May 9, 1961 F. P. WEESNER 2,983,083

METHOD OF FORMING PATTERNED TILE AND APPARATUS THEREFOR

Filed March 23, 1959 3 Sheets-Sheet 1

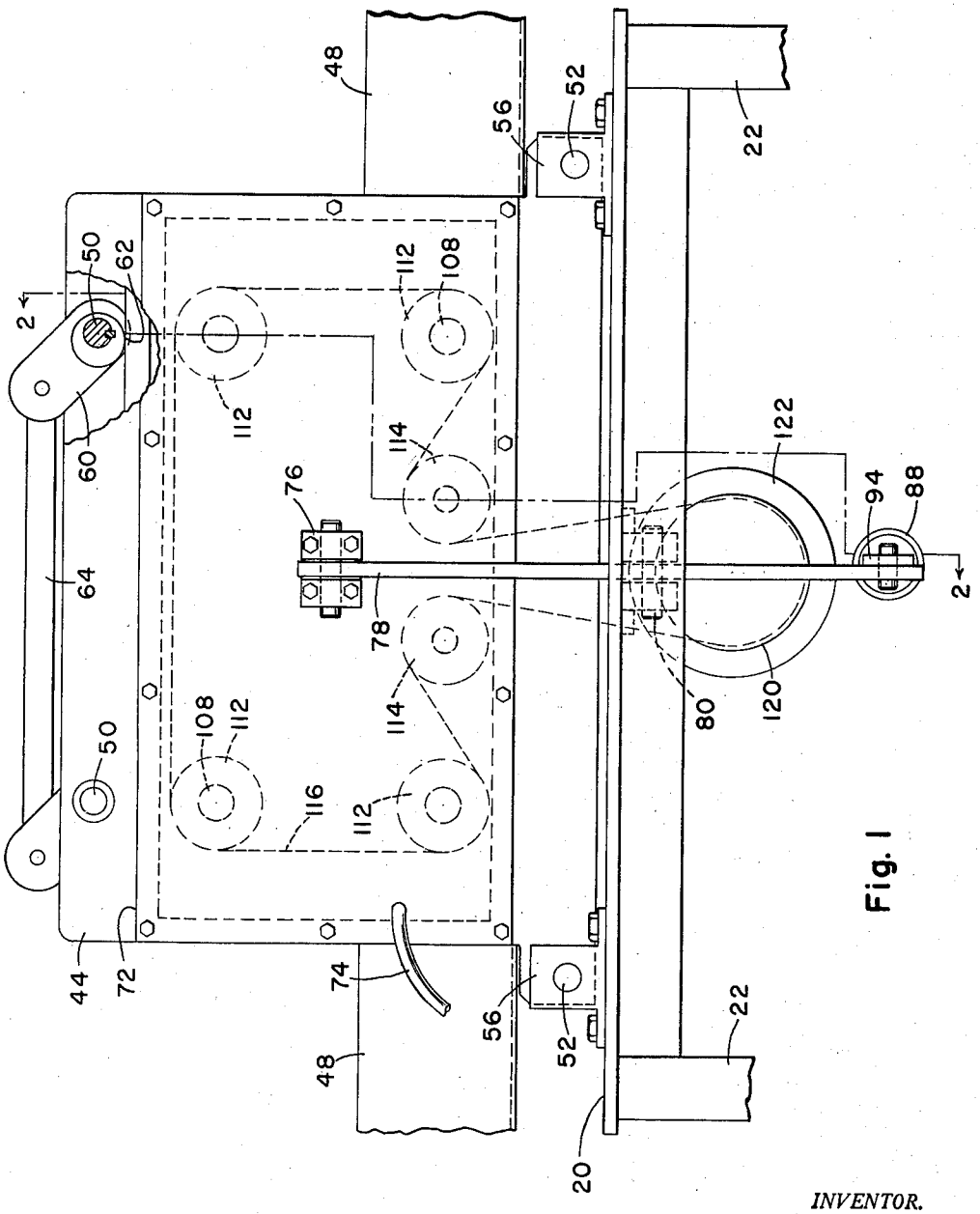

Fig. 1

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Filed March 23, 1959 3 Sheets-Sheet 2

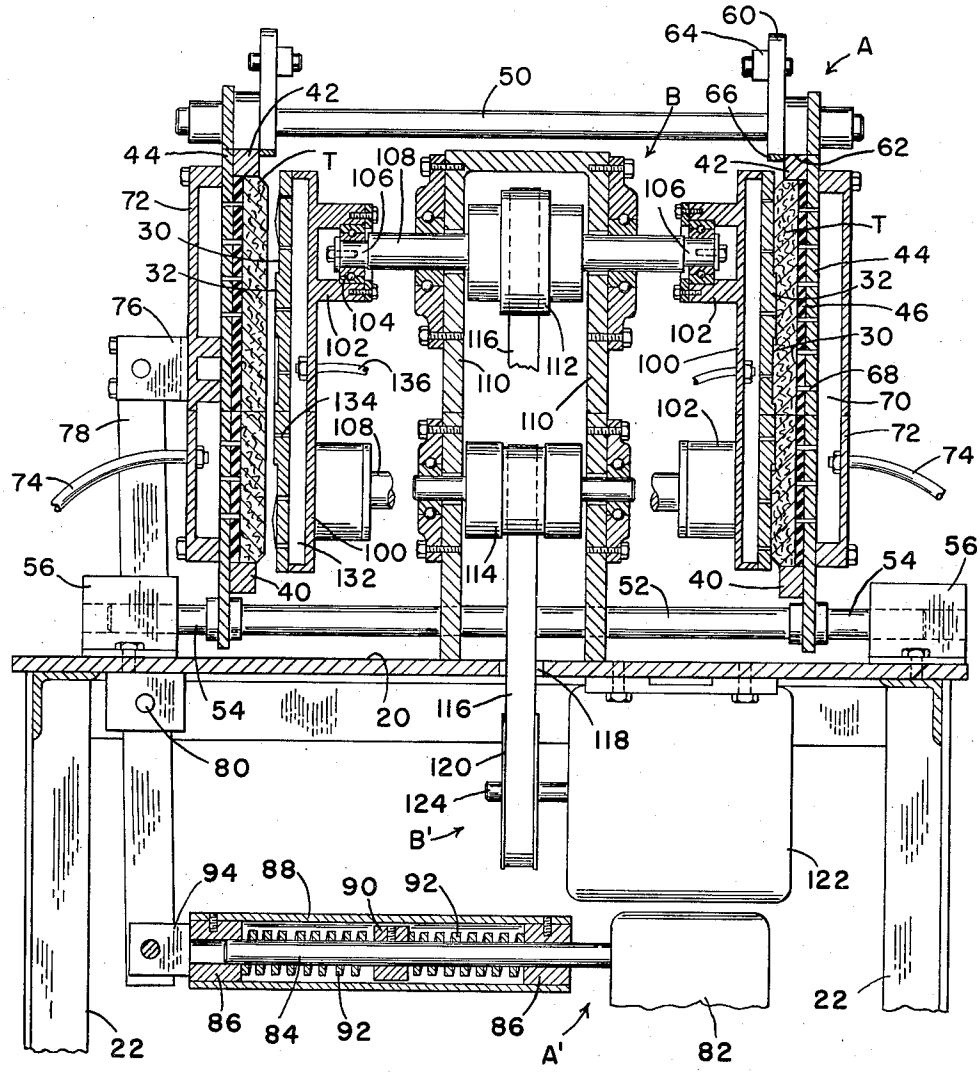

Fig. 2

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May 9, 1961 F. P. WEESNER 2,983,083

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Filed March 23, 1959 3 Sheets-Sheet 3

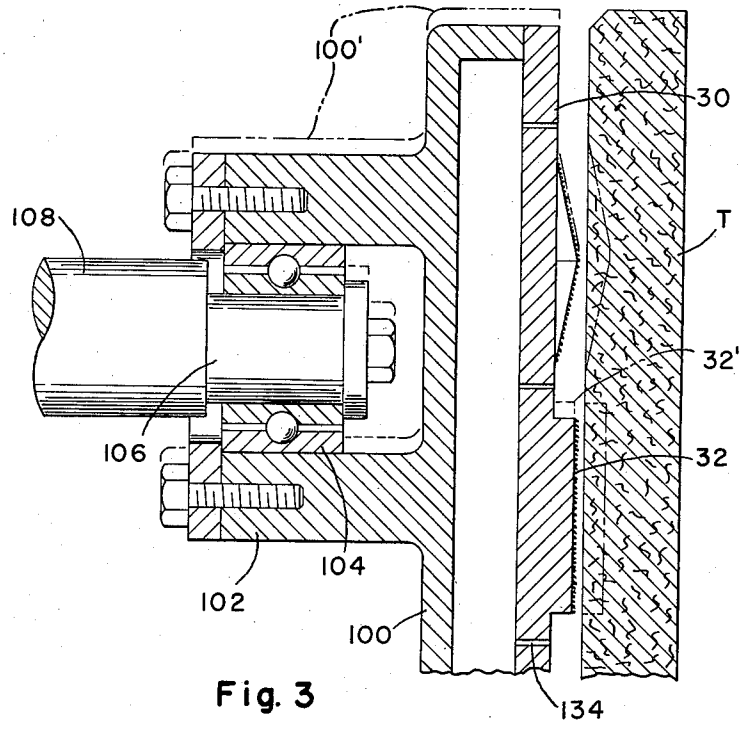

Fig. 3

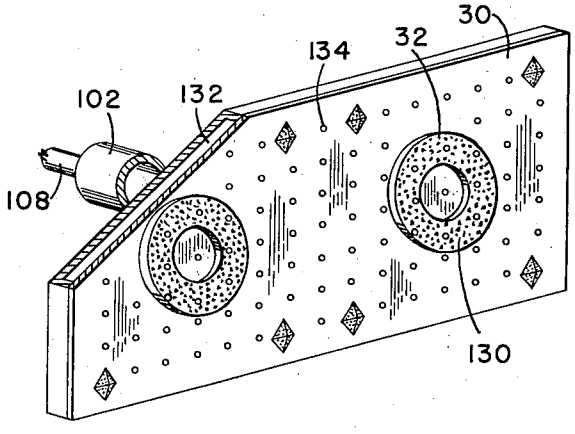

Fig. 4

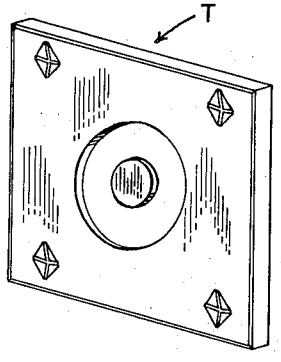

Fig. 5

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METHOD OF FORMING PATTERNED TILE AND APPARATUS THEREFOR

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5 Claims. (Cl. 51—119)

This invention relates to the removal of designed areas of surface material from a wall tile, and particularly to the method and apparatus for forming a design in relief in a mineral fiber wall tile face.

The removal of material from designed areas of the surface of wall tiles to provide a three dimensional wall design has been done heretofore using several various methods. The usual prior methods involved disposing a designated template over the areas of a tile from which material is not to be removed and applying means such as brushes or high velocity jets to the tile face to impinge and cause the removal of material from areas not covered by the template.

These methods are subject to several disadvantages and limitations. First, there is relatively little control with these methods over the quality, shape or configuration of the newly formed surfaces. The new surface will normally be limited to a mean flat plane parallel to the original tile surface. Designs embodying either inside or outside corners are often difficult to form with uniformity, especially corners of very small angles. Templates, to be disposed on the tile face during material removal, are limited in the designs which may be cut out without destroying the template's unity and strength, for example in forming a raised island portion the template portion covering the island portion must be joined to the outer edges of the template.

It is an object of the present invention to provide a novel method and means for removing preselected and designed portions of material from the face of a wall tile. It is a particular object to provide such method and means for use with relatively crumbly, low density, mineral fiber acoustical wall tile, most commonly ceiling tile.

It is a further object to provide novel means for removing designed portions of material from a wall tile face which is controllable as to the new surface formed in texture of surface, variations in depth of the surface, and angularity or slope of the surface.

It is a further object of the invention to provide such novel means which will form uniform inside or outside corners in the design of the material removed from the tile face.

It is a still further object to provide means for removing portions of material from a wall tile face in any design without the limitations existant with template methods, as discussed above.

The above and other objects of the invention will be more readily apparent when considered in relation to the preferred embodiment as set forth in the specification and shown in the drawings in which:

Fig. 1 is a side view of a tile abrading apparatus embodying the present invention.

Fig. 2 is a sectional end view taken along line 2—2 of Fig. 1.

Fig. 3 is an enlarged portion of Fig. 2 including particularly the eccentric driving elements.

Fig. 4 is an isometric view of the abrading elements

of the apparatus of Fig. 1, with portions shown broken away.

Fig. 5 is an isometric view of a tile produced in accordance with the invention by the abrading elements of Fig. 4.

Referring to Figs. 1 and 2 there is shown an abrading machine table comprising table top 20 and legs 22. Mounted atop table top 20 are the primary work performing elements of the novel tile face abrading apparatus of the invention including as best shown in Fig. 2, a rigidly joined, two sided, reciprocating, tile holding assembly A, and a centrally disposed, rotary driven, gyratory abrading assembly B disposed between the two sides of tile holding assembly A. Mounted below table top 20 are the drive elements including a reciprocating drive assembly A' for providing reciprocating motion for tile holding assembly A, and a rotary drive assembly B' for driving the moving parts of the abrading assembly B.

The gyratory abrading assembly B includes two oppositely, outwardly facing abrading faces 30, 30 having patterned raised portions 32 of a suitable abrasive, such as silicon carbide grit, coarse sand paper, solid carbide or equivalent. The balance of assembly B, as will be described below, consists of means for moving the faces 30 in a manner such that all points on each face are simultaneously describing preferably a small circle within the fixed plane of the face, and with any given line of said face maintaining constant parallelism. A preferable amount of movement is such that circles of about ⅛" diameter are generated, however diameters of from about 1/16" to one inch are contemplated within the invention.

The reciprocating tile holding assembly A includes, as described fully below, means for holding abradable ceiling tile T parallel to faces 30, on each respective side of the machine and means for reciprocating the tile in a direction perpendicular to their general plane, to alternately push the tile against the respective faces 30 so the gyratory action of faces 30 will abrade and cause to become removed portions of the tile in accordance with the patterned arrangement of the abrasive raised portion 32.

In the present embodiment, four tile T are simultaneously held in the assembly A, two on each side disposed side by side. In accordance with the novel method of the invention, the tile T are composed of a major portion of mineral fibers bonded together with a minor portion of starch as is well known in the art. The two tile T on each side are held between a vertically fixed bottom rail 40 and a vertically movable top rail 42, both mounted on respective vertical main plates 44, 44 of each respective side. A relatively hard rubber backing 46, of standard grit surface, pyramid tread conveyor belting, extends through the extent of each plate 44 between the bottom rail 40 and top rail 42, providing a relatively highly frictioned surface against which the back of tiles T are disposed. Troughs 48, 48 extend from each end of bottom rail 40 for loading and unloading tile. Two upper cross-shafts 50 and two lower cross-shafts 52 are each fixed to and extend between the two plates 44 to form a unitary two sided assembly A.

The two lower cross-shafts 52, extending between and fixed to the two bottom corners of the two plates 44, have end portions 54 which extend beyond plates 44 and are slidably mounted in hollow supporting blocks 56, mounted respectively near each of the four corners of table top 20. Accordingly, supporting blocks 56 support and permit the reciprocation of tile holding assembly A.

The two upper cross-shafts 50, extending generally between the two upper corners of the two plates 44, are rotatably mounted in but otherwise fixed relative to plates 44. Locking arms 60, having an eccentric lower surface 62, are keyed to upper cross-shafts 50 adjacent each end, and a connecting rod 64, connects the upper end of lock-

ing arms 60 on opposite cross-shafts, the arrangement being that on a slight rotation of a locking arm 60, all locking arms 60 rotate accordingly, and the eccentric lower surfaces 62 push downward the two movable top rails 42, one on each side of the assembly A, compressively grasping all tiles T between the top rails 42 and bottom rails 40. Locking arms 60 further include a downwardly projecting shoulder 66, which in combination with the plate 44 and the rubber backing 46, hold the movable top rail in position atop the rubber backing 46.

To provide even firmer holding of tiles T, a vacuum is drawn behind the tiles T by the provision of a plurality of holes 68 extending through the backing 46 and plate 44, of each side of the assembly A. The holes 68 terminate in vacuum boxes 70 formed by vacuum box walls 72 bolted to the outer side of each plate 44 and a flexible vacuum hose 74 attached to each vacuum wall 72 withdraws air from vacuum boxes 70.

The outer side of one plate 44 is rigidly connected to a centrally disposed outwardly extending bifurcated arm 76. Arm 76 is pivotally connected to a vertical pivot arm 78 which is centrally pivotally mounted on table top 20 by pivot pin 80. The bottom end of vertical pivot arm 78 is pivotally connected to the reciprocating drive assembly A'.

The reciprocating drive assembly A' consists of a positive reciprocating drive means 82 which provides continuous equal reciprocations of a piston shaft 84. Piston shaft 84 is slidably mounted in bearings 86, 86 affixed at opposite ends of a cylindrical housing 88. A piston 90 is affixed to piston shaft 84 generally centrally of bearings 86 and two coil compression springs 92, 92 are disposed about piston shaft 84, one between each bearing 86 and piston 90. The housing 88 includes a short arm 94 extending from the end opposite the drive means 82, arm 94 being pivotally attached to the bottom end of vertical pivot arm 78.

By the arrangement here defined, reciprocation of piston shaft 84 and piston 90 urges, through springs 92, identical reciprocation of housing 88, and thus, through pivot arm 78, urges identical reciprocation of tile holding assembly A. A resistance to complete reciprocation will be seen to exist when tiles T contact the respective abrading faces 30, 30, of the gyratory abrading assembly B, and upon meeting such resistance, the further reciprocation of piston 90 will compress a respective spring 92, without further reciprocation of housing 88 or tile holding assembly A. Tiles T will, however, be held compressively against a respective face 30 during such compression of a spring 92.

Considering now the gyratory abrading assembly B, the two oppositely facing abrading faces 30, 30 are each respectively fixedly mounted on a rigid frame 100, 100, each having four inwardly directed hollow hubs 102, disposed generally at the respective four corners of frames 100. As shown more clearly in Fig. 3, hubs 102 have bearings 104 therein in which are mounted the eccentric end portions 106 of four main rotary shafts 108. Main shafts 108 are rotatably mounted, with suitable bearings, in two spaced vertical shaft support plates 110, 110, and have suitable belt-driven pulleys 112 keyed to each shaft and disposed between support plates 110.

Also disposed between support plates 110, at spaced positions between the bottom two pulleys 112 are two rotatably mounted idler pulleys 114. A drive belt 116 extends around the four pulleys 112, over the top of the two idler pulleys 114 and the portion of belt 116 between the two idler pulleys 114 extends downward through a suitable opening 118 in table top 20 and around a motor pulley 120.

The rotary drive assembly B' consists of the motor pulley 120, a motor 122 and a connecting motor shaft 124, and provides the driving means for drive belt 116, mounted on pulley 120.

Drive belt 116 thus drives the pulleys 112 and the main rotary shafts 108. Referring again to Fig. 3, the eccentric end portions 106, of main shafts 108, are cylindrical portions of shafts 108 which are preferably about 1/16 inch eccentric to the central portion of the main shaft, and preferably the two opposite end portions 106 of each respective shaft are eccentric in opposite diametric directions, as shown in Fig. 2. Rotation of main shafts 108 rotates end portions 106 about an axis spaced 1/16" from the center of the end portions causing the frames 100, 100 and abrading faces 30, 30 to move circularly gyrating in 1/8" diameter circles in a constant vertical plane, remaining in constant parallelism. A gyrating motion of about 2200 r.p.m. has been found most suitable in accordance with the invention. The broken lines 32' and 100' of Fig. 3 indicate the opposite limit of movement of the abrading elements and frame in the gyrating movement.

The rigid frames 100, 100 and the abrading faces 30, 30 are formed to provide an air cavity 132 behind the faces 30, 30 and a plurality of air blast holes 134 through faces 30, 30, whereby air, under pressure, supplied by air hoses 136, continually passes through holes 134 tending to continually remove dust from the tile T during each reciprocation away therefrom. The number of reciprocations necessary in the abrading of one set of four tiles will be about five to twenty, depending upon the tile hardness and brittleness, and depth of pattern desired. The two sided arrangement of the machine provides constant abrading first on one side to one pair of tile T while air jets are removing dust from the opposite tile T and then following each subsequent half reciprocation, the abrading and dust removal operations alternate and occur on opposite sides.

A typical form of a patterned face 30 is shown in Fig. 4, including two similar, side-by-side patterns 130, whereby four tile are abraded simultaneously, two by each face 30. In typical pattern 130, a raised "O" and four pyramidal diamonds are included to illustrate the varied adaptability of the apparatus. The "O" design illustrates the manner in which a completely isolated unabraded center portion may be formed. The pyramidal diamonds illustrate the manner in which abrading to varied or sloping depths may be provided.

Fig. 5 illustrates a tile abraded by the patterned face 30 of Fig. 4. It will be recognized that the gyratory abrading action is limited in forming corners of a radius equal to the radius of the gyratory motion, in the present embodiment 1/16 inch. Such limitation is found actually preferable in most tile, avoiding sharp corners which would otherwise be overly subject to damage.

A highly efficient tile face patterning means is provided in accordnace with the invention capable of accurate reproduction of substanitally limitless designs and shapes.

Having completed a detailed disclosure of the preferred embodiment of my invention so that those skilled in the art may practice the same, I contemplate that variations may be made without departing from the essence of the invention or the scope of the appended claims.

What is claimed is:

1. The method of forming relief patterns in the face of a mineral fiber tile of a relatively crumbly mineral nature, comprising the steps of holding the face of said tile face parallel to a patterned abrading face having raised portions of abrasive material formed in substantially opposite relief to the desired tile pattern, moving said abrading face relative to said tile face such that all portions of said abrading face move in substantially circular paths of from about 1/16 inch to one inch diameter relative to said tile face, said circular paths being in respective planes parallel to the normal plane of said tile face, simultaneously in a plurality of cycles alternately first pressing said tile face and said abrading face tightly against one another and second spacing apart

said tile face from said abrading face, and removing a substantial portion of abraded tile material from between said tile face and said abrading face during said spacing apart thereof.

2. Apparatus for forming a relief pattern in the face of a tile of a relatively crumbly mineral nature, comprising a patterned abrading face having raised portions of abrasive material formed in substantially opposite relief to the desired tile pattern, means on said apparatus for firmly holding said tile with a face thereof against said abrading face, reciprocating means on said apparatus for alternately first pressing said tile face and said abrading face tightly together and second spacing said tile face and said abrading face apart one from the other, and means on said appartus for providing a gyratory movement of said abrading face relative to said tile face, which said gyratory movement is such that all portions of said abrading face move in substantially circular paths of from about 1/16 inch to one inch diameter relative to said tile face, said circular paths being in respective planes parallel to the normal plane of said tile face.

3. Apparatus as defined in claim 2 further comprising a plurality of small holes extending through said abrading face and means for supplying air to said holes under superatmospheric pressure whereby jets of air are projected therefrom against said tile face for removal of abraded material therefrom.

4. Apparatus for forming a relief pattern in the face of a tile of a relatively crumbly mineral nature, comprising two oppositely directed abrading faces having raised portions of abrasive material formed in substantially opposite relief to the desired tile pattern, means on said

apparatus for firmly holding tile with faces thereof parallel to each of said opposed abrading faces and holding each said tile in fixed spaced relation from the opposed tile a distance greater than the spacing between said oppositely directed abrading faces, reciprocating means on said apparatus for alternately pressing said tile faces of said respective opposed sides against said respective opposed abrading faces, and means on said apparatus for providing a gyratory movement of said abrading faces relative to said tile faces, which said gyratory movement is such that all portions of said abrading faces move in substantially circular paths of from about 1/16 inch to one inch diameter relative to said tile faces, said circular paths being in respective planes parallel to the normal plane of said tile face.

5. Apparatus as defined in claim 4 wherein said abrading faces are eccentrically mounted on a plurality of rotatable shafts, and said tile holding means are slidably mounted for reciprocation in a direction toward and from said abrading faces, and comprising means for rotating said shafts and means for reciprocating said tile holding means.

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