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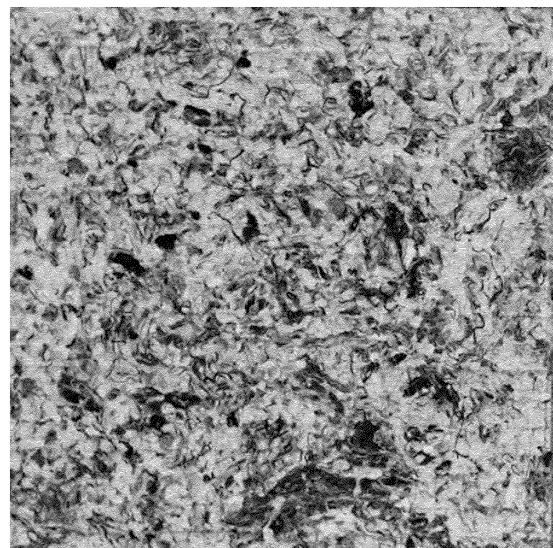
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(54) **METHOD FOR PRODUCING A SOUND-ABSORBING PANEL**

(57) Method for producing of a sound-absorbing panel (F), comprising a step of preparing a predetermined amount of cellulose fibres and a step of immersing the cellulose fibres in a first water basin (100) to form a cellulose pulp (P1). The method then comprises a step of preparing a predetermined amount of textile fibres (V) and a step of mixing, in water, the cellulose pulp (P1) with the textile fibres (V) to obtain a final pulp (P3) and a step of depositing the final pulp (P3) on a forming mould (300). The method then comprises a step of pressing at least the final pulp (P3) in order to cause an at least partial removal of the water contained in the final pulp (P3) making a fibre mat (T) and a step of drying the fibre mat (T) so as to cause evaporation of the water remained in the fibre mat (T) making a sound-absorbing panel (F).

Fig.3A



F

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Description

[0001] The present invention relates to a method for producing a sound-absorbing panel.

[0002] The term "sound-absorbing panel" refers to a cladding with the objective of making an acoustically insulated and/or more comfortable environment by absorbing noise and consequently reducing reverberation. In particular, a sound-absorbing panel is a panel capable of limiting the propagation of sound waves in buildings and homes.

[0003] Sound-absorbing panels are usually made of porous and/or fibrous materials of various kinds, including, for example, glass wool and rock wool, wood wool and cement, polyester and polymeric expanded foams of various kinds.

[0004] As a rule, sound-absorbing panels made of synthetic materials are not environmentally friendly and do not have a particularly pleasant appearance when visibly installed.

[0005] Acoustic panels can also be made from materials and fibres of plant or animal origin, including cellulose, i.e. a natural fibrous polymer. In such a situation, depending on the length of the fibres and the level of final density of the material produced, the panel is more or less brittle.

[0006] However, as known, the use of cellulose fibres entails a problem of mechanical stability, strength and brittleness of the acoustic panel.

[0007] In order to overcome this problem, synthetic additives have been known to bind the cellulose fibres together.

[0008] In particular, in order to give panels made of cellulose fibres better mechanical properties, it is known to process these fibres using processes typical of the paper and/or packaging industry.

[0009] Such panels, however, while having good mechanical properties, are poorly sound-absorbing.

[0010] Panels can also be made with cellulose fibres and lignin, another natural polymer originally contained in wood (to which it gives the typical brown colouring), which is known to provide better mechanical properties. However, even in this situation, the resulting panel has good mechanical properties but no sound-absorbing properties.

[0011] In other words, it is now possible to make panels that, when they have good mechanical properties, have poor sound-absorbency and vice versa.

[0012] Several methods and relative variations for producing sound-absorbing panels are also currently known.

[0013] According to a first method, unrefined wood fibres, thus containing one part of cellulose and one part of lignin, are distributed in water to form a pulp that is then pressed under high pressure and high temperature.

[0014] This method makes it possible to make panels wherein the binding agent of the wood fibres is lignin, which, in water and at high temperatures, behaves as a fibre binder.

[0015] As an alternative to the distribution of unrefined wood fibres in water, it is possible to dry bind the fibres by using resins, which are pressed together with the unrefined wood fibres to create the panel.

[0016] According to a second method, cellulose fibres are heat-treated at high temperature. In more detail, fibre distribution takes place by means of a blowing operation during which the fibres are bound with a binder (e.g. a resin or glue) and then hot-pressed. In this case as well, the binding process is conventionally carried out using glues or synthetic resins.

[0017] However, most commercially available resins that can be applied in the aforementioned dry process include a high content of formaldehydes, which cause both a major environmental and health problem due to the illnesses that may result from inhaling these substances when the panels obtained are applied indoors.

[0018] In other words, binding cellulose fibres using chemical resins or synthetic glues has become a habit. Such resins or glues, while allowing to obtain a panel with acceptable mechanical and sound-absorbing properties, make this panel difficult and expensive to produce and dispose of precisely because of the chemical (and sometimes toxic) nature of these substances.

[0019] The technical task of the present invention is therefore to make available a method for producing a panel capable of overcoming the drawbacks emerging from the prior art.

[0020] The object of the present invention is therefore to make available a method for producing a sound-absorbing panel with good sound-absorbing properties and, at the same time, good mechanical properties.

[0021] A further object of the present invention is to make available a method for producing a sound-absorbing panel having a lower environmental impact and therefore environmentally sustainable.

[0022] A further object of the present invention is to make available a method for producing a sound-absorbing panel that is recyclable.

[0023] The defined technical task and the specified objects are substantially achieved by a method for producing a sound-absorbing panel comprising the technical characteristics set forth in one or more of the appended claims. The dependent claims correspond to possible embodiments of the invention.

[0024] Further characteristics and advantages of the present invention will become clearer from the indicative and therefore non-limiting description of an embodiment and method for producing a sound-absorbing panel.

[0025] Such description will be set forth herein below with reference to the accompanying drawings, provided for merely indicative and therefore non-limiting purposes, wherein:

- Figure 1 shows a schematic of a first embodiment of the method covered by the present invention;
- Figure 2 shows a schematic of a second embodiment of the method covered by the present inven-

- tion;
- Figure 3 shows a front and rear plan view of a sound-absorbing panel obtained using the method shown in Figure 1;
 - Figure 3 shows a front and rear plan view of a sound-absorbing panel obtained using the method shown in Figure 2.

[0026] The method for producing a sound-absorbing panel "F", which is the subject of the present invention, comprises a step of preparing a predetermined amount of cellulose fibres.

[0027] Preferably, cellulose fibres have a length between 0.5 mm and 5 mm.

[0028] Preferably, the average length of cellulose fibres is between 1.3 mm and 2.5 mm.

[0029] Advantageously, the length of the cellulose fibres used in the method of the present invention makes the cellulose easier to be processed.

[0030] The method further comprises a step of immersing the cellulose fibres in a first water basin 100 to form a cellulose pulp "P1".

[0031] In this situation, the cellulose fibres are dispersed in water so as to form the cellulose pulp "P1".

[0032] In accordance with a possible embodiment, the method comprises a step of adding at least one dye in the first water basin 100 in order to give the cellulose pulp "P1" a predetermined colouring.

[0033] In other words, if a predetermined colouring is to be imparted to the final sound-absorbing panel "F", a dye is added to the water of the first basin 100 in which the cellulose fibres are immersed to form the cellulose pulp "P1" so that the latter absorbs the dye.

[0034] Preferably, the dye used is a natural type of dye, e.g. a mineral origin dye.

[0035] Preferably, the dye is a powder dye with a particle size, for example, between 20 μm and 80 μm .

[0036] Preferably, the dye consists of kaolin and at least one additional component.

[0037] For example, iron oxide and manganese oxide can be mixed with the kaolin to give it a sienna, i.e. red, colouring.

[0038] For example, calcium, manganese and iron carbonates can be mixed with the kaolin to give it a black colouring.

[0039] Advantageously, the use of natural dyes enables the production of coloured and, at the same time, safe sound-absorbing panels "F". In particular, natural dyes eliminate the problems resulting from possible harmful inhalation from formaldehyde-based resins used in the prior art.

[0040] In addition, the use of natural dyes lowers the environmental impact of the whole process of making sound-absorbing panels "F" as they are easier to dispose of and non-toxic.

[0041] The method further comprises a step of preparing a predetermined amount of textile fibres "V".

[0042] Preferably, the method comprises, prior to the

step of preparing a predetermined amount of textile fibres "V", a step of shredding textile material from which textile fibres "V" are obtained.

[0043] Preferably, the textile material from which these textile fibres "V" are obtained is a waste textile material.

[0044] Advantageously, the use of a waste textile material makes the obtained panel "F" eco-friendly as it avoids the waste of such textile material that would otherwise have to be disposed of.

[0045] Preferably, these textile fibres "V" are heterogeneous fibres.

[0046] Even more preferably, textile fibres "V" comprising one or more of: cotton; wool; polyamide; polyester.

[0047] Following the step of preparing textile fibres "V", the method comprises a step of mixing, preferably in water, the cellulose pulp "P1" with textile fibres "V" to obtain a final pulp "P3".

[0048] In this situation, the final pulp "P3" is formed from the cellulose pulp "P1" into which the textile fibres "V" have been mixed i.e. a mixture in which cellulose pulp "P1" and textile fibres "V" have been mixed.

[0049] While the cellulose pulp "P1" mixes with textile fibres "V", textile fibres "V" bind to the cellulose fibres of the cellulose pulp "P1". The cellulose fibres of the cellulose pulp "P1" act as binders. In this situation, there is no need to add any kind of synthetic/chemical binder as it is the cellulose fibres of the cellulose pulp "P1" that act as binders for the entire panel "V".

[0050] Advantageously, using cellulose fibres as a binder, it is possible to avoid adding synthetic binders, making the panel "F" easier to manufacture and, above all, to dispose of.

[0051] Advantageously, the panel "F" is completely recyclable, e.g. the panel "F" can be introduced into water to obtain the final pulp "P3" and proceed to form a new panel "F".

[0052] After the final pulp "P3" is obtained, the latter is deposited on a forming mould 300.

[0053] Preferably, the forming mould 300 has, in section, the shape to be given to the final sound-absorbing panel "F".

[0054] Following the distribution step, the method comprises a step of pressing the final pulp "P" such that at least part of the water it contains is removed and a fibre mat "T" is created.

[0055] In other words, during the pressing step, the final pulp "P3" is crushed and squeezed so as to remove the water incorporated therein and so as to give the final pulp "P3" the desired shape for the final sound-absorbing panel "F".

[0056] By way of example, Figure 1 and Figure 2 show a press in which the lower half-mould is the forming mould 300 and in which an upper half-mould is moved closer to the lower half-mould in order to press the final pulp "P3" and make the fibre mat "T".

[0057] Preferably, the method comprises a step of collecting water resulting from the pressing step.

[0058] In more detail, during the pressing step, when

the water contained in the final pulp "P3" is expelled, it is collected, e.g. in a container to be disposed of. In such a situation, in case a dye has been added during the immersion steps, as it is natural, the disposal of the water could be carried out in a simple and environmentally friendly manner by a settling process.

[0059] Following the pressing step, the final pulp "P3" was "squeezed" to remove water and was deformed to form a fibre mat "T".

[0060] In this situation, the method comprises a step of drying the fibre mat "T" so as to cause evaporation of the water remained in the fibre mat "T" itself making the sound-absorbing panel "F".

[0061] Preferably, the drying step takes place at a temperature between 25°C and 40°C.

[0062] Preferably, at the end of the drying step, the method comprises a step of applying an aqueous solution containing a waterproofing element on at least one surface of the sound-absorbing panel "F".

[0063] At the end of the drying step, and possibly of the application step, the panel obtained has a first and a second face like those shown in Figure 3, wherein the textile fibres "V" drowned within the cellulose fibres are visible. In accordance with the embodiment of the method shown in Figure 2, on the other hand, the method comprises, prior to the step of mixing the pulp "P1" with the textile fibres "V", a step of removing a predetermined amount of cellulose pulp "P1" from the cellulose pulp "P1" itself.

[0064] In other words, before the cellulose pulp "P1" is mixed together with the textile fibres "V", part of the cellulose pulp "P1" is extracted and kept aside. In this situation, in the deposition step, the final pulp "P3" is deposited on the mould 300 to define a lower layer "I". Subsequently, the removed cellulose pulp "PR" is also deposited on the mould 300, and in particular on the lower layer "I", to define an upper layer "S".

[0065] In other words, once the final pulp "P3" is deposited on the mould 300, the removed pulp "PR" is deposited on the third pulp "P3" so that there is a lower layer "I" and an upper layer "S".

[0066] After the final pulp "P" and the removed pulp "PR" have been deposited on the mould 300, the pressing step takes place to allow the water contained in the final pulp "P3" and the removed pulp "PR" to escape.

[0067] During the pressing step, a mixing sub-step occurs wherein, near an interface surface between the upper layer "S" and the lower layer "I", part of the final pulp "P3" amalgamates at least partially with part of the removed pulp "PR" defining an interface layer interposed between the lower and upper layers "I", "S".

[0068] Thanks to the aforementioned mixing, the lower and upper layers "I", "S" are bound together with no need to add any resin and/or chemical binder.

[0069] Furthermore, by layering the final pulp "P3" and the removed pulp "PR", it is possible to obtain a panel "F", shown in Figure 4, having:

- a "coarser" face, given by the lower layer "I" defined by the final pulp "P3" in which the textile fibres "V" mixed with cellulose fibres are visible;
- a second face, opposite the first face, which is "smoother and more homogeneous", given by the upper layer "S" defined by the removed pulp "PR" wherein there are no textile fibres "V" but only cellulose fibres.

[0070] In other words, following the drying step, it can be seen that the panel "F" has a smooth face defined by the pressed and dried cellulose fibres alone, and a face on which the textile fibres "V" bound and mixed with the cellulose fibres are recognisable.

[0071] According to a further embodiment of the method (not shown), following the textile fibre "V" preparation step, the method could comprise a step of immersing the textile fibres "V" in a second water basin to form a fibre pulp.

[0072] In this situation, at the mixing step, the cellulose pulp "P1" is mixed with the aforementioned fibre pulp to obtain the final pulp "P3".

[0073] In other words, the pulp "P1" and fibre pulp are mixed together in water in order to obtain the final pulp "P3" from a mixture of the pulp "P1" and fibre pulp.

[0074] In accordance with this embodiment, the method could further comprise a step of adding at least one dye in the second water basin in order to give the fibre pulp a predetermined colouring.

[0075] Preferably, as was the case with the first water basin 100, a natural dye, e.g. a mineral dye, is used in the second water basin.

[0076] In this case as well, preferably, the dye is a powder dye with a particle size of, for example, 20 µm to 80 µm.

[0077] Preferably, the dye consists of kaolin and at least one additional component.

[0078] It is possible that only the cellulose pulp "P1" may be coloured. Alternatively, only the fibre pulp is coloured.

[0079] Alternatively, both the cellulose pulp "P1" and the fibre pulp are coloured. In the latter case, the cellulose pulp "P1" and the fibre pulp may be coloured the same colour or different colours.

[0080] Once the cellulose pulp "P1" and the fibre pulp have been mixed together, the steps of the method are identical to those described above for the embodiments shown in the attached figures.

[0081] A sound-absorbing panel "F" made in accordance with the method described above is also an object of the present invention.

[0082] The sound-absorbing panel "F" thus produced has a density value between 100 kg/m³ and 700 kg/m³, preferably between 150 Kg/ m³ and 350 Kg/ m³.

[0083] The sound-absorbing panel "F" thus produced has a sound-absorption value between 0.4 α_w and 1 α_w.

[0084] It is also an object of the present invention to use textile fibres to make a pulp to obtain a sound-absorbing

panel "F" as described above.

[0085] In other words, textile fibres "V" are used to make a sound-absorbing panel "F" in accordance with the foregoing.

[0086] The present invention achieves the intended purposes overcoming the drawbacks of the prior art.

[0087] The use of textile fibres "V" mixed with cellulose fibres avoids the introduction of glues, solvents, resins or any other non-natural and toxic material/substance into the panel "F" as the textile fibres "V" are bound with the cellulose fibres.

[0088] Furthermore, the fact that no adhesives and/or chemical dyes are used makes both the manufacturing process and the use of the sound-absorbing panel "F" safe for health.

[0089] The use of textile fibres "V" makes the panel "F" eco-friendly as waste textile fibres "V" are used and given new life in an industrial process.

Claims

1. Method for producing a sound-absorbing panel (F), the method comprising the steps of:

- preparing a predetermined amount of cellulose fibres;
- immersing the cellulose fibres into a first water basin (100) to form a cellulose pulp (P1);
- preparing a predetermined amount of textile fibres (V);
- mixing, preferably in water, said cellulose pulp (P1) with said textile fibres (V) to obtain a final pulp (P3);
- depositing said final pulp (P3) on a forming mould (300);
- pressing at least said final pulp (P3) in order to cause at least partial removal of the water contained in the final pulp (P3) making a fibre mat (T);
- drying said fibre mat (T) so as to cause evaporation of the water remained in said fibre mat (T) making a sound-absorbing panel (F).

2. Method according to claim 1, wherein the method comprises, prior to the mixing step, a step of removing a predetermined amount of cellulose pulp (P1) from said cellulose pulp (P1), and wherein in the deposition step, said final pulp (P3) is deposited on the mould (300) to define a lower layer (I) and said removed cellulose pulp (PR) is deposited on said lower layer (I) to define an upper layer (S).

3. Method according to claim 2, wherein during said pressing step a mixing sub-step occurs wherein, near an interface surface between the upper layer (S) and the lower layer (I), part of the final pulp (P3) is at least partially amalgamated with part of said re-

moved cellulose pulp (PR) defining an interface layer interposed between said lower and upper layer (I, S).

4. Method according to any one of the preceding claims, wherein the method comprises, prior to said step of preparing a predetermined amount of textile fibres (V), a step of shredding textile material, preferably said textile material being waste textile material, to obtain the textile fibres (V).
5. Method according to any one of the preceding claims, wherein said textile fibres (V) are heterogeneous fibres, preferably said textile fibres (V) comprising one or more among: cotton; wool; polyamides; polyester.
6. Method according to any one of the preceding claims, comprising a step of adding at least one dye in said first water basin (100) so as to give a predetermined colouring to the cellulose pulp (P1), preferably said at least one dye being a natural dye.
7. Method according to any one of the preceding claims, wherein prior to the mixing step, the method comprises a step of immersing the textile fibres (V) into a second water basin to form a fibre pulp, and wherein in said mixing step, said cellulose pulp (P1) is mixed with said fibre pulp to obtain said final pulp (P3).
8. Method according to claim 7, comprising a step of adding at least one dye in said second water basin so as to give a predetermined colouring to the fibre pulp, preferably said at least one dye being a natural dye.
9. Method according to claim 7 and/or claim 8, wherein said at least one dye is a powder dye, preferably the dye having a particle size between 20 μm and 80 μm .
10. Method according to any one of the preceding claims, wherein said cellulose fibres have a length between 0.5 mm and 5 mm.
11. Sound-absorbing panel (F) made according to the method claimed in one or more of the preceding claims from 1 to 10, having a density value between 100 Kg/ m^3 and 700 Kg/ m^3 , preferably said density value being between 150 Kg/ m^3 and 350 Kg/ m^3 .
12. Use of textile fibres to make a pulp to obtain a sound-absorbing panel (F) according to claim 11.

Fig.1

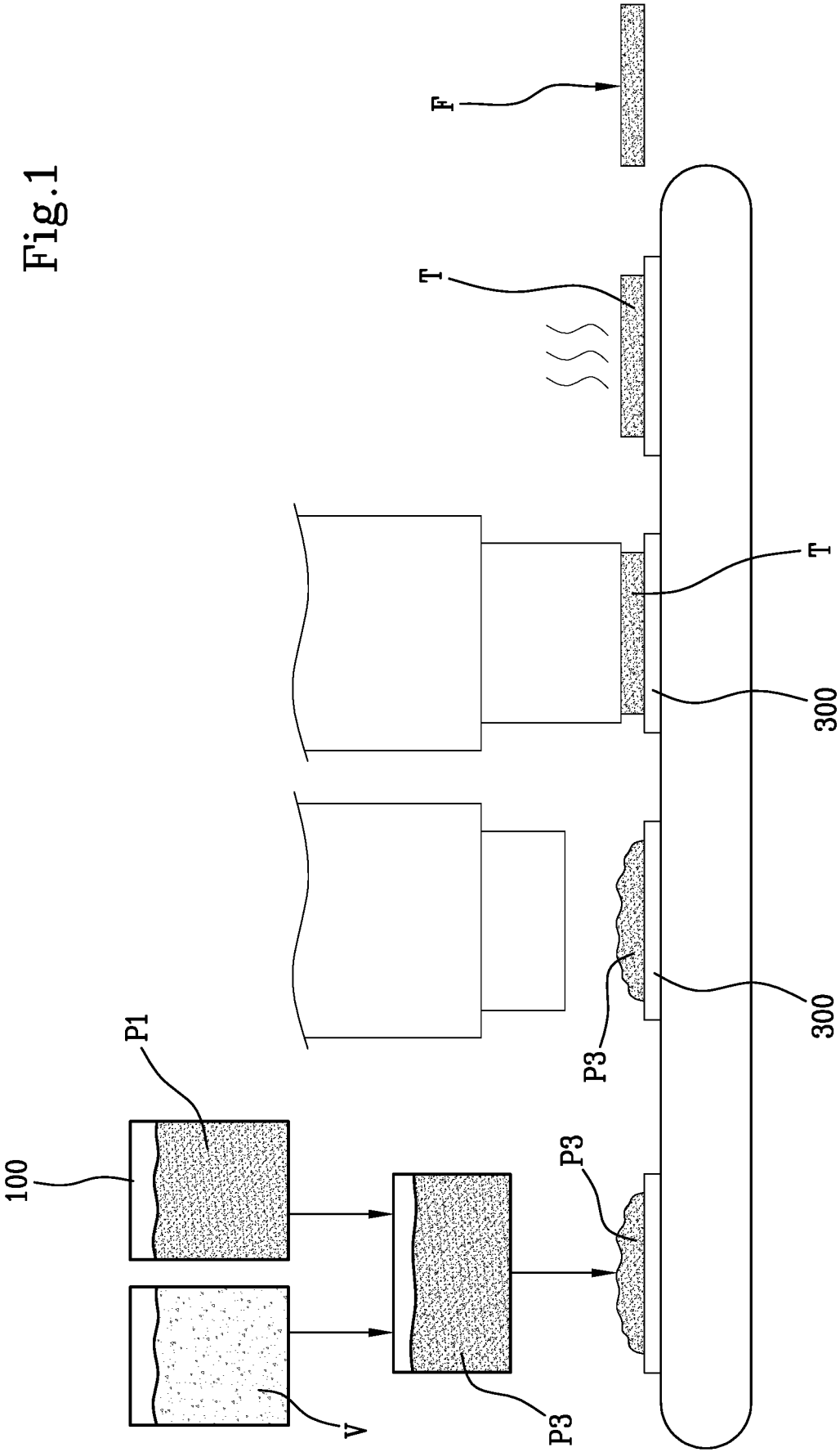


Fig.2

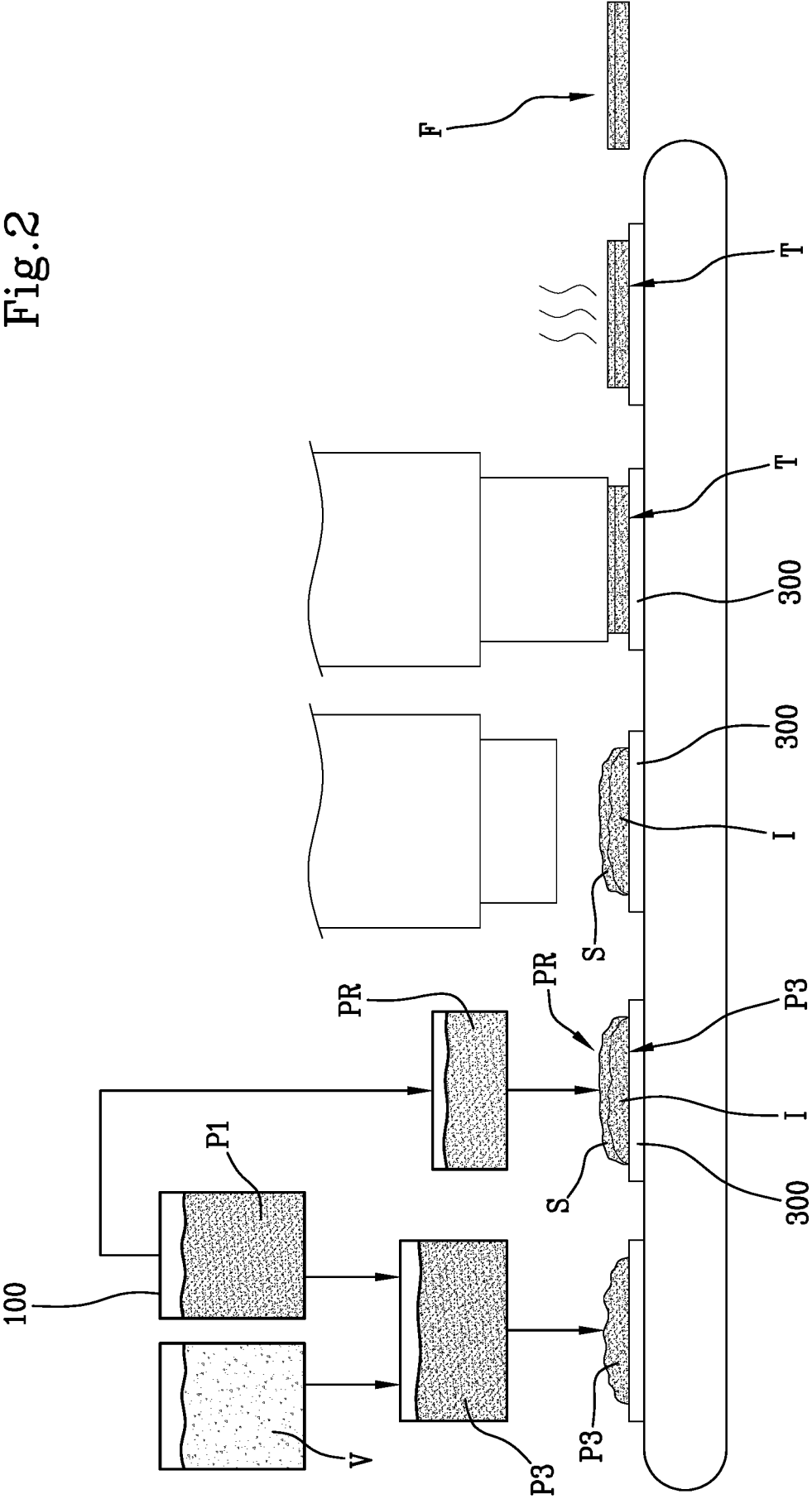


Fig.3B

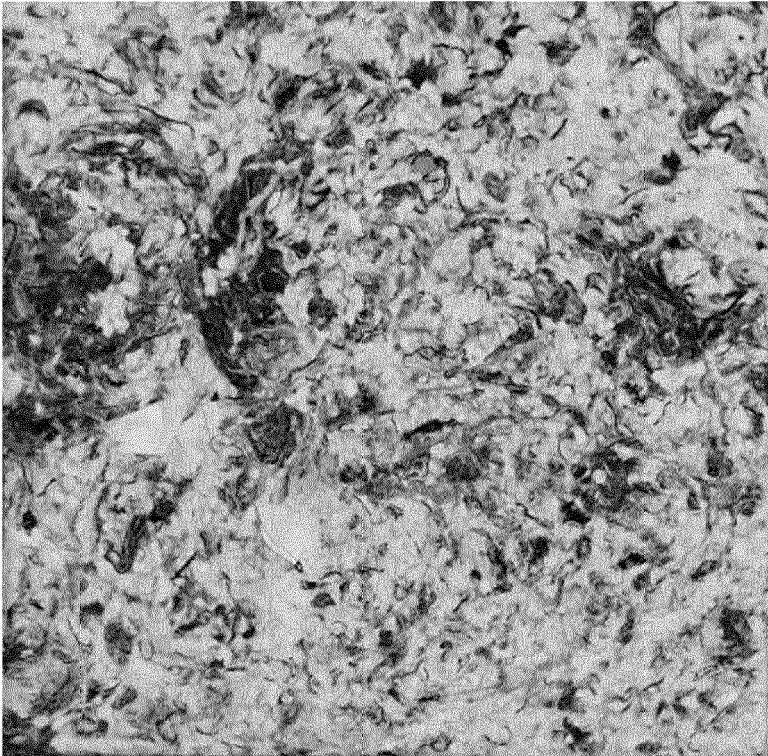


Fig.3A

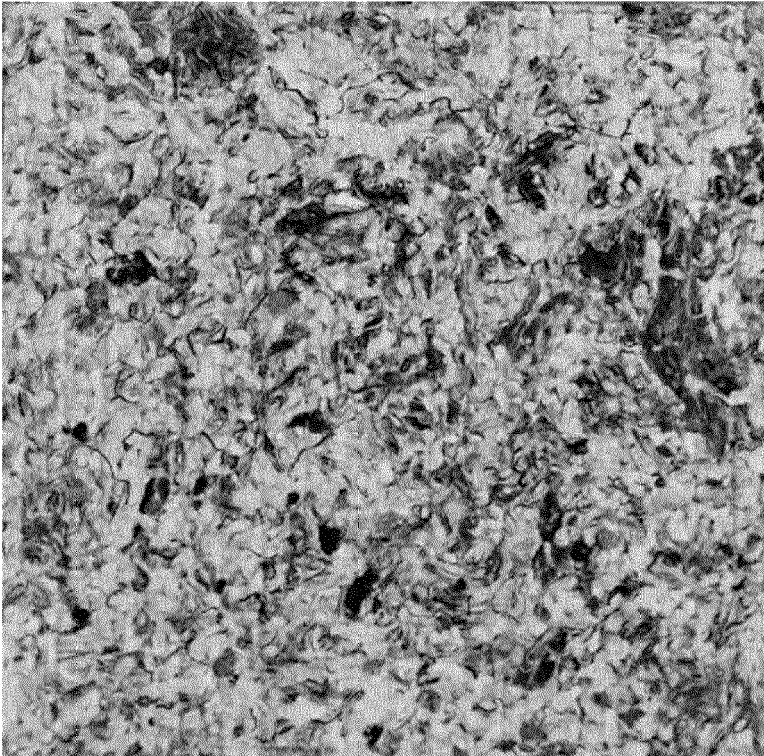


Fig.4B

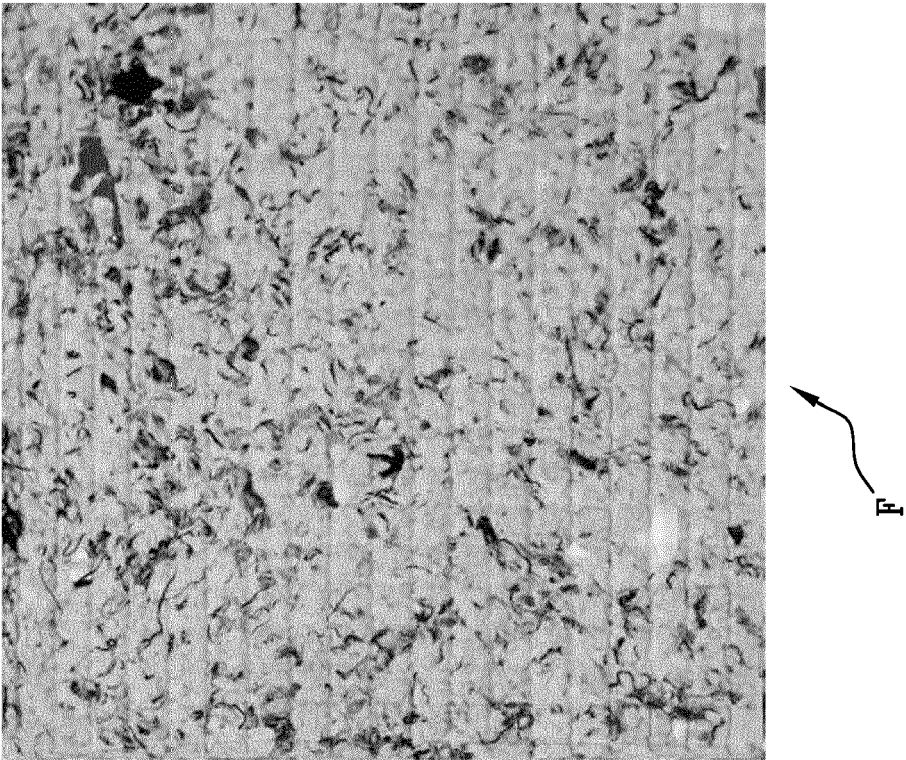
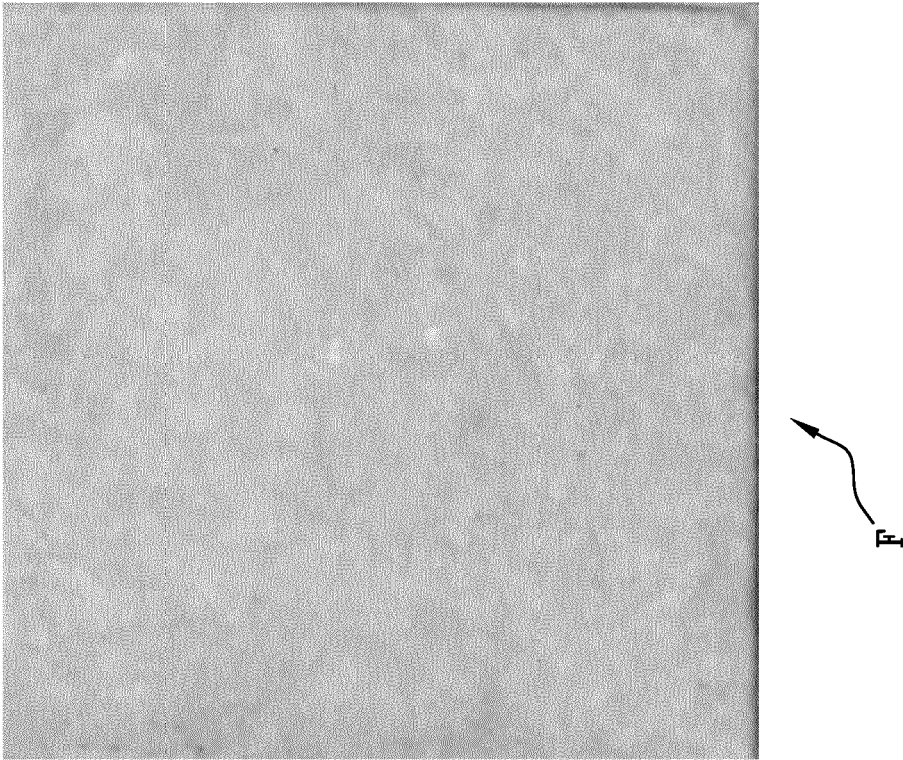


Fig.4A





EUROPEAN SEARCH REPORT

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 April 2025	Examiner Pregetter, Mario
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