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(54) Method and apparatus for manufacturing paving and/or panelling modules

(57) A method of manufacturing paving and/or panelling modules which comprises arranging a plurality of blocks or tesserae (24) in a suitable template (18), according to a layout predefined by a locating grid (20) of a module (1); cutting a piece of a layer (45) of flexible material provided with through openings so that it

matches the configuration of the module (1) and is larger than the module (1); and securing through permanent securing means, the layer (45) of flexible material to each one of the blocks or tesserae (24) forming a module (1), so that they are held together by the layer (45) with the possibility of changing their mutual inclination.

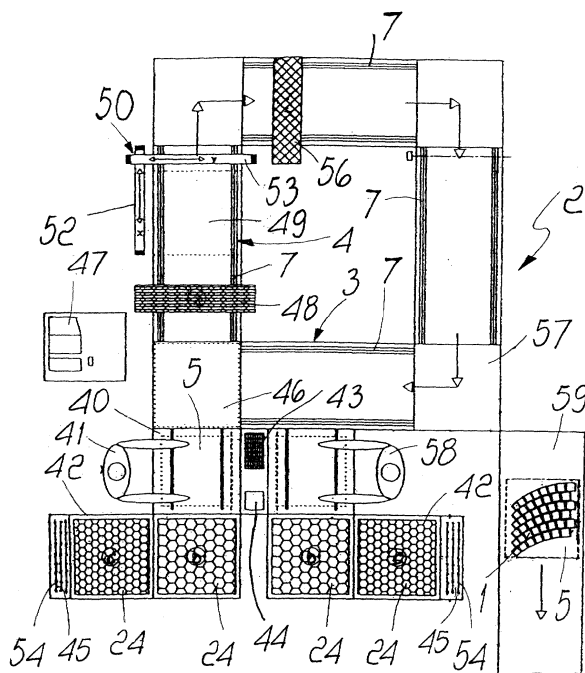


Fig. 1

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Description

[0001] The present invention relates to a method and an apparatus for manufacturing paving and/or panelling modules.

[0002] Paving by means of blocks or tesserae in a mosaic-like pattern is currently generally performed by manually laying a single block or tessera at a time on a sand or cement bed.

[0003] The manner in which the individual blocks are arranged creates, as a whole, ornamental patterns which reproduce geometric shapes, e.g. an arc, a circle or a compound fan, which are repeated identically a number of times depending upon the dimensions of the surface to be covered.

[0004] The workers assigned to laying the blocks must then be expert in the trade, since carrying out these geometric shapes requires long working experience and a special skill in placing the individual blocks in order to obtain the best overall results, at a fair laying speed.

[0005] A drawback of current block laying methods is therefore the fact that since they must be performed necessarily on site and by specialized personnel, they entail long production times and rather high labor costs.

[0006] Another drawback of paving and/or panelling with current laying techniques is that any detachment of a single block and/or mosaic tessera leaves space for the adjacent elements to move and, in a relatively short time, detach, thereby compromising the integrity of the composition.

[0007] The main object of the present invention is to provide a new method for paving and/or panelling by means of blocks or tesserae which does not necessarily involve the use of specialized labor, thereby significantly reducing its implementation costs.

[0008] Another object of the present invention is to provide an apparatus for the mass-production of modules for street paving and/or panelling by means of which it is possible to cover larger surfaces in less time, while making the laying operation simpler and above all faster.

[0009] Another object of the present invention is to allow mass production of a plurality of variously shaped modules which can be mutually assembled and are suitable for producing multiple ornamental patterns also for panelling sloping surfaces and vertical walls.

[0010] Another object of the present invention is to provide modules which adapt themselves to the unevenness of the surface to be covered and ensure integrity of the finished work, thereby preventing detachment of single blocks, which would cause movement and gradual separation of adjacent blocks.

[0011] Another object of the present invention is to provide modules which, once laid, are durable and ensure particularly extended resistance to mechanical stresses and atmospheric agents.

[0012] Another object of the present invention is to provide a paving system which is permeable to, and ca-

pable of draining rainwater while preventing washing out of the sand from the bed.

[0013] Another object of the present invention is to provide modules which can be easily lifted and carried by one operator.

[0014] According to a first aspect of the present invention, there is provided a method for manufacturing paving and/or panelling modules which comprises the following operating steps:

- arranging a plurality of blocks or tesserae in a suitable template, according to a predetermined layout defined by a locating grid delimiting a module;
- cutting a piece of a layer of flexible material having through openings so as to match the configuration of said module and being of larger dimensions than said module;
- securing, by means of permanent securing means said layer of flexible material to each one of said blocks or tesserae forming said module, so that they are held together by said piece of flexible material with the possibility of changing their mutual inclination.

[0015] Advantageously, said method, before rigidly coupling said layer to the bottom of said blocks, includes an operation of spraying and drying a primer onto the bottom of said blocks in order to promote adhesion of said coupling means.

[0016] According to another aspect of the present invention there is provided an apparatus for performing the above method, which has a supporting frame, a plurality of workstations arranged sequentially and a conveyor which extends sequentially through said workstations, and is characterized in that it comprises at least one moving unit designed to be arranged on said conveyor to convey a module through each one of said workstations, and in that one of said workstations comprises a device for applying permanent coupling means, thereby coupling a piece of flexible material to the bottom of said module.

[0017] Advantageously, said moving unit comprises a movable transfer tray which is designed to be arranged on said conveyor, a template supporting tray arranged to be located on said movable transfer tray, at least one reference template to be fitted on said template supporting tray and a locking cover which is designed to fix the or each reference template on said template supporting tray.

[0018] According to another aspect of the present invention, there is provided at least one module for street paving and/or panelling which comprises at least one block or tessera, characterized in that it comprises a layer of flexible material which has through openings and permanent securing means for rigidly coupling said layer of flexible material to the or each block.

[0019] Advantageously, said layer of flexible material provided with through openings comprises a meshed

net.

[0020] Conveniently, said module comprises two or more of said blocks or tesserae arranged according to a predetermined composition and held together by said net.

[0021] Further aspects and advantages of the present invention will become better apparent from the following detailed description of some currently preferred embodiments thereof, given merely by way of non-limitative example with reference to the accompanying drawings, wherein:

Figure 1 is a plan view of an apparatus for producing a prefabricated module according to the present invention;

Figure 2 is an axonometric view of a movable transfer tray;

Figure 3 is an axonometric view of a template supporting tray;

Figure 4 is an axonometric view of a locking cover;

Figure 5 is an axonometric view of a detail of the locking cover of Figure 4;

Figure 6 is a plan view of a composition shaped like a contrasting arc;

Figure 7 is a plan view of a left module of the composition of Figure 6;

Figure 8 is a plan view of a reference template for producing the module of Figure 7;

Figure 9 is a plan view of a right module of the composition of Figure 6;

Figure 10 is a plan view of a left initial module of the composition of Figure 6;

Figure 11 is a plan view of a right initial module of the composition of Figure 6;

Figure 12 is a plan view of a left final module of the composition of Figure 6;

Figure 13 is a plan view of a right final module of the composition of Figure 6;

Figure 14 is a plan view of a lateral closure module of the composition of Figure 6;

Figure 15 is a plan view of a circular composition;

Figure 16 is a plan view of a module of the composition of Figure 15;

Figure 17 is a plan view of a module with corner frame of the composition of Figure 15;

Figure 18 is a plan view of a module with left frame of the composition of Figure 15;

Figure 19 is a plan view of a module with right frame of the composition of Figure 15;

Figure 20 is a plan view of a composition shaped like a compound fan;

Figure 21 is a plan view of a left module of the composition of Figure 20;

Figure 22 is a plan view of a right module of the composition of Figure 20;

Figure 23 is a plan view of a central module of the composition of Figure 20;

Figure 24 is a plan view of a left half central module

of the composition of Figure 20;

Figure 25 is a plan view of a right half central module of the composition of Figure 20;

Figure 26 is a plan view of a left module of the composition of Figure 20 according to another embodiment;

Figure 27 is a plan view of a right module which can be coupled to the module of Figure 26;

Figure 28 is a plan view of a left final module of the composition of Figure 20;

Figure 29 is a plan view of a right final module of the composition of Figure 20;

Figure 30 is a plan view of a left lateral closure module of the composition of Figure 20; and

Figure 31 is a plan view of a right lateral closure module of the composition of Figure 20.

[0022] In the accompanying drawings, identical or similar parts or components have been designated by the same reference numerals.

[0023] Initially with reference to Figures 1 to 8, reference numeral 1 indicates a generic module, the method for producing a module 1 requiring an apparatus 2 comprising a frame 3 which supports an uninterrupted conveyor 4 arranged to move a series of movable units 5.

[0024] Each movable unit 5 comprises a movable transfer tray 6, shown in Figure 2, which is designed to slide along guides 7 of the conveyor 4 and to support a template supporting tray 8, as shown in Figure 3.

[0025] The movable transfer tray 6 can be constituted by a square platform 9 which has two straight and parallel raised guides 11 on its upper surface 10 and a vertical locating pin 12 at each one of its four corners.

[0026] Each locating pin 12 has a rack-shaped side or front 13 and is orientated so that its rack-shaped side is directed toward the rack-shaped front of the pin located in the adjacent corner and on the same side with respect to the guides 11.

[0027] The template supporting tray 8, shown in Figure 3, has on its lower surface 14 two straight and parallel grooves 15 which are designed to slide, in use, along the guides 11 of the transfer tray 6.

[0028] The template supporting plate 8 also has, at its upper surface, a peripheral rim 16 which delimits a recessed inner surface 17.

[0029] A reference template 18, e.g. shaped as shown in Figure 8, is arranged, in use, on the recessed surface 17.

[0030] The reference template 18, which can be made of aluminum, steel or plastics, has an external supporting frame 19, which is common to all kinds of template, and a locating grid 20 which instead varies according to the shape to be given to the module 1.

[0031] In the specific case shown in Figure 8, the locating grid 20 has a series of ribs 21 which reproduce the shape of a left module 22, shown in Figure 7, of a composition shaped like a contrasting arc 60, shown in Figure 6, thereby delimiting spaces 23 within which the

blocks or tesserae 24, shown in Figure 1, are to be arranged.

[0032] Figure 4 illustrates a locking cover 25 which is constituted by an outer border 26 delimiting a central opening 27 which is smaller than the recessed surface 17 of the template supporting tray 8.

[0033] The outer border 26 has, at its four corners, wider regions 28 at which there are provided through openings 29 arranged to act as female elements in coupling with the locating pins 12 when the locking cover 25 is superimposed, in use, on the transfer tray 6.

[0034] On each shoulder 30 and 31 of the border 26 there is a locking device 32 of the type shown in Figure 5, which is constituted by a pair of rods 33 and 34 which are aligned and fitted on a respective shoulder by means of brackets 35 and free to perform small straight strokes lengthwise.

[0035] The rods 33 and 34 are connected, at their ends, by a spring 36 which has a central supporting cylinder 37 which is designed to keep them at a predefined distance.

[0036] In order to use the locking device 32 it is necessary to move the rods 33 and 34 mutually closer, thus overcoming the urge of the spring 36 and, once the locking cover 25 has been placed on the template supporting tray 8, release them so that the outward ends 38 of the two wedge-shaped rods 33 and 34 interact with the rack-shaped front 13 of the respective facing locating pins 12, thereby preventing any upward movement of the cover 25.

[0037] As shown in Figure 1, a movable unit 5 is prepared in the workstation 40 of the apparatus 2 and is initially constituted only by the transfer tray 6 and the template supporting tray 8.

[0038] An operator 41 can thus arrange on the template supporting tray 8 a reference template 18 which is suitable for providing a module such as the module 22 of Figure 7.

[0039] The same operator 41 can deposit the blocks 24, available in containers 42 located in the vicinity of the workstation 40, inside the grid 20, by placing them with their bottom upward and trying to completely fill the spaces 23 delimited by the ribs 21 that constitute the grid 20.

[0040] After blocks 24 have been placed on the template 18, the operator 41 can also be given the task of cleaning the bottom of the blocks 24 of any impurities that might be present. For cleaning the blocks 24 it is possible to use a rotating brush with steel bristles 43, which is located near the workstation 40 within reach of the operator 41.

[0041] Alternatively, the same cleaning operation can be performed by subjecting the blocks 24 to a jet of water under pressure; in this case it is necessary to perform a subsequent drying step, e.g. by employing jets of hot air; this solution is not shown in Figure 1.

[0042] While the movable unit 5 is still located in the workstation 40, a primer 44 is advantageously sprayed

onto it; said primer includes for example a petroleum resin and/or rosin applied in a solvent phase and is designed to increase bonding of an adhesive material on the bottom of the blocks 24. This operation, too, can be performed manually by the operator 41 or by a suitable primer dispensing device (not shown in Figure 1).

[0043] The operator 41 then places on the template 18, and therefore on the blocks 24 arranged therein, a piece of net 45 cut beforehand so as to have the same configuration as that of the module being produced and larger dimensions than said module, so as to protrude from its contour to a predetermined extent.

[0044] In order to complete the preparation of the movable unit 5, the locking cover 25 is arranged on the template supporting tray 8, by inserting the pins 12 of the transfer tray 6 inside the through openings 29 of the cover 25. In this manner, the frame 26 of the locking cover 25 locks the template 18 on the template supporting tray 8 owing to the two locking devices 32.

[0045] Once the preparation of the movable unit 5 has been completed, the operator 41 arranges it on the initial station 46 of the conveyor 4, which by being controlled by a control unit 47 transfers it sequentially through a series of workstations according to a predefined production cycle.

[0046] Preferably, the conveyor 4, controlled by a control unit 47, causes a given module 1 being produced to pass through a drying device 48 provided with hot air jets, not shown in Figure 1, so as to ensure full drying of the primer 44 and heating of the material to the temperature suitable for the subsequent glueing step.

[0047] Once the drying step is terminated, the control unit 47 sends a control signal for the advancement of the movable unit 5 to the workstation 49. Once the movable unit 5 has reached the workstation 49, a device 50 for applying permanent securing means is energized in order to rigidly secure the net 45 to the bottom of the blocks 24.

[0048] Preferably, a dispenser 50 of an adhesive material is used which is equipped with a metering device (not shown) and is mounted on suitable mechanical arms 52 and 53 which can freely move, upon control, along two perpendicular directions X and Y.

[0049] In this manner, adhesive material, which can be for example of the hot-melt type including EVA (Ethyl Vinyl Acetate) and synthetic resins or synthetic adhesives, is deposited at preset points upon control of the control unit 47 and are usually distributed so as to secure the net 45 at its nodes 54 to the bottom of the blocks 24.

[0050] Advantageously, a step is provided for drying the freshly deposited adhesive material; in this case, the module 1 being produced is forwarded to another drying device 56 e.g. provided with a series of hot air jets (not shown).

[0051] The production cycle at this points provides for the advancement of the movable unit 5 to the workstation 57, where an operator 58 has the task of checking

the quality of the finished product and, should the module 1 meet predefined characteristics, transferring it to a conveyor belt 59 which discharges into a store.

[0052] Transfer of the finished module 1 from the workstation 57 to the conveyor 59 can be performed manually by the operator 58, who can overturn it in order to prepare it for the subsequent step of packaging or storage.

[0053] As shown in Figure 7 and in Figures 9 to 23, a generic module 1 can be composed of blocks or tesserae 24 made of porphyry, granite or other stone-like or artificial materials.

[0054] In the specific case of module 22 in Figure 7, which illustrates the left module of a composition shaped like a contrasting arc 60 shown in Figure 6, it will be noted that the blocks 61 that are designed to occupy, in use, positions at the center of the composition 60 are larger than the lateral ones 62.

[0055] Moreover, module 22 of Figure 7 and modules shown in Figures 9 to 14 have a step-shaped side 63 which is designed to delimit, in use, one of the two lateral edges of the contrasting arc composition 60; two adjacent modules which belong to two nearby arcs 60 are thus coupled by arranging the corresponding lateral edges 63 side by side, thereby penetrating each other so as to ensure a self-locking effect in addition to uniformity of the finished work.

[0056] So far as the module 22 of Figure 7 and to those of Figures 9 to 13 are concerned, the lateral sawtooth edge 64 which is opposite to the step-shaped edge 63 is constituted by an alternation of recesses 65 and protrusions 67 which is studied so as to allow to combine them by interlocking in pairs, i.e., the left module 22 with the right one 68, the left initial module 69 with the right one 68, the right initial module 70 with the left one 22, the left final module 71 with the right one 68, and the right final module 72 with the left one 22. The lateral module 95 of Figure 14 instead has a straight lateral edge 96 which is opposite to the step-shaped one 63, since it acts as an element for defining the border of the surface to be covered.

[0057] If the composition is circular, like the composition 73 shown in Figure 15, the module 74 of Figure 16 is a single one and represents a quarter of a circle. The module 74 is constituted by a sequence of concentric circular arcs 75 formed by blocks 24 whose dimensions decrease towards the center of the circle. There is also an angular module 76 and two lateral modules, a left one 78 and a right one 79, as shown respectively in Figures 17, 18 and 19.

[0058] The composition shaped like a compound fan 80 of Figure 20 is composed of two lateral modules, a left one 81 as in Figure 21 and a right one 82 as in Figure 22, and a central module 83 of Figure 23.

[0059] The standard central module 83 shown in Figure 23 can in turn be constituted by two modules which represent, respectively, its left half 84, shown in Figure 24, and its right half 85, shown in Figure 25.

[0060] A second embodiment of the fan-shaped composition 80 is constituted only by two modules, a left one 86 and a right one 87, shown respectively in Figures 26 and 27, each of which already includes the left half 84 and the right half 85 of the central module 83, respectively.

[0061] The left and right final prefabricated modules 89 and 90 and the left and right lateral closure modules 91 and 92, shown respectively in Figures 28, 29, 30 and 31, are common to both of the embodiments of the fan-shaped composition 80.

[0062] The method and the apparatus for producing prefabricated modules for paving and/or panelling are susceptible of numerous modifications and variations within the scope of the protection defined by the content of the appended claims.

[0063] The disclosures in Italian Patent Application No. VR2000A000010 from which this application claims priority are incorporated herein by reference.

[0064] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A method of manufacturing modules for paving and/or panelling, comprising the following operating steps:
 - arranging a plurality of blocks or tesserae (24) in a suitable template (28), according to a pre-determined layout defined by a locating grid (20) delimiting a module (1);
 - cutting out a piece of a layer (45) of flexible material having through openings so as to match the configuration of said module (1) and being of larger dimensions than said module (1);
 - securing, by means of permanent securing means (12) said layer (45) of flexible material to each one of said blocks or tesserae (24) forming said module (1), so that they are held together by said piece (45) of flexible material with the possibility of changing their mutual inclination.
2. The method according to claim 1, characterized in that said blocks (24) are arranged on said template (18) with their bottom facing upwards.
3. The method according to claims 1 or 2, characterized in that said piece (45) of flexible material is placed on said blocks (24).

4. The method according to claim 3, characterized in that a locking cover (25) is superimposed on said template (18) and acts as a complementary template, so as to lock said blocks (24) on said template (18) and keep said piece (45) flat on said blocks 24. 5
5. The method according to claim 1, characterized in that said piece (45) of flexible material is provided with through openings and coupled to the bottom of each one of said blocks (24) by means of adhesive material. 10
6. The method according to claim 5, characterized in that it comprises, before securing said piece (45) of flexible material to said blocks (24), spraying and drying a primer on the bottom of said blocks (24) in order to promote adhesion of said adhesive material to the bottom of said blocks (24). 15
7. The method according to claim 6, characterized in that it comprises a drying step in order to accelerate setting of said adhesive material. 20
8. The method according to any one of claims 6 or 7, characterized in that it comprises an initial step of cleaning said blocks (24) in order to ensure better adhesion of said primer to the bottom of said blocks (24). 25
9. The method according to any one of the preceding claims, characterized in that it comprises, once said piece (45) has been secured to the bottom of said blocks (24), removal of said locking cover (25) from said template (18). 30
10. An apparatus for performing the method according to any one of the preceding claims, having a supporting frame (3), a plurality of sequentially arranged workstations (40,48,49,56,57) and a conveyor (4) which extends sequentially through said workstations (40,48,49,56,57), and characterized in that it comprises at least one movable unit (5) which can be arranged on said conveyor (4) in order to pass a module (1) through each one of said workstations (40,48,49,56,57), and in that one (49) of said workstations comprises a device for applying permanent coupling means in order to secure a piece (45) of flexible material to the bottom of said module (1). 35 40 45
11. The apparatus according to claim 10, characterized in that said movable unit (5) comprises a movable transfer tray (6) which is designed to be arranged on said conveyor (4); a template supporting tray (8) to be arranged on said movable transfer tray (6), at least one reference template (18) which can be fitted on said template supporting tray (6), and a locking cover (25) designed to fix the or each reference 50
- template (18) onto said template supporting tray (6).
12. The apparatus according to claim 11, characterized in that said reference template (18) comprises a grid (20) which is shaped according to the intended composition, thereby simplifying the operation of laying blocks or tesserae (24) on said reference template (18) in order to form said module (1).
13. The apparatus according to claim 11 or 12, characterized in that said cover (25) acts as complementary template for the or each reference template and can be superimposed thereon so as to lock said blocks (24) inside said grid (20) and keep said piece (45) of flexible material spread flat over said blocks (24).
14. The apparatus according to any one of claims 10 to 13, characterized in that said device for applying permanent securing means comprises a metering device for adhesive material.
15. The apparatus according to claim 14, characterized in that it comprises a relative movement between said metering device and said movable unit (5) to distribute said adhesive material on the bottom of each one of said blocks (24) forming said module (1).
16. The apparatus according to claim 14 or 15, characterized in that said dosage device for adhesive material is movable with respect to said movable unit (5) in two mutually perpendicular directions.
17. The apparatus according to any one of claims 14 to 16, characterized in that downstream of said dosage device there is provided a drying station (48), so as to accelerate drying of said adhesive material.
18. The apparatus according to any one of claims 14 to 17, characterized in that it comprises a device (43) for cleaning said blocks or tesserae (24).
19. The apparatus according to claim 18, characterized in that said cleaning device (43) comprises an apparatus for dispensing pressurized liquid.
20. The apparatus according to claim 19, characterized in that it comprises a drying system downstream of said pressurized liquid dispensing apparatus.
21. The apparatus according to claim 18, characterized in that said cleaning device comprises a series of brushes (43) which are suitable to eliminate during a dry process any impurities present on the bottom of said blocks (24). 55
22. The apparatus according to any one of claims 10 to

13, characterized in that said device for applying permanent locking means comprises at least one applicator of mechanical retention elements.

23. A module for street paving and/or cladding according to any one of the preceding claims, comprising at least one block or tessera (24), characterized in that it comprises a layer of flexible material (45) provided with through openings and means (12) for permanent coupling between the or each block or tessera (24) and said layer (45) of flexible material. 5
24. The module according to claim 23, characterized in that said layer (45) of flexible material is constituted by a net. 10
25. The module according to claim 23 or 24, characterized in that it comprises two or more units of said block or tessera (24) which are arranged according to a chosen composition and are held together by means of said net (45) with the possibility of changing their mutual inclination. 15
26. The module according to any one of claims 23 to 25, characterized in that said net (45) is cut so as to have the same shape as said module (1) and be larger than said module (1). 20
27. The module according to any one of claims 23 to 26, characterized in that said permanent coupling means comprise adhesive materials. 25
28. The module according to claim 27, characterized in that said adhesive materials comprise a hot-melt adhesive based on EVA (Ethyl Vinyl Acetate) and synthetic resins or synthetic adhesives. 30
29. The module according to any one of claims 23 to 26, characterized in that said coupling means comprise mechanical retention elements. 35
30. The module according to claim 29, characterized in that said mechanical retention elements comprise at least one staple. 40
31. The module according to claim 29, characterized in that said mechanical retention devices comprise at least one rivet. 45
32. The module according to claim 29, characterized in that said mechanical retention elements comprise at least one screw anchor. 50
33. The module according to any one of claims 23 to 32, characterized in that it comprises a plurality of configurations for said module (1) which are combined in order to form a pattern or composition which is repeated identically a number of times 55

which depends on the dimensions of the surface to be covered.

34. The module according to claim 33, characterized in that said pattern or composition is shaped like a contrasting arc.
35. The module according to claim 33, characterized in that said pattern or composition is shaped like a circle.
36. The prefabricated module according to claim 33, characterized in that said pattern or composition is shaped like a compound fan.

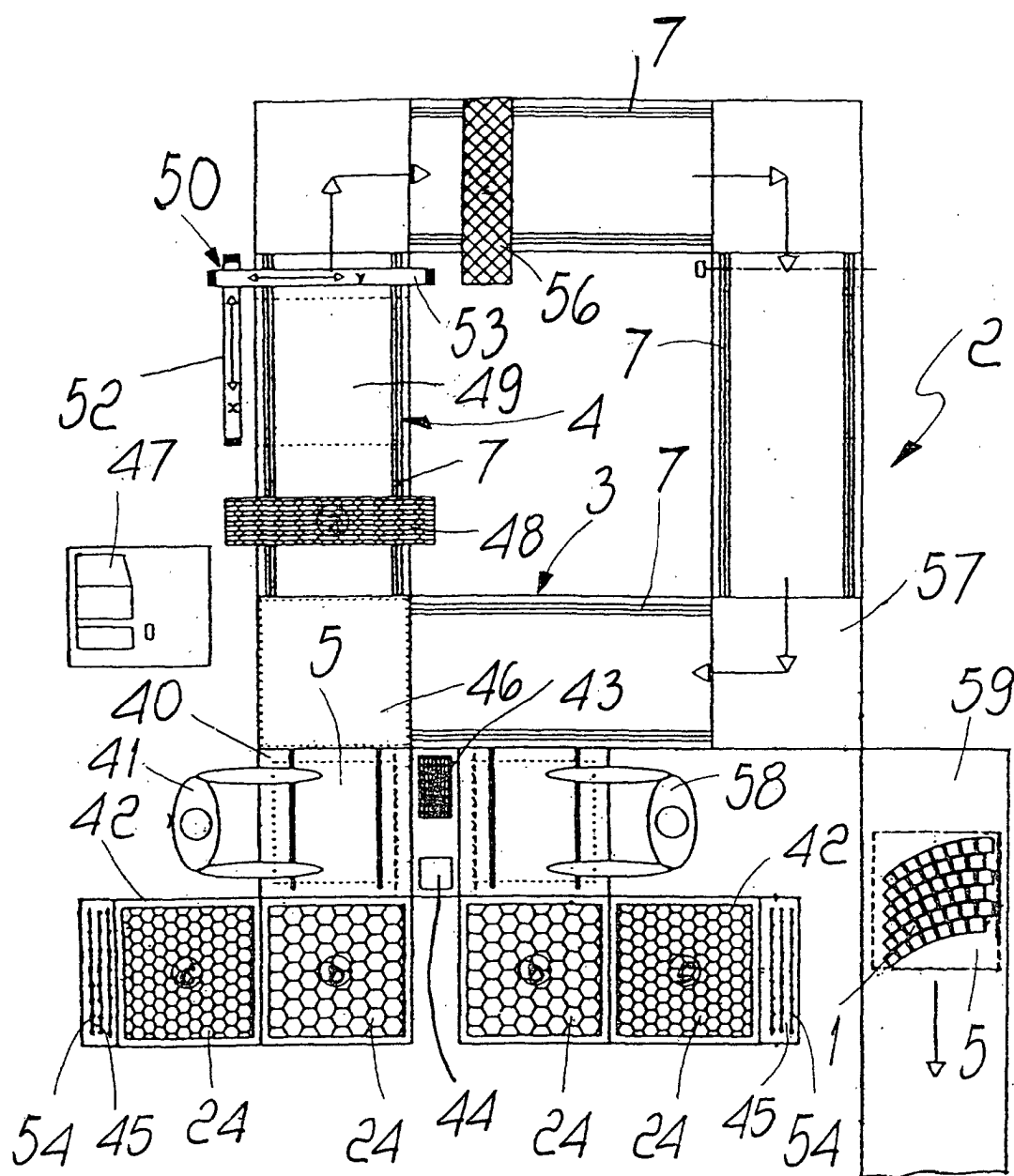
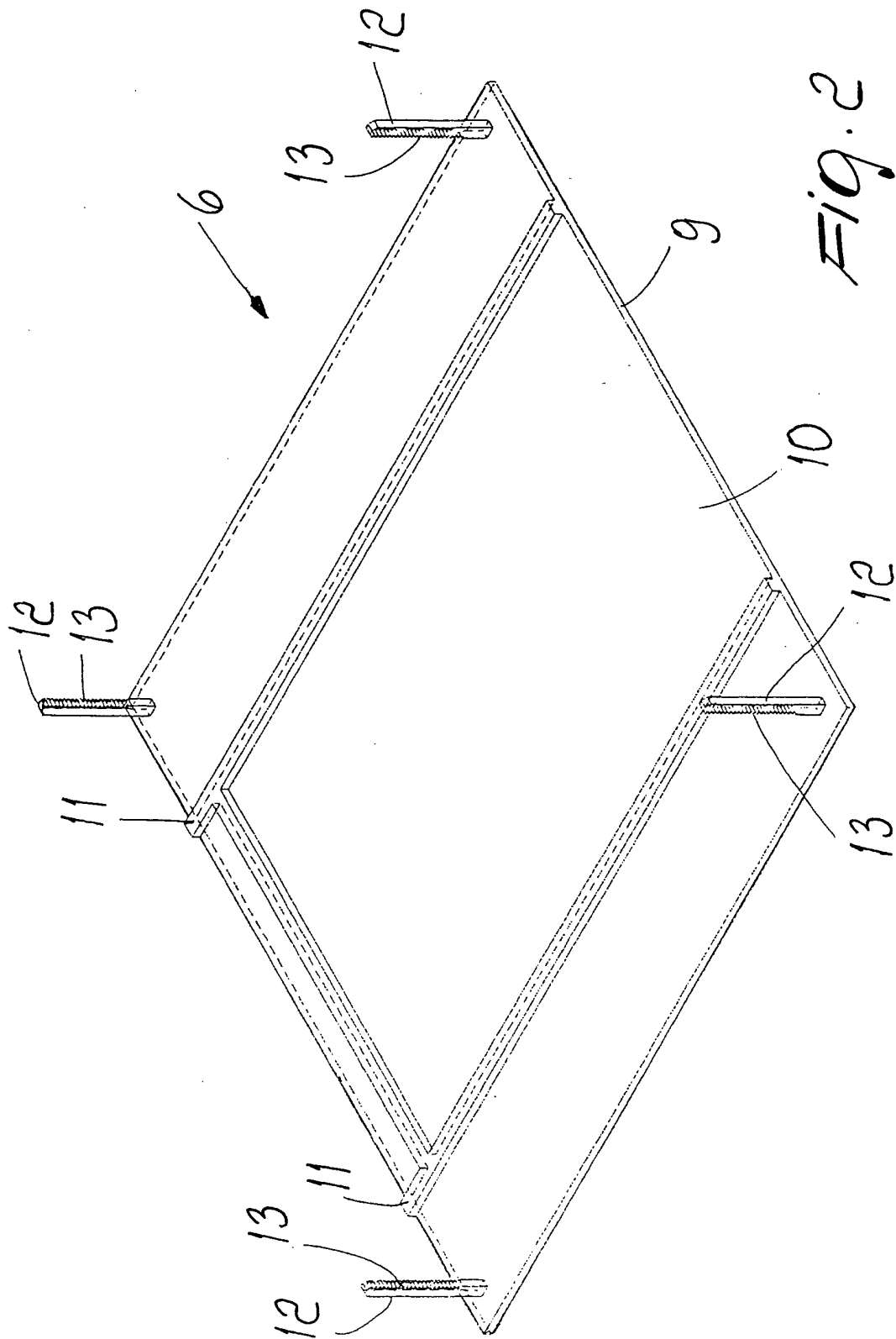
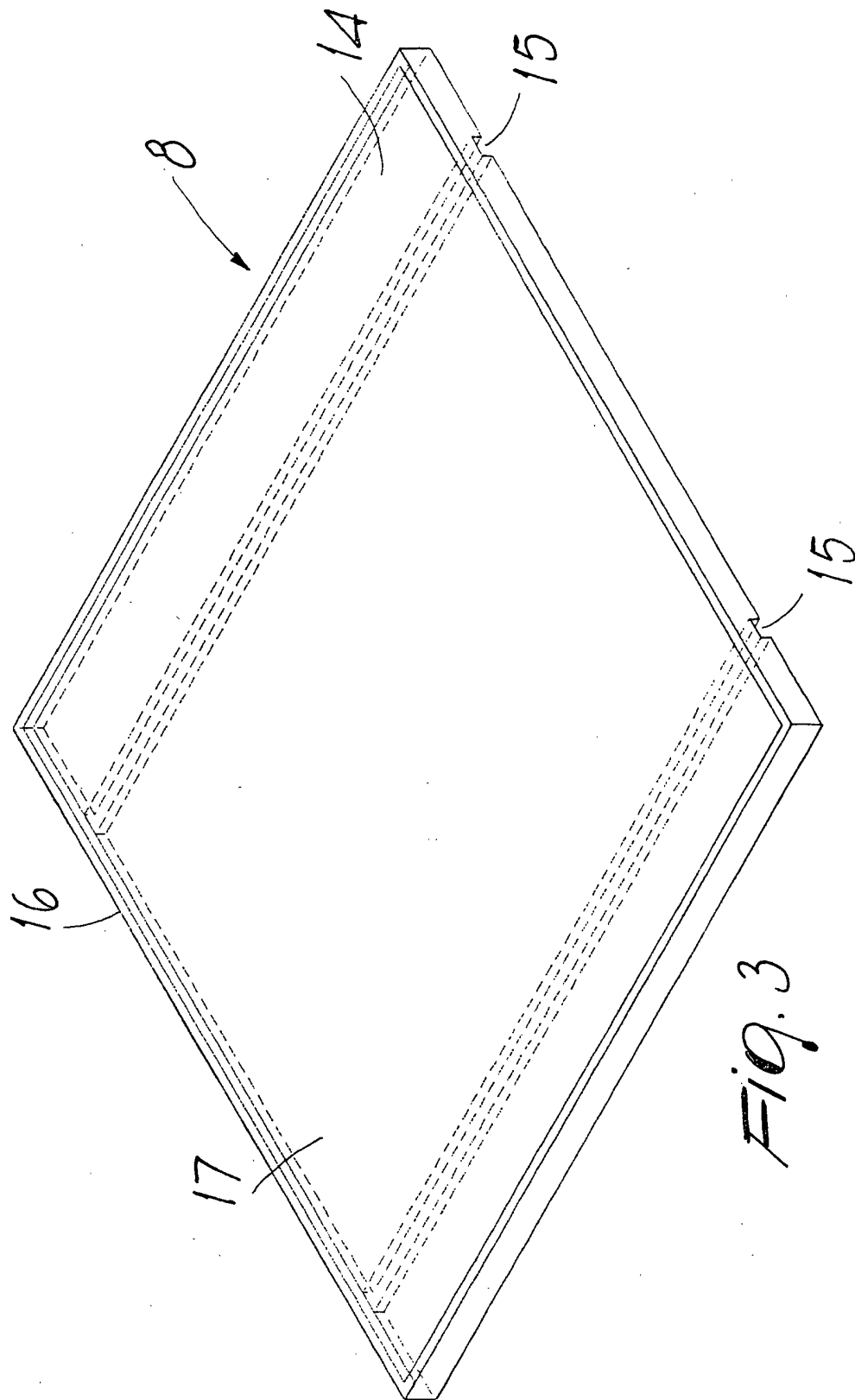
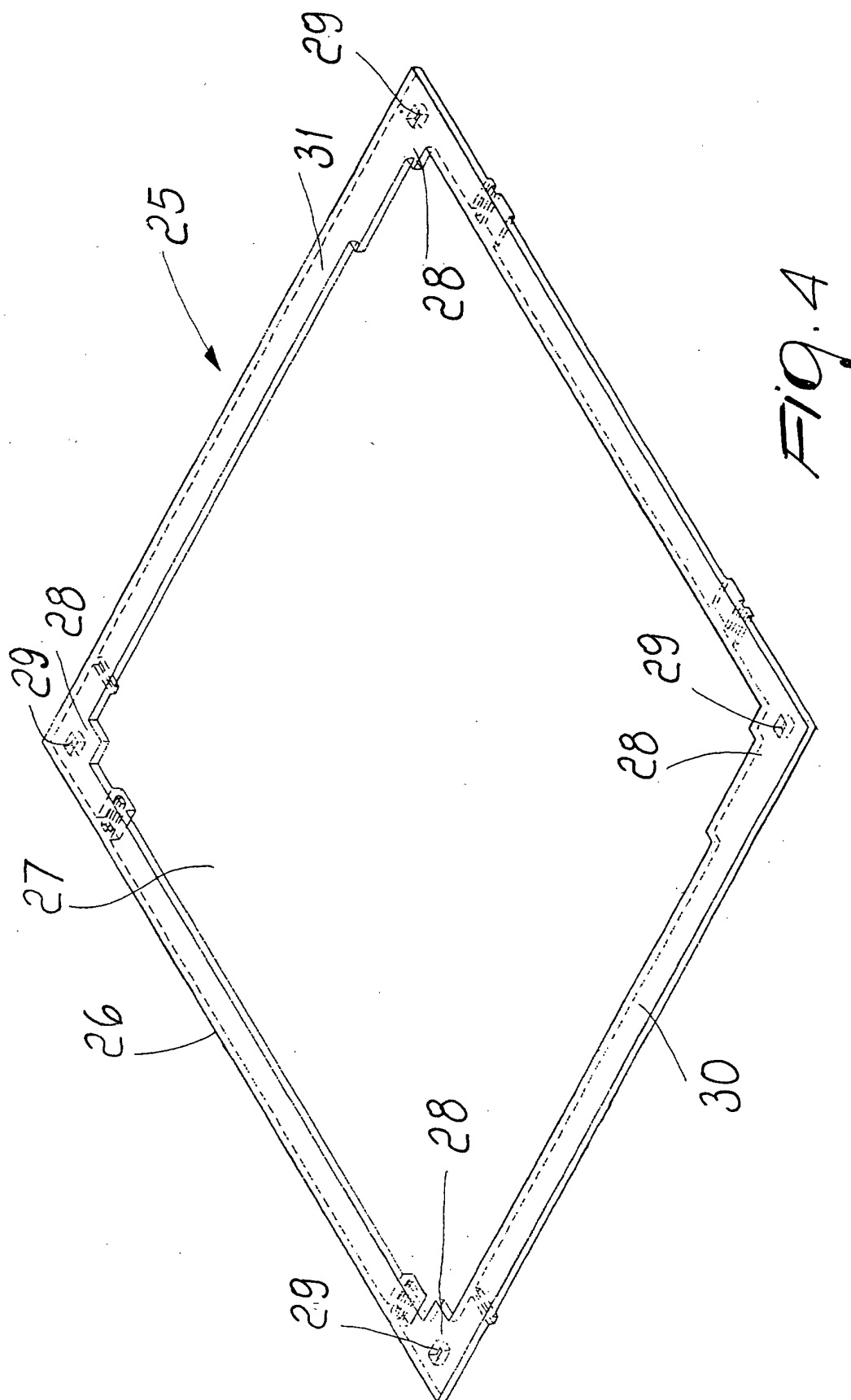
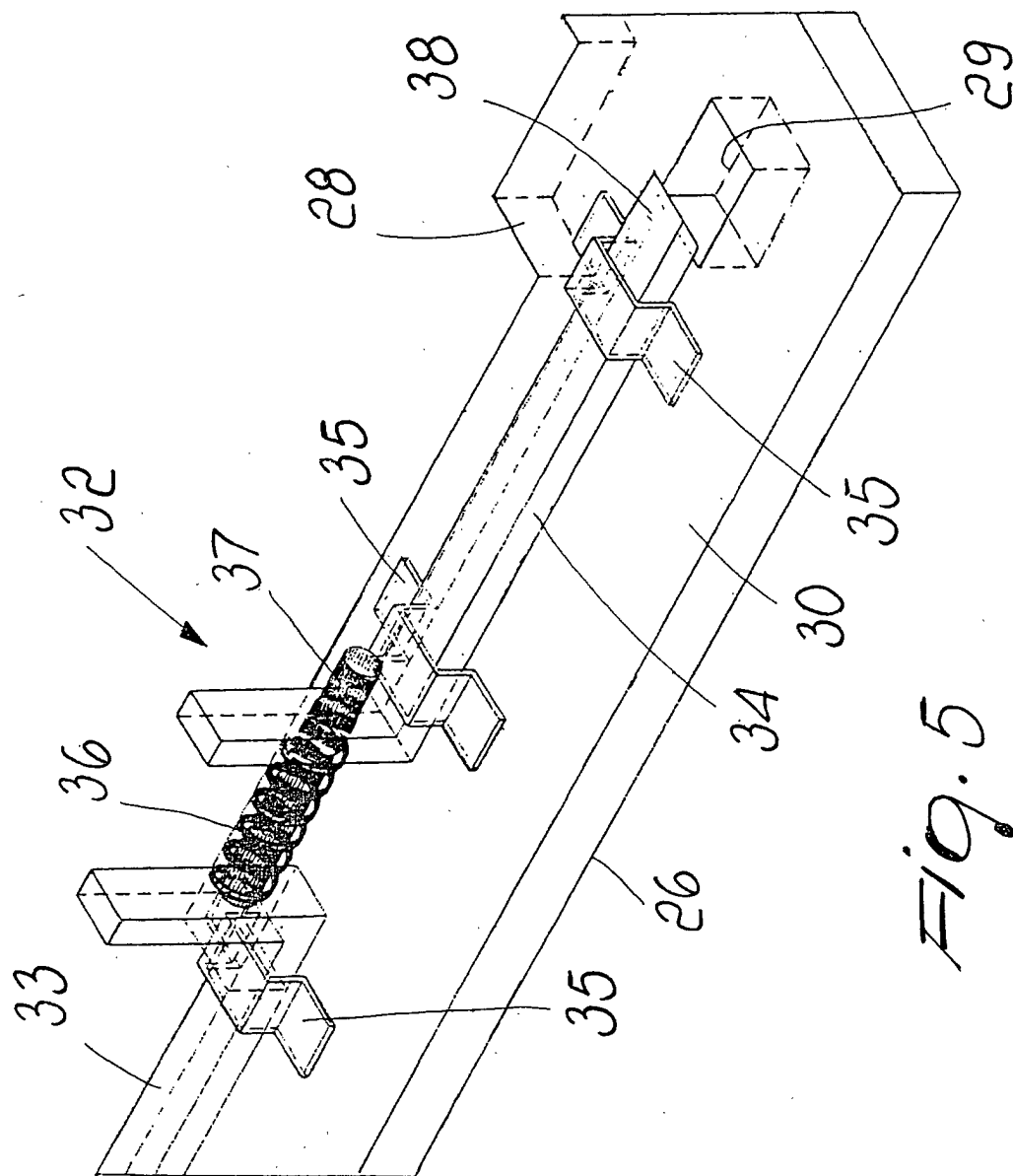


Fig. 1









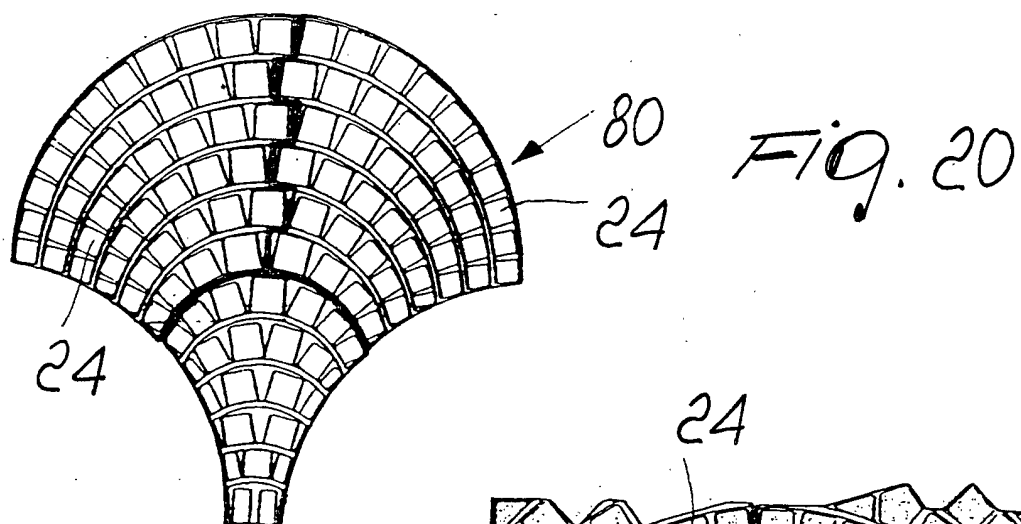
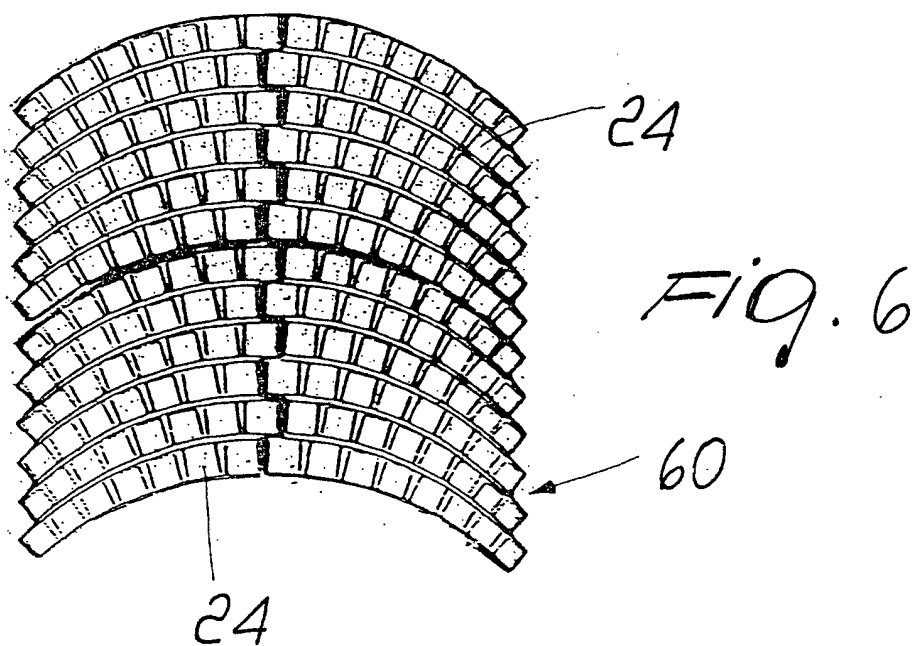
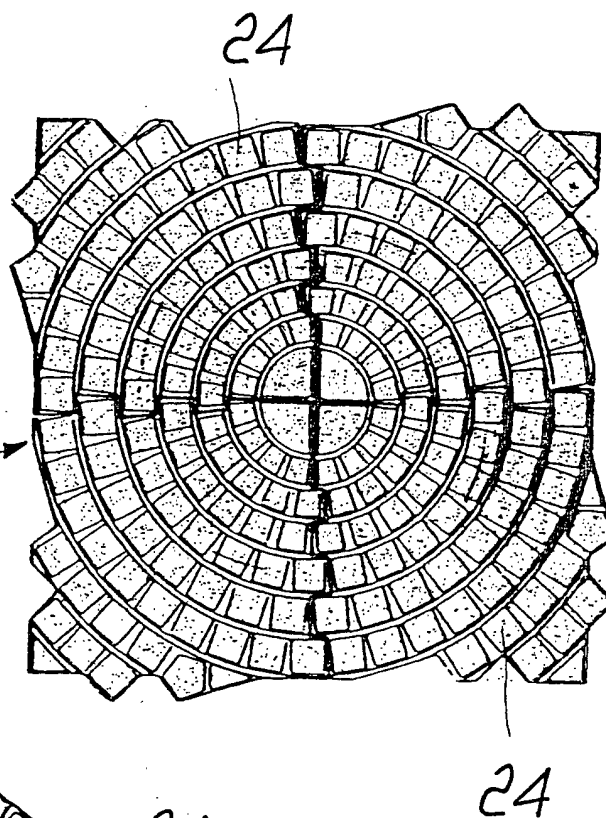
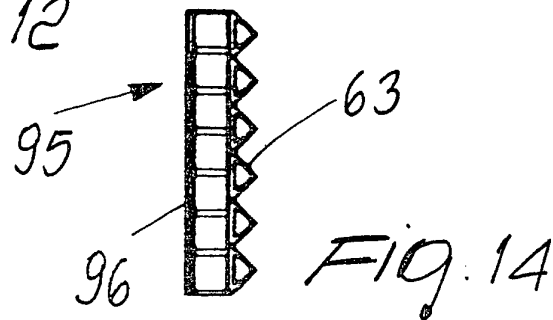
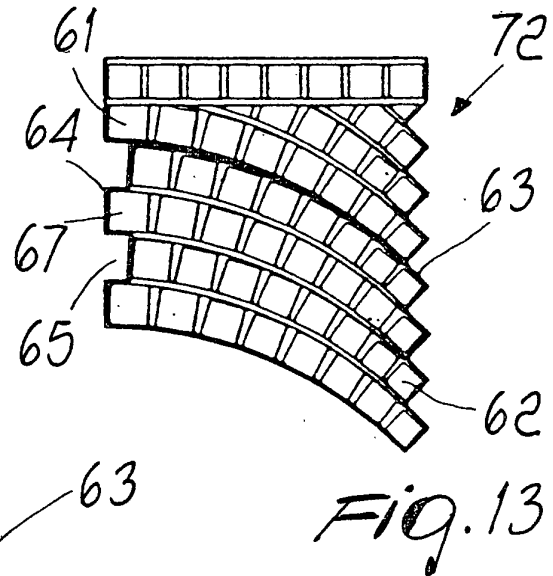
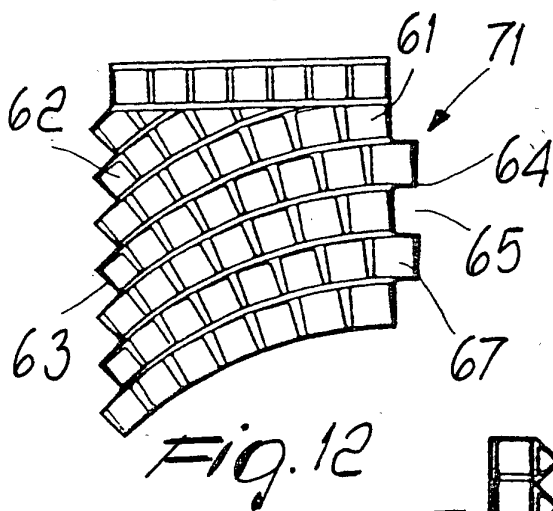
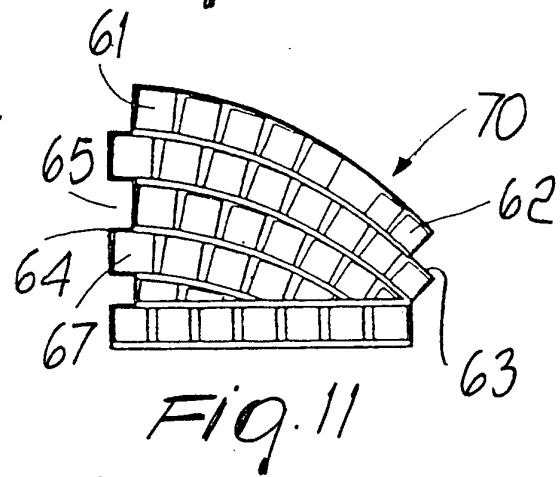
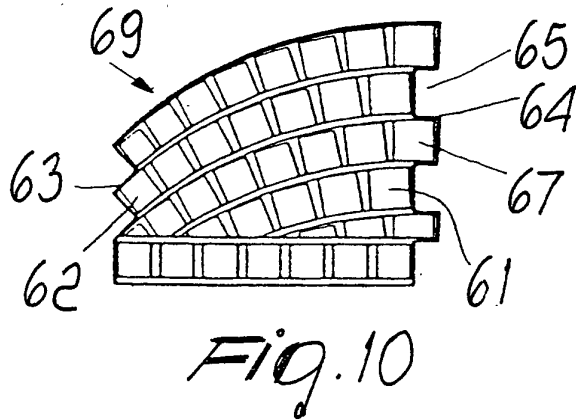
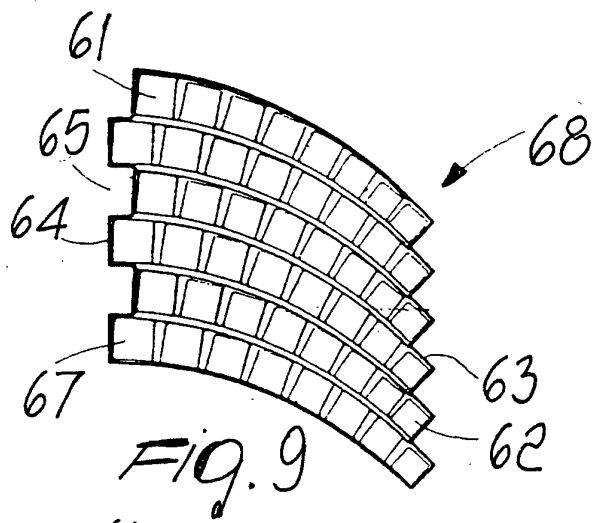
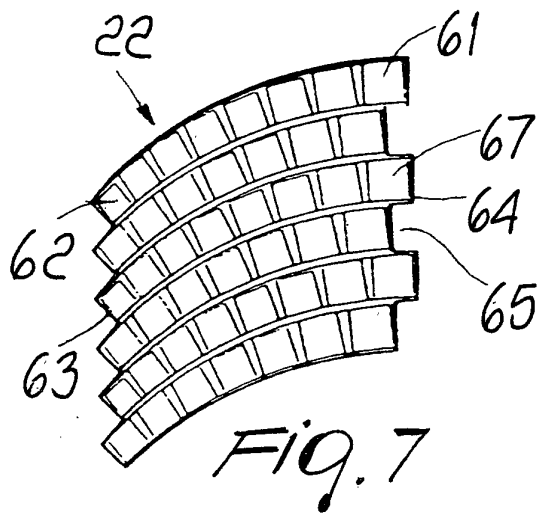


Fig. 15

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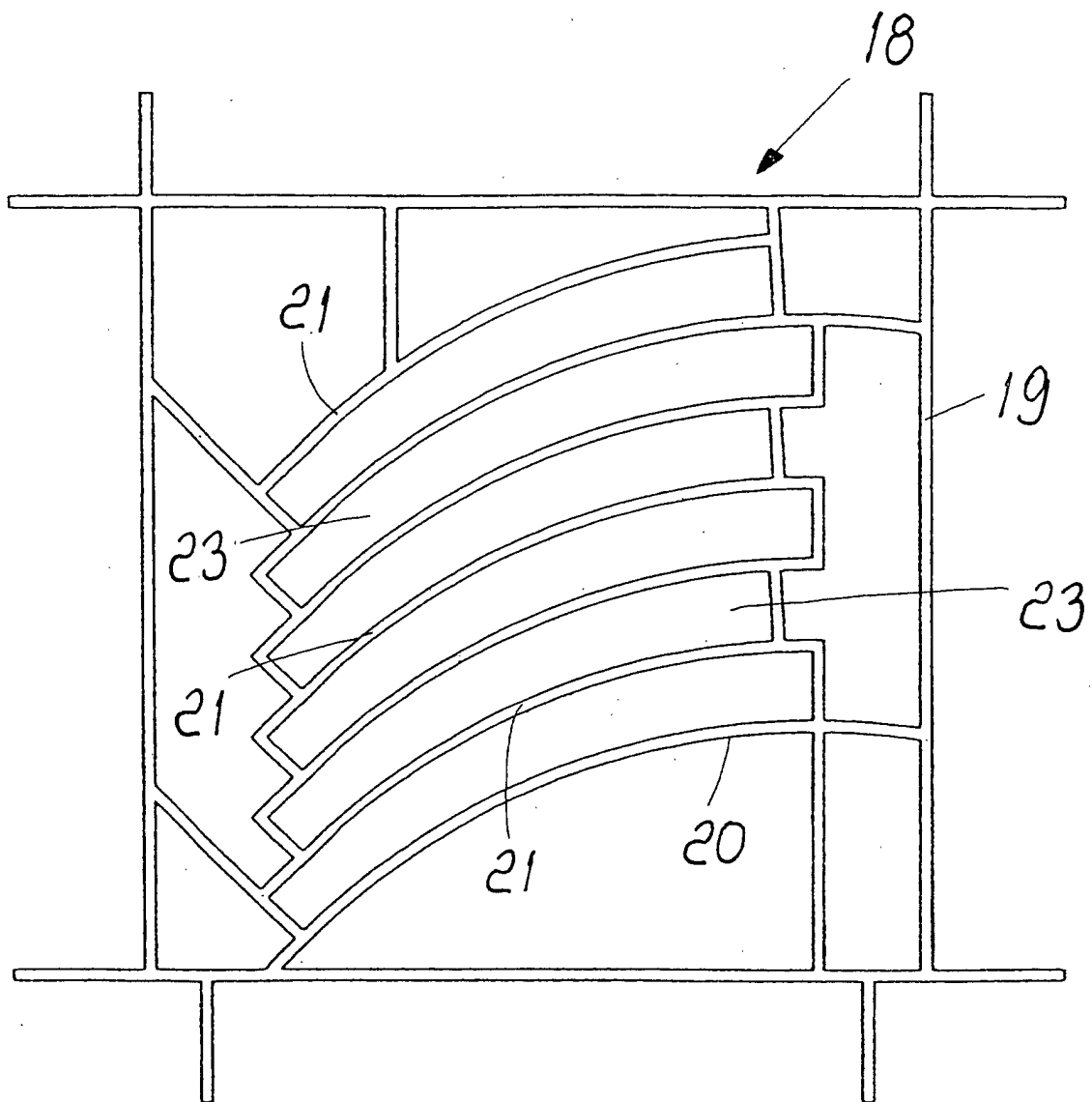


Fig. 8

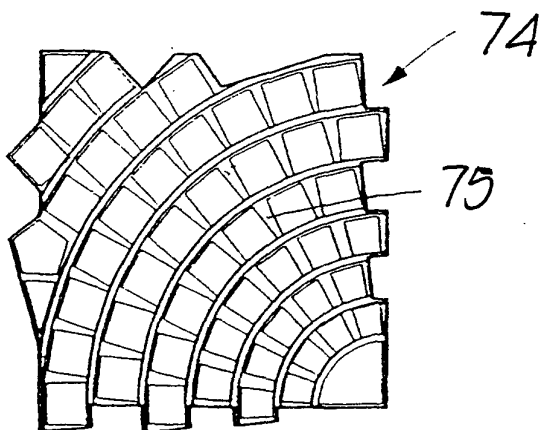


Fig. 16

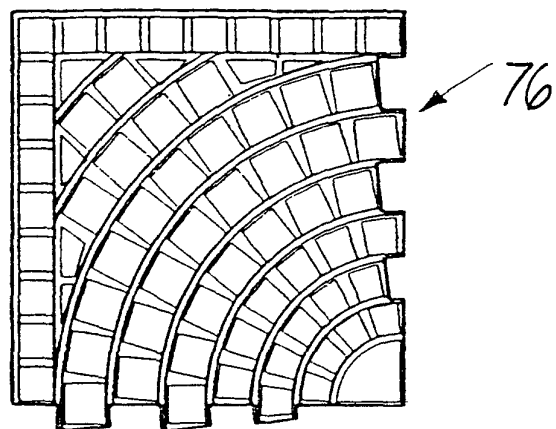


Fig. 17

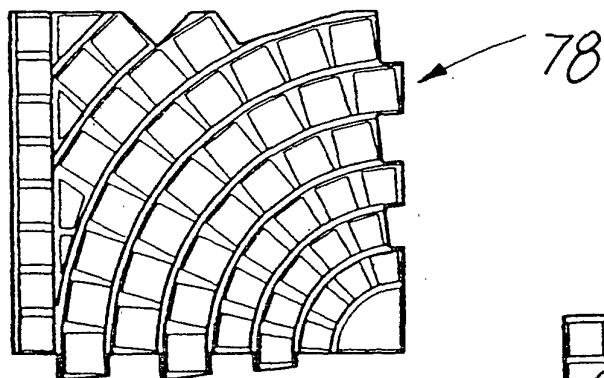


Fig. 18

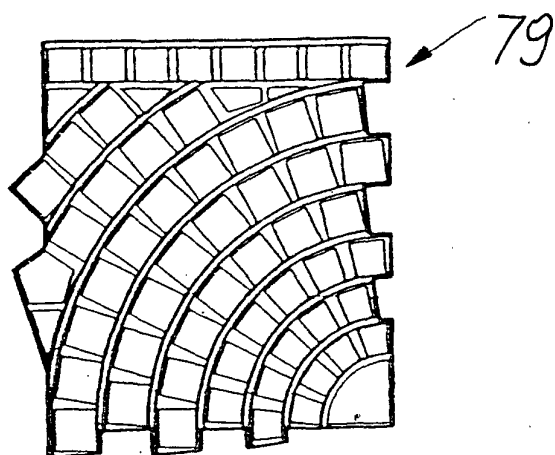
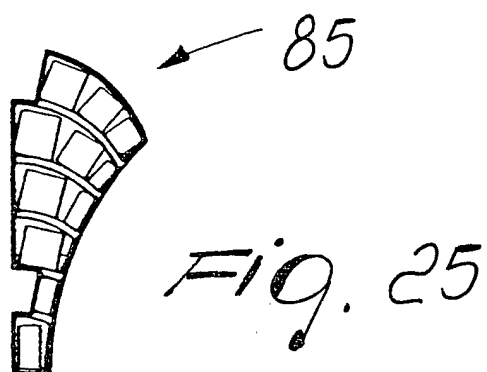
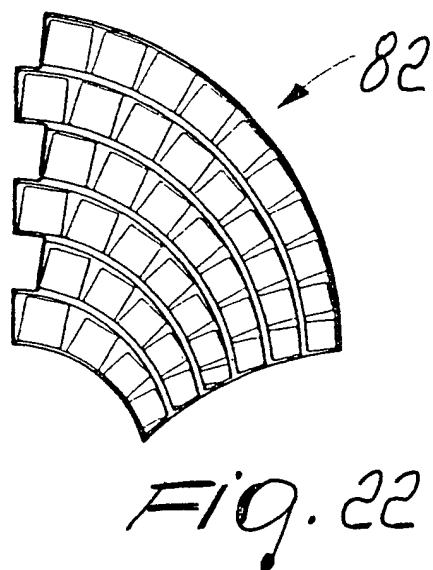
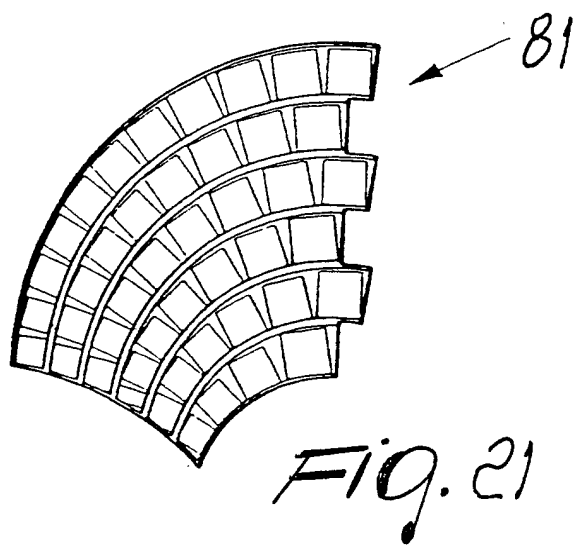
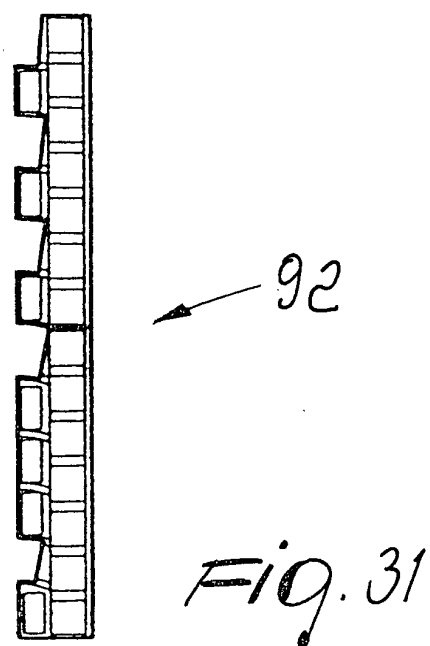
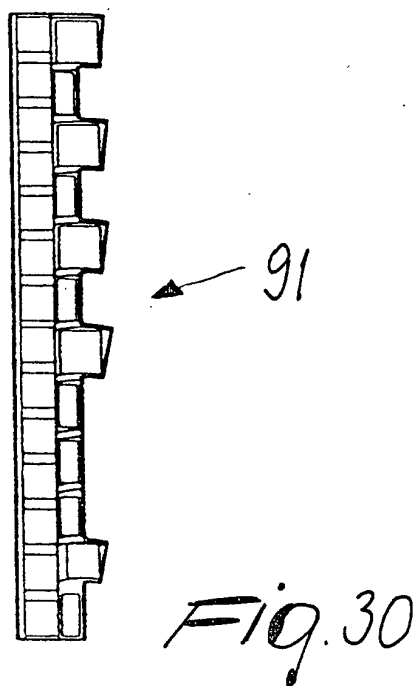
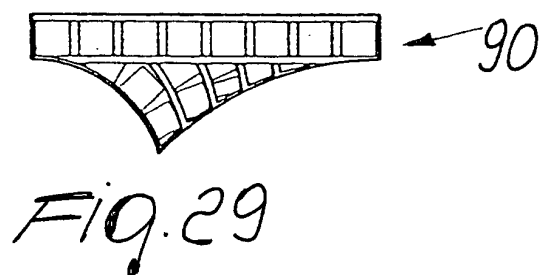
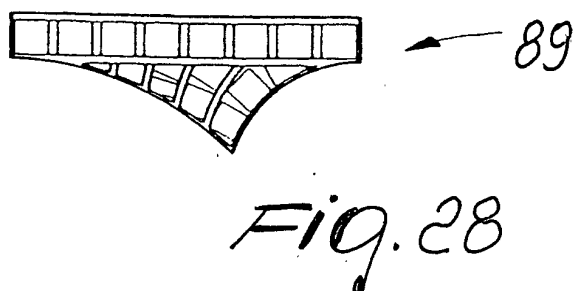
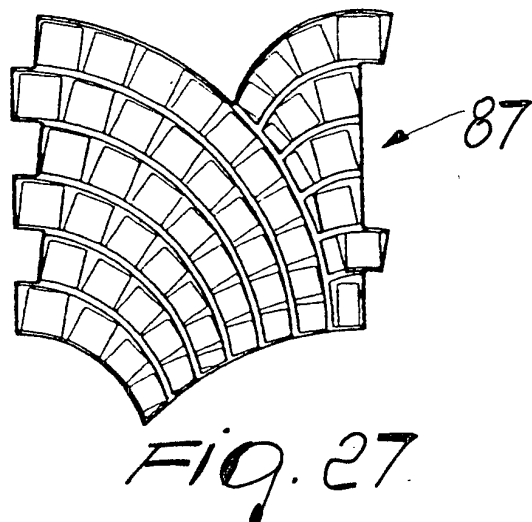
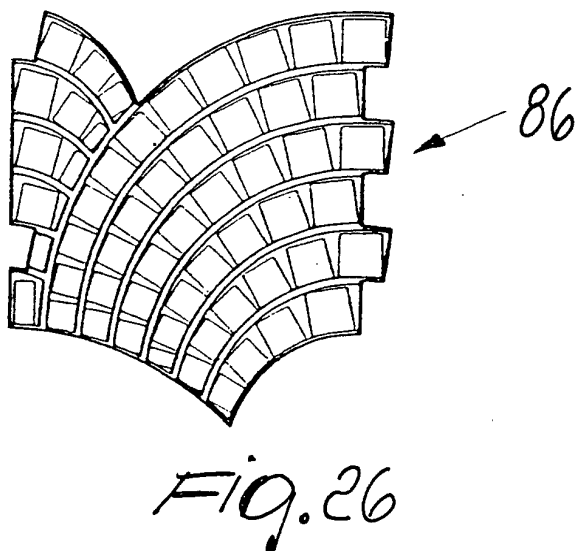


Fig. 19







European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 01 10 2153

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Place of search MUNICH		Date of completion of the search 31 May 2001	Examiner Westhues, T
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