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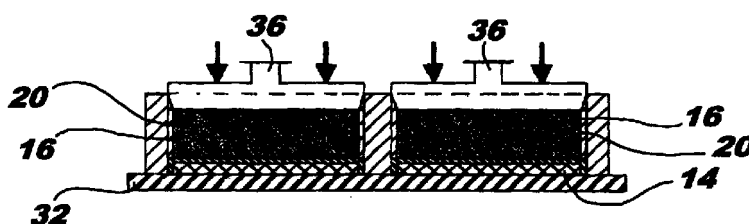
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(54) **A selflocking paving element and the manufacturing method thereof**

(57) A multi-layer paving element (12) has an upper wear layer constituted by a slab (14) and a lower support layer of cementitious material (16). The production method involves the steps of: arranging the slab (14), the plan dimensions of which are between 99.9% and 97% of the corresponding dimensions of the mould (20), in the bottom of a mould (20) which also has means for centering the slab (14); pouring fresh cementitious material (16) into the mould (20) and subjecting it to

vibro-compression so that it is evenly distributed within the mould (20); leaving the cementitious material (16) to dry out so that it hardens and adheres to the slab (14), thereby obtaining an intermediate multi-layer product (38); and removing material from the side walls of the intermediate product (38) in order to give the multi-layer element (12) the desired profile.

fig. 10



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Description

[0001] The present invention relates to the field of paving formed by multi-layer self locking elements to be laid dry on a levelled bed of sand.

[0002] Such paving is formed by laying a plurality of such elements closely spaced and filling the gaps left between them with sand. In order to ensure that the load bearing on each element is partially transmitted to the surrounding elements, thus distributing it more evenly and reducing the wear on the paving, it is essential that the distance between the various laid elements should not exceed a predetermined value of around 4 mm.

[0003] The object of the present invention is to provide a method for producing paving elements and the paving elements manufactured thereby which make it easier to comply with this spacing.

[0004] This object is achieved according to the invention by providing a method for producing selflocking elements, the elements produced thereby and a device for use with the method, having the characteristics specifically claimed in the following Claims.

[0005] Advantages and characteristics of the present invention will become apparent from the following detailed description, which refers to the drawings appended purely by way of non-limitative example, in which:

Figure 1 is a plan view of a form for carrying out the method of the invention,

Figure 2 is a perspective view of a paving element of the invention,

Figure 3 is a section taken on the line III-III of Figure 1,

Figure 4 illustrates on an enlarged scale a corner portion of a mould of the form of Figure 1, and

Figures 5 to 14 illustrate various steps in the method for producing a paving element of the invention.

[0006] In Figure 1, a form for the simultaneous formation of four multi-layer paving elements 12 (see Figures 2 and 3) is indicated 10. Each element 12 has a three dimensional body substantially in the shape of a rectangular parallelepiped shape and has an upper wear layer constituted by a slab 14 and a lower support layer of cementitious material 16, with a spacer shoulder 18 protruding from the base thereof.

[0007] The form 10 includes (see Figure 1) four moulds 20, each of which is in the shape of a rectangular frame. In the example illustrated, the moulds are made of steel and are rectangular. The shape and construction material can vary, however, in accordance with the specific requirements of their use.

[0008] A plurality of narrow ribs 22 are spaced around the inner walls (see Figure 4) of each mould 20, with their principal dimension extending heightwise of

the mould 20. In cross section, each rib 22 forms an isosceles trapezium with the shorter base 24 facing into the centre of the mould and extends into the centre of the mould 20 for a distance (corresponding in the case illustrated to the height 26 of the trapezium) of between 0.1% and 3% of the corresponding dimension 28 of the mould, and preferably of between 1% and 2% of this dimension. The ribs 22 also have (see figure 5) an entry portion 30 which tapers towards the top. The ribs 22 can be formed in one piece with the walls of the mould 20 or may be produced separately and then applied thereto.

[0009] In the method for manufacturing the layered element 12 shown in Figures 2 and 3, the form 10 is first arranged on a base 32 (see Figure 5) and a slab 14, of stony material for example, is then lowered into each mould 20 (see Figures 6 and 7). The use of other materials for the slab is not ruled out, such as plastics, composites and the like.

[0010] During the step of lowering the slab 14, the ribs 22 act as centering means and prevent it from being positioned asymmetrically bearing on one or two internal walls of the relative mould 20. Thanks to the presence of the ribs, in plan each dimension of the slab 14 is between 99.9% and 97%, and preferably between 99% and 98%, of the corresponding dimension of the mould 20.

[0011] A layer of adhesive 34 is then preferably applied (see Figure 8) to the upwardly facing surface of the slab 14 and fresh cementitious material 16 is poured into the mould 20 (see Figure 9) to cover the slab 14 and fill the gaps between this latter and the walls of the mould 20, caused by the presence of the ribs 22. The cementitious material can be constituted by mortar, concrete or the like.

[0012] The mould 20 is then subjected to vibro-compression with a tamper 36 (see Figure 10) using a conventional method, so that the cementitious material 16 is distributed uniformly within the mould 20 on top of the slab 14. Since the latter is in contact with the mould 20 only at the site of the narrow ribs 22, it is affected only by a reduced transmission of vibrations, which could otherwise fracture it and/or compromise the adhesion of the cementitious material 16.

[0013] The mould 20 and the tamper 36 are then lifted (see Figure 11) and the cementitious material 16 is left to dry so that it hardens and adheres to the slab 14.

[0014] At the end of the drying step, an intermediate multi-layer product 38 (see Figure 12) is obtained, the dimensions of which do not yet correspond to those of the finished element 12 illustrated in Figures 2 and 3. There is an excess of cementitious material on the side walls which corresponds to the volume of the gaps which had been formed between the side walls of the mould 20 and the edges of the slab 14.

[0015] This excess material is removed, by means of a grinding machine 39 for example (see Figure 13) in such a way that the portion of the cementitious layer 16

immediately adjacent the slab 14 is flush with it, with the spacer shoulder 18 left protruding from the base of the lower layer of cementitious material 16 (see Figures 2 and 3). The side walls of the intermediate product 38 are usually ground in two successive stages, first working on one pair of opposite walls and then on the remaining pair, by rotating the product 38 through 90°. The shoulder 18 extends continuously around the entire perimeter of the base of the element 12. In embodiments of the invention, not illustrated, it could have one or more interruptions.

[0016] It is also possible to shape the side walls of the body of the element 12 into any profile - flush with the slab 14 for their entire height, for example - as well as to remove material (see Figure 14) also from the base of the cementitious layer 16, should this have any irregularities. This operation should preferably be carried out before the side walls are ground, when the intermediate product 38 is still in its forming configuration, with the slab 14 facing downwards.

[0017] Thanks to these grinding operations, the two dimensions 40, 42 of the element 12 intended to lie parallel to the overall plane of the paving (see Figure 2), and possibly also the dimension 44 intended to be perpendicular thereto, can be obtained with a tolerance which does not exceed an absolute value of 0.5 mm.

[0018] Finally, the paving element 12 is subjected, in a manner known per se, to drying and sanding operations for surface finishing and for eliminating any traces of dirt, and is packed for forwarding to where it will be used.

[0019] When being laid, several elements 12 of the type described are placed on a bed of sand, with the respective shoulders 18 in contact. In this way, spaces of predetermined and substantially constant width - determined by the sum of the width of the shoulders 18 - are formed between adjacent elements 12, thanks to the low tolerance achieved for the dimensions 40, 42. In this way, once the gaps are filled with sand by a conventional method, the various elements 12 are effectively self locking and able to transmit to surrounding elements at least a portion of the load bearing on each thereby spreading it more evenly.

[0020] On the other hand, the fact that the transverse dimension 44 of the elements 12 is substantially constant ensures that the surface of the paving is regular, without bumps or differences of level, thereby providing clear advantages from the point of view both of aesthetics and of ease of use.

[0021] Naturally, the principle of the invention remaining unchanged, manufacturing details and embodiments may vary widely from those described purely by way of non-limitative example, without departing thereby from the scope of the invention.

Claims

1. A method for producing a multi-layer paving ele-

ment (12) with an upper wear layer constituted by a slab (14) and a lower support layer of cementitious material (16), the said method including the steps of:

- arranging the said slab (14) in the bottom of a mould (20), the dimensions in plan of which slab constitute between 99.9% and 97% of the corresponding dimensions of the mould (20), the said mould (20) also having means for centering the slab (14),
- pouring fresh cementitious material (16) into the mould (20),
- subjecting the said cementitious material (16) to vibro-compression whereby it becomes evenly distributed within the mould (20),
- leaving the cementitious material (16) to dry out so that it hardens and adheres to the slab (14), thereby producing an intermediate multi-layer product (38), and
- removing material from the side walls of the intermediate multi-layer product (38) so as to achieve the desired profile of the multi-layer element (12).

2. A method according to Claim 1, characterised in that the plan dimensions of the said slab (14) are between 99% and 98% of the corresponding dimensions of the mould (20).

3. A method according to either of the preceding Claims, characterised in that the said centring means are formed by ribs (22) protruding from the side walls of the mould (20).

4. A method according to any one of the preceding Claims, in which material is to be removed from the side walls of the cementitious layer (16) of the intermediate multi-layer product (38) by grinding.

5. A method according to any preceding Claim, in which material is also to be removed from the base surface of the cementitious layer (16) of the intermediate multi-layer product (38).

6. A method according to any preceding Claim, which also involves depositing a layer of adhesive (34) on the upward facing surface of the slab (14) arranged in the mould (20), before pouring in the cementitious material (16).

7. A multi-layer paving element (12) obtainable by a method according to any preceding Claim and having a three-dimensional body, of which at least the two dimensions (40, 42) intended to lie parallel to the overall plane of the paving are produced with a tolerance not exceeding an absolute value of 0.5 mm.

8. An element (12) according to Claim 7, having a spacer shoulder (18) along the base of the layer of cementitious material (16).
9. A paving element (12) according to Claim 7 or Claim 8, in which the dimension (44) intended to be perpendicular to the overall plane of the paving is also produced with a tolerance not exceeding an absolute value of 0.5 mm.
10. A paving element (12) according to any one of Claims 7 to 9, in which the said shoulder (18) extends continuously around the entire perimeter of the base of the layer of cementitious material (16).
11. A paving element (12) according to any one of Claims 7 to 9, in which the shoulder (18) has at least one interruption long the base perimeter of the layer of cementitious material (16).
12. A mould (20) for producing a multi-layer paving element (12) having an upper wear layer constituted by a slab (14) and a lower support layer of cementitious material (16), the said mould (20) including at least one rectangular frame with a plurality of spaced narrow ribs (22) protruding from its inner walls with their principal dimension extending heightwise of the mould (20).
13. A mould according to Claim 12, in which each rib (22) extends towards the centre of the mould (20) for a length of between 0.1% and 3%, and preferably of between 1% and 2% of the corresponding dimension (28) of the mould (20).
14. A mould according to any one of the preceding Claims 12 or 13, in which the cross section of at least one rib (22) forms an isosceles trapezium with the shorter base (24) facing inwardly of the mould (20).
15. A mould according to any one of Claims 12 to 14, in which at least one rib (22) has at least one portion (30) tapering towards the top.

fig. 1

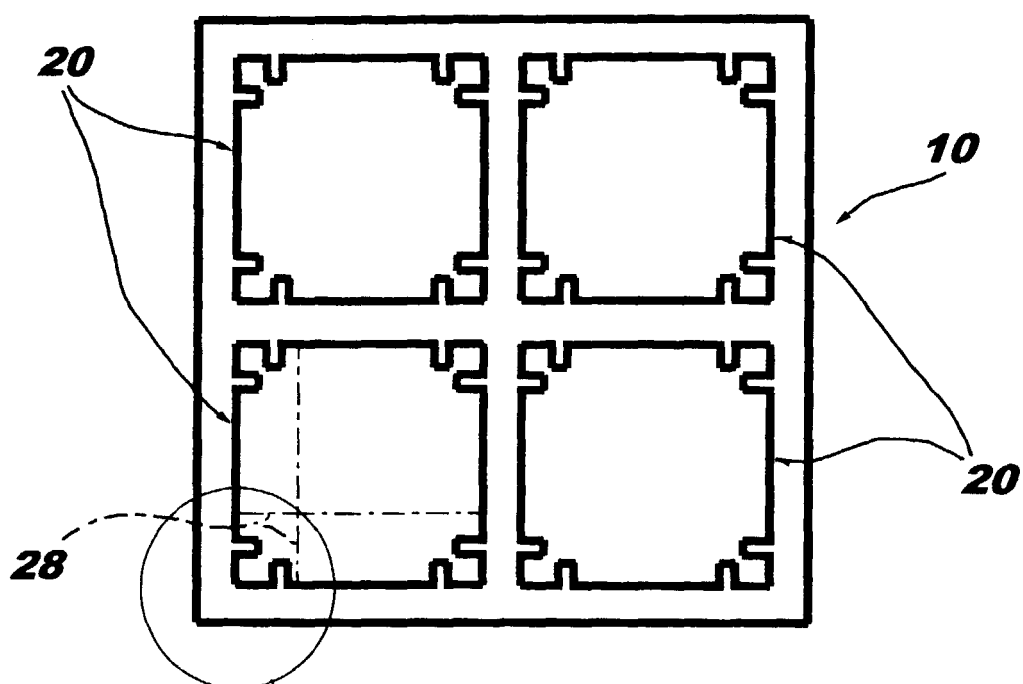
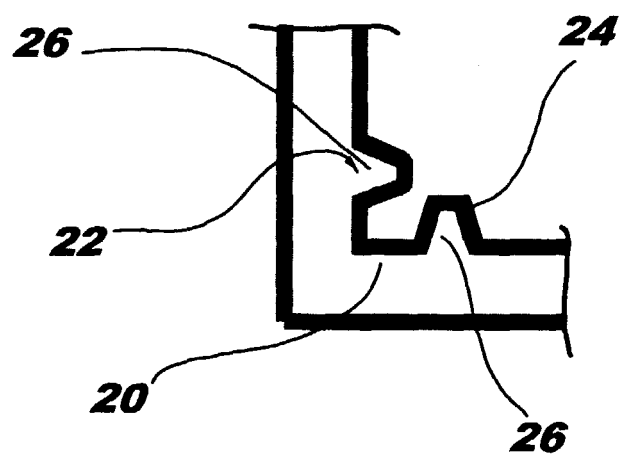


fig. 4



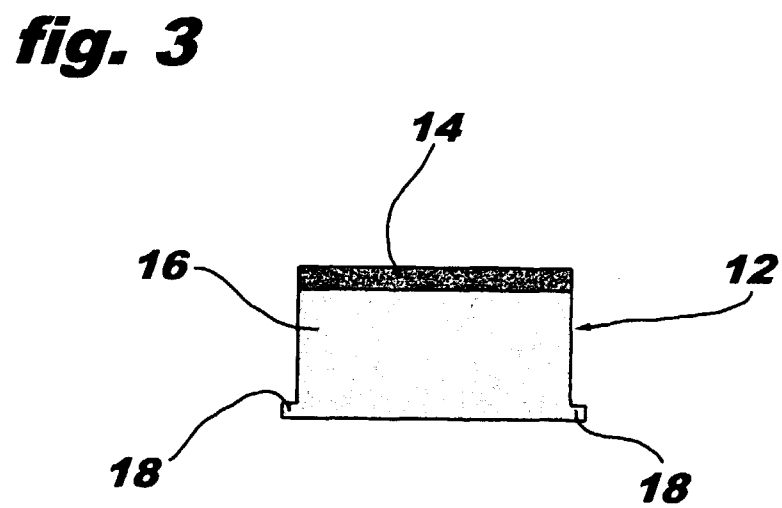
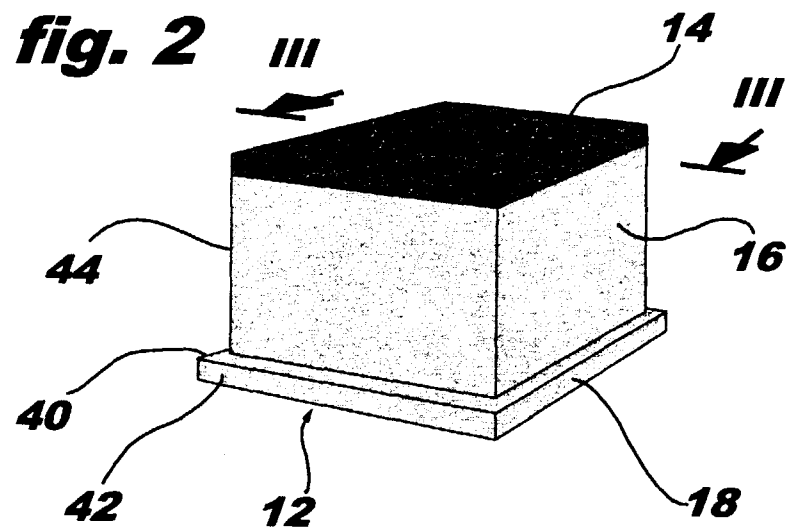


fig. 5

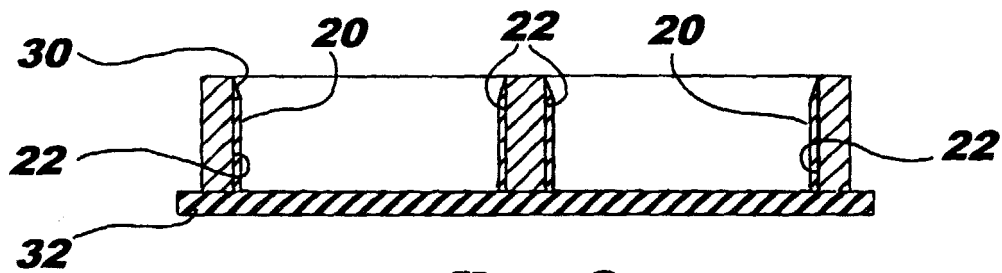


fig. 6

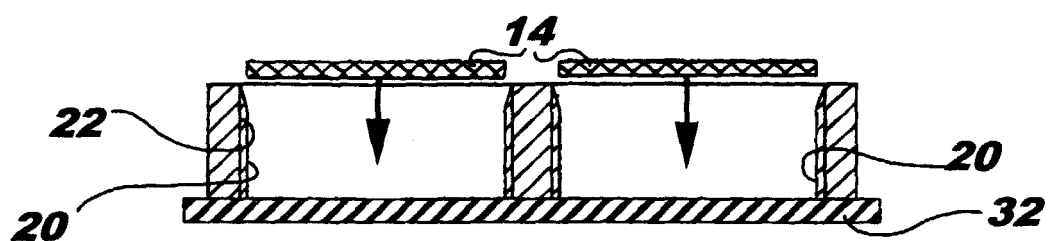


fig. 7

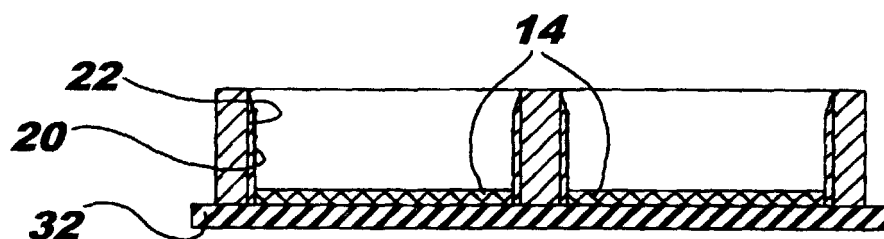


fig. 8

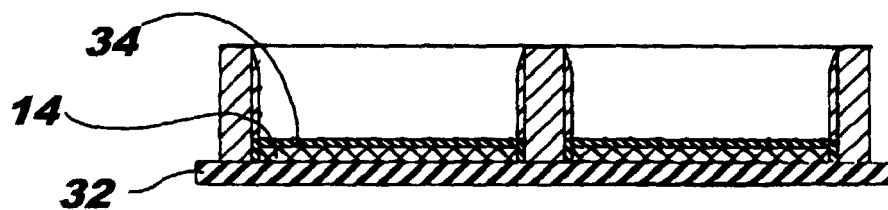


fig. 9

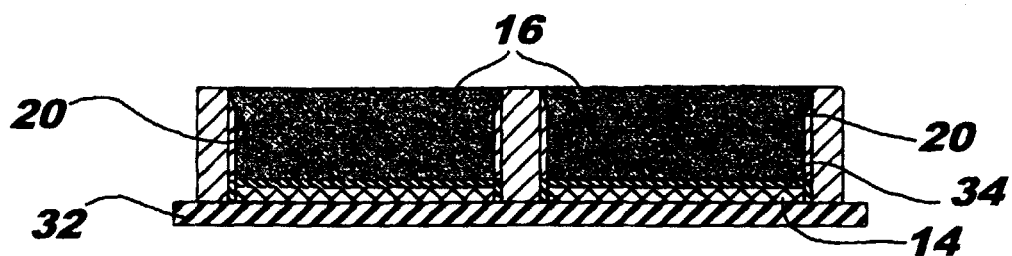


fig. 10

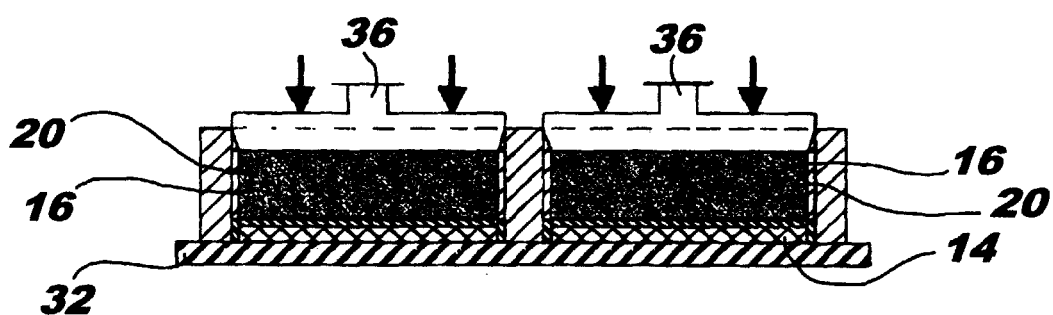


fig. 11

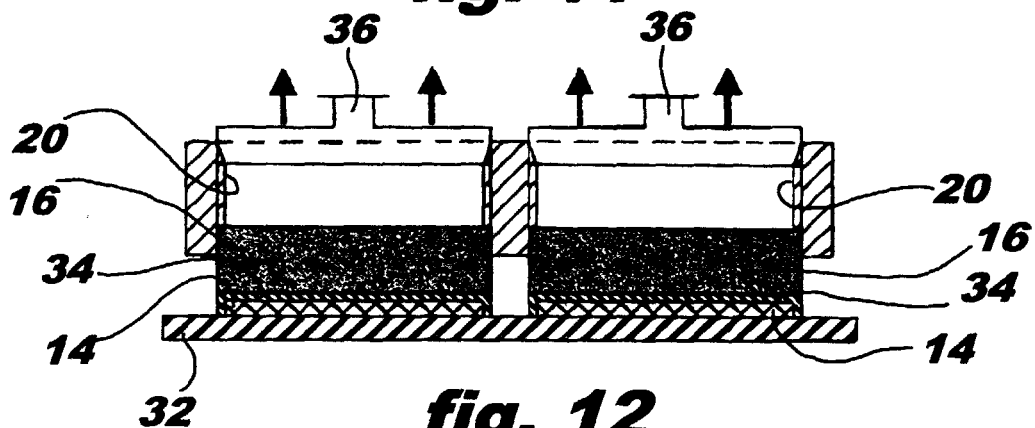


fig. 12

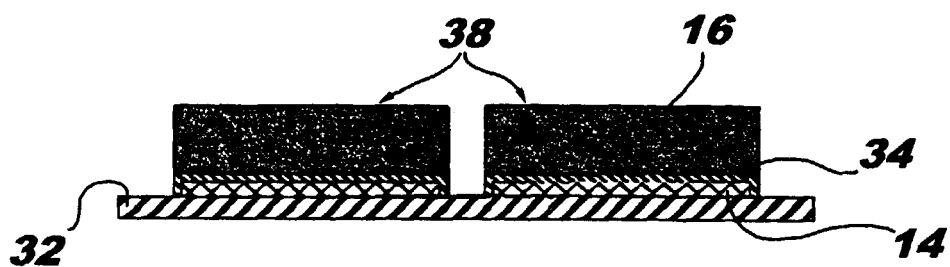


fig. 13

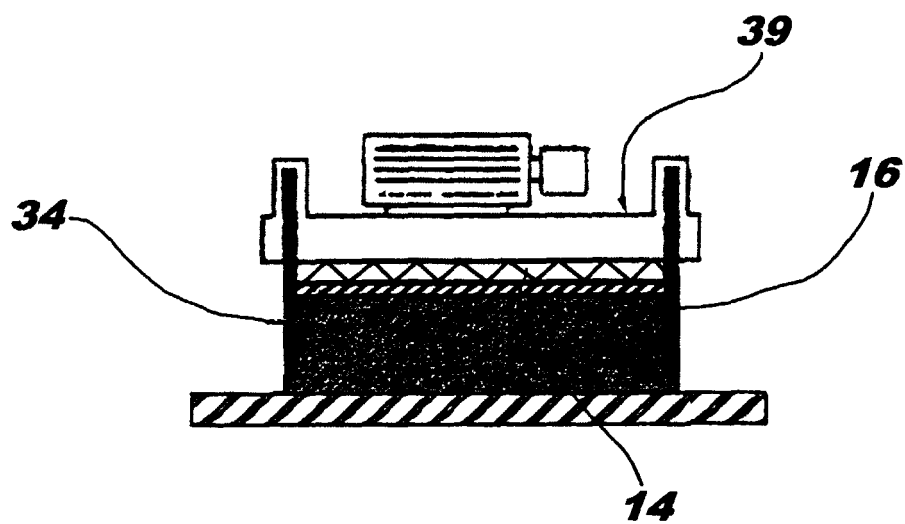


fig. 14

