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(71) Applicant: **SACMI COOPERATIVA MECCANICI IMOLA SOCIETA' COOPERATIVA**
40026 Imola (Bologna) (IT)

(72) Inventors:
- **Cocquio, Alessandro**
  40026 Imola (Bologna) (IT)
- **Valli, Silvano**
  40026 Imola (Bologna) (IT)
- **Babini, Alan**
  40026 Imola (Bologna) (IT)

(74) Representative: **Corradini, Corrado et al**
Ing. C. Corradini & C. S.R.L.
Via Dante Alighieri 4
I-42100 Reggio Emilia (IT)

(54) Improved plant for forming ceramic tiles or slabs

(57) A plant for forming ceramic tiles or slabs comprising a conveyor belt (2) on which a continuous strip (100) of powdered ceramic material is created, compacting devices (4, 5) that allow said strip (100) of powders on the belt (2) to be subjected to continuous pressing to obtain a coherent article of compacted powders, and means that allow the lateral containment of the material on the belt, said means comprising at least one pair of parallel elastically deformable containment walls (8, 9), between which the powdered material is contained before, during and after pressing. Said containment walls (8, 9) have the interfacing sides (80, 90) inclined with respect to the plane of the conveyor belt (2), so that they do not interfere, after pressing, with the article of compacted powders, so as not to induce stresses in it that could cause it to be damaged.

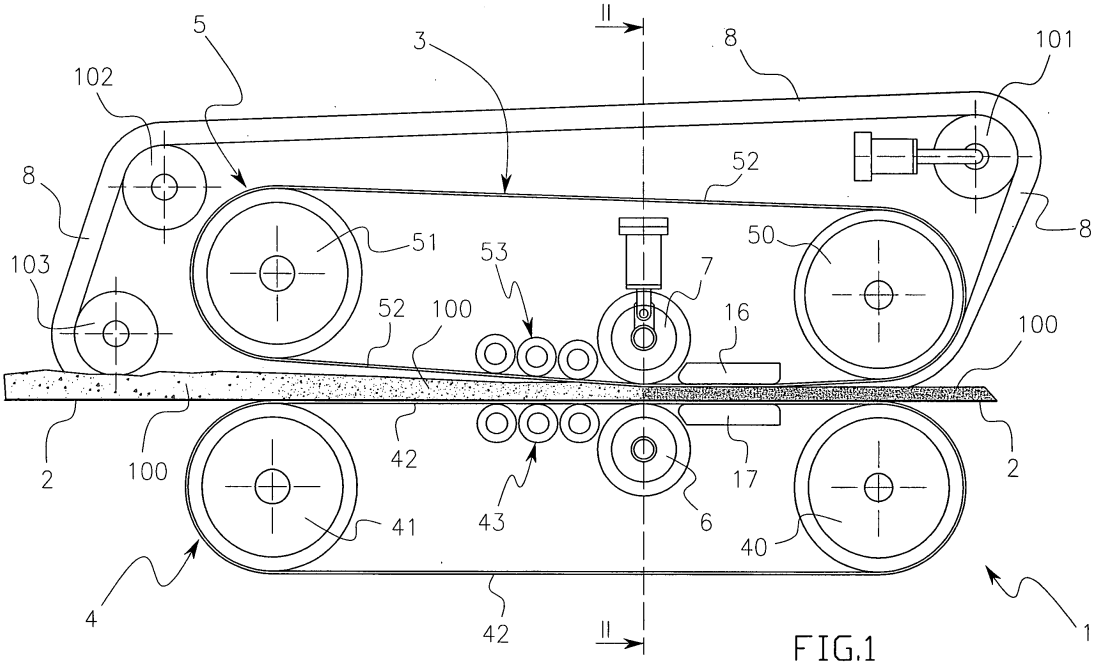

FIG.1

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Description

[0001] The present invention concerns, in general, a plant for manufacturing ceramic tiles or slabs, and in particular a plant for forming the aforementioned slabs.

[0002] Plants for forming ceramic slabs are known that comprise a conveyor belt suitable for making a continuous strip of powdered ceramic material advance through a pressing station, which is equipped with two motorised compacting devices one on top of the other that allow the powders to be continuously pressed on the belt that advances in the station, to obtain an article of coherent material.

[0003] Then, through a suitable cutting station, said article is trimmed at the edges and possibly divided into tesserae that, according to the degree of pressing to which the powders on the belt are subjected, can make the end tiles, or else a group of precompacted slabs that will have to be subjected to a second pressing.

[0004] Such a plant is described in detail in European patent application EP 1 356 909 to the same Applicant, to which we refer for a complete understanding thereof.

[0005] Generally the pressing stations of known plants also comprise means suitable for controlling the spontaneous expansion of the strip of compacted powders, downstream of the compacting devices, to avoid the occurrence of cracks and/or splits, and means suitable for laterally containing the powdered material on the conveyor belt.

[0006] In particular, said lateral containment means substantially consist of two longitudinal walls that, parallel to each other and arranged above the conveyor belt along the advancing direction, accompany the powders from their deposition on the belt, during the pressing step, in which they are also squashed by said compacting devices, until the end of the expansion step.

[0007] Said containment walls have the sides facing each other substantially flat and perpendicular to the advancing plane defined by the conveyor belt, are mobile at the same speed as it, and are elastically deformable so as not to significantly oppose the action of the compacting devices, ensuring that the pressure exerted by them at the edges of the strip of powdered ceramic material is the same as that exerted at its centre.

[0008] During the pressing step, however, the interfacing sides of the containment walls are also subjected to lateral thrusts caused by the ceramic material being compacted, which make said walls assume a substantially curved transversal profile with concavity facing towards the material itself.

[0009] In the subsequent expansion step, the longitudinal edges of the compacted article interfere with the containment walls that tend to reposition themselves in the non-deformed configuration, which consequently subject the article itself to compression stresses that generate cracks or splits in it.

[0010] Since, generally, said cracks are distributed at random in the compacted article, and occur mainly close to its longitudinal edges, this drawback has until now been dealt with by subsequently trimming said longitudinal edges by a sufficient amount to eliminate them.

[0011] However, such a solution creates large quantities of waste material, worsening the productivity of the plant and increasing the production costs, and is not always effective. Indeed, said cracks and/or splits can sometimes extend only inside the compacted article, and therefore be hidden at the surface: the article is not discarded, nor adequately trimmed, and the defect only appears during the subsequent firing step, with further dissipation of production resources.

[0012] The purpose of the present invention is that of preventing the occurrence of the aforementioned cracks and/or splits, so that the useful portion of compacted material is as big as possible, and so that the waste is kept to the minimum.

[0013] Such a purpose is accomplished through a plant for forming ceramic tiles or slabs comprising a conveyor belt on which a continuous strip of powdered ceramic material is created, compacting devices that allow said strip of powders on the belt to be subjected to continuous pressing to obtain a coherent article of compacted powders, and means that allow the lateral containment of the material on the belt, said means comprising at least one pair of elastically deformable parallel containment walls, mobile with the belt, between which the powdered material is contained before, during and after pressing.

[0014] In accordance with the finding, said containment walls have the interfacing sides inclined with respect to the plane of the conveyor belt, so that they do not interfere, after pressing, with the article of compacted powders, so as not to induce stresses in it that could cause it to be damaged.

[0015] More specifically, the finding foresees that, when not deformed, each of said sides of the containment walls are inclined with respect to the plane of the conveyor belt, so that the tangent to its profile, at any point of its profile, forms an acute angle with the plane of the conveyor belt facing towards the strip of powdered material.

[0016] Further characteristics and advantages of the invention shall become clear from reading the following description provided as an example and not for limiting purposes, with the help of the figures illustrated in the attached tables, in which:

- figure 1 shows a schematic side section view of the plant according to the finding;
- figure 2 is the cross section II-II indicated in figure 1;
- figures 3a, 3b and 3c show the detail of one of the containment walls during the transportation, pressing and expansion steps, respectively, of the strip of powdered material;
- figures 4, 5 and 6 are similar to figure 3a and each show a containment wall in accordance with a different embodiment of the finding.

[0017] From the mentioned figures (see especially fig. 1) the plant 1 can be seen, which comprises a motorised conveyor belt 2 on which, through normal devices, not illustrated since they are per se known, a continuous strip 100 of powders is deposited.

[0018] The belt 2 crosses a pressing station 3 that has the function of pressing the powders of the strip 100 to obtain an article, substantially parallelepiped in shape, of coherent material. Such an article can possibly then be decorated and then divided into tesserae of suitable size according to the size of end product that one wishes to obtain, which can be subjected to a second pressing step.

[0019] The pressing station 3 comprises two compacting devices 4 and 5, motorised and one on top of the other, the first of which is arranged below the belt 2, and the second above it at a height from the belt 2 that can be adjusted according to the thickness of the strip 100 of powders to be compacted, as well as the pressure value at which one wishes to carry out the pressing.

[0020] Each of the compactors 4 and 5 is provided with a motorised roller and an idle roller, respectively indicated with reference numerals 40, 41 and 50, 51, on which a respective belt 42, 52 is wound. Between each pair of rollers 40, 50, and 41, 51 a roller conveyor 43 and 53 is arranged, consisting of a plurality of idle rollers that have the function of keeping the belts 42 and 52 pressed to press the strip 100 of powdered material. In the illustrated embodiment, the roller conveyor 53 is inclined in the direction in which the belt 2 advances so as to make the compacting of the powders of the strip 100 gradual.

[0021] Downstream of the roller conveyors 43 and 53 there are two opposite rollers 6 and 7, of which the roller 6 is arranged below the belt 42, whereas the roller 7 is arranged above the belt 52, and presses the latter against the strip 100 of powders that advance on the belt 2.

[0022] The rollers 6 and 7 define the pressing area of the strip 100 of powders, downstream of which there is a decompression area in which the strip of powders expands, thanks to suitable means, in a controlled manner to avoid the occurrence of cracks or splits in the compacted article. In the illustrated example embodiment, said decompression area comprises two overlapping plates 16 and 17, the bottom one of which 17 is arranged below the belt 2 and the top one of which 16 is arranged above the belt 2, and in greater detail in contact with the belt 52.

[0023] The pressing station 3 also comprises lateral containment means of the strip 100 of powders, which, in the illustrated embodiment, are made through two belts 8 and 9 associated with the compacting device 5 (see also fig. 2).

[0024] Each of the two belts is indeed partially wound on the compacting devices 5 and on idler wheels 101, 102 and 103 (see fig. 1). It should be specified that said idler wheels are with adjustable gage, so as to be able to vary the size of the strip of compacted powders in the direction perpendicular to that in which the belt 2 advances according to the format that one wishes to obtain.

[0025] As can be seen in figure 2, said belts 8 and 9, in the portion in which they are in contact with the belt 2, make a pair of parallel containment walls that, arranged along the direction in which the belt 2 itself advances, are suitable for laterally containing the powders of the strip 100.

[0026] In greater detail, the belts 8 and 9 are able to slide at the same speed as the conveyor belt 2 and, as can be seen in figure 1, follow the powders before, during and after the pressing step, until the end of the subsequent expansion step. In particular, during the pressing step they are subjected, together with the strip 100 of powdered material, to the action of the roller conveyors 43 and 53, and of the rollers 6 and 7 (see also fig. 2).

[0027] In this step the belts 8 and 9 define a sufficiently strong lateral support to ensure a good compacting of the strip 100 of powders also at the longitudinal edges and, at the same time, elastically deform in the vertical direction without offering excessive resistance to the action of the compactors 4 and 5, ensuring the substantial uniformity of the pressure exerted by them on the entire mass of powders of the strip 100.

[0028] In order to be able to achieve said purposes, the two belts 8 and 9 are made from a material capable of squashing in the pressing area between the compactors 4 and 5, of expanding in the decompression area, and of going back into the non-deformed position in the other portions.

[0029] According to the finding, the cross section of the belts 8 and 9 is configured so that, after pressing, during the expansion step, the belts cannot interfere with the longitudinal edges of the compacted article and, instead help their linear expansion in width and height, i.e. in the two directions perpendicular to the direction in which the conveyor belt 2 advances.

[0030] In this way, said article is prevented from being subjected to compression stresses that would generate cracks and/or splits and, therefore, the wastage of material is minimal.

[0031] From figure 2, and in greater detail in figure 3a, it can indeed be seen that the interfacing sides 80 and 90, respectively of the belt 8 and 9, are inclined with respect to the plane of the conveyor belt 2. More specifically, said sides 80 and 90 are inclined so that the tangent to their transversal profile, at any point thereof, forms an acute angle α with the plane of the conveyor belt facing towards the strip 100 of powders. In this way, in particular, said sides converge upwards, i.e. in the direction in which the vertical expansion of the strip takes place, in a preferential way, after pressing.

[0032] Thanks to this (see fig. 3b), when the belts deform (squashed vertically between the compactors 4 and 5 and pushed laterally by the strip 100 of material being compacted) each of said interfacing sides 80 and 90 assumes a concave profile that gives the edge of the compacted strip a corresponding curved profile, which, as can be seen in figure 3c, does not interfere in any way

with the belt when, during the expansion step, it goes back into the non-deformed position.

[0033] In the particular embodiment shown in figure 3a, the profile of the side 80 of the belt 8 facing the belt 9 (and vice-versa) is a rectilinear segment inclined with respect to the plane of the conveyor belt 2 to form an acute angle facing towards the strip 100 of powders; however it should be specified that said profile can, in general, consist of rectilinear portions, curvilinear portion, or combinations thereof. Regarding this in figures 4, 5 and 6 further, although not exclusive, profiles are shown that can be given to the interfacing sides of the belts 8 and 9 without departing from the scope of the finding.

[0034] Finally, it should be highlighted that experimental tests conducted by the Applicant have shown excellent results when the aforementioned angle α, between the tangent to the transversal profile of each side 80 and 90 (whatever it is provided that it is in accordance with the finding) and the plane of the conveyor belt, is at any point of the profile itself between 40° and 89° (see figs. 3a and 5).

Claims

1. Plant for forming ceramic tiles or slabs comprising a conveyor belt (2) on which a continuous strip (100) of powdered ceramic material is created, compacting devices (4, 5) that allow said strip (100) of powders on the belt (2) to be subjected to continuous pressing to obtain a coherent article of compacted powders, and means that allow the lateral containment of the material on the belt, said means comprising at least one pair of parallel elastically deformable containment walls (8, 9), mobile with the belt, between which the powdered material is contained before, during and after pressing,
characterised in that said containment walls (8, 9) have the interfacing sides (80, 90) inclined with respect to the plane of the conveyor belt, so that they do not interfere, after pressing, with the article of compacted powders, so as not to induce stresses in it that could cause it to be damaged.

2. Plant according to claim 1, **characterised in that** each of said sides (80, 90) of the containment walls is inclined so that the tangent to its transversal profile, at any point thereof, forms an acute angle (α) with the plane of the conveyor belt facing towards the strip of powdered material.

3. Plant according to claim 2, **characterised in that** said angle α, is always between 40° and 89°.

4. Plant according to claim 2, **characterised in that** the transversal profile of the interfacing sides (80, 90) of the containment walls comprises at least one rectilinear portion.

5. Plant according to claim 2, **characterised in that** the transversal profile of the interfacing sides (80, 90) of the containment walls is curvilinear.

6. Plant according to claim 2, **characterised in that** the transversal profile of the interfacing sides (80, 90) of the containment walls is mixtilinear, comprising a combination of rectilinear and curvilinear portions.

7. Plant according to claim 1, **characterised in that** said containment walls are made through parallel sliding belts (8, 9).

8. Plant according to claim 7, **characterised in that** each compacting device (4, 5) comprises at least one motorised roller (40 and 50), and the belts (8, 9) are partially wound on at least one of said compacting devices (4, 5), running at the same speed as the conveyor belt (2).

9. Plant (1) according to claim 7, **characterised in that** said belts (8, 9) are made from an elastically deformable material.

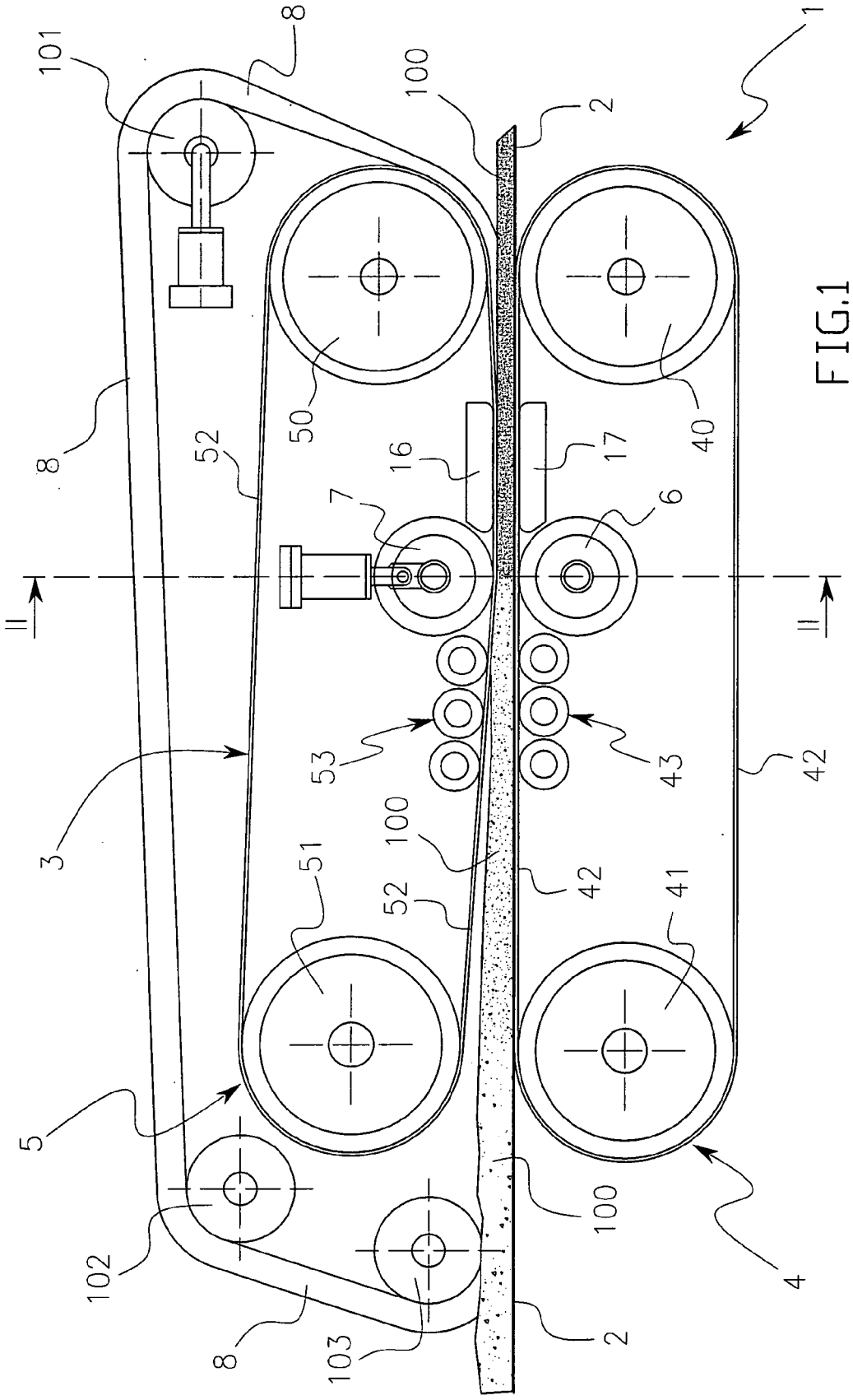

FIG.1

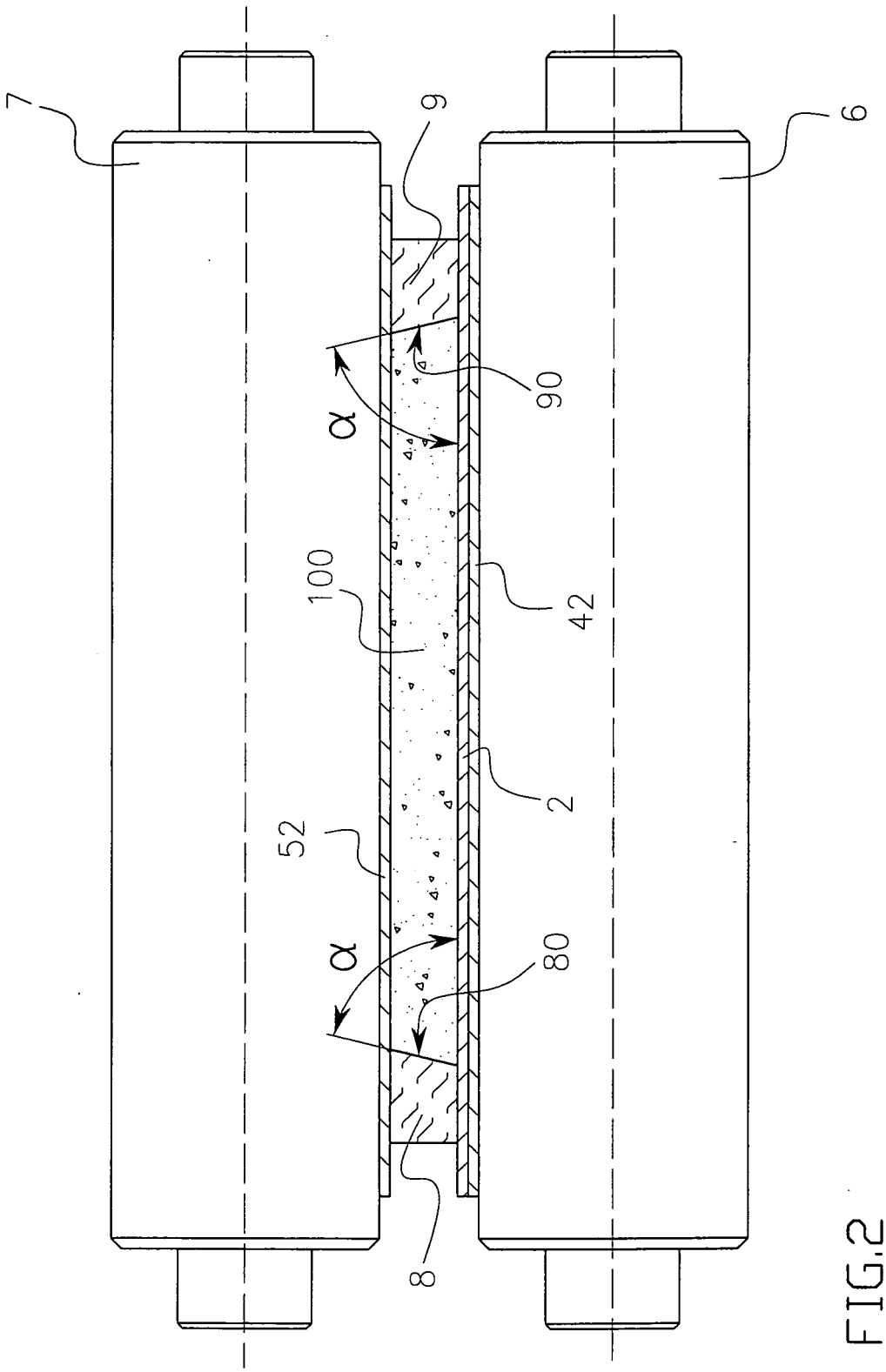

FIG.2

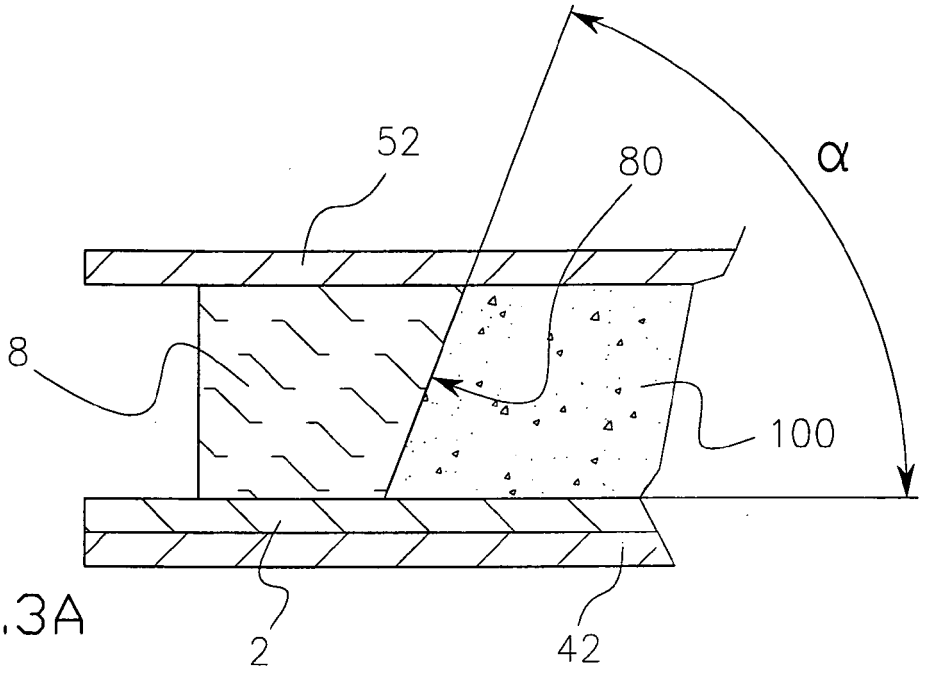

FIG.3A

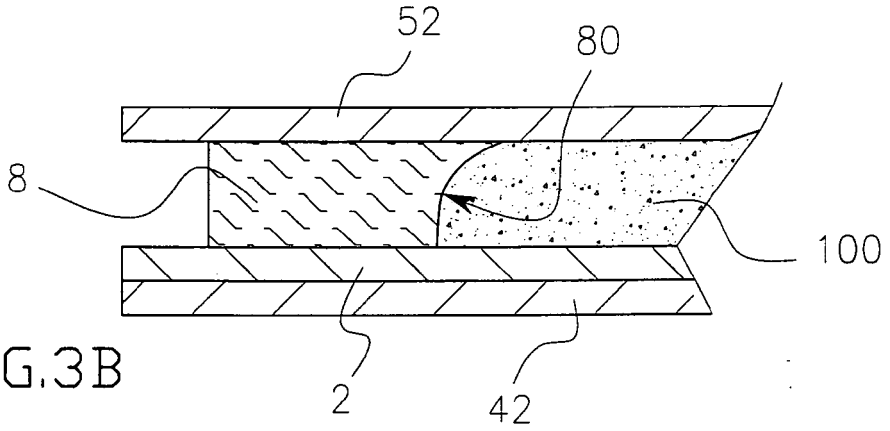

FIG.3B

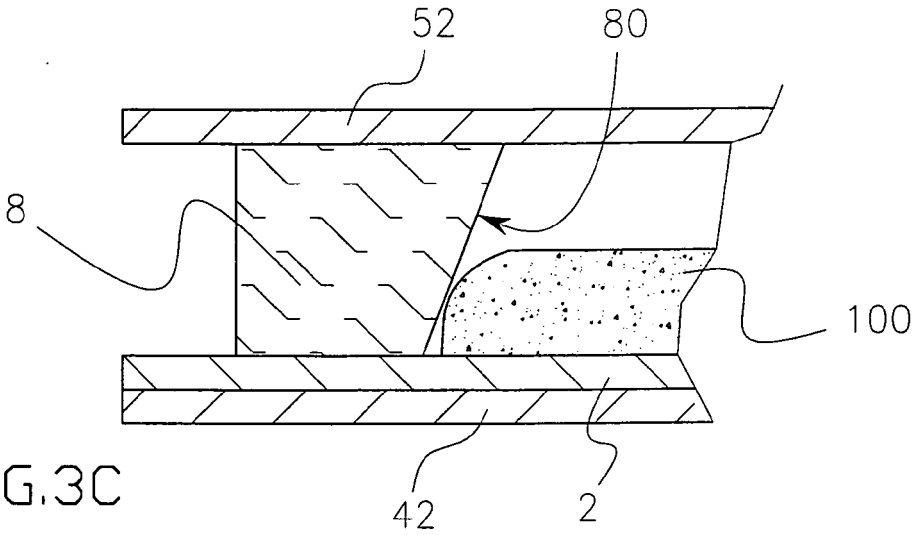

FIG.3C

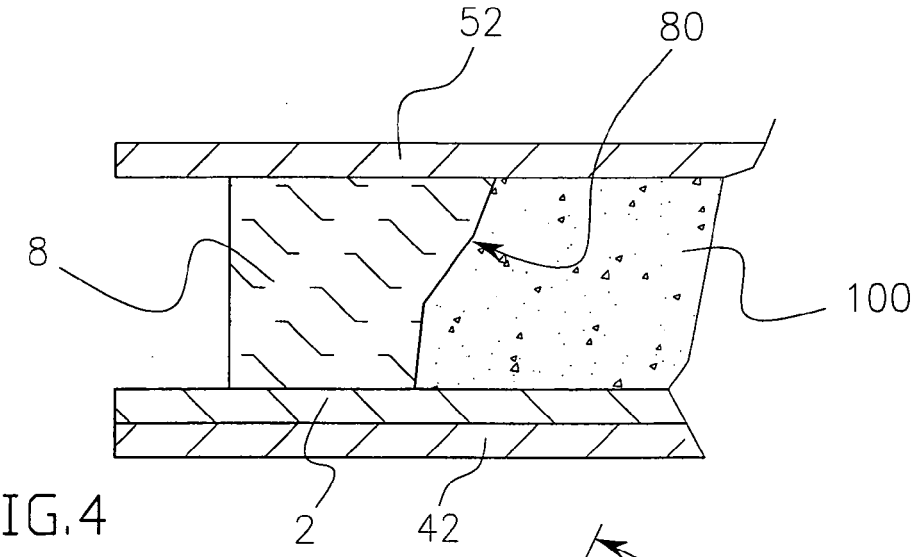

FIG.4

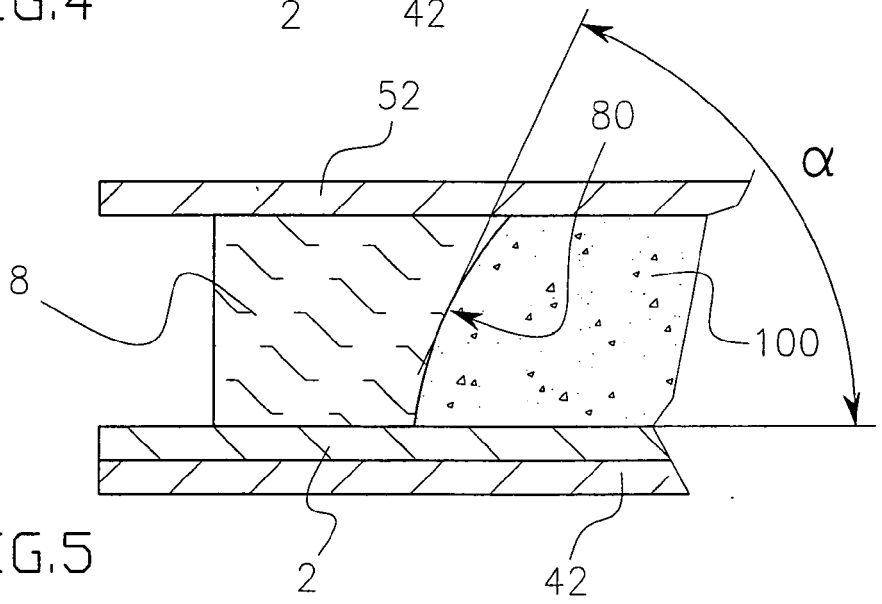

FIG.5

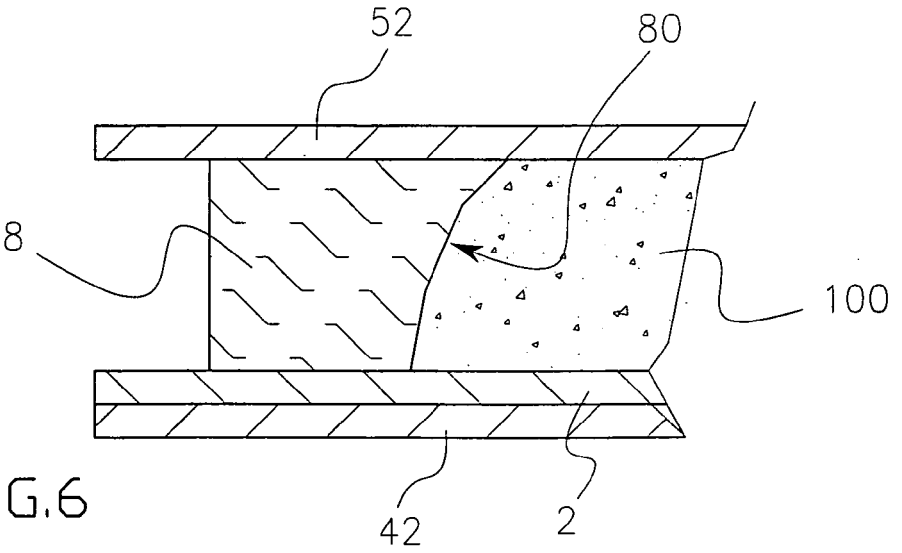

FIG.6