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## (54) A method of producing a flooring and a flooring producted according to the method

(57) In a method of producing a flooring which rests on a sub-floor. The sub-floor (1) is coated with a first layer (2) of binder. A layer of aggregate material (3) is spread over the binder (2) which is then allowed to dry or set so that the particles (3) bond therein. A second layer of binder (9) is spread out over the first layer of binder (2) and aggregate material (3) bonded therein. A second layer of aggregate material (11) is spread over the second layer of binder (9). Finally, the flooring is allowed to dry or set, whereafter it is ground flat and even. In order to obtain thin layers and to reduce the requirement for removal of material by grinting, it is suggested that, prior to drying or setting of the second layer of binder (9), the aggregate material (11) of the second layer is mechanically processed to drive out air and in order to orient the particles of the aggregate material so that these turn their sharp edges and jagged tips (13) away from the top side of the impending flooring (2,3,9,11).

The flooring comprises: a lower layer of binder (2), an aggregate material (3), an upper layer of binder (9), an aggregate material (11) whose particles are oriented, and a protective and sealing layer (2,3,9,11).

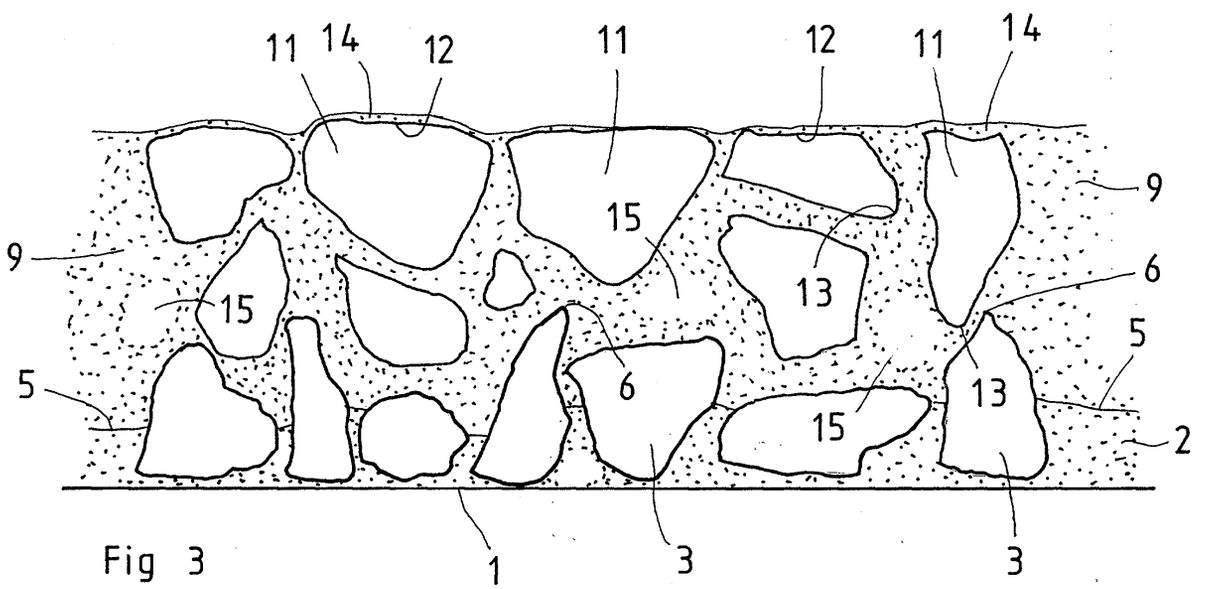


Fig 3

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## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to a method of producing a flooring resting on a sub-floor and comprising the steps of: providing the sub-floor with a first layer of liquid or paste binder, spreading a layer of aggregate over the layer of binder, allowing the binder to dry or set so that the individual pieces or particles of the aggregate are bonded therein, spreading a second layer of liquid or paste binder over the first and the aggregate material bonded therein, spreading a second layer of aggregate over the second layer of liquid or paste binder, allowing the second layer of binder to dry or set, and grinding the flooring to an even and planar finish.

**[0002]** The present invention also relates to a flooring resting on a sub-floor and comprising a lower layer of binder with pieces or particles of an aggregate bonded therein, an upper layer of binder with pieces or particles of an aggregate bonded therein, and a protective and sealing layer on the top side of the flooring.

### BACKGROUND ART

**[0003]** Methods for producing flooring and flooring designed in accordance with the above-outlined guidelines are previously known in numerous different variations.

**[0004]** Patent Specification CH 361 114 discloses a flooring which is applied on a porous concrete floor which is sealed and insulated with a number of insulating layers. On these, there is disposed a covering layer which is substantially based on a plastic binder. In the covering layer, there are further placed particles of aggregate, whereafter, after complete setting, the top surface of the flooring is ground smooth.

**[0005]** A floor of this type may, in certain cases, function satisfactorily, but is not particularly durable and does not withstand point loadings more than that permitted by the plastic material in the covering layer. In addition, and this is the most important factor, the costs for production of such a floor are extremely high, since a large proportion of the aggregate material and the plastic binder must be ground off before flatness in the floor can be guaranteed.

**[0006]** Patent Specification DE 1 509 879 discloses a similar prior art floor.

**[0007]** Patent Specification SE-C2-512 627 discloses a floor which is built up on a sub-floor by means of a binder layer and a layer of particulate aggregate. In such instance, the binder is intended to fix the aggregate material in the sub-floor but may also form bridges between adjacent particles of the aggregate so that this forms a three-dimensional, stable lattice. In those cavities which are formed between adjacent granules or particles of the aggregate in the lattice, there is then disposed an inorganic filler which is intended, as far as is possible, to fill out the cavities. Once the filler has dried or set, the top surface of the flooring is ground flat and possibly provided with an upper sealing layer of a paint.

**[0008]** The flooring according to this Swedish Patent Specification possesses superior load-carrying capacity and durability, but is expensive to produce int. al. because an extremely thick layer of filler and aggregate must be ground off before the floor may have a guaranteed planar and smooth top surface. Finally, the flooring according to the Swedish Patent Specification builds up to a relatively large level of height and, as a result, cannot be employed in such situations where a flooring in a thin layer is required.

### PROBLEM STRUCTURE

**[0009]** The present invention has for its object to obviate the drawbacks inherent in the prior art constructions. Thus, the present invention has for its object to realise a method which is simple and economical to reduce into practice, which makes for the construction of floorings of thin layers, and, above all, reduces the requirement for the removal of material in the final grinding operation.

### SOLUTION

**[0010]** The objects forming the basis of the present invention will be attained in respect of the method if this is characterised in that, prior to the drying or setting of the second layer of binder, the aggregate material in the second layer is mechanically processed for removing air and for orienting the individual pieces or particles of aggregate so that these are at least partly caused to turn with sharp edges and projecting tips and portions facing away from the future top side of the flooring.

**[0011]** In that the individual pieces or particles of aggregate are, after the mechanical processing, substantially turned with their most planar sides upwards, and where their most planar sides substantially lie flush with one another, the amount of material which must be removed by grinding before the floor is perfectly flat is reduced to a minimum.

**[0012]** The objects forming the basis of the present invention will be attained in respect of the flooring if this is characterised in that the pieces or particles of aggregate bonded by the upper layer of binder are at least partly oriented with projecting edges, tips and jaggedness turned to face away from the top surface of the flooring.

### BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

**[0013]** The present invention will now be described hereinbelow, with reference to the accompanying Drawings. In the accompanying Drawings:

Fig. 1 is a cross section through a flooring in the proc-

ess of construction, a first layer of aggregate having been bonded in a layer of binder on a sub-floor;

Fig. 2 shows the cross section of Fig. 1, a second layer of binder having been applied;

Fig. 3 shows the section according to Fig. 2, a second layer of aggregate having however been applied, and this second layer having been mechanically processed for orienting the individual pieces or particles of aggregate so that their flattest and smoothest sides are substantially turned to face upwards;

Fig. 4 is a section approximately according to Fig. 1 and indicates the thickness of material that must be removed if the flooring with unoriented pieces or particles of aggregate is to be flattened by grinding;

Fig. 5 shows the section according to Fig. 3, showing the amount of material that must be ground off before the flooring is smooth and flat; and

Fig. 6 shows the section according to Figs. 3 and 5 in the flat-ground state.

## DESCRIPTION OF PREFERRED EMBODIMENT

**[0014]** Fig. 1 shows a cross section through a flooring according to the present invention in the process of being built up and reference numeral 1 relates to a sub-floor or generally to a floor substrate. Reference numeral 2 relates to a layer of binder, for example epoxy based. The binder layer 2 is spread on the substrate 1, whereafter a first layer of particulate aggregate material, for example marble chips, are spread in the binder layer. The individual pieces or particles of aggregate material have been given reference numeral 3.

**[0015]** Since one object of the present invention is to realise a thin flooring which saves material and which does not accumulate excessively in the vertical direction, it is vitally important that the sub-floor or substrate 1 is completely flat. Should this not be the case, the sub-floor 1 is adjusted in this respect using a cement-based screed possibly followed by grinding before the first layer 2 of binder is spread out.

**[0016]** While it is not the intention, there may possibly occur small air pockets 4 in the binder layer 2, but as long as these pockets are not overly large or overly numerous, this is of no consequence to the quality of the flooring.

**[0017]** The binder in the first binder layer is applied in a quantity of approximately 0.2 kg per $m^2$ and the aggregate in a quantity of approximately 2 kg per $m^2$. This implies that the binder layer will have a thickness of the order of magnitude of 2 mm. The aggregate material need not be graded, but, in the relevant embodiment, has a maximum particle size of 3-5 mm.

**[0018]** It will be apparent from Fig. 1 that the individual particles or pieces 3 of aggregate are depressed in the binder layer 2 or alternatively have sunk down into it as a result of their higher density, for which reason the top surface 5 of the binder layer in Fig. 1 lies on a higher level than it did prior to the application of the aggregate material.

**[0019]** Given that the aggregate material may consist, for example, of crushed marble, cullet, crushed stone of types other than marble, wood chips, seashells etc., the individual pieces or particles 3 are of an irregular shape and the individual particles themselves may differ considerably in both shape and also size. In that the aggregate material is spread out over the binder layer 2 applied on the substrate 1, the individual particles or pieces 3 of aggregate material will be wholly randomly oriented. However, a certain orientation of the individual particles or pieces 3 may possibly be over-represented, where the pieces have their largest and flattest side turned to face downwards, since an upstanding piece or particle will probably show a tendency to "topple over". This is illustrated in Fig. 1 in that certain pieces of aggregate have upwardly extending jagged or sharp edges 6 while other pieces or particles may have largely planar surfaces 7 turned to face upwards, while still further pieces or particles may have arched surfaces 8 turned to face upwards. The foregoing also implies that the flooring in the process of being built up will have an upper surface that is extremely rough in the production stage it is in according to Fig. 1.

**[0020]** In addition to, or possibly as an alternative to, the binder layer 2 applied on the substrate 1, it is possible to apply the binder on the individual pieces 3 of aggregate by running them in a suitable mixer with an addition of binder prior to the spreading operation.

**[0021]** Fig. 2 shows the same cross section as Fig. 1, but after the next step in the production process where the flooring in the process of being built up has been given an additional layer of binder 9, a second layer of binder with the top surface 10. The binder in the second layer of binder is preferably of the same type, or at least same nature as the binder in the first layer 2.

**[0022]** The second layer 9 of binder is only applied once the first layer 2 has dried or set at least so far that the individual pieces or particles 3 of aggregate are properly bonded and can also most preferably be trodden on.

**[0023]** Since the binder in the second layer 9 is relatively fugitive, liqueform or paste, it may be assumed that, at least after the application in Fig. 2, it is largely free of air pockets.

**[0024]** The second layer of binder 9 is spread with a greater thickness than the first, and in such instance this thickness may lie in the order of magnitude of 3 to 4 mm, in which event the binder in the second layer 9 may also include filler in the form of aggregate material of finer

grading than that which was otherwise employed, as well as colour pigment, suitably a colour pigment which harmonises with the colour of the aggregate material employed. Ideally, the spreading of the binder in the second layer may be put into effect using a rubber scraper or similar implement, since the binder is liqueform or in paste form. The proportion of filler may be as much as two thirds of the total and the quantity may amount to 6 kg per $m^2$.

**[0025]** After the application of the second layer of binder 9, a second layer of particulate aggregate 11 is applied or spread out, which, for example, may consist to two thirds of a fraction having a particle size of 1-3 mm and to one third of a fraction having a particle size of 3-5 mm. The type of aggregate material is the same as in Figs. 1 and 2 and the applied quantity may amount to the order of magnitude of 4 kg per $m^2$.

**[0026]** In that the second layer of aggregate is spread out over the second layer of binder, the individual pieces or particles 11 in the aggregate material will initially be randomly oriented in the same manner as the individual pieces or particles 3 in the first layer of aggregate material were randomly oriented.

**[0027]** The next step of the production process entails that the individual particles 11 in at least the upper region of the second layer of aggregate are oriented by a mechanical processing so that, on the one hand, air is driven out, and, on the other hand, the individual pieces 11 or particles of aggregate material are at least partly caused to turn with their sharp and jagged edges 13 away from the top side of the impending flooring. After the mechanical processing and orientation of the individual pieces 11 or particles in the second layer of aggregate material, the cross section through the flooring in the process of being built up will have the appearance as is apparent from Fig. 3.

**[0028]** It will be apparent from Fig. 3 that the pieces 11 of the aggregate material have, at least to some degree, been oriented in such a manner that their more or less planar surfaces 12 are turned to face upwards, while sharp edges and jagged portions 13 are turned to face away from the top side of the floor. It will also be apparent from the Figure that the pieces 11 are thoroughly surrounded by the binder 9 and that also a thinner layer 14 of the binder may be present on the upper side of the pieces 11. It is also largely apparent that there are no air pockets 15 in the second layer of binder 9, nor in the second layer of aggregate 11, possibly with exception of the lower regions thereof.

**[0029]** The mechanical processing and orientation of the individual particles or pieces 11 proceeds such that these are subjected to forces which are substantially parallel with the upper defining surface of the flooring. This will cause the individual particles to turn to the positions illustrated in Fig. 3. The mechanical processing also entails that the individual particles are acted on by forces that are directed downwards towards the substrate 1 so that the particles will thereby be "kneaded down" into the binder 9, which, as a result, may float up to the top side of the individual pieces 11 and form the upper, thin layer 14.

**[0030]** During the mechanical processing of the upper layer of aggregate material, the lower layer of aggregate material functions as an arrest surface which prevents individual particles 11 or pieces in the upper layer of aggregate material from being depressed too far down so that the layer thickness in the flooring in the process of being formed locally may become too slight or that, in a later stage, a grinding down to an excessive grinding depth is required.

**[0031]** The peaks 6 of the lower layer of aggregate material may fulfil the same function as an arrest surface when the second layer of binder 9 is spread out using a suitable scraper.

**[0032]** Ideally, the mechanical processing of the second layer of aggregate material 11 may be put into effect employing spring-biased plates which move approximately parallel with the top surface of the layer and in contact therewith. In such instance, the individual sheets or plates make an acute angle with the substrate so that their front edges in the direction of movement lie somewhat higher than the rear edges. Through viscous forces in the second layer of binder 9 and as a result of direct mechanical friction between the plates and the individual pieces 11 of the aggregate material in the upper layer, these pieces 11 will be turned in the above-described manner and oriented with their substantially planar surfaces 12 facing upwards.

**[0033]** The next step in the production process for the flooring entails that, after setting or drying of the second layer 9 of binder, the somewhat uneven and undulating upper surface of the flooring in Fig. 3 is to be ground totally flat. In this instance, Fig. 5 shows the quantity of material which must be'removed for this to be put into effect. In Fig. 5, the upper, broken line 16 shows the level that corresponds to the upper point 18 in the flooring, in this case, the upper surface of the thin binder layer 14 which may exist on the top side of any individual particle or piece 11 in the upper layer of aggregate material. The lower broken line 17 shows the level of the lower point 19 where an individual piece or particle 11 of aggregate material has an upwardly facing, continuous grinding surface.

**[0034]** If an analogy is drawn with the grinding of the flooring in the state according to Fig. 1, the levels 16 and 17 would be found as shown in Fig. 4. It will readily be appreciated that, with randomly oriented pieces or particles in the aggregate material, the amount of material that must be ground off is considerably greater than is the case after an orientation of the individual pieces 11 carried out according to the present invention.

**[0035]** After grinding down of the top surface of the flooring, it will have the appearance which is apparent from Fig. 6. In such instance, it should be observed that the upper pieces 11 of aggregate material all display upper grinding surfaces 20 which lie in the one and same

plane, while, on the other hand, the amount of binder 9 which is to be found in the upper surface 21 is considerably less.

**[0036]** The grinding process between the steps of the production process illustrated in Figs. 5 and 6 takes place in several stages using gradually finer grinding material. IN the last stages, use is made of an extremely fine particulate grinding material, possibly a pure polishing agent so that, as a result, the upper surface 20 and 21 will be smooth.

**[0037]** After grinding to the desired surface structure, the ground surface is sealed with a protective paint, a wax or the like, whereafter a possible further polishing takes place.

## Claims

1. A method for the production of a flooring resting on a sub-floor and comprising the steps of:

   providing the sub-floor (1) with a first layer (2) of liquid or paste binder,

   spreading a layer of aggregate material (3) over the binder (2),

   allowing the binder (2) to dry or set so that the individual pieces or particles of aggregate material (3) are bonded therein,

   spreading a second layer of liquid or paste binder (9) over the first (2) and the aggregate material (3) bonded therein,

   spreading a second layer of aggregate material (11) over the second layer of binder (9),

   allowing the second layer of binder (9) to dry or set, and,

   grinding the flooring to flatness and evenness,

   **characterised in that**

   prior to the drying or setting of the second layer of binder (9), the aggregate material (11) in the second layer is processed mechanically for removing air and for orienting the individual pieces or particles of aggregate material so that these are at least partly caused to turn with sharp edges (13) and jagged tips (13) and portions facing away from the top surface of the impending flooring (2, 3, 9, 11).

2. The method as claimed in Claim 1, **characterised in that** the sub-floor (1) is, prior to the application of the first layer of binder (2), adjusted in respect of flatness.

3. The method as claimed in Claim 2, **characterised in that** the adjustment is carried out using a cement-based screed.

4. The method as claimed in any of Claims 1 to 3, **characterised in that** the ground flooring (2, 3, 9, 11) is provided with an upper protective and sealing layer.

5. The method as claimed in any of Claims 1 to 4, **characterised in that** use is made of the same type of aggregate material in the first (3) and in the second (11) layers.

6. The method as claimed in any of Claims 1 to 5, **characterised in that** use is made of the same type of binder in the first (2) and in the second (9) layers.

7. The method as claimed in any of Claims 1 to 6, **characterised in that** the aggregate material (3) in the first layer is kept with the individual pieces or particles in a random orientation.

8. The method as claimed in any of Claims 1 to 7, **characterised in that** the pieces (11) or particles of aggregate material are, during the mechanical processing, subjected to forces which are substantially directed parallel with the plane of the flooring (2, 3, 9, 11).

9. The method as claimed in any of Claims 1 to 8, **characterised in that** the pieces (11) or particles of aggregate material are, during the mechanical processing, subjected to forces which are substantially directed towards the sub-floor (1).

10. Flooring resting on a sub-floor (1) and comprising:

    a lower layer of binder (2) with pieces or particles of an aggregate material (3) bonded therein,

    an upper layer of binder (9) with pieces or particles of an aggregate material (11) bonded therein, and

    a protective and sealing layer on the top side of the flooring (2, 3, 9, 11),

    **characterised in that**

    the pieces (11) or the particles of aggregate material bonded by the upper layer of binder (9) are at least partly oriented with projecting edges (13), jagged tips
    (13) and portions turned to face away from the

top side of the flooring (2, 3, 9, 11).

**11.** The flooring as claimed in Claim 10, **characterised in that** the pieces (3) or particles of aggregate material bonded by the lower layer of binder (2) are randomly oriented.

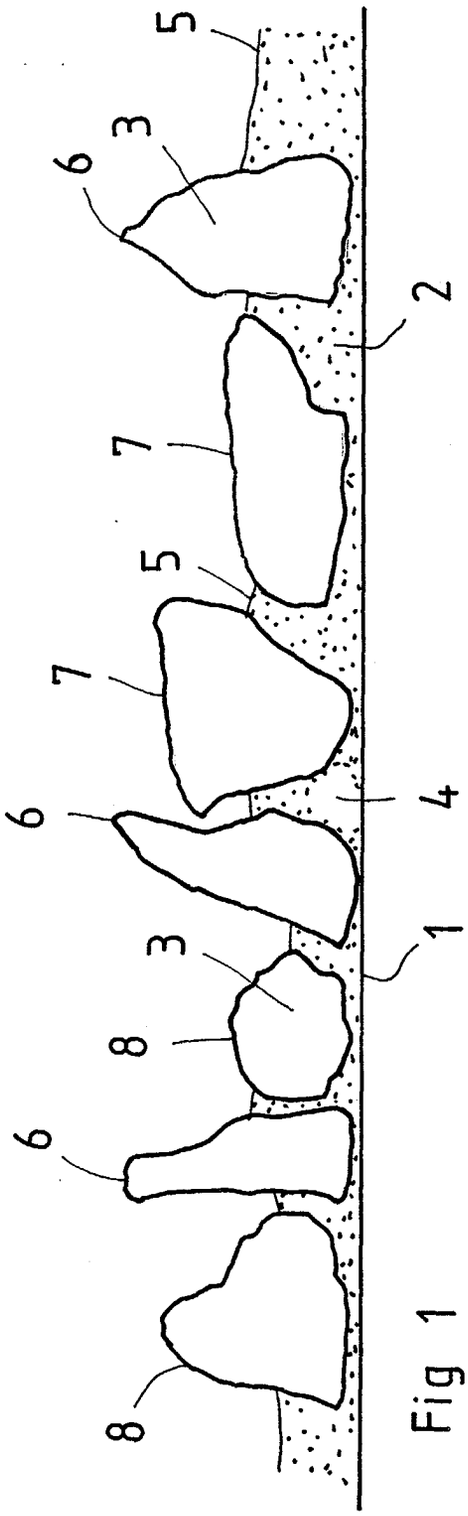


Fig 1

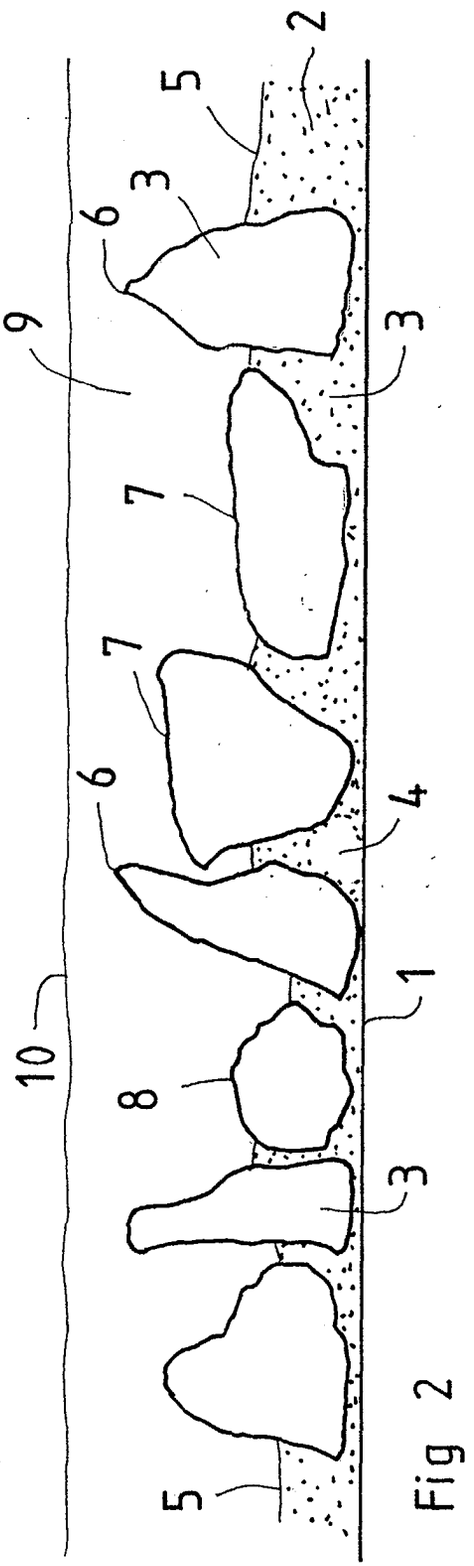


Fig 2

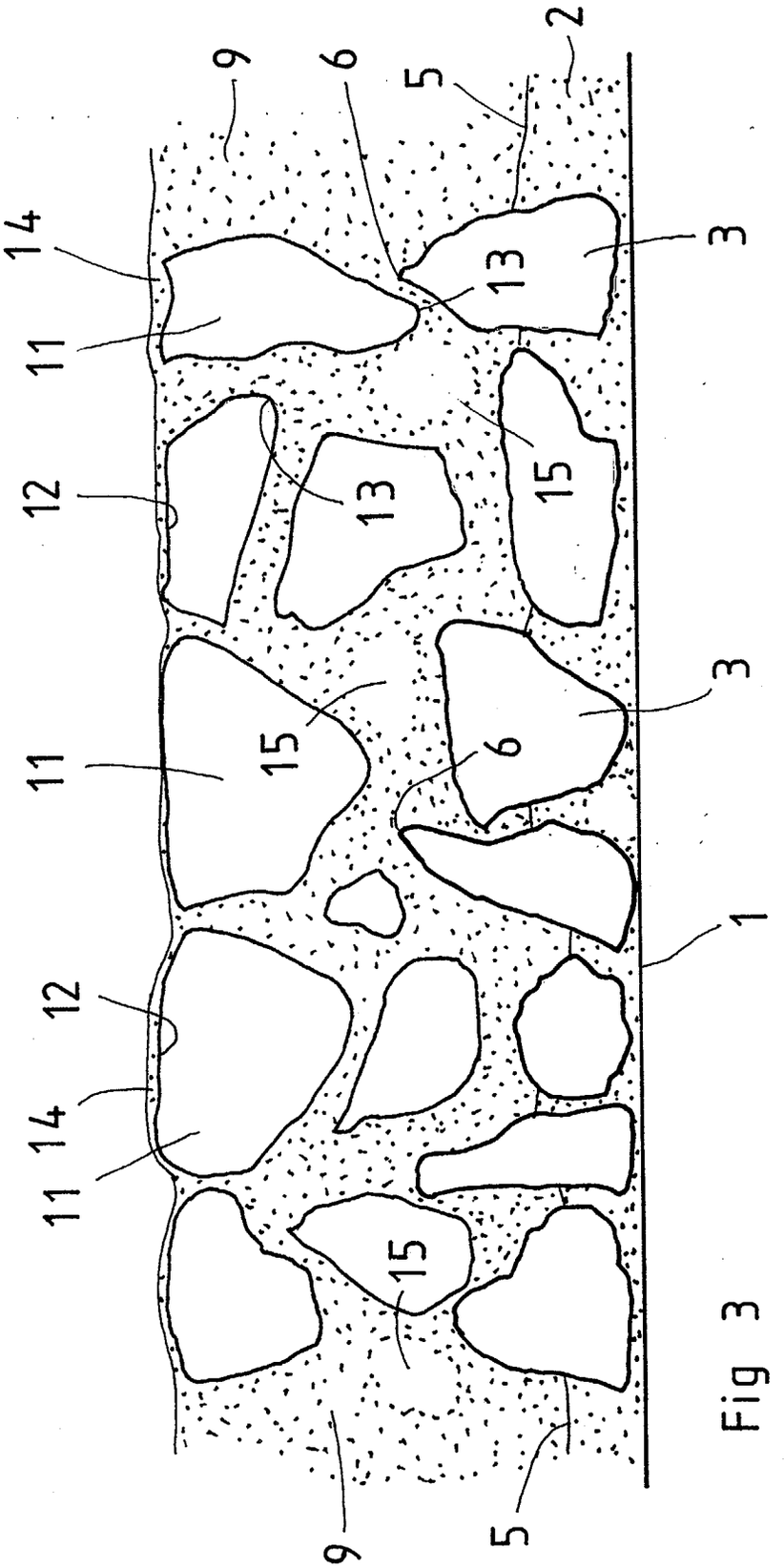


Fig 3

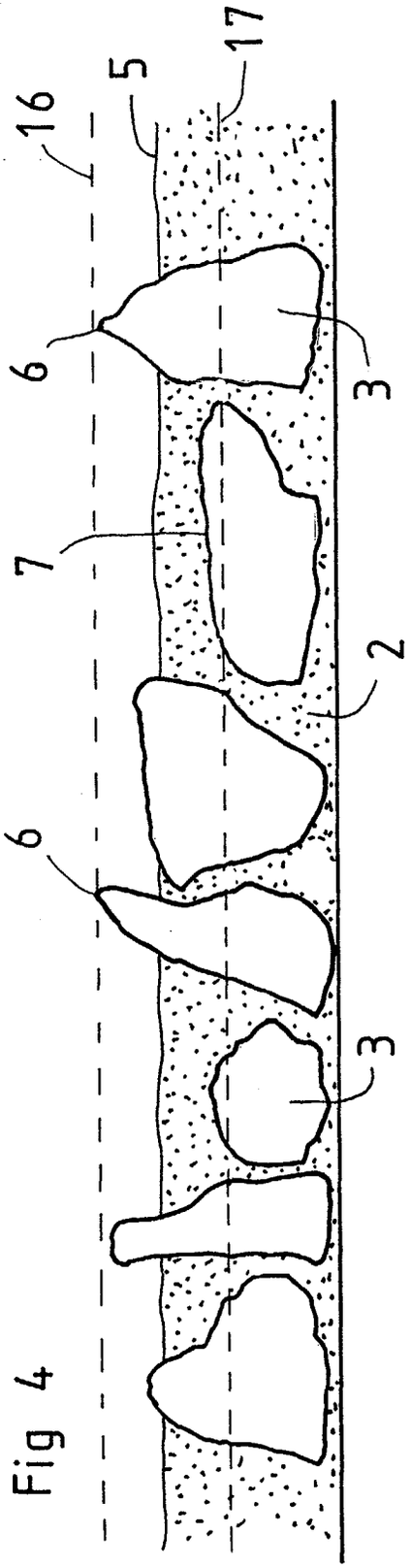


Fig 4

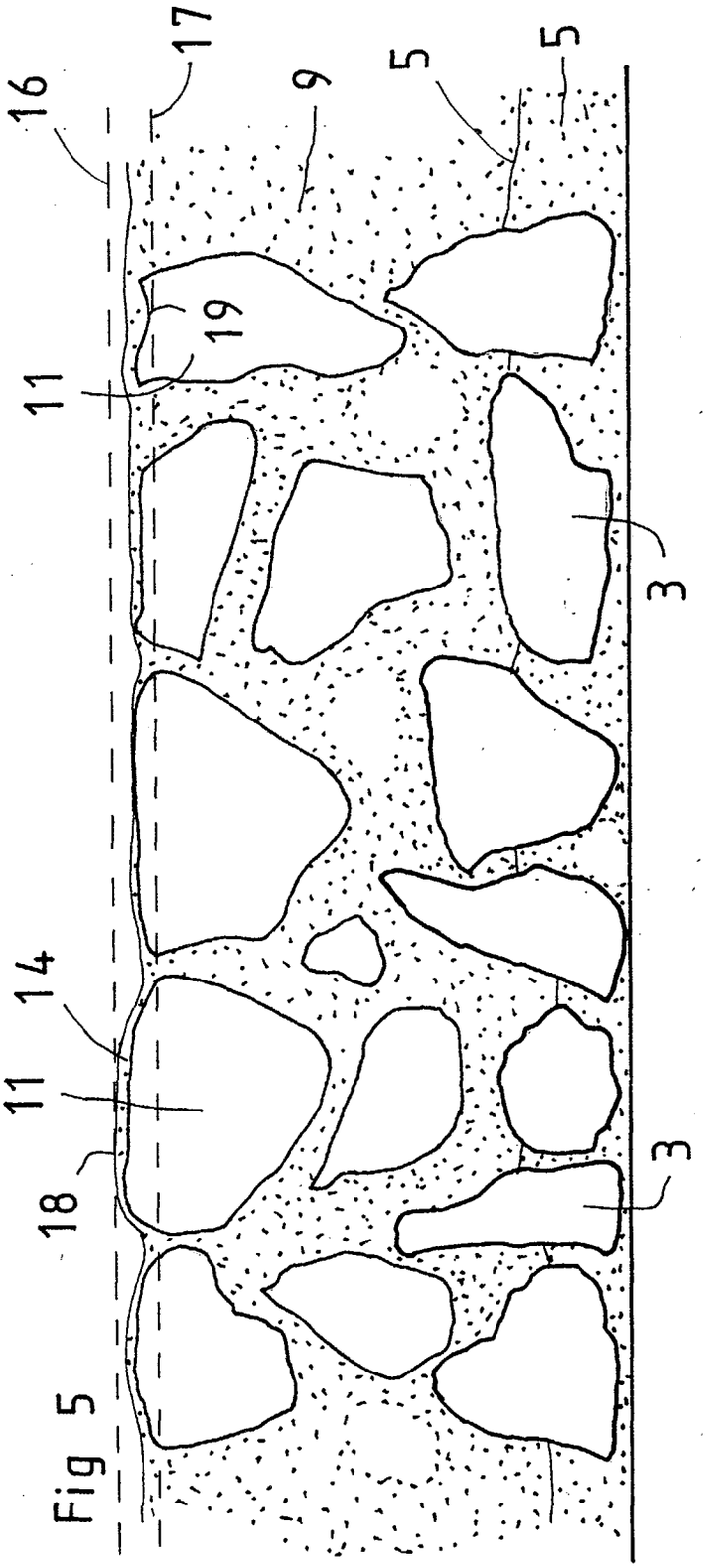


Fig 5

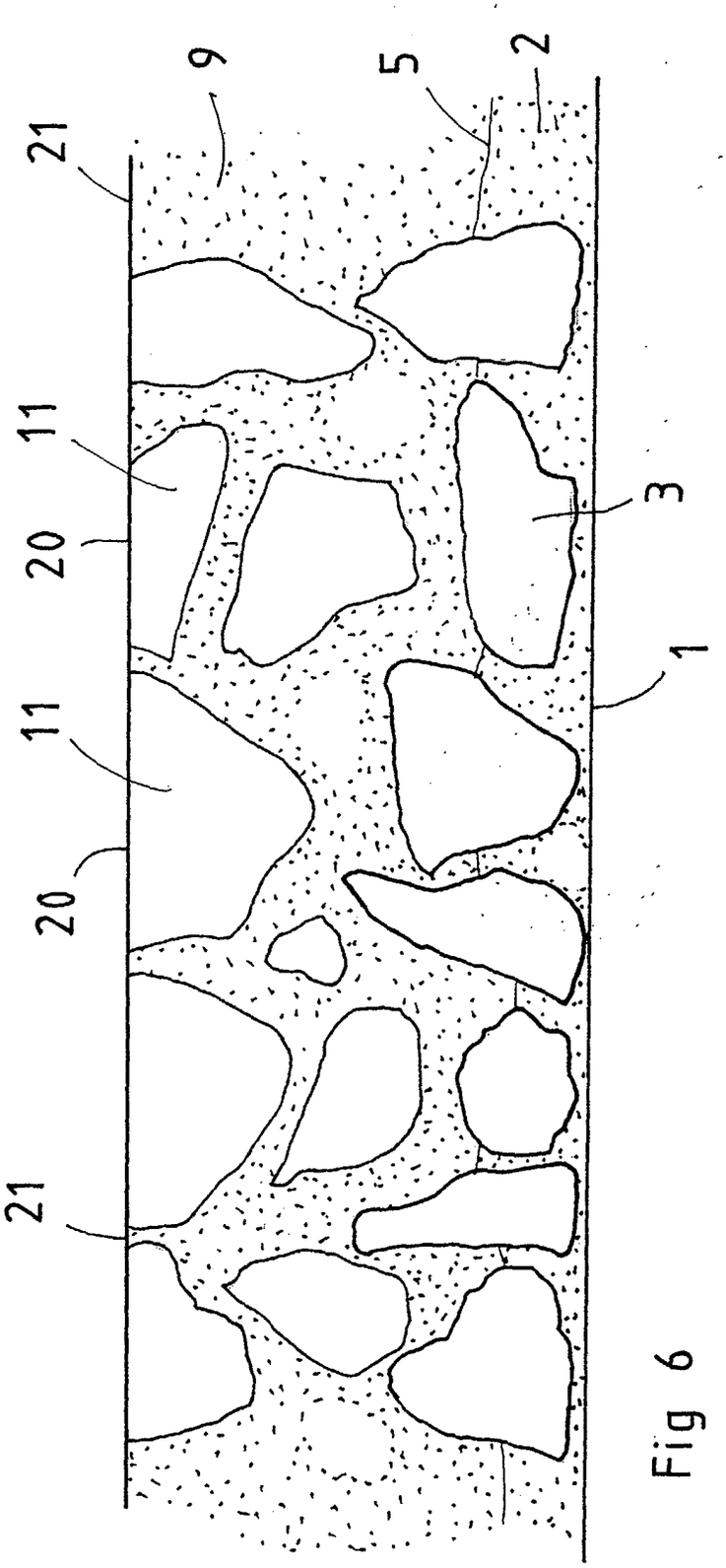


Fig 6

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# EUROPEAN SEARCH REPORT

Application Number
EP 04 07 5677

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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| MUNICH | 3 June 2004 | Bouyssy, V |

CATEGORY OF CITED DOCUMENTS

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# EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
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CATEGORY OF CITED DOCUMENTS

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 07 5677

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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