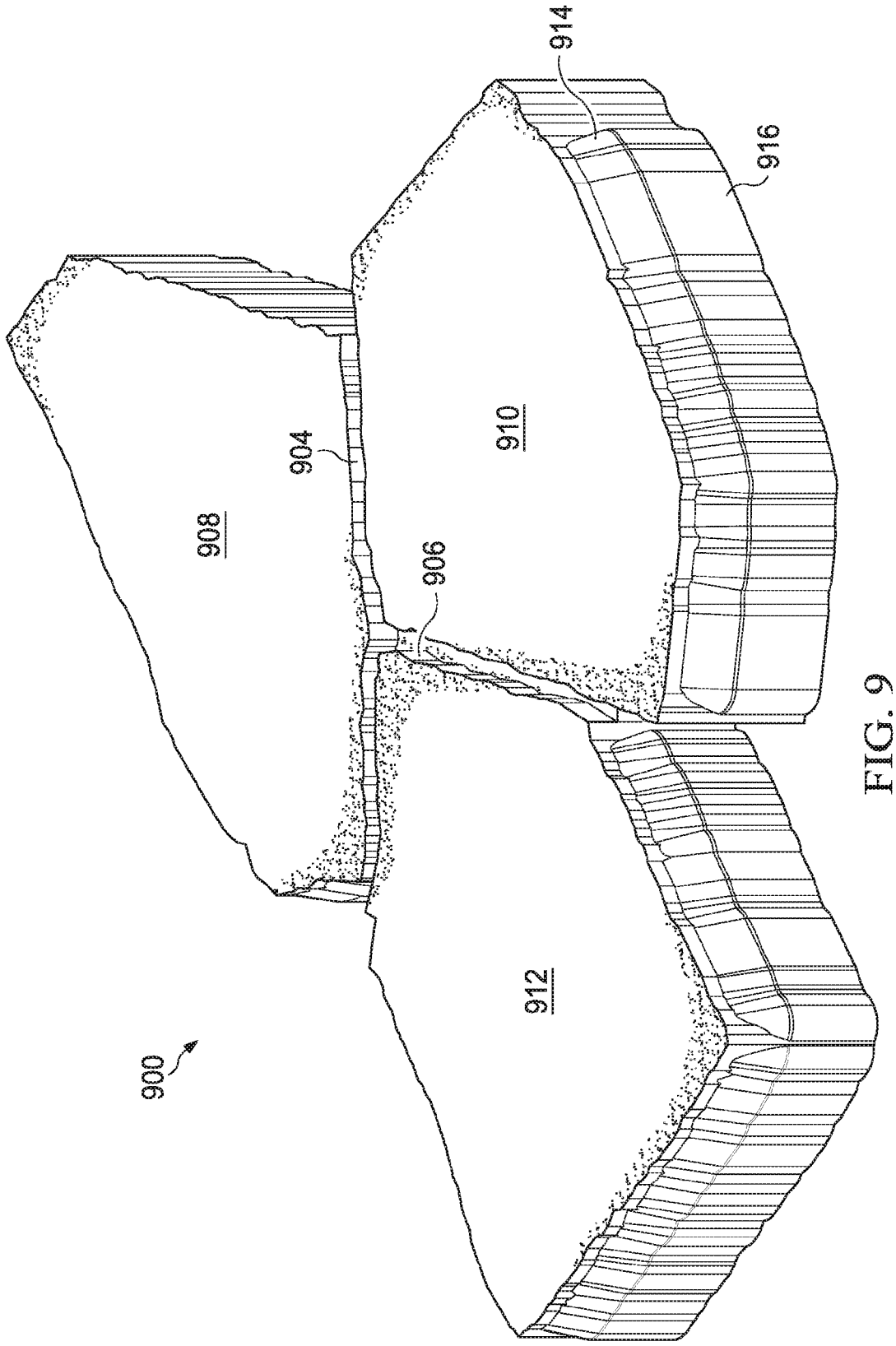

FIG. 9

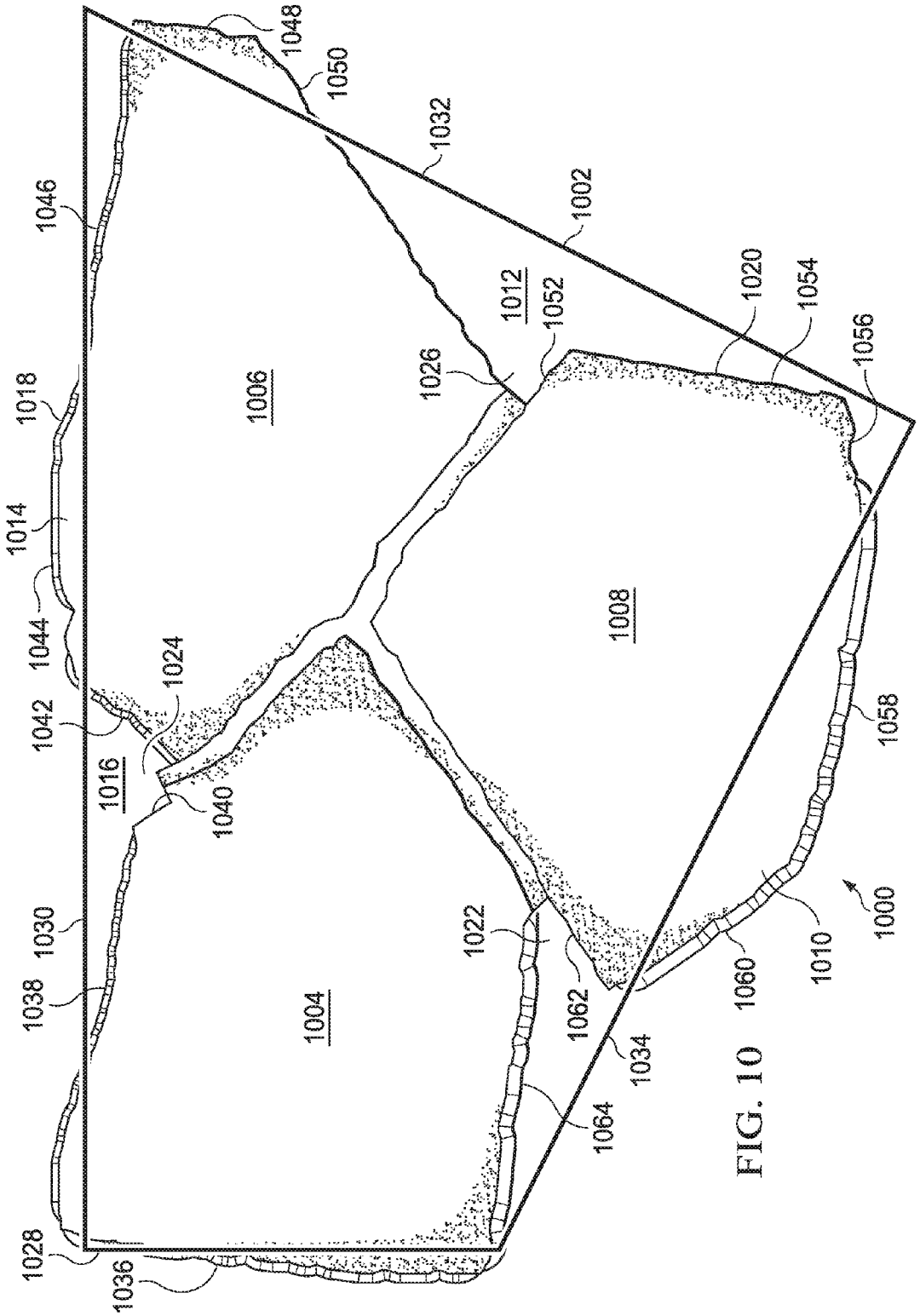
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FIG. 10

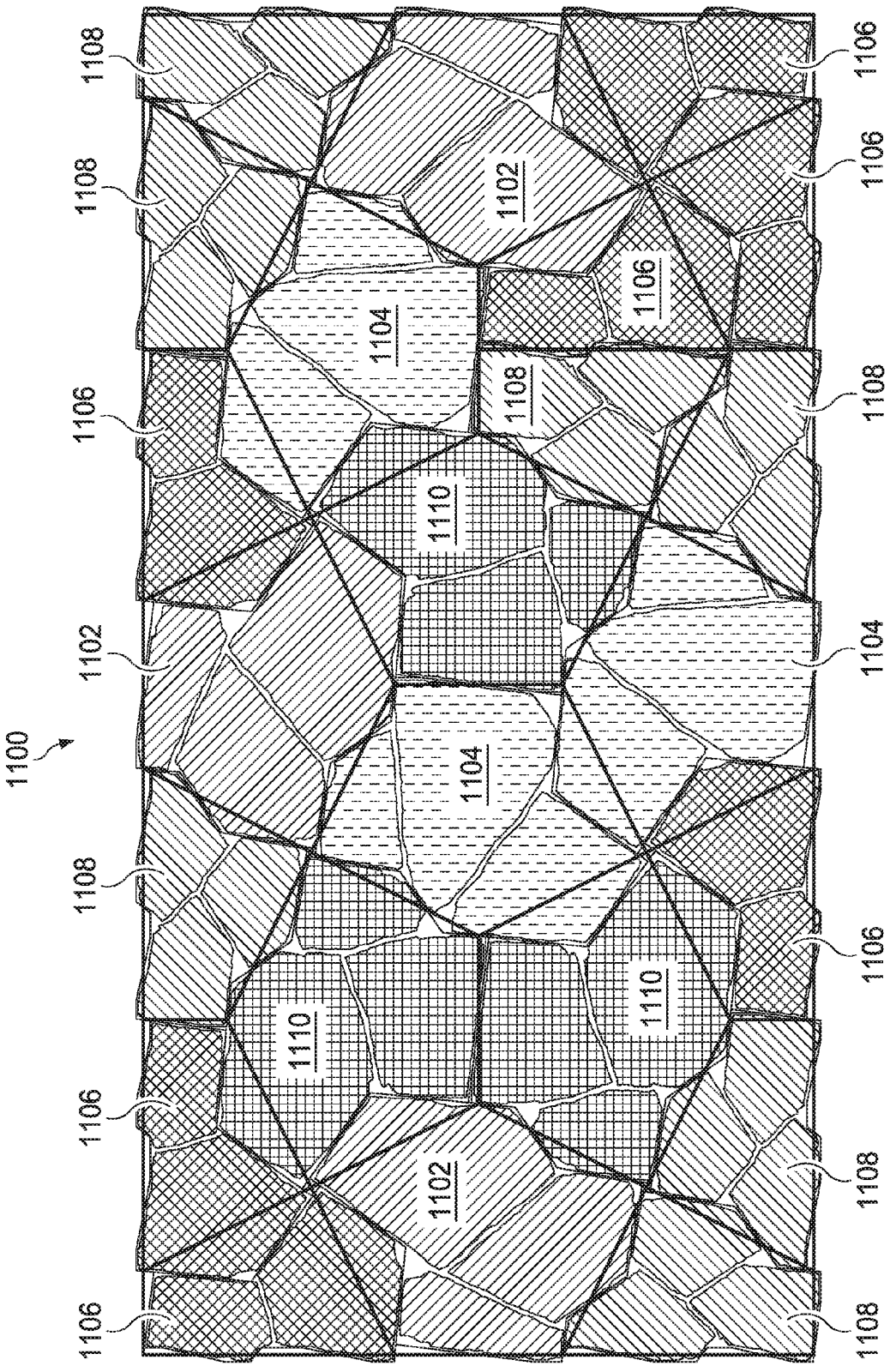

FIG. 11

PAVING SYSTEM

RELATED APPLICATIONS

[0001] The present application is a continuation-in-part of pending U.S. Design patent application No. 29/543,176, filed Oct. 21, 2015.

TECHNICAL FIELD

[0002] The present disclosure relates generally to a paving system, and more specifically to a paving system that utilizes a Cairo pentagon as a guide for a set of different paver shapes.

BACKGROUND OF THE INVENTION

[0003] Paving systems are known that use different pavers, but despite the use of different pavers, an irregular appearance that avoids repeating configurations is not known.

SUMMARY OF THE INVENTION

[0004] A paving system is disclosed that includes a first paving stone having a virtual perimeter outline and a plurality of first physical sides, where the virtual perimeter outline has a plurality of segments, where each segment of the plurality of segments corresponds to two or more of the first physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent first physical sides by a predetermined distance. A second paving stone has the virtual perimeter outline and a plurality of second physical sides, where each segment of the plurality of segments corresponds to two or more of the second physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent second physical sides by a predetermined distance. The plurality of first physical sides is different from the plurality of second physical sides.

[0005] Other systems, methods, features, and advantages of the present disclosure will be or become apparent to one with skill in the art upon examination of the following drawings and detailed description. It is intended that all such additional systems, methods, features, and advantages be included within this description, be within the scope of the present disclosure, and be protected by the accompanying claims.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0006] Aspects of the disclosure can be better understood with reference to the following drawings. The components in the drawings may be to scale, but emphasis is placed upon clearly illustrating the principles of the present disclosure. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views, and in which:

[0007] FIG. **1** is an isometric projection of a first paving stone in accordance with an exemplary embodiment of the present disclosure;

[0008] FIG. **2** is a top view of a first paving stone in accordance with an exemplary embodiment of the present disclosure;

[0009] FIG. **3** is an isometric projection of a second paving stone in accordance with an exemplary embodiment of the present disclosure;

[0010] FIG. **4** is a top view of a second paving stone in accordance with an exemplary embodiment of the present disclosure;

[0011] FIG. **5** is an isometric projection of a third paving stone in accordance with an exemplary embodiment of the present disclosure;

[0012] FIG. **6** is a top view of a third paving stone in accordance with an exemplary embodiment of the present disclosure;

[0013] FIG. **7** is an isometric projection of a fourth paving stone in accordance with an exemplary embodiment of the present disclosure;

[0014] FIG. **8** is a top view of a fourth paving stone in accordance with an exemplary embodiment of the present disclosure;

[0015] FIG. **9** is an isometric projection of a fifth paving stone in accordance with an exemplary embodiment of the present disclosure;

[0016] FIG. **10** is a top view of a fifth paving stone in accordance with an exemplary embodiment of the present disclosure; and

[0017] FIG. **11** is a layout diagram showing a plurality of first paving stones, second paving stones, third paving stones, fourth paving stones and fifth paving stones arranged in a Cairo pentagon pattern, in accordance with an exemplary embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE INVENTION

[0018] In the description that follows, like parts are marked throughout the specification and drawings with the same reference numerals. The drawing figures may be to scale and certain components can be shown in generalized or schematic form and identified by commercial designations in the interest of clarity and conciseness.

[0019] Prior art paving systems includes those where the pavers are differently sized units, each of which is an integer multiple of a basic rotational tessellation element. This configuration has the effect of interrupting the joint pattern and making the pavers less regular in appearance. Although the various units fit together, it is difficult for an installer to assemble the pavers, and this idea has largely failed in the marketplace.

[0020] Another prior art paving system is the single-piece system, wherein all of the units are of the same size and form a repeating pattern that is easier to install. The repeating pattern is disguised in part by false joints in the stones themselves, but the single piece system, which unavoidably has a joint surrounding each unit, also has limitations that render it unacceptable. First, the sides of the stones generally extend from the vertices of the tessellation. So, although the joints are irregularly shaped, they intersect at regular intervals along a straight line, and the joints meet in perfect crossing alignment with each other. These characteristics degrade the illusion of randomness in the completed pavement.

[0021] Second, sides of adjacent stones have the same length, which introduces another degree of artificiality, and which further degrades the illusion of randomness. Third, the sides of adjacent stones are rotational images of one another, and have the same configuration with only minor

variations in the sides. This characteristic limits the ability to imitate hand-split flagstone, which rarely fractures into polygons of any significant concavity. The result is sides which conform closely, and revealingly, to those of the base tessellation array, because for one stone to depart from the array in a credible, convex way requires the adjacent stone to have an incredible, concave side.

[0022] Fourth, the use of 120 degree rotational tessellations makes layout and installation difficult for workmen accustomed to rectilinear arrangements. Constructing a rectangular pavement requires either 1) overlaying and trimming the perimeter, which is costly, or 2) employing a variety of specially-configured termination blocks, which creates estimating and inventory challenges.

[0023] The present disclosure addresses these problems. In one exemplary embodiment, pavers derived from a Cairo pentagonal tiling are used to form the arrangement of stones. The arrangement is fundamentally orthogonal, integrates more readily with common landscape features (such as rectangular building foundations), and is simple to lay-out with common tools such as try squares, string lines, and Pythagorean triangles.

[0024] Second, although the perimeter of each stone fits within a common block-bounding polygon, the vertices of the polygon are substantially displaced from the vertices of its associated Cairo pentagon, resulting in joints that intersect imperfectly with each other, and also in the misalignment of the joint intersections with the axes of the tiling array.

[0025] Third, the misalignment of the joint intersections results in abutting sides of adjacent stones having different lengths, which also helps to obscure the Cairo-pentagonal shape that is the basis of each paver. Fourth, the sides of adjacent stones are not images of one another. Instead, substantial gaps, notches, and intersecting false joints on one side of a joint bear no complementary resemblance to the side of the stone on the opposite side of the joint.

[0026] Fifth, the disclosed block-bounding polygon is significantly concave, and the stones inscribed therein include false joints to visually subdivide them into multiple substantially convex polygons, which conform to the usual appearance of flagstone. Sixth, the Cairo pentagon is easily subdivided into two termination stones, which together in normal arrangement can replace a whole stone in the array, together in abutting arrangement can form a straight edge termination, and pairs thereof can easily form outside 90 degree corners.

[0027] One aspect of the present disclosure is the avoidance of rotational images, which improves the ability to avoid readily observable repeating patterns. Rotational images are avoided by using perimeter segments that do not mate or conform to each other, but which also do not interfere with each other. In addition, multiple sides are used to form the perimeter segments for adjacent pavers, which improves the ability to avoid rotational images, mating sides and other inferior features that result in readily discernable repeating patterns.

[0028] FIG. **1** is an isometric projection of a first paving stone **100**, in accordance with an exemplary embodiment of the present disclosure. Paving stone **100** and all other paving stones disclosed herein can be formed from concrete, masonry or other suitable materials, can be wet cast, dry cast or manufactured in other suitable manners.

[0029] As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. As used herein, phrases such as "between X and Y" and "between about X and Y" should be interpreted to include X and Y. As used herein, phrases such as "between about X and Y" mean "between about X and about Y." As used herein, phrases such as "from about X to Y" mean "from about X to about Y."

[0030] Paving stone **100** includes false joints **102** and **104**, which separate the upper surface of paving stone **100** into a large area **106**, an intermediate area **108** and a small area **110**. In this manner, paving stone **100** appears to be three different stones to a casual observer, and the false joints **102** and **104** also help to channel water to the joints between paving stone **100** and adjacent paving stones. Paving stone **100** also includes upper perimeter segment surface **112** and lower perimeter segment surface **114**, where upper perimeter segment surface **112** gradually decreases in diameter from the diameter of lower perimeter segment surface **114**. In this manner, the minimum spacing between paving stone **100** and adjacent paving stones can appear to be approximately the same as the spacing of the false joints.

[0031] FIG. **2** is a top view of a first paving stone **200**, in accordance with an exemplary embodiment of the present disclosure. Cairo pentagon overlay **202** shows the outline of an ideal or virtual Cairo pentagon, and the outline of paving stone **200** can be seen to deviate from Cairo pentagon overlay **202**. In particular, a portion **210** of large section **204** extends significantly beyond the boundary of Cairo pentagon overlay **202**, and the point of contact between large section **204** and small section **208** forms a corner of space **212** within Cairo pentagon overlay **202**, where space **212** is approximately equal in size to portion **210** of large section **204**. Likewise, intermediate section **206** extends for a smaller section **214** outside of Cairo pentagon overlay **202**, and intermediate section **206** forms a corner of space **216** with large section **204**, where space **216** is approximately the size of smaller section **214**.

[0032] The perimeter of paving stone **200** is formed in one of two configurations—either offset perimeter segment **218** or flat perimeter segment **220**. Offset perimeter segment **218** is located along a continuous section opposite from flat perimeter segment **220**, and is oriented so that paving stone **200** can be readily fitted with other paving stones of the disclosed paving system, by assembling the paving stones so that an offset perimeter segment **218** is adjacent to a flat perimeter segment **220**, or in other suitable manners.

[0033] Each of the five perimeter segments **274**, **276**, **278**, **280** and **282** are formed from multiple sides or portions of sides, so as to avoid rotational images. For example, perimeter segment **274** is formed from a portion of side **270**, side **272** and a portion of side **250**, and thus avoids the creation of a vertex where perimeter segment **274** meets with perimeter segment **276** or perimeter segment **282**. Likewise, perimeter segment **276** is formed from a portion of side **250**,

side **252**, side **254** and a portion of side **256**, which avoids the creation of a vertex at the intersection of perimeter segment **276** and perimeter segment **278**. Perimeter segment **278** is formed from a portion of side **256**, side **258**, side **260** and most of side **262**, although it will be recognized by one of skill in the art that the "sides" that are discussed herein with respect to every exemplary embodiment are not really sides, as they are formed from irregular shapes that are not straight line segments and are not amenable to characterization as a true "side." Perimeter segment **280** is formed from a portion of side **262** and most of side **264**, and perimeter segment **282** is formed from a portion of side **264**, sides **266** and **268**, and most of side **270**. As can be seen, no vertices are formed in paving stone **200** that correspond to the intersection of perimeter segment **280** with perimeter segment **278** or perimeter segment **282**.

[0034] Paving stone **200** also includes notches **222**, **224** and **226**, which are used to improve the random appearance of paving stone **200** when it is used in conjunction with other pavers, and which also provides a space for water to drain from the surface of paving stone **200**.

[0035] Paving stone **200** thus has a bottom surface with a fixed orientation relative to its associated Cairo pentagon. The perimeter of the bottom surface encloses an area greater than about 90% of the area of the Cairo pentagon, but can include greater or lesser areas as suitable. At least about 8% of the bottom surface falls outside the boundaries of the Cairo pentagon, although more or less can fall outside as suitable. In addition, paving stone **200** has no vertices that coincide with the vertices of its associated Cairo pentagon, which helps to avoid the creation of a rotational image. In application, the distance between a perimeter segment of paving stone **200** and a vertex of its associated Cairo pentagon can be within about 10 mm or other suitable distances, can be within about 5% of the total length of the perimeter or other suitable distances, and can have other suitable unique or repeating features. Likewise, while a Cairo pentagon is used in the disclosed embodiments, other suitable shapes can be used as the basis for a paving stone in accordance with the present disclosure, where the paving stone has the other disclosed features and functional attributes as disclosed herein.

[0036] While it is recognized that paving stone **200** and other paving stones as disclosed herein also have certain non-functional and ornamental attributes, the ability to have a paving stone system with a small number of different stones that nonetheless creates a random appearance provides the functional attributes of reducing an amount of manual work that is required to create a paving stone layout with a random appearance, reducing the number of different types of paving stones that need to be kept on site to create a random appearing paving stone section, facilitating the easy placement of paving stones within a common rectangular space while maintaining a random appearance, and numerous other benefits as further discussed and disclosed herein, such as facilitating the drainage of water from the surface of the paving stones.

[0037] FIG. **3** is an isometric projection of a second paving stone **300**, in accordance with an exemplary embodiment of the present disclosure. Paving stone **300** includes false joints **302** and **304**, which separate the upper surface of paving stone **300** into a large area **306**, an intermediate area **308** and a small area **310**. In this manner, paving stone **300** appears to be three different stones to a casual observer, and the false joints **302** and **304** also help to channel water to the joints between paving stone **300** and adjacent paving stones. Paving stone **300** also includes upper perimeter segment surface **312** and lower perimeter segment surface **314**, where upper perimeter segment surface **312** gradually decreases in diameter from the diameter of lower perimeter segment surface **314**. In this manner, the minimum spacing between paving stone **300** and adjacent paving stones can appear to be approximately the same as the spacing of the false joints.

[0038] FIG. **4** is a top view of a second paving stone **400**, in accordance with an exemplary embodiment of the present disclosure. Cairo pentagon overlay **402** shows the outline of an ideal Cairo pentagon, and the outline of paving stone **400** can be seen to deviate from Cairo pentagon overlay **402**. In particular, a portion **410** of large section **404** extends significantly beyond the boundary of Cairo pentagon overlay **402**, and the point of contact between large section **404** and intermediate section **406** forms a corner of space **412** within Cairo pentagon overlay **402**, where space **412** that is approximately equal in size to portion **410** of large section **404**. Likewise, large section **404** extends for a smaller section **414** outside of Cairo pentagon overlay **402**, and small section **408** forms a corner of space **416** with large section **404**, where space **416** is approximately the size of smaller section **414**.

[0039] The perimeter of paving stone **400** is formed in one of two configurations—either offset perimeter segment **418** or flat perimeter segment **420**. Offset perimeter segment **418** is located along a continuous section opposite from flat perimeter segment **420**, and is oriented so that paving stone **400** can be readily fitted with other paving stones of the disclosed paving system, by assembling the paving stones so that offset perimeter segment **418** is adjacent to flat perimeter segments **420**, or in other suitable manners.

[0040] Perimeter segment **428** is formed from a portion of side **468**, side **438** and a portion of side **440**. Perimeter segment **430** is formed from a portion of side **440**, sides **442**, **444**, **446** and **448** and a portion of side **450**. Perimeter segment **432** is formed from a portion of side **450**, sides **452**, **454** and **456** and most of side **458**. Perimeter segment **434** is formed from a portion of side **458** and most of side **460**. Perimeter segment **436** is formed from a portion of side **460**, sides **462**, **464** and **466**, and most of side **468**. The vertices of perimeter segments **428**, **430**, **432**, **434** and **436** do not coincide with any vertex of sides of paving stone **400**, and thus avoid any rotational images. In addition, the large number of sides of paving stone **400** and the variations in the number of sides of perimeter segments **428**, **430**, **432**, **434** and **436** results in non-matching perimeter segments that are not rotational images of other perimeter segments, and which do not match perimeter segments on other paving stones, which helps to avoid the creation of easily-observable repeating patterns while simplifying installation.

[0041] Paving stone **400** also includes notches **422**, **424** and **426**, which are used to improve the random appearance of paving stone **400** when it is used in conjunction with other pavers, and which also provides a space for water to drain from the surface of paving stone **400**.

[0042] Paving stone **400** thus has a bottom surface with a fixed orientation relative to its associated Cairo pentagon. The perimeter of the bottom surface encloses an area greater than about 90% of the area of the Cairo pentagon, but can include greater or lesser areas as suitable. At least about 8% of the bottom surface falls outside the boundaries of the

Cairo pentagon, although more or less can fall outside as suitable. In addition, paving stone **400** has no vertices that coincide with a vertex of its associated Cairo pentagon, which also helps to avoid the creation of a rotational image. In application, the distance between a perimeter segment of paving stone **400** and a vertex of its associated Cairo pentagon can be within about 10 mm or other suitable distances, can be within about 5% of the total length of the perimeter or other suitable distances, and can have other suitable unique or repeating features. Likewise, while a Cairo pentagon is used in the disclosed embodiments, other suitable shapes can be used as the basis for a paving stone in accordance with the present disclosure, where the paving stone has the other disclosed features and functional attributes as disclosed herein.

[0043] FIG. **5** is an isometric projection of a third paving stone **500**, in accordance with an exemplary embodiment of the present disclosure. Paving stone **500** includes false joints **502** and **504**, which separate the upper surface of paving stone **500** into a large area **506**, an intermediate area **508** and a small area **510**. In this manner, paving stone **500** appears to be three different stones to a casual observer, and the false joints **502** and **504** also help to channel water to the joints between paving stone **500** and adjacent paving stones. Paving stone **500** also includes upper perimeter segment surface **512** and lower perimeter segment surface **514**, where upper perimeter segment surface **512** gradually decreases in diameter from the diameter of lower perimeter segments surface **514**. In this manner, the minimum spacing between paving stone **500** and adjacent paving stones can appear to be approximately the same as the spacing of the false joints.

[0044] FIG. **6** is a top view of a third paving stone **600**, in accordance with an exemplary embodiment of the present disclosure. Cairo pentagon overlay **602** shows the outline of an ideal Cairo pentagon, and the outline of paving stone **600** can be seen to deviate from Cairo pentagon overlay **602**. In particular, a portion **610** of intermediate section **606** extends significantly beyond the boundary of Cairo pentagon overlay **602**, and the point of contact between large section **604** and intermediate section **606** forms a corner of space **612** within Cairo pentagon overlay **602**, where space **612** is approximately equal in size to portion **610** of intermediate section **606**. Likewise, small section **608** extends for a smaller section **614** outside of Cairo pentagon overlay **602**, and small section **608** forms a corner of space **616** with large section **604**, where space **616** is approximately the size of smaller section **614**.

[0045] The perimeter of paving stone **600** is formed in one of two configurations—either offset perimeter segment **618** or flat perimeter segment **620**. Offset perimeter segment **618** is located along a continuous section opposite from flat perimeter segment **620**, and is oriented so that paving stone **600** can be readily fitted with other paving stones of the disclosed paving system, by assembling the paving stones so that offset perimeter segment **618** is adjacent to flat perimeter segment **620**, or in other suitable manners.

[0046] Perimeter segment **628** is formed from a portion of side **668**, side **670** and a portion of side **638**. Perimeter segment **630** is formed from a portion of side **638**, sides **640** and **642**, and a portion of side **644**. Perimeter segment **632** is formed from a portion of side **644**, side **646** and a portion of side **648**. Perimeter segment **634** is formed from a portion of side **648**, sides **650**, **652**, **654**, **656**, **658**, **660** and a portion of side **662**. Perimeter segment **636** is formed from a portion of side **662**, sides **664** and **666**, and a portion of side **668**. The vertices of perimeter segments **628**, **630**, **632**, **634** and **636** do not coincide with any vertex of sides of paving stone **600**, and thus avoid any rotational images. In addition, the large number of sides of paving stone **600** and the variations in the number of sides of perimeter segments **628**, **630**, **632**, **634** and **636** results in non-matching perimeter segments that are not rotational images of other perimeter segments, and which do not match perimeter segments on other paving stones, which helps to avoid the creation of easily-observable repeating patterns while simplifying installation.

[0047] Paving stone **600** also includes notches **622**, **624** and **626**, which are used to improve the random appearance of paving stone **600** when it is used in conjunction with other pavers, and which also provides a space for water to drain from the surface of paving stone **600**.

[0048] Paving stone **600** thus has a bottom surface with a fixed orientation relative to its associated Cairo pentagon. The perimeter of the bottom surface encloses an area greater than about 90% of the area of the Cairo pentagon, but can include greater or lesser areas as suitable. At least about 8% of the bottom surface falls outside the boundaries of the Cairo pentagon, although more or less can fall outside as suitable. In addition, paving stone **600** has no vertices that coincide with a vertex of its associated Cairo pentagon. In application, the distance between a perimeter segment of paving stone **600** and a vertex of its associated Cairo pentagon can be within about 10 mm or other suitable distances, can be within about 5% of the total length of the perimeter or other suitable distances, and can have other suitable unique or repeating features. Likewise, while a Cairo pentagon is used in the disclosed embodiments, other suitable shapes can be used as the basis for a paving stone in accordance with the present disclosure, where the paving stone has the other disclosed features and functional attributes as disclosed herein.

[0049] FIG. **7** is an isometric projection of a fourth paving stone **700**, in accordance with an exemplary embodiment of the present disclosure. Paving stone **700** includes false joint **702**, which separates the upper surface of paving stone **700** into a large area **704** and a small area **706**. In this manner, paving stone **700** appears to be three different stones to a casual observer, and the false joint **702** also helps to channel water to the joints between paving stone **700** and adjacent paving stones. Paving stone **700** also includes upper perimeter segment surface **708** and lower perimeter segment surface **710**, where upper perimeter segment surface **708** gradually decreases in diameter from the diameter of lower perimeter segment surface **710**. In this manner, the minimum spacing between paving stone **700** and adjacent paving stones can appear to be approximately the same as the spacing of the false joints.

[0050] FIG. **8** is a top view of a fourth paving stone **800**, in accordance with an exemplary embodiment of the present disclosure. Cairo pentagon overlay **802** shows the outline of an ideal Cairo pentagon, and the outline of paving stone **800** can be seen to deviate from Cairo pentagon overlay **802**. In particular, a portion **808** of large section **804** extends significantly beyond the boundary of Cairo pentagon overlay **802**, and the point of contact between large section **804** and small section **806** forms a corner of space **810** within Cairo pentagon overlay **802**, where space **810** is approximately equal in size to portion **808** of large section **804**. Likewise, small section **806** extends for a smaller section **812** outside

of Cairo pentagon overlay **802**, and small section **806** forms a corner of space **814** with large section **804**, where space **814** is approximately the size of smaller section **812**.

[0051] The perimeter of paving stone **800** is formed in one of two configurations—either offset perimeter segment **816** or flat perimeter segment **818**. Offset perimeter segment **816** is located along a continuous section opposite from flat perimeter segment **818**, and is oriented so that paving stone **800** can be readily fitted with other paving stones of the disclosed paving system, by assembling the paving stones so that offset perimeter segment **816** is adjacent to flat perimeter segment **818**, or in other suitable manners.

[0052] Perimeter segment **824** is formed from a portion of side **848**, side **832** and a portion of side **834**. Perimeter segment **826** is formed from a portion of side **834**, sides **836** and **838**, and a portion of side **840**. Perimeter segment **828** is formed from a portion of side **840**, sides **842** and **844**, and a portion of side **846**. Perimeter segment **830** is formed from a portion of side **846** and a portion of side **848**. The vertices of perimeter segments **824**, **826**, **828**, **830** and **832** do not coincide with any vertex of sides of paving stone **800**, and thus avoid any rotational images. In addition, the large number of sides of paving stone **800** and the variations in the number of sides of perimeter segments **824**, **826**, **828**, **830** and **832** results in non-matching perimeter segments that are not rotational images of other perimeter segments, and which do not match perimeter segments on other paving stones, which helps to avoid the creation of easily-observable repeating patterns while simplifying installation.

[0053] Paving stone **800** also includes notches **820** and **822**, which are used to improve the random appearance of paving stone **800** when it is used in conjunction with other pavers, and which also provides a space for water to drain from the surface of paving stone **800**.

[0054] Paving stone **800** thus has a bottom surface with a fixed orientation relative to its associated Cairo pentagon. The perimeter of the bottom surface encloses an area greater than about 90% of the area of the Cairo pentagon, but can include greater or lesser areas as suitable. At least about 8% of the bottom surface falls outside the boundaries of the Cairo pentagon, although more or less can fall outside as suitable. In addition, paving stone **800** has no vertices that coincide with a vertex of its associated Cairo pentagon. In application, the distance between a perimeter segment of paving stone **800** and a vertex of its associated Cairo pentagon can be within about 10 mm or other suitable distances, can be within about 5% of the total length of the perimeter or other suitable distances, and can have other suitable unique or repeating features. Likewise, while a Cairo pentagon is used in the disclosed embodiments, other suitable shapes can be used as the basis for a paving stone in accordance with the present disclosure, where the paving stone has the other disclosed features and functional attributes as disclosed herein.

[0055] FIG. **9** is an isometric projection of a fifth paving stone **900**, in accordance with an exemplary embodiment of the present disclosure. Paving stone **900** includes false joints **902**, **904** and **906**, which separate the upper surface of paving stone **300** into three areas **908**, **910** and **912** of approximately equal size. In this manner, paving stone **900** appears to be three different stones to a casual observer, and the false joints **902**, **904** and **906** also help to channel water to the joints between paving stone **900** and adjacent paving stones. Paving stone **900** also includes upper perimeter segment surface **914** and lower perimeter segment surface **916**, where upper perimeter segment surface **914** gradually decreases in diameter from the diameter of lower perimeter segment surface **916**. In this manner, the minimum spacing between paving stone **900** and adjacent paving stones can appear to be approximately the same as the spacing of the false joints.

[0056] FIG. **10** is a top view of a fifth paving stone **1000**, in accordance with an exemplary embodiment of the present disclosure. Cairo pentagon overlay **1002** shows the outline of an ideal Cairo pentagon, and the outline of paving stone **1000** can be seen to deviate from Cairo pentagon overlay **1002**. In particular, a portion **1010** of section **1008** extends significantly beyond the boundary of Cairo pentagon overlay **1002**, and the point of contact between section **1008** and section **1006** forms a corner of space **1012** within Cairo pentagon overlay **1002**, where space **1012** is approximately equal in size to portion **1010** of section **1008**. Likewise, section **1006** extends for a smaller section **1014** outside of Cairo pentagon overlay **1002**, and section **1004** forms a corner of space **1016** with section **1006**, where space **1016** is approximately the size of smaller section **1014**.

[0057] The perimeter of paving stone **1000** is formed in one of two configurations—either offset perimeter segment **1018** or flat perimeter segment **1020**. Offset perimeter segment **1018** is located along a continuous section opposite from flat perimeter segment **1020**, and is oriented so that paving stone **1000** can be readily fitted with other paving stones of the disclosed paving system, by assembling the paving stones so that offset perimeter segment **1018** is adjacent to flat perimeter segment **1020**, or in other suitable manners.

[0058] Perimeter segment **1028** is formed from a portion of sides **1064** and **1036**. Perimeter segment **1030** is formed from a portion of side **1036**, sides **1038**, **1040**, **1042**, **1044** and a portion of **1046**. Perimeter segment **1032** is formed from a portion of side **1046**, sides **1048**, **1050**, **1052**, **1054** and a portion of side **1056**. Perimeter segment **1034** is formed from a portion of side **1056**, sides **1058**, **1060**, **1062** and a portion of side **1064**. The vertices of perimeter segments **1028**, **1030**, **1032** and **1034** do not coincide with any vertex of sides of paving stone **1000**, and thus avoid any rotational images. In addition, the large number of sides of paving stone **1000** and the variations in the number of sides of perimeter segments **1028**, **1030**, **1032** and **1034** results in non-matching perimeter segments that are not rotational images of other perimeter segments, and which do not match perimeter segments on other paving stones, which helps to avoid the creation of easily-observable repeating patterns while simplifying installation.

[0059] Paving stone **1000** also includes notches **1022**, **1024** and **1026**, which are used to improve the random appearance of paving stone **1000** when it is used in conjunction with other pavers, and which also provides a space for water to drain from the surface of paving stone **1000**.

[0060] Paving stone **1000** thus has a bottom surface with a fixed orientation relative to its associated Cairo pentagon. The perimeter of the bottom surface encloses an area greater than about 90% of the area of the Cairo pentagon, but can include greater or lesser areas as suitable. At least about 8% of the bottom surface falls outside the boundaries of the Cairo pentagon, although more or less can fall outside as suitable. In addition, paving stone **1000** has no vertices that coincide with a vertex of its associated Cairo pentagon. In

application, the distance between a perimeter segment of paving stone **1000** and a vertex of its associated Cairo pentagon can be within about 10 mm or other suitable distances, can be within about 5% of the total length of the perimeter or other suitable distances, and can have other suitable unique or repeating features. Likewise, while a Cairo pentagon is used in the disclosed embodiments, other suitable shapes can be used as the basis for a paving stone in accordance with the present disclosure, where the paving stone has the other disclosed features and functional attributes as disclosed herein.

[0061] FIG. **11** is a diagram **1100** showing a plurality of first paving stones **1102**, second paving stones **1104**, third paving stones **1106**, fourth paving stones **1108** and fifth paving stones **1110** arranged in a Cairo pentagon pattern, in accordance with an exemplary embodiment of the present disclosure. Diagram **1100** shows an exemplary arrangement of first paving stones **1102**, second paving stones **1104**, third paving stones **1106**, fourth paving stones **1108** and fifth paving stones **1110** that results in a rectangular shape, and which demonstrates the manner in which the modified Cairo pentagons of the present disclosure can be easily arranged in patterns that are difficult to discern but which can be implemented using only five different pavers. As can be readily seen, there are no matching sides, and no side is a rotational image of another side.

[0062] It should be emphasized that the above-described embodiments are merely examples of possible implementations. Many variations and modifications may be made to the above-described embodiments without departing from the principles of the present disclosure. All such modifications and variations are intended to be included herein within the scope of this disclosure and protected by the following claims.

What is claimed is:

1. A paving system comprising:

a first paving stone having a virtual perimeter outline and a plurality of first physical sides, the virtual perimeter outline having a plurality of segments, where each segment of the plurality of segments corresponds to two or more of the first physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent first physical sides by a predetermined distance;

a second paving stone having the virtual perimeter outline and a plurality of second physical sides, where each segment of the plurality of segments corresponds to two or more of the second physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent second physical sides by a predetermined distance; and

wherein the plurality of first physical sides is different from the plurality of second physical sides.

2. The paving system of claim **1** wherein the virtual perimeter outline is a Cairo pentagon.

3. The paving system of claim **1** wherein each end point of each segment is located at a point between each end point of a closest physical side.

4. The paving system of claim **1** further comprising a third paving stone having the virtual perimeter outline and a plurality of third physical sides, where each segment of the plurality of segments corresponds to two or more of the third physical sides and the plurality of third physical sides is different from the plurality of first and second physical sides.

5. The paving system of claim **1** further comprising a third paving stone having the virtual perimeter outline and a plurality of third physical sides, where each segment of the plurality of segments corresponds to two or more of the third physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent third physical sides by a predetermined distance.

6. The paving system of claim **5** wherein the plurality of third physical sides is different from the plurality of first physical sides and the plurality of second physical sides.

7. The paving system of claim **1** further comprising a third paving stone having a first portion of the virtual perimeter outline with a corresponding first portion of the segments and one or more additional first segments and a plurality of third physical sides, where each segment of the plurality of segments of the first portion of the virtual perimeter outline corresponds to two or more of the third physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent third physical sides by a predetermined distance.

8. The paving system of claim **7** wherein the plurality of third physical sides is different from the plurality of first physical sides and the plurality of second physical sides.

9. The paving system of claim **6** further comprising a fourth paving stone having a second portion of the virtual perimeter outline with a corresponding second portion of the segments and one or more additional second segments and a plurality of fourth physical sides.

10. The paving system of claim **6** further comprising a fourth paving stone having a second portion of the virtual perimeter outline with a corresponding second portion of the segments and one or more additional second segments and a plurality of fourth physical sides, where each segment of the plurality of segments of the second portion of the virtual perimeter outline corresponds to two or more of the fourth physical sides.

11. The paving system of claim **10** wherein the plurality of fourth physical sides is different from the plurality of first physical sides, the plurality of second physical sides and the plurality of third physical sides.

12. The paving system of claim **6** further comprising a fourth paving stone having a second portion of the virtual perimeter outline with a corresponding second portion of the segments and one or more additional second segments and a plurality of fourth physical sides, where each segment of the plurality of segments of the second portion of the virtual perimeter outline corresponds to two or more of the fourth physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent fourth physical sides by a predetermined distance.

13. The paving system of claim **1** further comprising a third paving stone having the virtual perimeter outline and a plurality of third physical sides, wherein the plurality of third physical sides is different from the plurality of first physical sides and the plurality of second physical sides.

14. The paving system of claim **13** further comprising a fourth paving stone having a first portion the virtual perimeter outline and a plurality of fourth physical sides.

15. The paving system of claim **14** wherein the plurality of fourth physical sides is different from the plurality of first physical sides, the plurality of second physical sides and the plurality of third physical sides.

16. The paving system of claim **15** further comprising a fifth paving stone having a second portion the virtual perimeter outline and a plurality of fifth physical sides.

17. The paving system of claim **16** wherein the plurality of fifth physical sides is different from the plurality of first physical sides, the plurality of second physical sides, the plurality of third physical sides and the plurality of fourth physical sides.

18. The paving system of claim **16** wherein the first portion of the virtual perimeter and the second portion of the virtual perimeter form the virtual perimeter when combined.

19. The paving system of claim **12** wherein each end point of each segment is located at a point between each end point of a closest physical side.

20. A paving system comprising:

a first paving stone having a virtual perimeter outline and a plurality of first physical sides, the virtual perimeter outline having a plurality of segments, where each segment of the plurality of segments corresponds to two or more of the first physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent first physical sides by a predetermined distance;

a second paving stone having the virtual perimeter outline and a plurality of second physical sides, where each segment of the plurality of segments corresponds to two or more of the second physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent second physical sides by a predetermined distance;

a third paving stone having the virtual perimeter outline and a plurality of third physical sides, where each segment of the plurality of segments corresponds to two or more of the third physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent third physical sides by a predetermined distance, wherein the plurality of third physical sides is different from the plurality of first physical sides and the plurality of second physical sides;

a fourth paving stone having a second portion of the virtual perimeter outline with a corresponding second portion of the segments and one or more additional second segments and a plurality of fourth physical sides, where each segment of the plurality of segments of the second portion of the virtual perimeter outline corresponds to two or more of the fourth physical sides, wherein the plurality of fourth physical sides is different from the plurality of first physical sides, the plurality of second physical sides and the plurality of third physical sides, and wherein any vertex between two adjacent segments is separated from any vertex between two adjacent fourth physical sides by a predetermined distance;

a fifth paving stone having a second portion the virtual perimeter outline and a plurality of fifth physical sides, wherein the plurality of fifth physical sides is different from the plurality of first physical sides, the plurality of second physical sides, the plurality of third physical sides and the plurality of fourth physical sides, and wherein the first portion of the virtual perimeter and the second portion of the virtual perimeter form the virtual perimeter when combined;

wherein the plurality of first physical sides is different from the plurality of second physical sides;

wherein the virtual perimeter outline is a Cairo pentagon; and

wherein each end point of each segment is located at a point between each end point of a closest physical side.

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