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(54) Method for producing mosaic panels for facings and pavements, plant for carrying out this method and panel obtained thereby

(57) The invention concerns a method for producing a mosaic panel for pavements and facings in which onto a support sheet (4) constituted by a film of non-adhesive plastic material there is dispensed, before the sheet is coupled with a grouping (2) of tesserae (2a), a distribution of hot glue such as to affect all the tesserae (2a) of the grouping (2). The glue exerts a relatively strong adhesive force on the sheet (4) and a weaker adhesive force on the tesserae (2a), in such a way that the connection between tesserae and sheet will resist the detachment stresses due to the weight of the tesserae that occur during the normal operations of handling the panel before it is installed, and also such that when the panel has been installed and the sheet (4) is removed, the glue remains attached to the sheet (4). The invention also relates to an apparatus for carrying out this method and the panels obtained thereby.

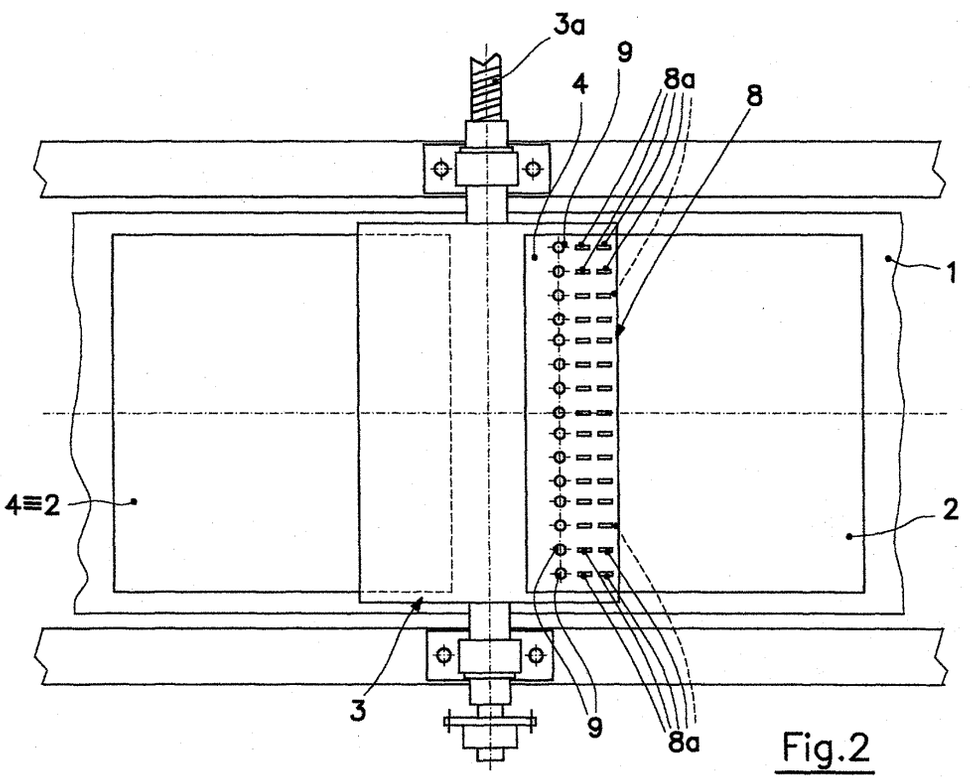

Fig.2

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Description

[0001] The present invention concerns the building industry and, more specifically, the field of the facing and paving construction. In particular, it concerns a new method for producing mosaic panels for facings and pavements. It also extends to an apparatus for carrying out such method and to the panels obtained thereby.

[0002] When mosaic facings and pavements have to be produced with tesserae, normally four-sided, of small size (with sides of not more than a few centimeters), in the greater part of cases the tesserae, in glass, marble, ceramics or other materials, are not placed one by one, but are first combined to form panels of remarkably larger size. As will readily be understood, this facilitates and speeds up the actual laying process and at the same time improves the quality of the work, because the tesserae can be positioned and spaced with the utmost regularity.

[0003] Various known techniques of forming panels make use of a two-dimensional non-rigid backing to which the tesserae are connected in an ordered fashion to form the panel. In accordance with a technique in relatively widespread use, the backing is constituted by a grid made of perforated cardboard or glass fiber that is glued onto the unfinished faces of the tesserae, that is to say, the faces that are not intended to remain in view. When the panel is placed in its built-in position, the grid will therefore remain imprisoned in the cement or other material with which the panel is anchored.

[0004] However, the grid reduces the anchorage surface of the panel and this reduction, in accordance with regulations in force in numerous countries, is tolerated up to a percentage of 20%. This percentage is exceeded by the greater part of the grids that have hitherto been used. In the case of a grid made of paper material, moreover, there may arise problems in the presence of humidity, because the grid will then tend to rot.

[0005] Lastly, a further important drawback of this technique is revealed when the panel has to line a curved surface, for example the transition that, for safety reasons, eliminates the sharp edge between a vertical wall and the walking surface at the edge of a swimming pool. When a panel is installed in this position, the interstices that extend along the generatrices of the curved surface tend to open towards the outside, because the interconnection that controls the spacing acts at the unfinished faces. This produces a quite unpleasant and at times even unacceptable aesthetic effect.

[0006] Ever more ground is therefore being gained by techniques that, with a view to forming the panel, envisage the use of a support sheet to which the tesserae are glued by their "finished face" (i.e. the face intended to remain in view). The sheet has therefore to be removed after the installation of the panel. The most widespread of these techniques makes use of sheets of paper that have one of their faces rendered adhesive by means of a water-soluble glue.

[0007] The paper is removed after the installation of the panel - when the anchorage material has thoroughly dried - by wetting the outside of the panel. The installer must however wait until the paper has absorbed the water, pull off the sheet and then wash the tesserae to remove the residual glue. The operation is therefore rather slow and troublesome. A second drawback is due to the fact that the paper is not transparent, so that the installer does not have a clear view of the tesserae and it becomes more difficult to position them accurately.

[0008] Another known system makes use of an adhesive band that is unwound from a reel of appropriate width and cut into portions of the desired length. Each portion, intended to form a support sheet of a panel, is deposited from above onto a vacuum-type transport roller mounted on a horizontal axis. More precisely, the sheet is deposited with its adhesive face turned to the outside and is retained by the surface of the roller due to the effect of a moderate depression, created within the roller by suitable suction means and acting through a series of appropriately distributed holes formed in the surface of the roller.

[0009] A conveyor belt extends horizontally below the roller and feeds the tesserae - that have previously been ordered on appropriate pitted grids - in such a way that the finished faces of the tesserae will intercept the surface of the roller tangentially and that, consequently, the sheet, following the rotation of the roller, will come into contact with the tesserae and adhere to them.

[0010] The adhesive force overcomes the suction force exerted by the roller, so that the sheet becomes detached and dragged away together with the tesserae, thus forming the panel. As mentioned above, the adhesive sheet has to be removed after a certain time during the course of the installation of the panel. The characteristics of the adhesion between sheet and tesserae must therefore be appropriately balanced, in such a way as to find the right compromise between opposite needs.

[0011] The adhesion must not be excessively strong, because in that case the removal of the sheet would become troublesome and could imply the detachment of tesserae from the cement, or residues of adhesive substance remaining on the finished faces, residues that would obviously have to be cleaned with consequent longer working times and greater installation costs. If the adhesion is too weak, on the other hand, the tesserae may drop off during the operations of handling the panels, both in the transport and storage phases and, above all, in the installation phases.

[0012] The balance in question is therefore particularly hard to reach, and from this there derives a first difficulty associated with this technique. In fact, the adhesion characteristics of the band are affected to an appreciable extent by the external temperature conditions. When the temperature exceeds certain values, the adhesion is excessive and, more particularly, the adhesive substance assumes a thickness that facilitates the for-

mation of residues on the finished face. On the other hand, when the temperature is low, especially when this is accompanied by a relatively high humidity of the air, the adhesive force becomes insufficient.

[0013] Another problem that arises, especially in the panel production phase, is bound up with the difficulty of handling the adhesive band. Particularly troublesome is the cutting of the band into portions, which is effected by means of a lengthy production step and the use of a dedicated and relatively complex and costly plant. Lastly, it must be considered the fact that the adhesive band is not by any means a cheap material, so that its use has significant effects on production costs.

[0014] The main object of the invention is to provide a new method for producing mosaic panels for facings and pavements that will overcome the mentioned drawbacks of the technique that has just been described and are essentially associated with the use of adhesive band and the particular characteristics of this material.

[0015] A particular object of the present invention is to provide a method of the aforementioned type that will make it possible to use as support sheet of the tesserae a material that is cheaper and easier to handle than the adhesive band in accordance with the known technique.

[0016] Yet another particular object of the present invention is to provide a method of the aforementioned type that will make it possible to obtain an adhesion between the tesserae and the support sheet that will prove perfectly satisfactory in relation to the various needs that have to be met as from the moment of forming the panel right through to its installation and, above all, an adhesion of which the strength will not be appreciably affected by normal variations of the environmental temperature and humidity.

[0017] These objects are achieved with the method for producing a mosaic panel for facings and pavements in accordance with the present invention, in which a support sheet is removably connected with the finished faces of an ordered grouping of tesserae constituting said mosaic. The method is characterized in that the support sheet consists in a film of non-adhesive plastic material on which, prior to being coupled with the grouping, there is dispensed a distribution of hot glue capable of affecting all the tesserae of the grouping. The glue exerts a relatively great adhesive force on the sheet and a smaller force on the tesserae, so that the connection of the tesserae to the sheet can resist the detachment stresses due to the weight of the tesserae that occur during the normal operations of handling the panel before it is installed, and so that when the panel is installed and the support sheet is removed, the glue remains attached to the sheet.

[0018] An apparatus for carrying out the method, and a mosaic panel for facings and pavements obtained by means of the method in accordance with the invention have the essential characteristics set out, respectively, in claims 10 and 16 attached hereto.

[0019] Other characteristics and advantages of the method for producing mosaic panels for facings and pavements, of the apparatus for carrying out the method and of the panel thus obtained in accordance with the present invention will be brought out more clearly by the description about to be given of some embodiments thereof, which are to be considered as examples and not limitative in any way, said description making reference to the attached drawings, in which:

- figure 1 shows a schematic side elevation of an apparatus for carrying out the method in accordance with the invention;
- figure 2 shows a top plan view of a part of the apparatus of figure 1; and
- figures 3 to 5 show plan views of different variants of mosaic panels realized with the method in accordance with the present invention as seen from the side of their finished faces.

[0020] Referring to figures 1 and 2, a preferred embodiment of the method in accordance with the invention envisages the use of an apparatus that, as far as the general principle of its configuration is concerned, is substantially similar to the plant of the prior art technique for producing mosaic panels with support sheets obtained from an adhesive band.

[0021] This configuration, already described in the introductive part, envisages a conveyor belt 1 on which the tesserae, typically quadrilateral, intended to make up the mosaic panels are arranged in an ordered manner in respective groupings 2, schematically outlined in the figures by means of the contour of the pitted grids, of the known type, used as backing. Each grouping 2 therefore comprises rows of tesserae placed side by side and with their finished faces turned upwards, the rows following each other with identical spacings in the direction of motion of the belt 1, indicated by means of the arrow A of figure 1.

[0022] The groupings 2 are fed towards a vacuum roller 3 arranged immediately above the belt 1 and such that, rotating in the direction indicated by the arrow B of figure 1, it will feed towards the groupings 2 respective support sheets 4 to form the panel. The vacuum inside the roller 3 is created by means of a suction duct 3a that extends axially from the roller, as can be seen in figure 2.

[0023] The peculiar features of the adhesion between a sheet 4 and the tesserae of a grouping 2 will be discussed in detail further on. From a kinematical point of view, however, the feeding of the sheets 4 to the roller 3 and their coupling with the tesserae are obtained in accordance with modalities similar to those mentioned in connection with the known technique. The sheets 4 derive from the cutting into portions of a band 5 unwound from a reel 6. The dragging and the cutting of the band 5 are carried out by an appropriate unit 7, obviously arranged between the reel 6 and the vacuum roller 3. The unit 7 is not here described in detail, being it of a typology that is known as such, even though it is different from

the one specifically used for the adhesive band technique.

[0024] According to the invention, in fact, the material of band 5 is a simple non-adhesive plastic film, e.g. a polyethylene, propylene or PVC film, so that the dragging and the cutting of the film do not give rise to the particular handling problematic of the adhesive band. It is therefore possible to utilize a unit 7 that is far simpler and more economic, similar - for example - to those used for cutting into pieces the cardboard or glass wool grids used as backings in the technique of gluing them onto the rough faces of the tesserae.

[0025] Still according to the invention, in order to make a sheet 4 adhere to the relative tesserae grouping 2, there is applied to the coupling face of the sheet, i.e. the face placed outwards when the sheet is on the roller 3, a distribution 8 - for example in accordance with a plurality of glue points 8a - capable of affecting all the tesserae of the grouping.

[0026] To this end, a glue dispensing unit is provided above the roller 3 and in the embodiment here illustrated comprises a row of injectors 9 that are aligned along a generatrix of the roller 3. In the given example the number of injectors 9 is equal to the number of tesserae in each row of the grouping, and the injectors are operated in a discontinuous manner and in coordination with the rotation of the roller 3, so that they will distribute the points 8a in the desired manner on the sheet 4.

[0027] As the roller 3 keeps on turning, the glue points 8a applied to the sheet 4 come into contact with the tesserae of the grouping 2, sticking to the relevant finished faces. Upon a further rotation of the roller 3, sheet 4 to become detached therefrom and remains coupled with the tesserae, thus forming the mosaic panel.

[0028] The dispensed glue is a hot glue capable of making the points 8a adhere relatively strongly to the sheet 4 and more weakly to the tesserae. More precisely, it will generally be sufficient for the adhesion to the tesserae to be capable of resisting a detachment stress caused by the actual weight of the tesserae, thus rendering possible all normal handling of the formed panel. In the specific embodiment here considered this adhesion force must also be greater than the suction force that the roller 3 exerts on the sheet 4, thus making sure that the latter will become regularly detached to form the panel.

[0029] The adhesion force with respect to the sheet, on the other hand, must be stronger, and such that when the workman removes the sheet 4 after having installed the panel, the glue will remain attached to the sheet without leaving any residues on the finished faces and without the risk of detaching some of the tesserae from the cement.

[0030] A contribution to the attainment of this result is made not only by the physical and chemical characteristics of the glue in relation to those of the two materials on which adhesion is to be obtained, but also by the fact that the glue is dispensed in a hot condition. In fact, the glue points 8a adhere to the sheet 4 as soon as the glue issues from the injectors 9 and therefore when, due to the high temperature (typically, about 160°C), the glue develops its maximum adhesive power. On the other hand, the adhesive power is remarkably lower when the points 8a come into contact with the tesserae, the glue having cooled to a certain extent during the rotation of the roller 3.

[0031] In connection with this latter aspect, it is important to note that, for compulsory construction requirements, the angle of rotation of the roller 3 between its passage beneath the injectors 9 and the coupling zone with the tesserae on the belt 1 is rather large (roughly 180°). This must be taken into account when choosing the glue, because a glue that, following the drop of temperature during this rotation, suffers an excessive loss of adhesive power will not be suitable.

[0032] There are numerous hot glues that, be it even to a greater or lesser degree, are capable of satisfying the requirements indicated above and will therefore make it possible to carry out the method in accordance with the invention. By way of example, glues that are particularly suitable for use in the method are permanent glues on an elastomer base like those known under the trade names "PRESSURE SENSITIVE 2000 PP" of Messrs. VABER S.p.A. of Turin, and "SINTECOL HT-HTS" of Messrs. COSTENARO S.p.A. of Vicenza.

[0033] Examples of mosaic panels obtained by means of the method in accordance with the invention are shown in figures 3 to 5, to which reference will henceforth be made. In these figures there can be seen the profile of the sheet 4, which is preferably transparent to afford the workman a complete view of the tesserae and thus enable him to carry out the laying operations more easily and precisely.

[0034] Likewise visible is the distribution 8 of the glue on the groupings 2 of tesserae 2a. Figure 3 shows a distribution 8 obtained with the apparatus and in accordance with the operating steps described in the above example. In fact, it envisages for each tessera 2a a single glue point 8a arranged centrally on the appropriate finished face. The point 8a has an elongated shape, due to the movement of the sheet 4 during the relevant dispensing time of the injectors 9.

[0035] A different distribution can be noted in Figure 4, with glue points 8b, once again of an elongated shape, but so arranged as to have two on each tessera, in proximity of two diagonally opposite corners of the tessera. Such a distribution can obviously be obtained by equipping an injector-type glue dispensing unit like the one mentioned hereinabove with twice the number of injection orifices 9 placed side by side.

[0036] Turning now to Figure 5, it will be noted that in this case the distribution 8 envisages a perimetral frame 8c for each tessera 2a. This solution can be obtained with a dispenser unit of a different typology that, rather than of injectors 9, avails itself of an offset print system, i.e. a printing roller that deposits the distribution 8 on the

sheet 4 by operating in tangential contact with the transport roller 3.

[0037] The latter distribution proves to be advantageous at the moment of the installation of the panels, because when the workman sets the tesserae in the anchorage material, tapping gently on the outer face of the panel, the frames 8c constitute a stop for said material, which - after having filled the spaces between the tesserae - tends to overspill onto the finished faces if the workman exerts an excessive pressure. The workman can therefore proceed more rapidly, with a greater tolerable error as regards the calibration of the pressure, obtaining a joint filling that will be substantially flush with the finished faces and will therefore need fewer finishing operations.

[0038] More generally, it is obvious that any glue distribution capable of affecting all the tesserae of the grouping can be used. For example, the sheet 4 could be simply sprinkled with glue by means of a spray-type dispenser unit.

[0039] With the mosaic panel obtained in accordance with the invention one generally has all the advantages of a gluing system on the finished face - deriving from the fact that the unfinished faces are free of a reticular backing - but without the drawbacks of the known solutions that were mentioned in the introductory part.

[0040] In fact, one obtains characteristics of adhesion between support sheet and tesserae that are perfectly appropriate in relation to the needs in handling and installing the panels, and these characteristics are not affected by variations of the humidity and temperature conditions, because the employed hot glue is practically inert. It should also be noted that the hot glue does not have to be dried, so that the panels can be sent to a packing station as soon as they come out of the apparatus employed for their production.

[0041] As compared with the adhesive band system, production becomes considerably less costly, this not only on account of the non-adhesive and much cheaper plastic film, but also on account of the constructive and maintenance simplicity of the dragging and cutting unit 7, which does not have to handle adhesive band and can therefore be based on elementary technical solutions.

[0042] It is also obvious that, as compared with the method involving a sheet of paper and water-soluble glue, the laying operations are appreciably faster, because there is no need for wetting and subsequently washing the tesserae. Furthermore, the transparency of the plastic film facilitates the operations and increases their accuracy.

[0043] Though the illustrated example makes reference to an embodiment with a transport system based on vacuum rollers, the use of hot glue in combination with a support film of non-adhesive plastic material, which constitutes the essential characteristic of the method for producing mosaic panels in accordance with the present invention, could also be realized by means of different constructions.

[0044] Other variations and/or modifications could be introduced into the method for producing mosaic panels for facings and pavements, the apparatus for carrying out this method and the panel thus obtained in accordance with the present invention without thereby departing from the scope of the invention itself.

Claims

1. A method for producing a mosaic panel for pavements and facings, wherein a support sheet is removably connected to the finished faces of an ordered grouping of tesserae constituting said mosaic, said method being **characterized in that** said support sheet consists in a film of non-adhesive plastic material onto which, prior to its being coupled with said grouping, there is dispensed a distribution of hot glue such as to affect all the tesserae of the grouping, said glue exerting a relatively strong adhesive force on said sheet and a weaker adhesive force on said tesserae, so that the connection of said tesserae to said sheet can resist the detachment stresses due to the weight of the tesserae that occur during the normal operations of handling the panel before it is installed, and so that when the panel is installed and the support sheet is removed, the glue remains attached to the sheet.

2. The method according to claim 1, wherein said non-adhesive plastic material is polyethylene.

3. The method according to claim 1, wherein said non-adhesive plastic material is transparent.

4. The method according to any one of the previous claims, wherein said glue is a permanent elastomer-base glue dispensed at a temperature of about 160°C.

5. The method according to any one of the previous claims, wherein said glue distribution provides a single glue point for each tessera of said grouping, said point being arranged centrally on the appropriate finished face.

6. The method according to any one of the claims for, wherein said glue distribution provides two glue points for each tessera of said grouping, said points being arranged on the appropriate finished face in proximity of respective diagonally opposite zones.

7. The method according to any one of the claims from 1 to 4, wherein said glue distribution provides a perimetral frame of glue for each tessera of said grouping.

8. The method according to any one of the claims from 1 to 4, wherein said glue distribution provides a sprayed dispersion over said sheet.

9. The method according to any one of the previous claims, wherein said glue distribution is dispensed onto said sheet arranged on the outside of a vacuum-type transport roller with a horizontal axis, a conveyer belt that extends horizontally beneath said roller feeding said grouping of tesserae in such a way that the finished faces of the tesserae tangentially intercept the roller surface, so that said sheet, following the rotation of the roller, comes into contact with said tesserae and adhere to them.

10. An apparatus producing mosaic panels for pavements and facings, each of said panels comprising a support sheet removably connected to the finished faces of an ordered grouping of tesserae constituting said mosaic, said apparatus comprising a station where said sheets are coupled with respective groupings of tesserae, and means for transporting said sheets and said groupings towards said station, said apparatus being **characterized in that** it comprises, in association with said means for transporting said sheets and upstream of said station, means for dispensing onto said sheets a hot glue distribution capable of affecting all the tesserae of the respective groupings in said station.

11. The apparatus according to claim 10, wherein said means for transporting said sheets comprise a vacuum-type roller with a horizontal axis that cooperates with said glue dispensing means and wherein said means for transporting said tesserae comprise a conveyor belt that extends horizontally beneath said roller in such a way that the finished faces of the tesserae tangentially intercept the roller surface and that, consequently, said sheets, following the rotation of the roller, come into contact with the tesserae and adhere to them.

12. The apparatus according to claim 11, wherein said glue dispensing means comprise at least one row of injectors aligned along a generatrix of said roller.

13. The apparatus according to claim 11, wherein said glue dispensing means comprise a printing roller capable of depositing the glue distribution on said sheets by operating in contact with said vacuum-type roller.

14. The apparatus according to claim 11, wherein said glue dispensing means comprise spray means for dispersing said glue over said sheet.

15. The apparatus according to any one of claims 10 to 14, wherein upstream of said means for transporting the sheets there is arranged a reel from which a band of plastic film is unwound, and means for cutting said film into portions to form said sheets.

16. A mosaic panel for pavements and facings, comprising a support sheet removably connected with the finished faces of an ordered grouping of tesserae constituting said mosaic, **characterized in that** said sheet consists in a film of non-adhesive plastic material, the connection between said tesserae and said film being realized by means of a distribution of hot dispensed glue, said glue exerting a relatively strong adhesive force on said sheet and a weaker adhesive force on said tesserae, so that the connection between said tesserae and said sheet can resist the detachment stresses due to the weight of the tesserae that occur during the normal operations of handling the panel before it is installed, and so that when the panel is installed and said sheet is removed, the glue remains attached to the sheet.

17. The panel according to claim 16, wherein said non-adhesive plastic material is polyethylene.

18. The panel according to claim 16 or claim 17, wherein said non-adhesive plastic material is transparent.

19. The panel according to any one of claims 16 to 18, wherein said glue is a permanent elastomer-base glue.

20. The panel according to any one of claims 16 to 19, wherein said glue distribution provides a single glue point for each tessera of said grouping, said point being arranged centrally on the relevant finished face.

21. The panel according to any one of claims 16 to 19, wherein said glue distribution provides two glue points for each tessera of said grouping, said points being arranged on the relevant finished face in proximity of respective diagonally opposite zones.

22. The panel according to any one of claims 16 to 19, wherein said glue distribution provides a perimetral frame of glue for each tessera of said grouping.

23. The panel according to any one of claims 16 to 19, wherein said glue distribution provides a sprayed dispersion over said sheet.

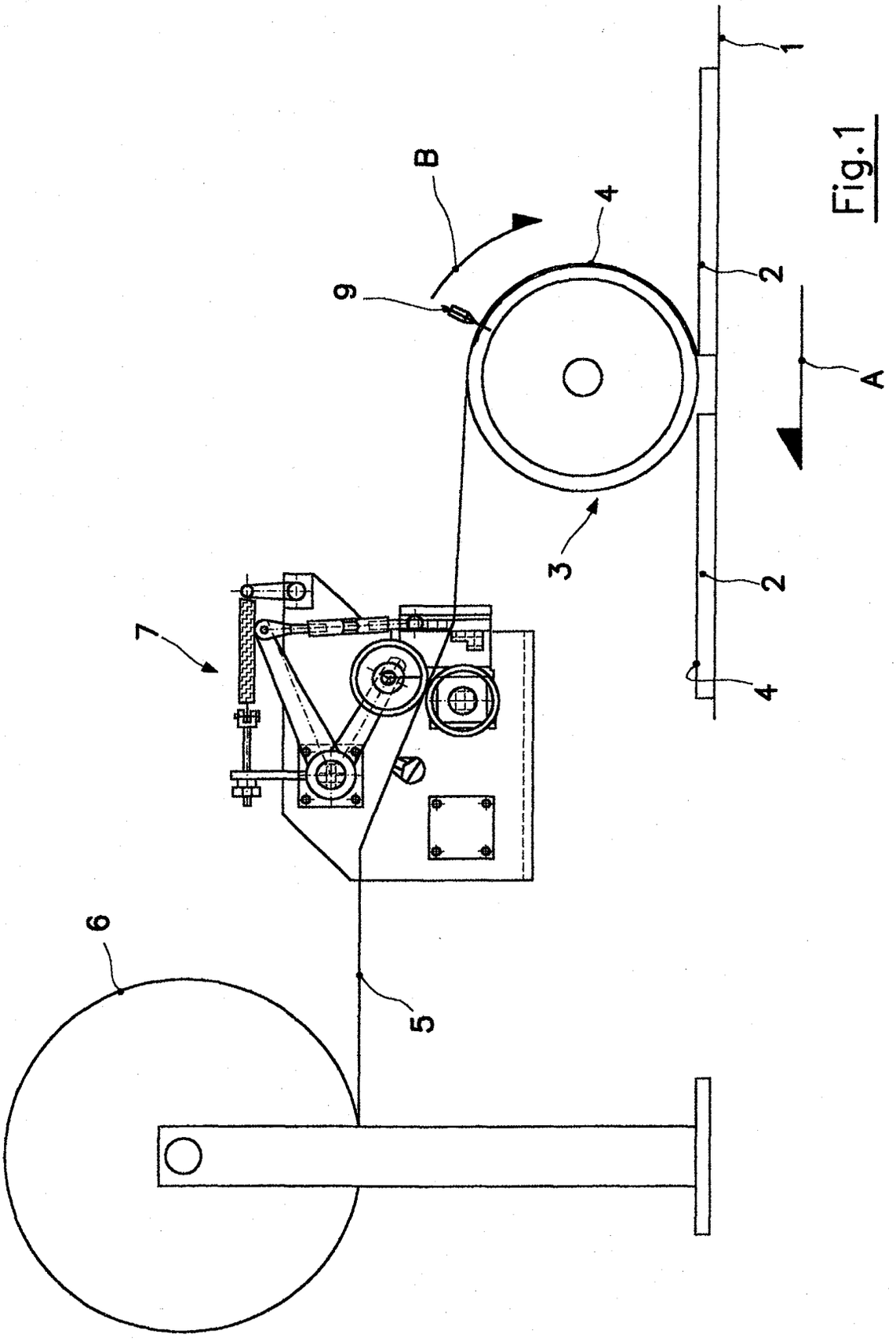

Fig.1

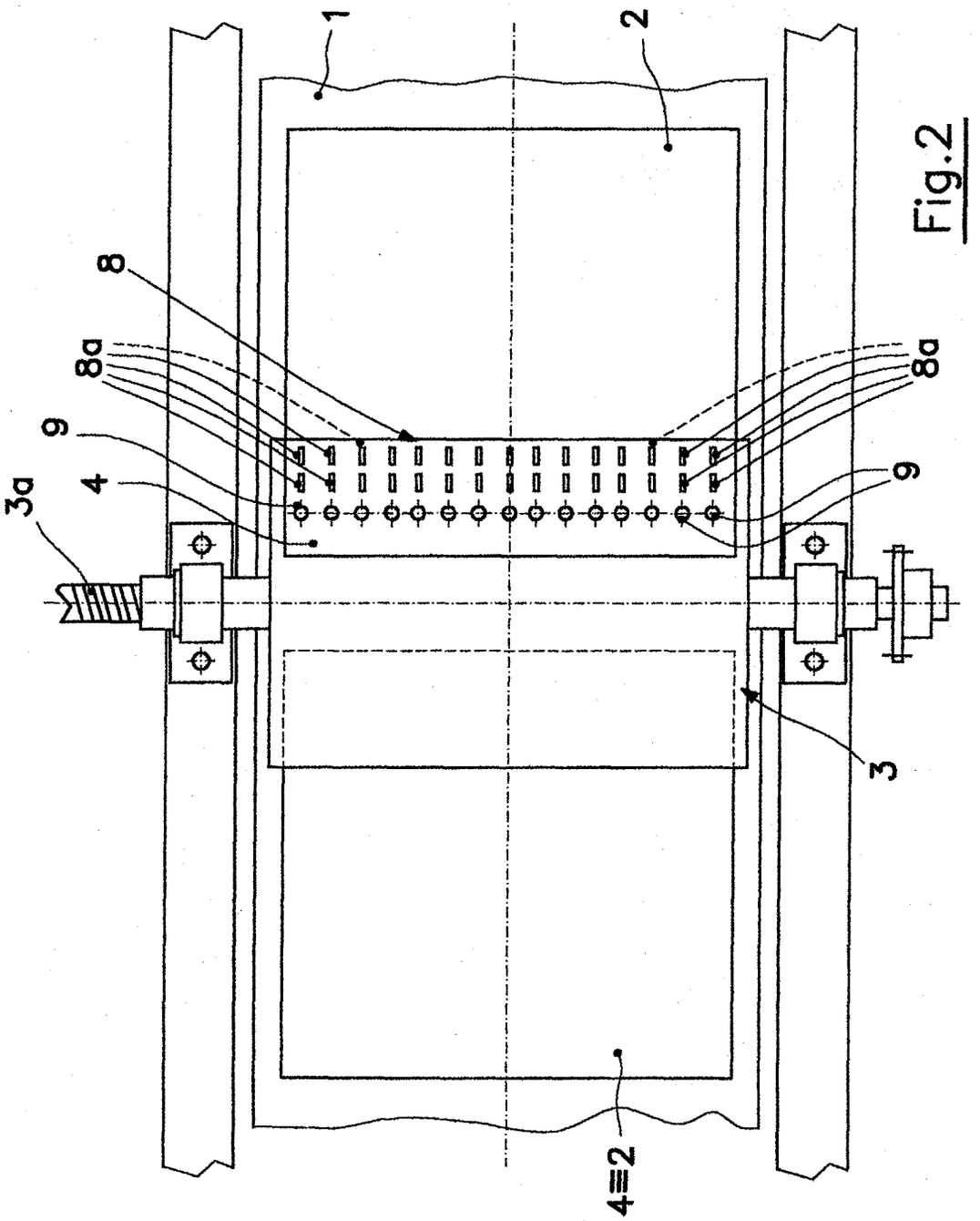

Fig.2

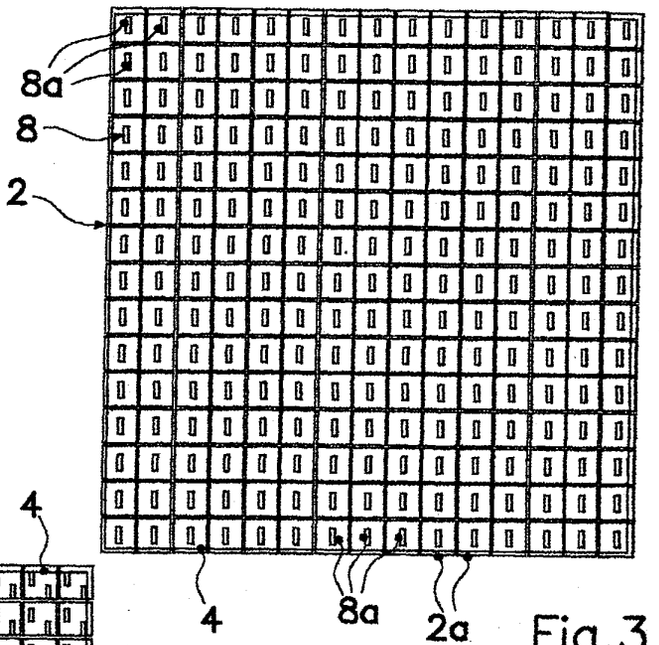

Fig.3

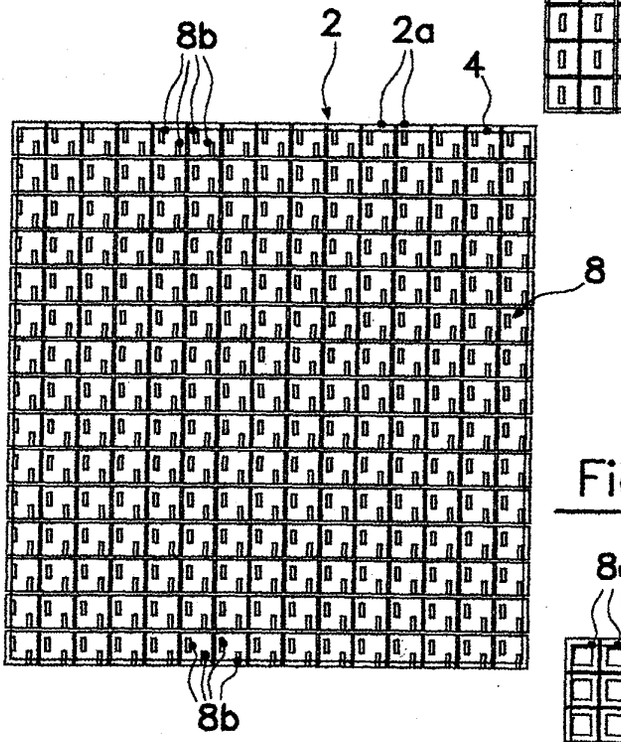

Fig.4

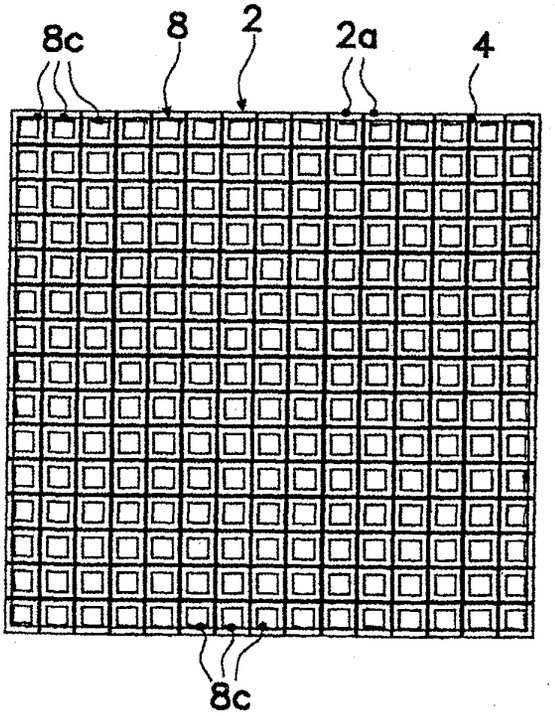

Fig.5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 42 5065

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 5 252 166 A (KRAWCZYK MARGARET M) 12 October 1993 (1993-10-12) * column 3, line 1 - column 3, line 22 * * column 7, line 43 - column 8, line 22 * * column 9, line 33 - column 9, line 55; figure 5 *	1,10,16	B44C3/12
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A	EP 1 179 439 A (BISAZZA SPA) 13 February 2002 (2002-02-13) * column 4, line 26 - column 4, line 27 * * column 4, line 38 - column 5, line 15; figures 1-3 *	1,10,16	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7) B44C B44D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	5 June 2003	Sartor, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 42 5065

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