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(19) **United States**(12) **Patent Application Publication**
Naganuma(10) **Pub. No.: US 2009/0151299 A1**(43) **Pub. Date: Jun. 18, 2009**(54) **MODULAR NATURAL STONE WALL
SYSTEM AND METHOD OF MAKING**(52) **U.S. Cl. 52/745.19**(76) **Inventor: Jun Naganuma, Iida (JP)**

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BETHESDA, MD 20817 (US)**(21) **Appl. No.: 11/821,195**(22) **Filed: Jun. 21, 2007****Related U.S. Application Data**(60) **Provisional application No. 60/817,155, filed on Jun.
27, 2006.****Publication Classification**(51) **Int. Cl.
E04B 1/02 (2006.01)**(57) **ABSTRACT**

The present invention provides a modular natural stone wall system and method of making that provides a modular solution that is able to build true natural stone walls in an efficient manner. The invention dramatically reduces the cost, time, and labor resources needed to build natural stone walls. It makes natural stone walls more affordable to consumers, more efficient for contractors to install, and eases the concerns surrounding skilled masonry labor shortages. In one particular embodiment, the present invention is created by first pre-designing multiple unit surfaces, natural stones are pre-cut; design is laid out on template; the back of pre-cut natural stone pieces and multiple block surfaces are preferably roughed out, bonding material is added and the natural stones are affixed to the block. As a result, the surface of the modular blocks are covered with natural stone prior to installation.

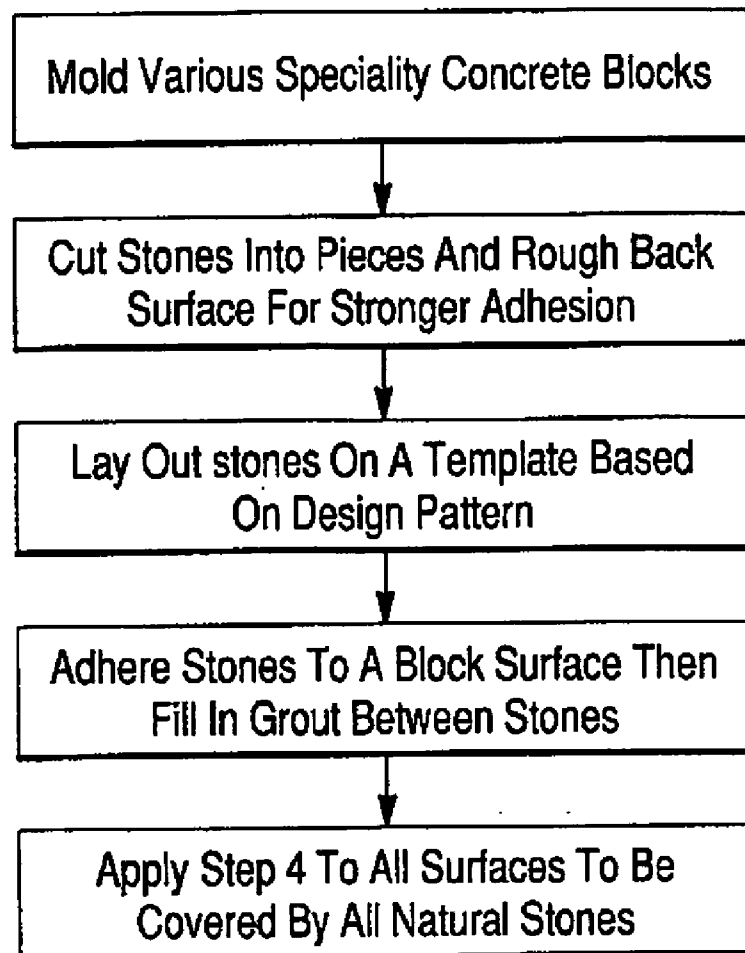


Fig. 1

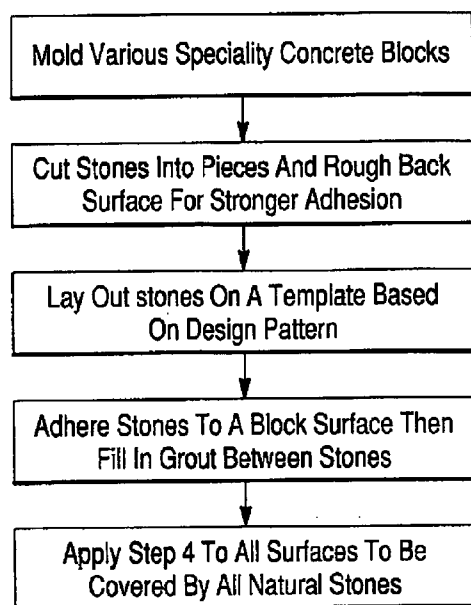


Fig. 2A

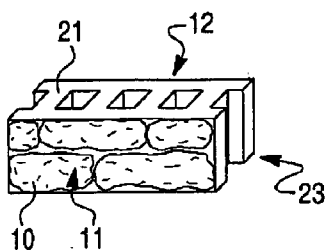


Fig. 2B

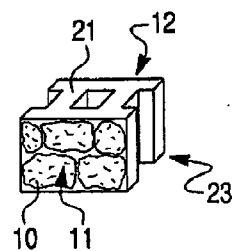


Fig. 2C

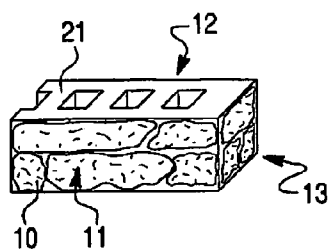


Fig. 2D

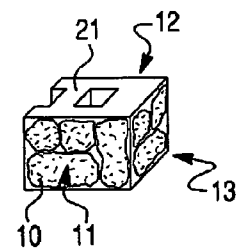


Fig. 2E

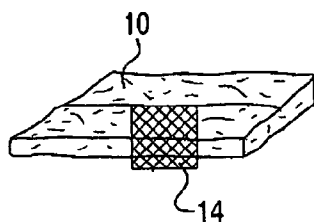


Fig. 2F

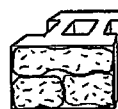


Fig. 2G

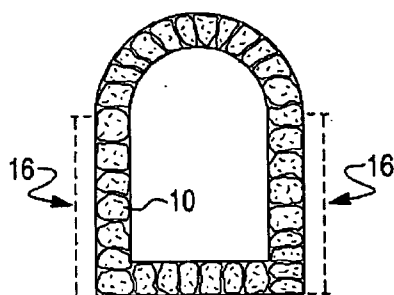


Fig. 2H

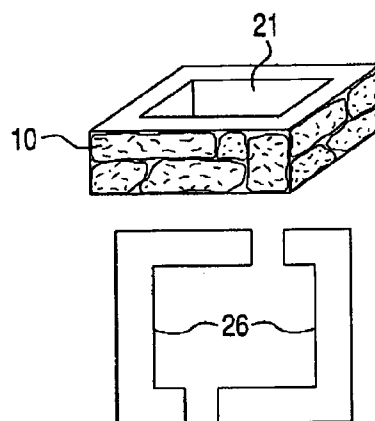


Fig. 2I

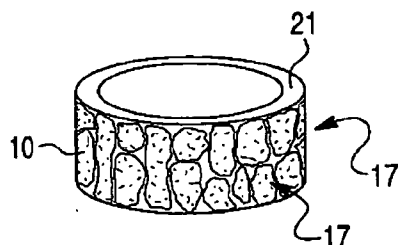
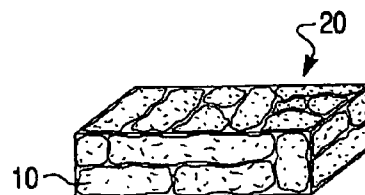


Fig. 2J



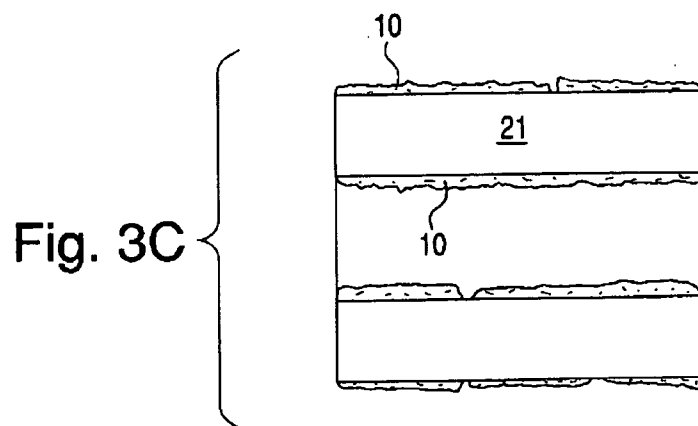
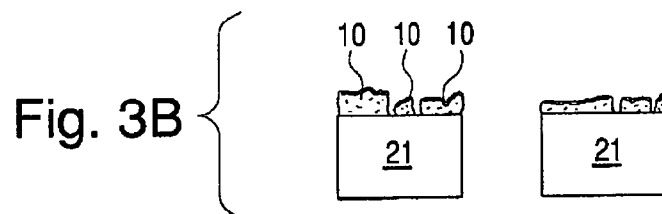
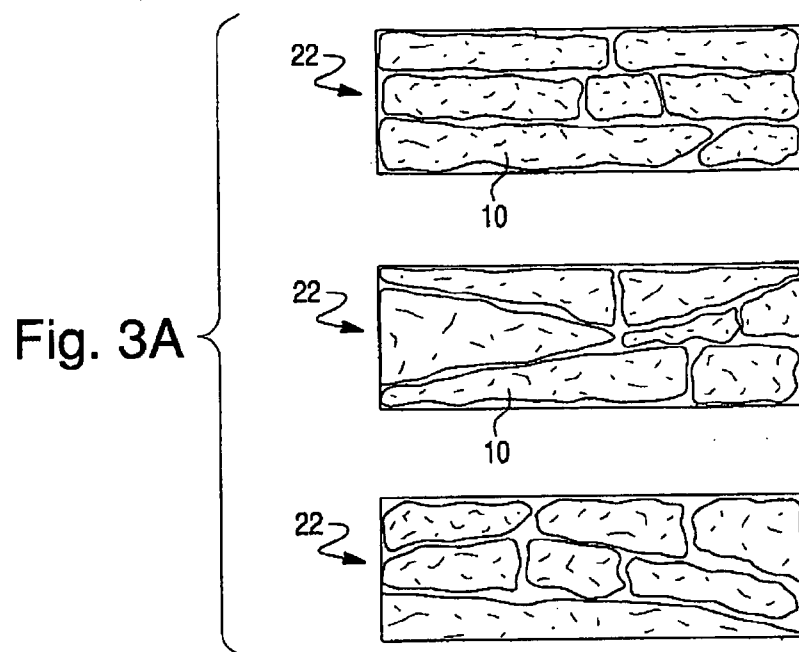


Fig. 4A

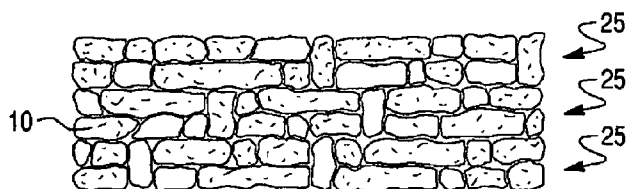


Fig. 4B

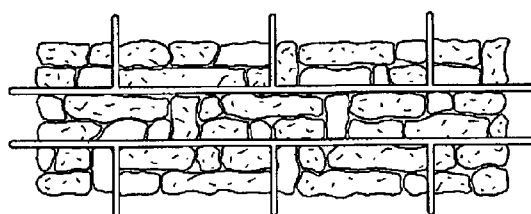


Fig. 5A

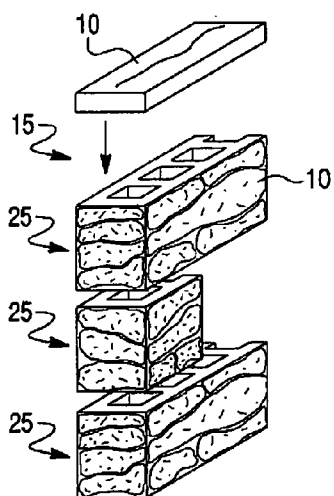
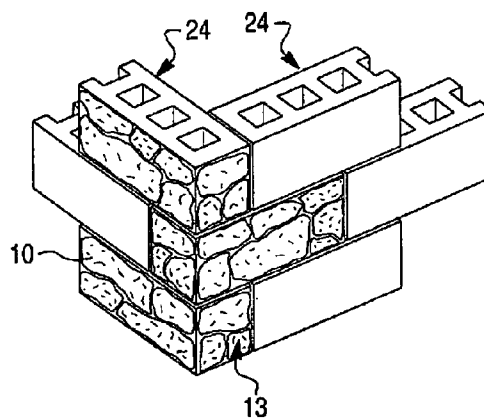


Fig. 5B



MODULAR NATURAL STONE WALL SYSTEM AND METHOD OF MAKING

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of a provisional patent filing, Ser. No. 60/817,155, entitled "Modular natural stone wall system and method of making," which was filed on Jun. 27, 2006.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] This invention relates generally to a modular natural stone wall system and method of making.

[0004] 2. Background

[0005] Conventionally, there are two methods to build a natural stone wall. One is to build a wall solely with natural stones and grouts. The other requires a two stage process to first build a concrete block wall and then secondly to cover that wall surface with natural stone veneers. Both are labor intensive, very costly, and time consuming. There have been numerous attempts to create wall systems and decorative facing that create the look of natural stones. However, there have been no solutions to build genuine natural stone walls in an efficient modular system.

[0006] Indeed, some methods attempt to manufacture blocks with natural stone in a face look, but these methods cannot make multi-faced natural stone blocks. In fact, known methods that relate to the creation of modular stone walls are limited to the simulation of the look of natural stone walls. In short, previous methods make blocks and panels with decorative faces resembling natural stones but which are not natural stones. These existing methods only create an artificial

[0007] Still other methods relating to natural stone blocks attempt to add natural stones or other materials to a face of concrete blocks, but these methods can only add natural stones to one face of a block and are, therefore, unable to create various multi-faced natural stone blocks. Furthermore, these manufacturing methods lack the flexibility in creating various patterns and randomness in stone shape and color.

[0008] Therefore, what is needed is a modular natural stone wall system and method of making that does not suffer from the aforementioned problems, and which provides a modular solution that is able to build true natural stone walls in an efficient manner, and which further could be used to build free-standing fence walls, columns, interior & exterior building walls, retaining walls, and decorative landscaping structures in both residential and commercial applications.

SUMMARY OF THE INVENTION

[0009] The present invention advantageously fills the aforementioned deficiencies by providing a modular natural stone wall system and method of making that provides a modular solution that is able to build true natural stone walls in an efficient manner, and which further could be used to build free-standing fence walls, columns, interior & exterior building walls, retaining walls, and decorative landscaping structures in both residential and commercial applications. Specifically, the present invention addresses the aforementioned deficiencies by significantly reducing labor resources, total costs, and timeliness. It creates efficiencies in building a true natural stone-faced wall.

[0010] The objective of the present invention is to create an alternative solution for natural stone wall building by offering a cost-effective and efficient modular system solution. The present invention relates to the construction methods of natural stone walls. It further relates to a modular system that uses various block units with natural stones pre-adhered to their multiple faces. This system makes it possible to build natural stone fences, columns and, retaining and structural walls more efficiently and more cost-effectively than conventional methods.

[0011] In one particular embodiment of the present invention, the present invention is created by first pre-designing multiple unit surfaces, taking into consideration the exposure of unit faces so that the resulting creation is aesthetically pleasing and preferably appropriate for inclusion with the other surfaces that will be used. Once design is confirmed, natural stones are pre-cut; design is laid out on template; the back of pre-cut natural stone pieces and multiple block surfaces are preferably roughed out (i.e., surfaces are scraped to eliminate smooth surface and create a better bond). Bonding material, which can include but is not limited to cement-based inorganic bonding agent is now applied, preferably to both the multiple unit surfaces and the back of the pre-cut natural stone pieces. The natural stone pieces are then applied to multiple unit surfaces and then allowed to dry/cure.

[0012] In still another embodiment of the present invention the modular system is created after careful consideration of multiple exposed surfaces specific to each job. Start and end-points should be laid out and correct units utilized to provide natural stone finishes on exposed sides of the wall. Apply bonding material, which can include but is not limited to thin-set mortar mixed with fine particle sands such as glass sand and silica sand, to top and sides of modular unit, preferably enough to create a 3 mm or smaller separation after unit surfaces are combined together, although it will be clear to someone of skill in the art that a larger separation is possible and within the scope of this invention. Offset blocks at 1/2 length intervals, following the same pattern consistently at all layers of the wall. Include installation re-bar and grout within the interior of the wall before applying cap on top of the wall.

[0013] It is therefore an object of the present invention to provide a natural stone pre-surface on multiple faces of modular blocks. The present invention makes it possible to easily and efficiently build a natural stone finish wall in this modular system.

[0014] As previously stated, currently when not building a stone wall with stone and grout, the building process requires two steps: 1) to build a concrete block wall, then 2) to install/adhere natural (or synthetic) stone veneers on the wall surface on site. The present invention, however, completely eliminates the second step of the conventional process, which is an extremely labor intensive and time-consuming step that requires experienced, skilled workers. Because in the present invention the surface of the modular blocks are already covered with natural stone prior to installation, the present invention revolutionizes the whole process of building a natural-stone-faced block wall by totally eliminating the second step of the convention process for building such a wall. As a result, the present invention dramatically cuts the duration of the whole building process, making workers significantly more productive. The masonry industry has been facing shortages of qualified skilled workers, and many contractors are unable to meet consumer demands. The present invention addresses the skilled labor shortage by making contractors more pro-

ductive and shortening project timeframes. Natural stone covered walls can be more attractive to consumers than alternatives such as vinyl fences, steel fences, natural stone look imitation walls, and brick walls. Hence, the present invention gives contractors a great advantage to reach more consumers and grow their businesses. This feature also makes natural stone wall more affordable and acceptable to consumers.

[0015] Another advantage of the present invention is in providing quality control. When a stone wall is constructed with the stone being applied to the block once the block is in place, there can be a number of stones that are not appropriately applied. Perhaps this could be due to the fact that not enough bonding material was used or perhaps because of inappropriate curing of said bonding material. The present invention can be manufactured under consistent quality control and management, with such factory prefabrication producing far better products in design and adhesion.

[0016] Still another advantage of the present invention is that the design patterns make a wall built look like an authentic natural stone wall solely made of layers of stones.

[0017] Still another advantage of the present invention is handcraftsmanship. The present invention allows for cutting and adhering stones to blocks and resulting randomness in stone allocation, stone shape and stone color. This helps obscure the edge and the shape of modular units, making a finished wall look like an authentic natural stone wall with stones random in shape and color.

[0018] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, which are intended to be read in conjunction with both this summary, the detailed description and any preferred and/or particular embodiments specifically discussed or otherwise disclosed. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided by way of illustration only and so that this disclosure will be thorough, complete and will fully convey the full scope of the invention to those skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. 1 depicts the flow chart showing the process of making a natural stone block.

[0020] FIG. 2A through 2J depict the type of modular units for this wall system.

[0021] FIGS. 3A, 3B and 3C depict a sample layout of stones on modular units.

[0022] FIGS. 4A and 4B depict the effect of randomness and design to hide modular lines

[0023] FIGS. 5A and 5B depict the basic wall system this invention offers.

DETAILED DESCRIPTION OF THE INVENTION

[0024] The present invention is directed to a modular natural stone wall system and method of making. The main components of an individual unit are concrete blocks 21, which provide structural support, modularity, and multiple surfaces for natural stones 10. Natural stones 10 are pre-cut and pre-arranged in design patterns, to be adhered to multiple surfaces. An adhesive provides permanent attachment of any natural stone 10 to multiple surfaces, creating a water proof bond and extra structural strength on both sides of the unit. It should be apparent to those of skill in the art that additional components could be developed based on customization needs.

[0025] Now, with respect to the drawings, FIG. 1 shows the five main steps to complete the process of manufacturing

modular units, with Step 5, which is a repeating of Step 4, being optional. The production method heavily relies on hand craftsmanship. The handcrafting is necessary, in the preferred embodiment, to add various natural stones 10 in size and color to multiple faces and to achieve a natural, random and unique look of each unit. In Step 1, specialty blocks 21, which can be any type of block, such as but not limited to concrete blocks, cement blocks or any other block made of sufficiently rigid material for the purpose, but which are preferably concrete blocks, with various face shells are made, preferably with a concrete block machine. In Step 2, based on design patterns, natural stones 10, such as slates, limestone, sandstones, lava stones, coral stones, and any other type of stones, are preferably by diamond blades, to make a face for adhesion. The thickness of stones preferably ranges from 10 mm to 50 mm, depending on design pattern and stone type, but can certainly be smaller or larger. Stone surface could be either totally natural, hand cut, or machine cut, and the appropriate application is chosen based on the characteristic of stones and design. Then, in the preferred embodiment, a piece of stone is further cut by hand with hammer to create pieces of stones unique in shape and color. The bonding surface, to be adhered to a block 21, is preferably roughed out by diamond blade or wire brush, or other similar method, for better adhesion; then, stones are thoroughly washed and dried for the next process. It should, however, be apparent to those of skill in the art that the washing and drying of the stones is desirable, yet optional.

[0026] In Step 3, according to the particular design pattern, workers choose and layout stones on a template and pile up templates for the next adhesion process. It is desirable to create decorative faces unique to each other while following a design pattern, preferably a very basic design pattern.

[0027] In Step 4, stones in a template are preferably adhered to the designated block surface with the cement-based inorganic bonding material, but could be adhered using any other type of bonding material, which can include organic, inorganic and hybrid bonding materials, including but not limited to types of Latex, Acrylic, Polymer, Polyurethane, Epoxy, and Silicone. Indeed, any bonding material can be used, but it is preferable to use a bonding material that does not deteriorate and which has adhesion properties conforming to international building code standards. The block surface is first coated with a first bonding material by a brush; then the stones are also preferably coated with a bonding, are adhered to the block surface. It should be understood, however, that it is only necessary to coat one or the other of the block or the stone, but preferably both are coated with a bonding material. Furthermore, the bonding material used to coat both is preferably, but not necessarily, the same bonding material.

[0028] A hammer is preferably used to press and tighten the adhesion, although anything that can be used to apply pressure, such as a hand, a mallet, or other device could be used. Once the agent is dried, mortar grout is filled in between stones; then, extra grout is washed off right after grout is dried. The same process is repeated to create multiple stone faces. The adhesion strength in this application should far exceed the industry standards.

[0029] FIG. 2 show the structure and feature of each unit. For retaining and building wall applications, rear face 12 may not have natural stones adhered. Basic (FIG. 2A): Natural stones 10 on front 11 and rear 12 surfaces; used in the system as the main body. Basic Half (FIG. 2B): Natural stones 10 on front 11 and rear 12 surfaces; 1/2 the length of the Basic unit (FIG. 2A); also used within the system as the main body, but specifically at the endpoints; for applications where the end-face is not exposed for viewing 23. Corner (FIG. 2C): Natural

stones 10 on front 11, rear 12, and endface surfaces 13; used at every corner and endpoint where an endface is exposed for viewing. Corner Half (FIG. 2D): Natural stones 10 on front 11, rear 12, and endface surfaces 13; $\frac{1}{2}$ the length of the Corner unit; also used at every corner and endpoint where an endface is exposed for viewing. Cap Stone (FIG. 2E): Natural stone 10 with wire mesh 14 protruding from center; used to cap the top of walls 15. R-Unit (FIG. 2F): Natural stones 10 on front 11 and rear 12 surfaces; both endpoints 18 are cut at an angle 19 to allow for curvatures in wall design. Colosseo Window (FIG. 2G): Natural stones 10 on all surfaces except for portion of side faces 16 that connect to other units; used as an open window or arch. Rectangular Column (FIG. 2H): Natural stone 10 on all four sides; used to build columns or add gate posts to the wall system. Circular Column (FIG. 2I): Natural stones 10 on entire cylindrical surface 17; used for adding columns or as another gate post option. Capped units (FIG. 2J): Natural stones 10 on top surface 20 to all units except for Cap Stone and Colosseo Window.

[0030] FIG. 3A shows how stones 10 are arranged and laid out differently for each face application. It is preferable for workers to use different stones 10 in shape, thickness, and color as creative as possible while following the very basic rule of a design pattern 22. FIGS. 3B and 3C also illustrate the uniqueness of stones 10 in shape and height. Because of the uniqueness of the shape and height of the stones 10, it is preferred to fabricate the invention by hand, although it is within the scope of the invention to allow for automated or semi-automated fabrication.

[0031] FIG. 4A illustrates a part of a finished wall. FIG. 4B adds the modular lines 23 to FIG. 4A to show how modular blocks 24 are used to create the part of the wall. These figures show how randomness in stone shape, color, and size, along with design patterns, and the thin joint of 3 mm, effectively obscure or even hide modular lines 23 between units.

[0032] FIG. 5 show how component units 24 are used to create a wall totally covered by natural stones 10. Like a conventional concrete block wall, the Basic (FIG. 2A) and Basic Half (FIG. 2B) units are used to add layers 25 as the main body of the wall. Thin layer mortar joints of 3 mm are applied between blocks (top bottom and sides), providing flexural strength and minimizing the exposure of mortar lines 23. Corner (FIG. 2C) and Corner Half (FIG. 2D) units are used wherever the side of a module is exposed 13. R-Units (FIG. 2F) are used at points of curvature in the walls. Cap Stones (FIG. 2E) are used to cover the tops of walls 15. Other decorative units, such as Colosseo Windows (FIG. 2G), Rectangular Column (FIG. 2H), and Circular Column (FIG. 2I), are used as accents to the wall. Re-bar and grout are applied within the interior of the wall during its construction. This modular wall system instantly provides a natural stone finish as it is being built in one step, ensuring handmade authentic natural stone characteristics.

[0033] FIG. 5A shows how corner units (Corner and Corner Half) are used to end a wall with natural stone finish. FIG. 5B illustrates the typical application of how corner units (Corner and Corner Halo) are used for 90-degree angle in a wall.

[0034] While the present invention has been described above in terms of specific embodiments, it is to be understood that the invention is not limited to these disclosed embodiments. Many modifications and other embodiments of the invention will come to mind of those skilled in the art to which this invention pertains, and which are intended to be and are covered by both this disclosure and the appended claims. It is

indeed intended that the scope of the invention should be determined by proper interpretation and construction of the appended claims and their legal equivalents, as understood by those of skill in the art relying upon the disclosure in this specification and the attached drawings.

What is claimed is:

1. A modular method of making a natural stone wall system comprising the steps of:

creating at least one block with various face shells; cutting at least one natural stone to make a face for adhesion to the at least one block; selecting at least one natural stone for adhesion to the at least one block; adhering at least one natural stone to the at least one block by a bonding material.

2. The method of claim 1 wherein the at least one block is a concrete block.

3. The method of claim 2 wherein the creating at least one block step is accomplished by using a concrete block machine.

4. The method of claim 3 wherein the cutting at least one natural stone step is accomplished by using diamond blades.

5. The method of claim 4 wherein the selecting at least one natural stone step is done by following a design pattern.

6. The method of claim 5 wherein the at least one natural stone is selected from the group consisting of slate, limestone, sandstone, lava stone and coral stone.

7. The method of claim 6 wherein the adhering of at least one natural stone step is accomplished by coating the block with a first bonding material.

8. The method of claim 7 wherein the adhering of at least one natural stone step is accomplished by coating the at least one natural stone with a second bonding material.

9. The method of claim 8 wherein the first bonding material and the second bonding material are the same compound.

10. The method of claim 8 wherein the first bonding material and the second bonding material are a different compound.

11. The method of claim 9 wherein the bonding material does not deteriorate.

12. The method of claim 10 wherein the first bonding material and the second bonding material do not deteriorate.

13. The method of claim 10 wherein the first bonding material and the second bonding material are both selected from the group consisting of Latex, Acrylic, Polymer, Polyurethane, Epoxy, and Silicone.

14. The method of claim 11 wherein the first bonding material and the second bonding material are a cement-based inorganic bonding material.

15. The method of claim 14 wherein the at least one natural stone ranges in thickness from 10 mm to 50 mm.

16. The method of claim 15 wherein the at least one natural stone ranges in thickness from 10 mm to 50 mm.

17. The method of claim 16 further comprising the steps of washing and drying the natural stones prior to the adhering step.

18. The method of claim 17 wherein the natural stone is further cut by hand with hammer, after using the concrete block machine, to create pieces of stones unique in shape and color.

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