United States Patent

Gabbrielli

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[54] **HIGH PRODUCTION MACHINE FOR DECORATIVE PRINTING OF TILES OR THE LIKE**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** .....**101/35,** 101/126, 271/48, 198/33 R

[51] **Int. Cl.**.....**B41f 17/00**

[58] **Field of Search**.....101/43, 44, 11, 35, 126; 51/76, 277; 93/54; 198/33 R; 271/48; 141/165, 166, 180

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Assistant Examiner—Clifford D. Crowder
Attorney—Waters, Roditi, Schwartz & Nissen

[57] **ABSTRACT**

A succession of tiles are fed on a conveyor towards a printing position in which a plurality of tiles are simultaneously decoratively printed. A first retractable stop arrests the first stop of the succession in the printing position and a second retractable tile engages the last of the tiles to be printed in a single operation and pushes these tiles together against the first stop. A lateral arm presses the tiles to be printed against a lateral guide and the tiles to be printed are lifted from the conveyor against a screen while a printing head presses the screen into contact with the tiles to effect the printing operation. The printed tiles are then conveyed away while the next tiles to be printed are fed to the printing position.

10 Claims, 11 Drawing Figures

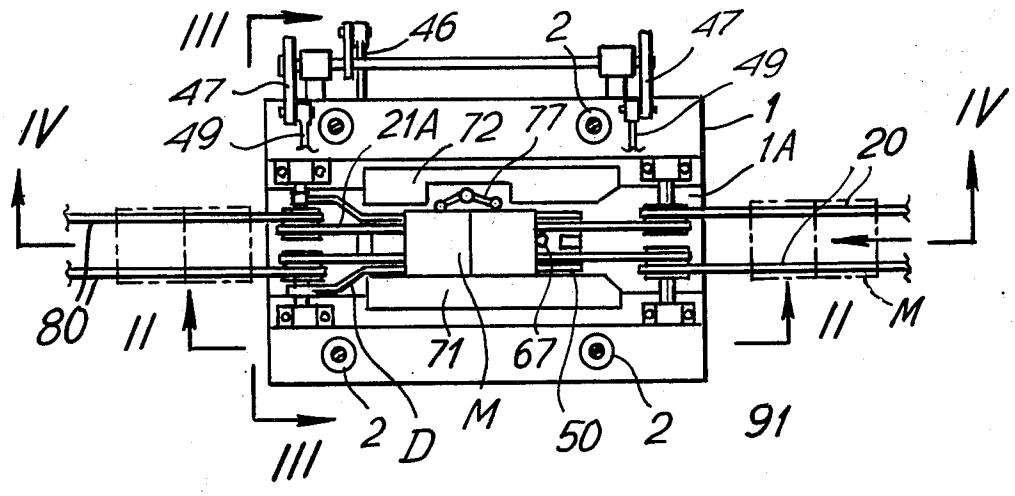


Fig. 1

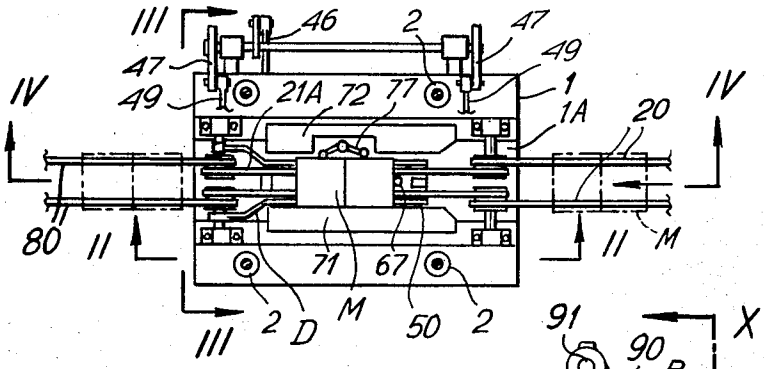

III
46
2
47
49
47
49
21A
72
77
1
1A
20
IV
IV
80
II
II
M
71
67
2
D
M
50
2
III

Fig. 3

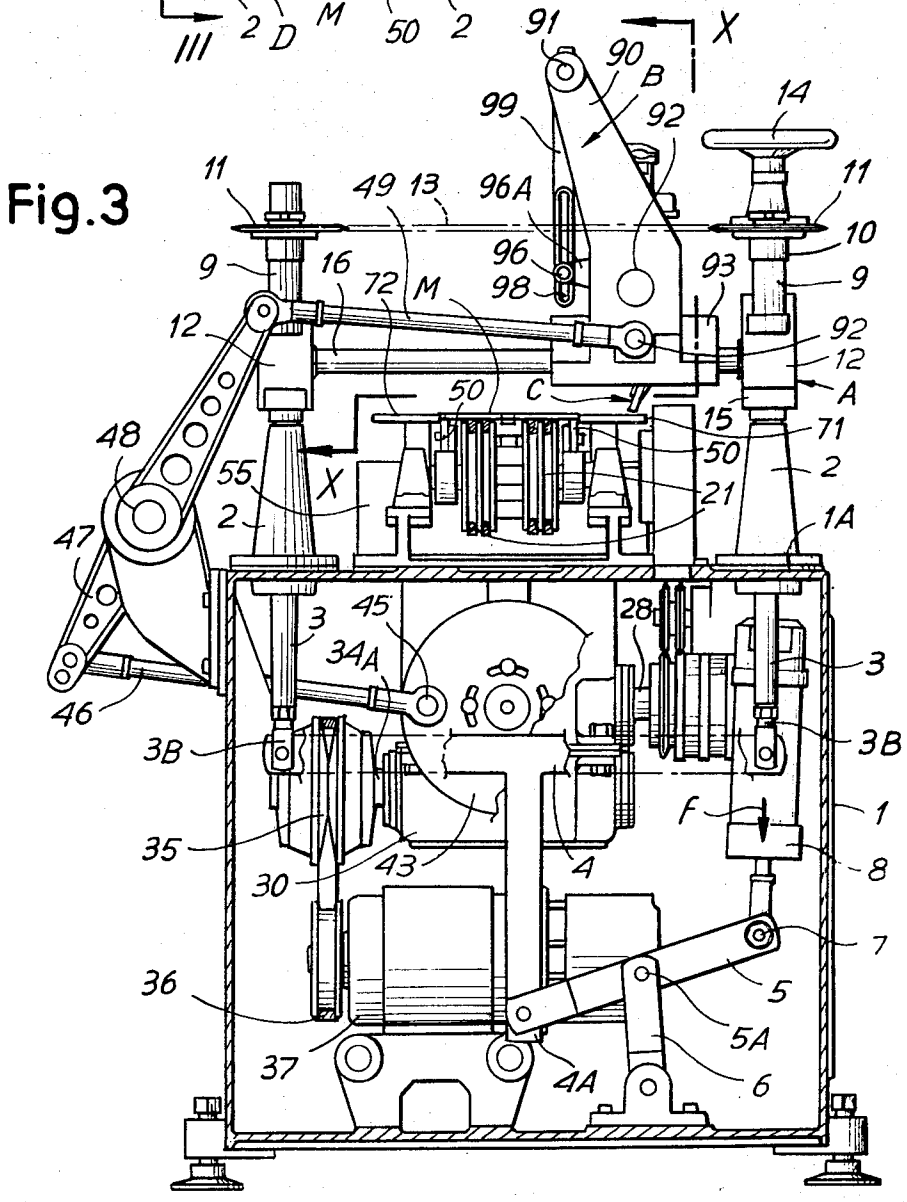

91
X
90
B
99
92
14
11
49
13
96A
11
10
9
16
72
M
96
98
93
9
12
92
12
A
50
C
15
71
48
55
X
50
2
21
2
1A
47
3
45
28
34A
3
46
3B
3B
F
1
35
43
A
8
30
7
36
5
5A
37
4A
6

Fig. 2A

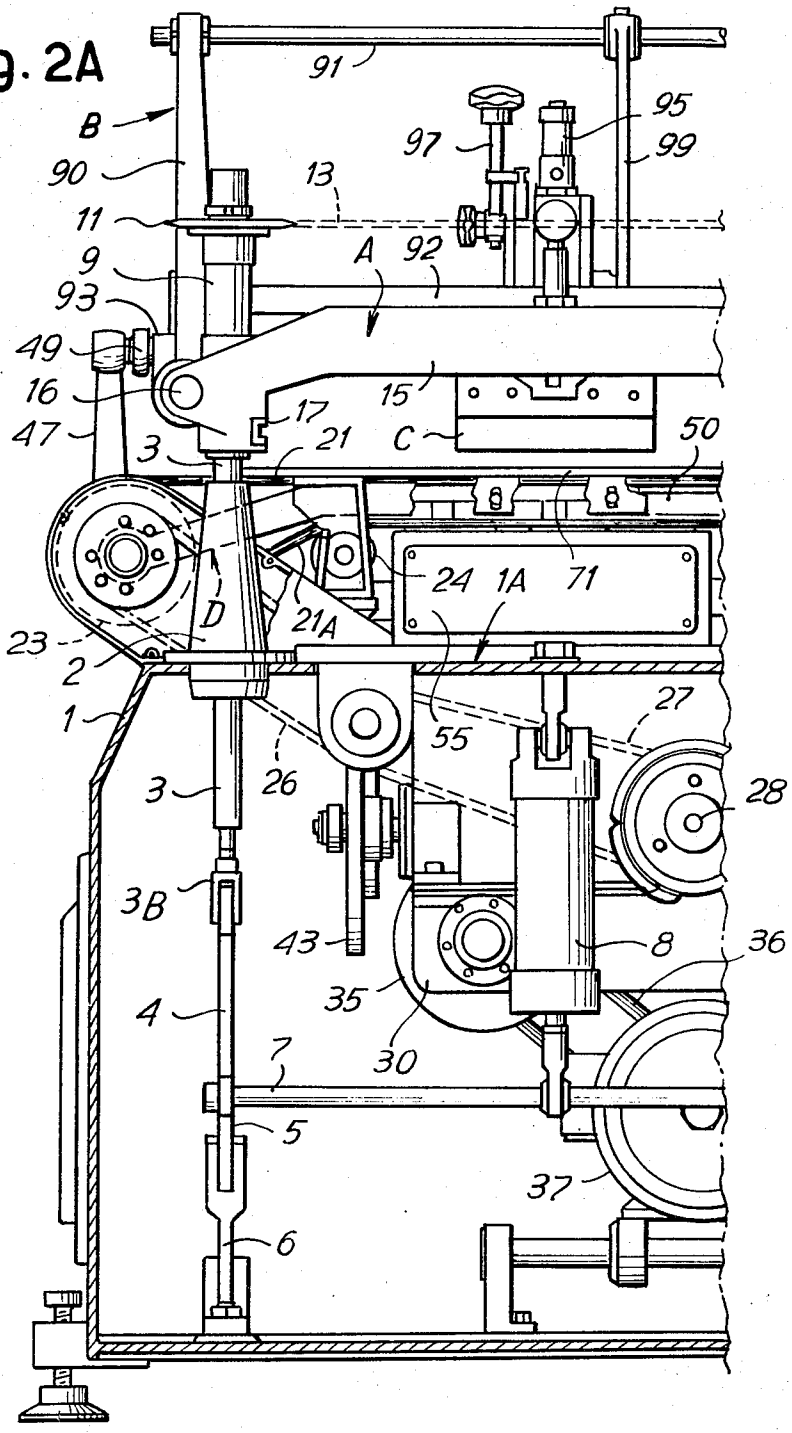

91
95
97
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B
90
13
11
A
92
9
93
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16
15
17
47
21
C
50
3
24
1A
71
D
21A
23
2
1
27
55
26
3
28
3B
43
8
36
35
4
30
7
5
37
6

Fig.2B

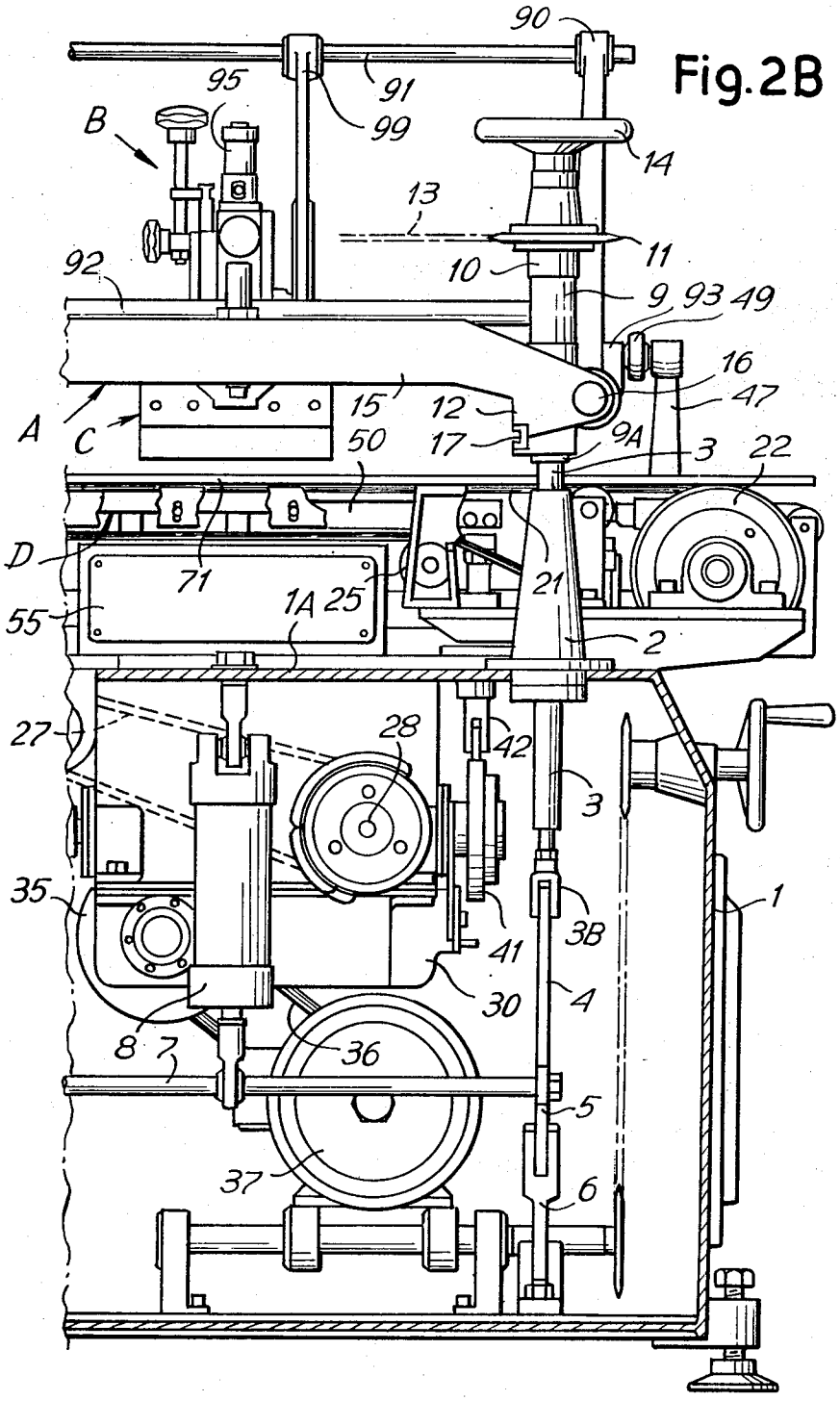

90
95
91
99
B
14
13
11
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92
9
93
49
16
47
A
C
15
12
50
17
9A
3
22
D
71
1A
25
21
55
2
27
28
42
3
35
1
38
41
30
4
8
7
36
5
37
6

Fig. 4

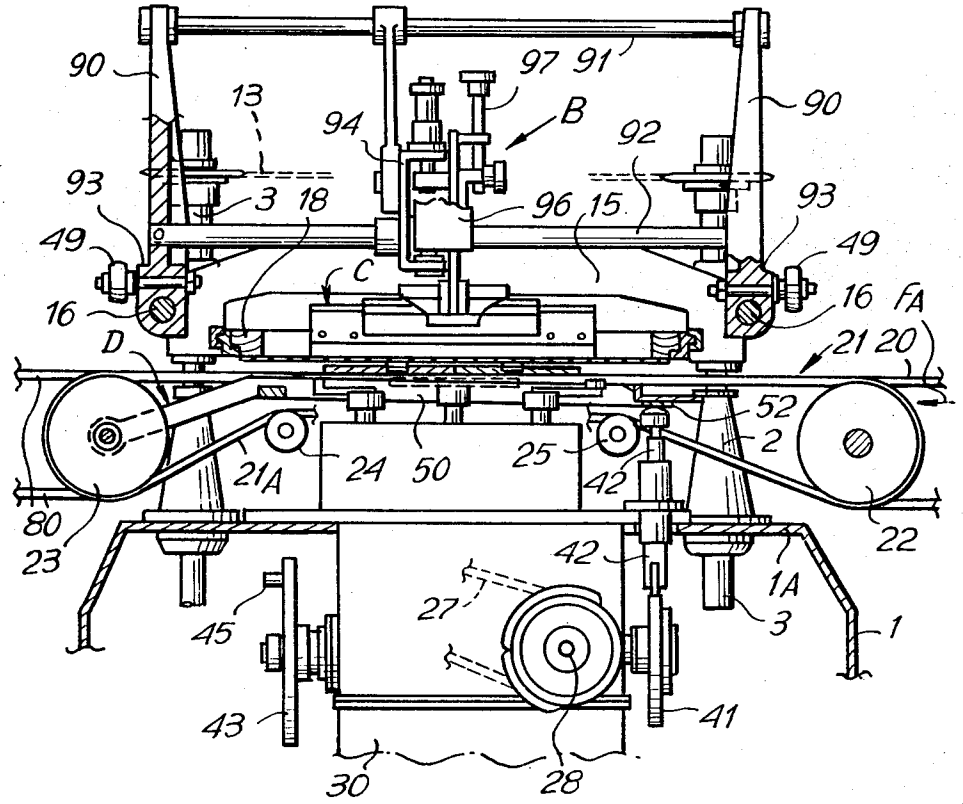

90
13
97 91
B
94
92
90
93
3 18
96 15
93
49
49
C
16
16 FA
D
21 20
52
2
21A
24 50
25
42
80
23
22
42
1A
27
45
3
1
43
41
30
28

Fig. 5

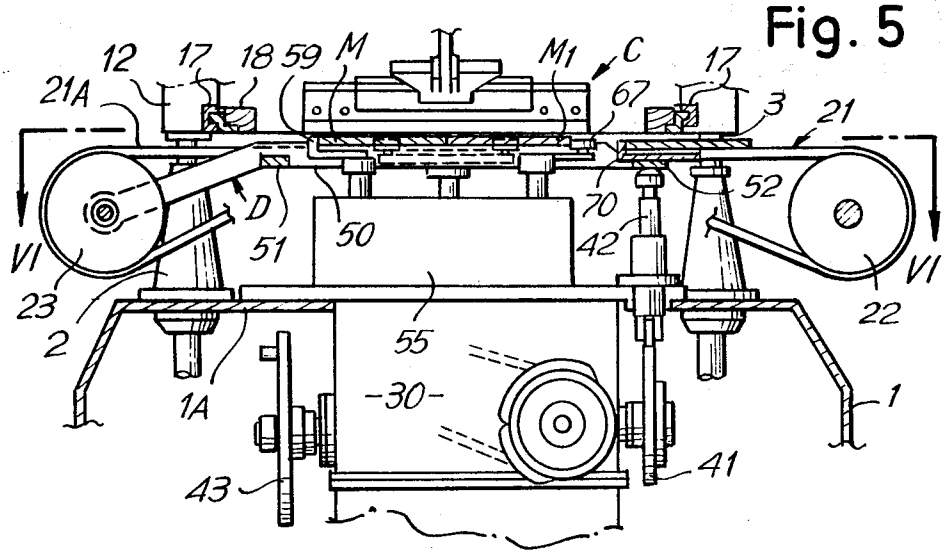

12 17 18 59 M
M1
C
17
21A
67
3
21
D
52
70
42
VI
51
50
VI
23
22
2
55
1A
-30-
1
43
41

Fig.6

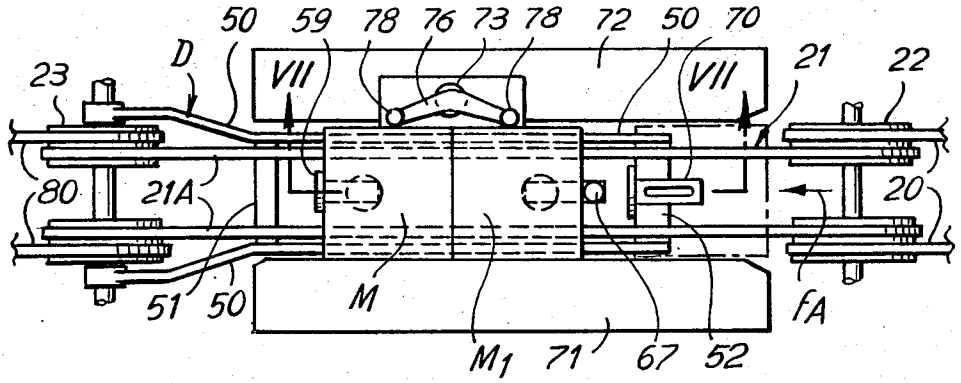

50 59 78 76 73 78 72 50 70
D
VII
VII
21
22
23
80
21A
20
51
50
M
fA
M1 71 67 52

Fig.7

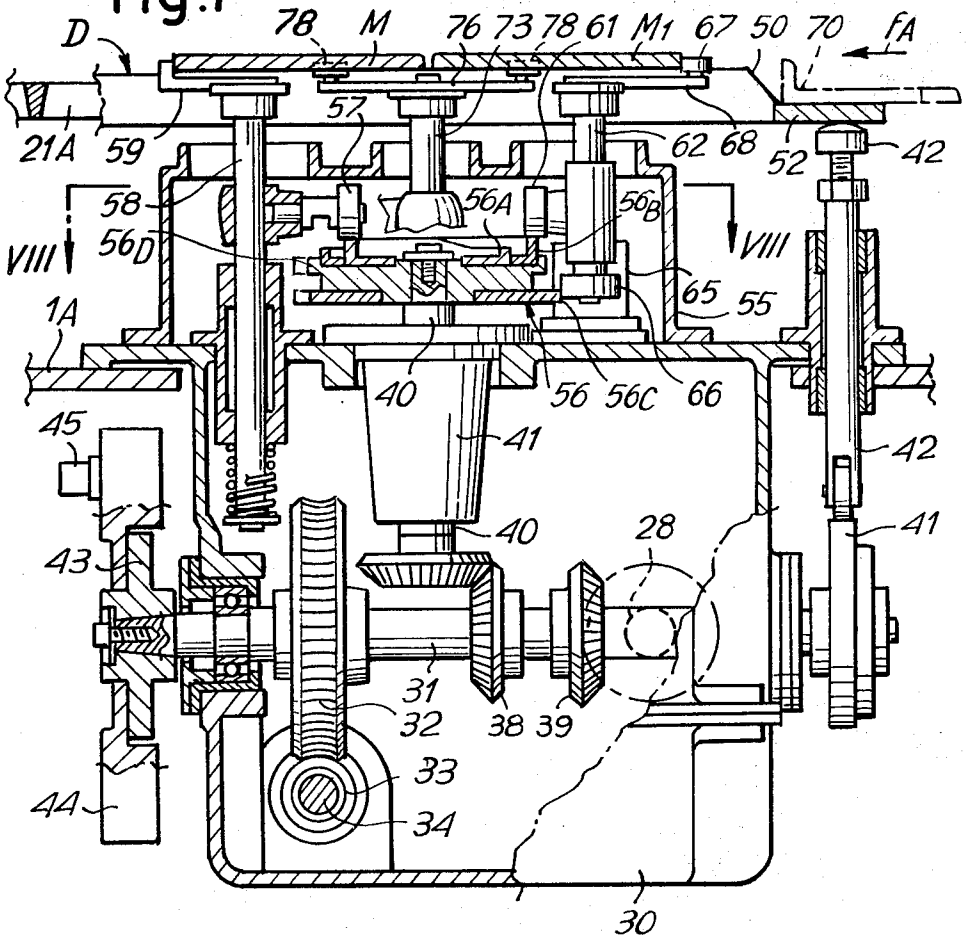

D
78 M 76 73 78 61 M1 67 50 70 fA
21A 59
57
62 68
52
42
58
56A
56B
VIII
56D
VIII
65 55
1A
40
56 56C 66
45
41
42
40
28
41
43
31
32
38 39
33
44
34
30

Fig. 8

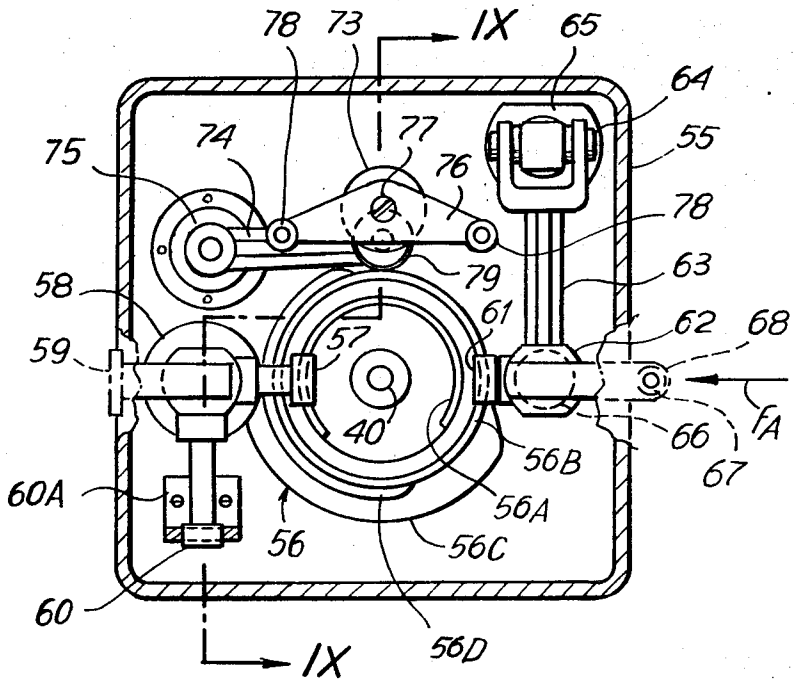
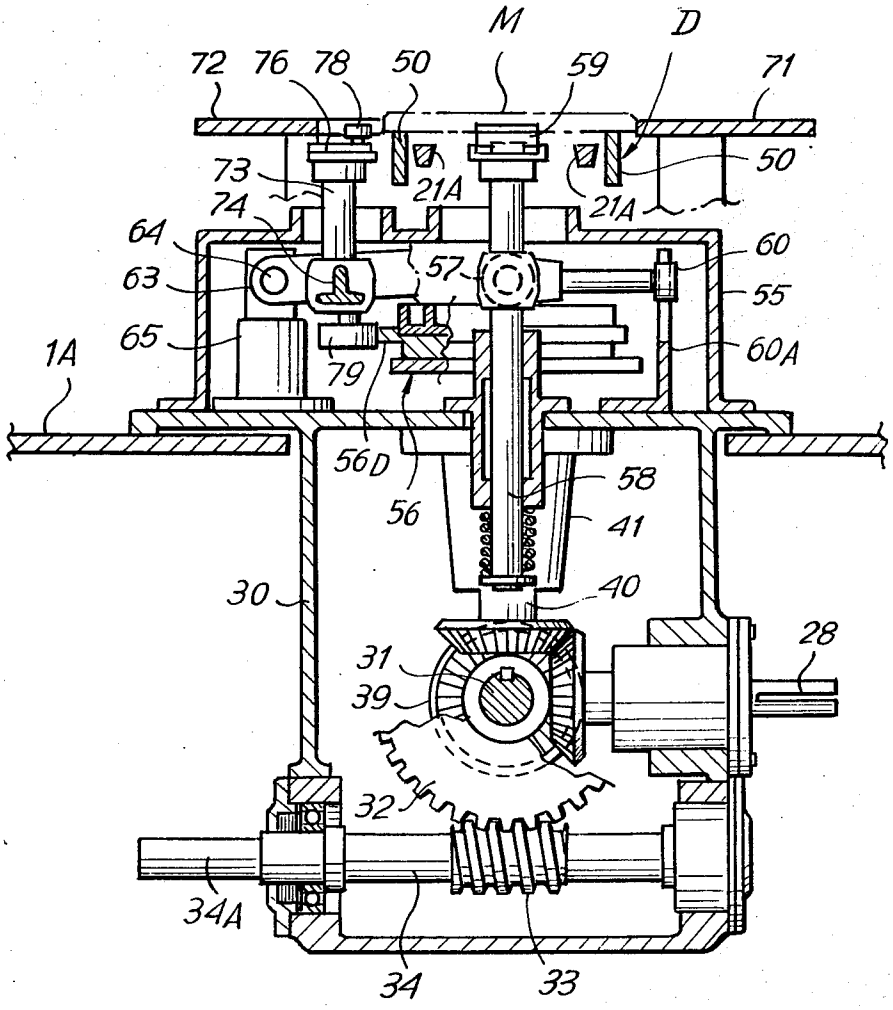

78
73
IX
65
64
75
74
77
76
55
78
79
63
58
61
62
68
59
57
40
FA
66
67
56B
60A
56A
56
56C
60
56D
IX

Fig. 9


M
D
72
76
78
50
59
71
73
74
21A
21A
50
64
63
65
57
60
55
60A
1A
79
56D
56
58
41
40
30
28
31
39
32
34A
34
33

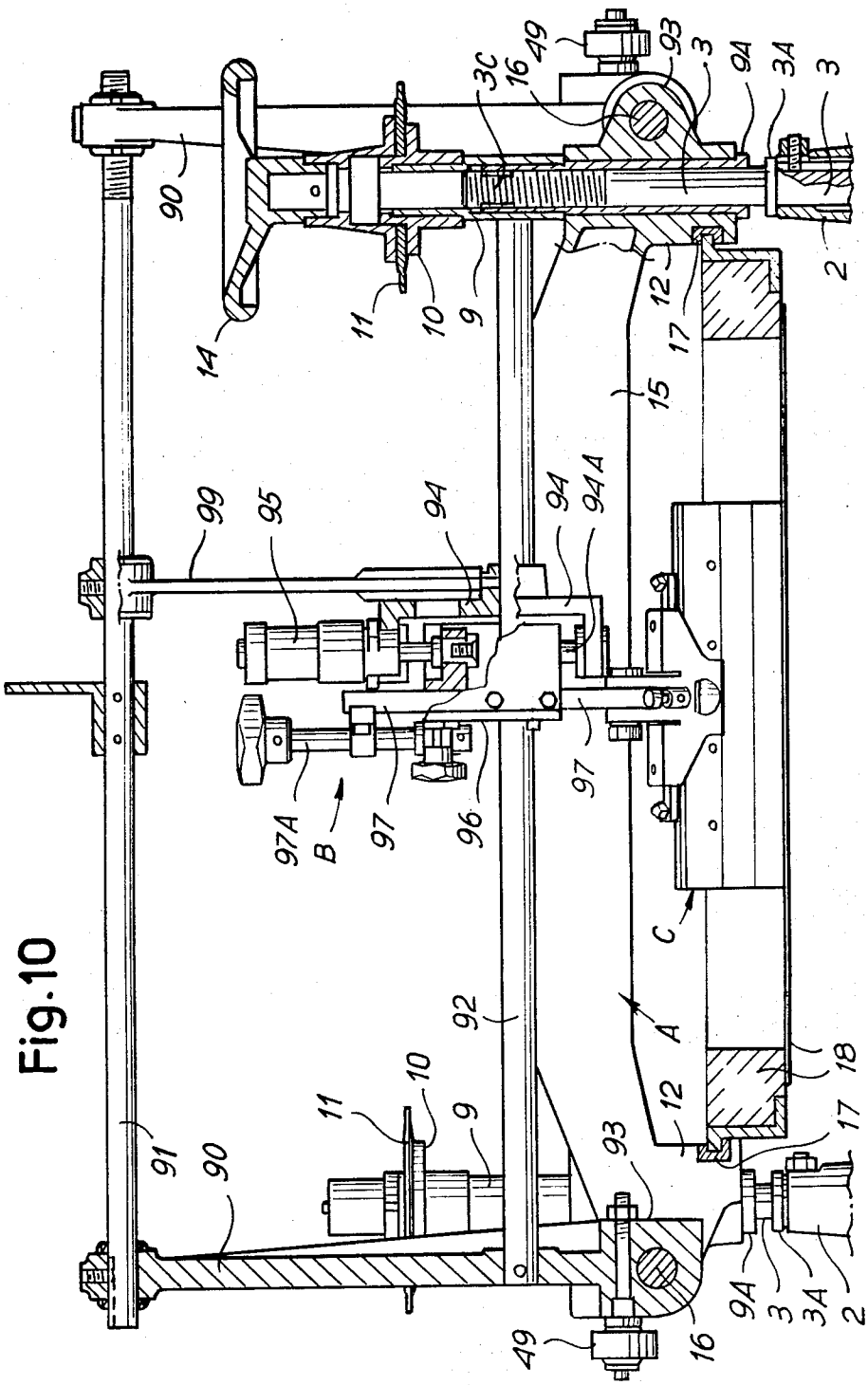

49
93
3
94
34
3
3C
16
90
2
12
17
11
10
9
14
15
99
95
94
94A
97
97A
B
96
C
A
92
18
12
17
11
10
9
91
90
93
94
3
3A
2
49
16

Fig.10

HIGH PRODUCTION MACHINE FOR DECORATIVE PRINTING OF TILES OR THE LIKE

BRIEF SUMMARY OF THE INVENTION

The invention is directed to a machine for decorating tiles or similar articles by silk-screen printing, or the like.

An object of the invention is to provide such a machine having high production rate.

According to the invention, the machine comprises feed means for advancing a succession of tiles, a first stop means having a raised position for arresting the first of the succession of tiles to hold the same in a printing position, and a retracted position out of the path of travel of the tiles after a printing operation, a second stop means movable to a raised position after the passage of at least two tiles therepast for advancing said at least two tiles in the feed direction thereof towards said first stop means, a lateral guide means adjacent one side of the path of travel of said tiles for laterally positioning said tiles in the printing position, means movable towards and away from said lateral guide means to press said at least two tiles thereagainst when the tiles are engaged by said second stop means and arrested by said first stop means, a vertically displaceable frame disposed beneath said at least two tiles in the printing position, pusher means for displacing said frame in synchronization with said first and second stop means to lift the frame and said at least two tiles therewith off said feed means and then to lower said tiles back onto said feed means, and means for decorative printing of said at least two tiles in the raised position thereof off said feed means.

According to a preferred embodiment, the means for pressing the tiles against the lateral guide means comprises, the case of the simultaneous printing of two tiles, a rocker arm member provided with two rollers spaced from an intermediate pivot axis, each roller pressing a corresponding tile against the lateral guide means.

According to a preferred embodiment by which particularly rapid operation of the machine is possible a multiple surface cam is provided to effect synchronized operation of the first and second stop means, and the lateral pressing means.

A stop is provided on the frame which effects tile lifting and the stop serves to intercept the feed of additional tiles during the lifting operation, the centering operation and the printing operation of said at least two tiles.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a diagrammatical illustration in plan view of the machine according to the invention;

FIGS. 2A and 2B illustrate on a larger scale and in two portions, a longitudinal section of the machine taken along the line II—II of FIG. 1;

FIG. 3 is a cross-section taken along the line III—III of FIG. 1;

FIGS. 4 and 5 illustrate in two different operational conditions, a partial longitudinal cross-section taken along the line IV—IV of FIG. 1;

FIG. 6 is a top view taken along the line VI—VI of FIG. 5;

FIG. 7 is a longitudinal section taken along the line VII—VII of FIG. 6 of the centering unit;

FIG. 8 is a horizontal section taken along the line VIII—VIII of FIG. 7;

FIG. 9 if a cross-section taken along the line IX—IX in FIG. 8; and

FIG. 10 is a partial longitudinal section taken along the line X—X of FIG. 3, showing the spatule control for the screen.

DETAILED DESCRIPTION

In the accompanying drawing, numeral 1 denotes a base having a planar surface 1A on which there are assembled, four, diagonally opposite glass supports 2 for vertical guiding of the same number of columns 3 constructed for lifting a screen-holder frame A to adjust the level of the frame. The columns 3, in the working position, are kept in contact with the upper portion of the supports 2 by rings 3A (see FIG. 10). The lower end of columns 3 are formed in the interior of the base 1 with fork ends 3B.

The ends 3B of columns 3 are connected by tie rods 4 with each other in pairs, one pair for each machine headstock. The tie-rods 4 are T-shaped and aligned one for each headstock in the cross direction of the machine (see FIG. 3). The tie rods are anchored at their lower end 4A to levers 5 pivotably connected at 5A to supporting cranks 6. The two levers 5 are mutually connected by a longitudinal rod 7 (see FIG. 2) on which a pneumatic piston 8 acts centrally. Thus, when pneumatic piston 8 is operated in the direction of the arrow f, the four rods 3 are raised therefore to raise the screen-holder frame A to a desired position above the underlying display zone of the tiles to be decorated.

The upper ends of the rods 3 are formed with threaded portions 3C (FIG. 10) each engaged with a respective threaded sleeve 9 integrally connected by means of suitable connection elements 10 with geared pinions 11. The sleeves 9 have lower shoulders 9A for supporting sleeves 12 formed on the screen-holder frame A. The four pinions 11 are connected by a closed chain 13 (see FIGS. 2 and 3); therefore, by means of a handwheel 14, integral with one of said pinions, it is possible to rotate simultaneously the four pinions 11 by the same amount, thus obtaining an accurate height adjustment of frame A by varying the threaded engagement of the sleeves 9 and the threaded ends 3C.

The frame A includes two cross-beams 15 forming the longitudinal sides thereof. Each cross-beam is formed at the ends with the respective sleeves 12, which are connected to one another in pairs by cylindrical guides 16, each of which connects the two sleeves of the same headstock, said guides forming the two cross sides of the frame A.

The cylindrical guides 16 are arranged to allow the alternative excursion of a unit B adapted for the control of a spatule or printing head C while between the sleeves 12 of the same headstock there are provided guides 17 of U shaped cross-section for the insertion of a frame bearing the screen 18.

The tiles M to be decorated are fed into the machine from a conveyor 20, from which they are passed to the decoration zone by means of a conveyor 21 which advances them in the direction of the arrow fA. The conveyor 21 is constituted by a pair of endless belts 21A wound on pulleys 22, 23, 24, 25 (FIG. 4). The pair of pulleys 23 are connected by means of a drive connec-

tion 26,27 with a drive shaft 28 at the output of a box 30 located under the surface 1A (see FIGS. 7 and 8). The box contains a longitudinal shaft 31 driven by a reduction gearing constituted by helical gear 32 and worm 33. The worm 33 is formed on a cross-shaft 34, extending from the box 30 by an extension 34A. A variable diameter pulley 35 (see FIG. 3) driven by means of the V belt 36 from the motor 37, is mounted on extension 34A. Two bevel gears 38 and 39 are mounted on the shaft 31. The gear 38 operates a vertical shaft 40 supported in a bushing in a support 41, while the gear 39 transmits the drive to the shaft 28 for the advance of the belts 21A. Furthermore, the shaft 31 is extended outside the box 30, on the side of the front headstock and bears a cam 41 adapted to vertically operate a stem 42 for a purpose to be described hereinafter. On the side of the rear headstock, the shaft 31 is extended to accomodate a flywheel 43, suitably counterbalanced by weights 44, on which a crank pin 45 is arranged. The crank pin 45 is operative through a crank 46, a transmission lever 47 and two cranks 49 (connected with each other through a linkage 48) to impart reciprocal motion to the assembly B for the stroke of spatule C on the screen.

A frame D, including two vertical ribs 50 arranged parallel at the outside of the belts 21A, and connected to each other by cross members 51, 52, is linked to the shaft supporting the pulleys 23. The upper edges of ribs 50, in the stage of tile advance, are slightly lower than the upper edge of the belts 21A of the conveyor 21 (see FIG. 4) while, when the tiles have reached the predetermined position for the decoration operation, frame D is slightly raised, rotating around the axis of pulleys 23 to slightly raise the tiles to be decorated from the belts 21A (see FIG. 5). The lift of the frame D is actuated through the cam 41 by the stem 42 which acts upwardly under the cross-member 52.

During this operation, the tiles M are stopped and centered in a decoration application position, by suitable dogs or stops to be hereinafter described.

The shaft 40 from the box 30 extends vertically into an additional box 55 mounted on the box 30 and the shaft 40 bears a multiple cam 56. The cam has two front profile surfaces 56A, 56B and two radial profile surfaces 56C, 56D. By the profile surface 56A a small column 58 is operated by means of a roller 57, said column bearing on its upper end a small square plate 59, adjustable in position and adapted to form a stop to arrest the first tile M to be decorated in the operational or printing position (see FIG. 7). The column 58 is guided in its vertical travel by a lateral roller 60, slidable in a slot provided on the plate 60A (see FIGS. 8 and 9).

The lifting of an element 62 linked by means of an arm 63, both in the vertical direction and in the horizontal direction, to a universal joint 64 borne by a support 65, is effected by the profile surface 56B via a roller 61. A second roller 66 at the bottom of the element 62 is urged by an elastic means (not shown) into contact with the radial profile surface 56C of the cam 56. An additional roller 67, supported by an adjustable plate 68, is provided at the top of the element 62.

When the second tile M1, advanced in the direction of the arrow fA by the conveyor 21, is brought against the first tile M, previously arrested by the dog 59, the element 62 is lifted by means of the profile surface 56B, raising the roller 67 above the level of the path of travel of the tiles.

Simultaneously, with the angular advance of the cam 56 and owing to the reduction of the profile surface 56C, the element 62 tends to move under the action of appropriate resilient means in the direction of the arrow fA of FIG. 8, thus pushing with the roller 67 the tile M1 against the tile M previously arrested by the stop 59, still in the direction of the arrow fA.

A stop plate 70, fixed on the cross-member 52 of the frame D intercepts and stops the other tiles advanced by the conveyor 21, upon the lifting of the frame D, and releases them upon the lowering of the frame D for a subsequent decoration operation.

Laterally on the strips 21 and the frame D there are provided two horizontal plates 71, 72 (see FIGS. 6 and 9) which function as lateral guides for the feed of the tiles.

A third centering means is provided for the lateral positioning of the tiles to be decorated. This is constituted by a vertical element 73, supported by an arm 74, which is linked to a vertical support 75 for movement in a horizontal plane. A rocker arm 76 is pivoted to arm 74 at pivot 77 and carries two rollers 78 at its two ends. The rocker arm 76 is mounted on the top of the element 73. The element 73 is provided at the bottom thereof with an additional roller 79 (see FIGS. 8, 9) which is urged under the action of appropriate resilient means (not shown) into contact with the profile surface 56D of the cam 56.

When the two tiles M and M1 are centered between the stop 59 and the roller 67, upon additional advance of the cam 56, the element 73, contacting the roller 79 with the small portion of the profile surface 56D, is urged by its associated resilient means (not shown) against the two tiles M and M1 acting on each of them with one of the two rollers 78 forcibly pushing the tiles against the inner edge of the lateral plate 71 (see FIG. 9).

The two tiles M and M1 are positively locked between the stop 59 and the edge of the plate 71 by the action of the rollers 67, 78 and are lifted from the strips 21A to approach the screen 18 by the action of the frame D; they thus may undergo the decoration operation by the simple actuation of the spatules C against the screen 18. The tiles thus are separated, during the printing, from the belts 21A such as to avoid any adverse influence from any belt motion during the printing.

Once the decoration operation has been completed, the different profile surfaces of the multiple cam 56 effect displacement of the centering members 78, 68, 59, while the cam 41 operates to lower the frame D, returning the tiles M and M1 onto the conveyor 21, from which they are conveyed to a drying operation by an exit conveyor 80. Thus two subsequent tiles (previously stopped by the dog 70) are permitted to be arranged in the decoration zone for a subsequent operation.

The assembly B, on which the spatule C is mounted, is essentially formed by a frame constituted by two vertical arms 90 mutually connected by bars 91 and 92. The arms 90 are formed at their lower section as sleeves 93 slidable along the cylindrical guides 16 of the frame A; the cranks 49 are linked to sleeves 93 and

the cranks impart the reciprocal motion to the unit B along the guides 16, for the travel of the spatule C with respect to the screen, for the decoration operation.

A C-shaped support 94 is assembled on the bar 92 and said support has assembled on its upper flange a pneumatic cylinder-piston system 95 adapted to operate the detachment and approach of the spatule with respect to the screen. The system 95 actuates a slide 96 guided on columns 94A of the support 94. The spatule is in turn assembled slidably with a stem 97 on the slide 96, and a set screw 97A adjusts the vertical position of the spatule C and of the stem 97 with respect to the slide 96. The assembly formed by the members 94 and 97 may be pivoted on the bar 92 and is adjusted suitably with the aid of a small lug 96A which is engaged for movement along a slit 98 formed in a plate 99 connected to the upper bar 91. The spatule is furthermore adjustable in inclination with respect to said unit.

The drawings only illustrate an embodiment given by way of example of the invention, and the embodiment can be varied and modified without departing from the spirit and scope of the invention as defined in the appended claims. For instance, the arrangement may be adapted for simultaneous decoration of three or more tiles.

What is claimed is:

1. A high production machine for decorative printing of tiles or the like, said machine comprising feed means for advancing a succession of tiles, a first stop means having a raised position for arresting the first of the succession of tiles to hold the same in a printing position, and a retracted position out of the path of travel of the tiles after a printing operation, a second stop means movable to a raised position after the passage of at least two tiles therepast for advancing said at least two tiles in the feed direction thereof towards said first stop means, a lateral guide means adjacent one side of the path of travel of said tiles for laterally positioning said tiles in the printing position, means movable towards and away from said lateral guide means to press said at least two tiles thereagainst when the tiles are engaged by said second stop means and arrested by said first stop means, a vertically displaceable frame disposed beneath said at least two tiles in the printing position, pusher means for displacing said frame in synchronization with said first and second stop means to lift the frame and said at least two tiles therewith off said feed means and then to lower said tiles back onto said feed means, and means for decorative printing of said at least two tiles in the raised position thereof off said feed means.

2. A machine as claimed in claim 1 wherein said feed means comprises an endless conveyor belt.

3. A machine as claimed in claim 1 wherein said means to press said at least two tiles against the lateral guide means comprises an arm with a plurality of rollers, one for each of said at least two tiles, each roller pressing against a respective tile in the printing position.

4. A machine as claimed in claim 1 comprising a cam means coupled to said first and second stop means and the lateral pressing means for synchronizing the operation thereof.

5. A machine as claimed in claim 4 wherein said cam means comprises a rotatable cam having a plurality of cam surfaces, one controlling said means to press the tiles against the lateral guide means, a second controlling said first stop means, and a third and fourth controlling said second stop means for vertical and horizontal movement thereof respectively.

6. A machine as claimed in claim 4 comprising means driving said feed means, said cam means and said pusher means from a common source.

7. A machine as claimed in claim 1 wherein said means for decorative printing of said tiles comprises a screen disposed above said at least two tiles when the latter are positioned by said first and second stop means and said lateral guide means, said at least two tiles being lifted into contact with said screen by said frame during the printing operation, and a vertically reciprocable printing head above said screen for being pressed against said screen to effect a printing a printing operation on the tiles.

8. A machine as claimed in claim 7 comprising means supporting said screen for manually adjustable vertical movement with respect to said at least two tiles in the printing position.

9. A machine as claimed in claim 1 comprising means on said frame for entering said path of travel of the tiles when said frame is raised to arrest travel of the successive tiles after said at least two tiles.

10. A machine as claimed in claim 1 wherein said feed means comprises a pair of spaced belts, said first and second stop means being positioned between said belts.

* * * * *