(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 913 524 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
06.05.1999 Bulletin 1999/18

(51) Int. Cl.[6]: **E01C 13/04**

(21) Application number: **98120552.9**

(22) Date of filing: **30.10.1998**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **03.11.1997 IT TO970963**

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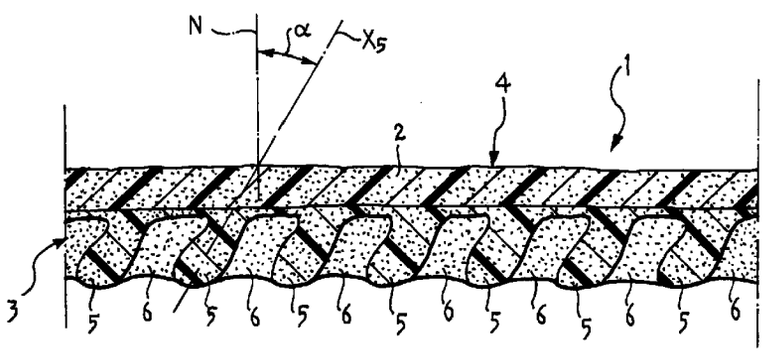
(54) Flooring having differential flexibility

(57) The flooring (1), preferably intended for use in the formation of athletics tracks, includes a tread layer (2) extending in a given plane, together with support formations (5, 6) extending from the said tread layer in a respective direction of extension. At least some of the said support formations (5) extend with their respective direction of extension inclined with respect to the plane of the tread layer. The flooring (1) also has characteristics of resilience that are differential according to the ways in which stress is applied.

FIG. 2



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Description

[0001] The present invention concerns flooring according to the preamble of Claim 1.

[0002] Flooring of the kind indicated above has, over the years, been widely used in widely differing applications. A particularly extensive sector of use is sporting or athletics floorings, the two terms in question being used here in their widest sense so as to include installations such as gymnasiums, fitness or medical centres, consulting rooms and the like.

[0003] Figure 1 illustrates, in an ideal vertical transverse section, a flooring according to the prior art. In particular, it shows flooring sold by the Applicant under the commercial name SPORTFLEX SUPER X™. This flooring has been widely used, for example, for athletics tracks and the like.

[0004] The flooring in question is constituted by a generally laminar or sheet-like structure 1, in which it is possible to distinguish:

- a tread layer 2 intended to face upwards with the flooring 1 in its forward orientation, and
- a set of support formations 3 having a structure that can be defined generally as pendunculate.

[0005] In practice, the flooring 1 is produced, for example, from mixtures of isoprene rubbers in one or more successive calendering operations. In this way it is possible to give the upper face 4 of the tread layer 2 a generally corrugated form, the primary function of which is to prevent slipping. The set of support formations 3 is usually a reticular structure comprising a transverse grid formed by a set of transverse ribs 5 connected to each other by a longitudinal grid formed by respective orthogonal ribs 6 substantially comparable to formations which extend in the form of bridges connecting adjacent ribs 5. The term "transverse" is intended here to refer to the preferred direction of running or walking on the flooring 1 which - usually - also corresponds to the direction in which the calendering operation is carried out.

[0006] In the particular arrangements according to the prior art, as illustrated in Figure 1, the height or depth of these bridges 6 (with reference to the general plane of the tread layer 2) is slightly less than that of the transverse ribs 5. In this particular embodiment, the ribs 5 thus constitute a kind of principal grid in the reticular structure of the formations 3, while the bridges 6, usually aligned to form respective longitudinal ribs of the flooring, orthogonally of the transverse ribs 5, constitute a kind of strengthening reinforcement. Bearing in mind that this is, however, identically applicable to the arrangement according to the invention, it can be stated that this particular configuration of the support formations 3 constitutes a preferred, although not an obligatory, choice. In fact, flooring exists according to the prior art in which the aforesaid support formations 3 are in the form of a uniform, regular structure (with ribs 5 and 6 of equal height) or, in general terms, as sets of isolated peduncular support formations, not configured as continuous or substantially continuous ribs.

[0007] It is also noted (this consideration also applies in an identical way to the invention which will be better described below) that producing the tread layer 2 from a material substantially similar to, although usually with a different formulation from the material constituting the support formations 3, is not imperative. For example, the tread layer 2 can be formed from a material that is completely different from that of the support formations 3, for example, in the form of a sheet of rigid or substantially rigid material.

[0008] An important characteristic of the flooring according to the invention considered here is that the resilience (usually understood in the sense of an elastic resilience) of the flooring 1 which is intended to be laid on a rigid foundation such as, for example, a layer of asphalt, bitumen or cement, is dictated primarily by the resilience of the support formations 3.

[0009] The term "primarily" is intended to mean that, even in an arrangement such as that illustrated in Figure 1, the characteristics of the tread layer 2 can have a certain bearing on the resilience of the flooring 1, this being largely dictated by the resilience of the support formations 3.

[0010] In practice, the formations in question (this applies both to the transverse ribs 5 and the longitudinal ribs 6) all lie with their principal direction orthogonal to the general plane of the tread layer 2. From the point of view of resilience, they operate as elastic elements similar to compression springs interposed between the tread layer 2 and the foundation on which the flooring 1 is laid.

[0011] The characteristics of a flooring of the type described above can be identified in a quantitatively precise manner by applying the elastic impact test of the DIN standard 18035/6. This standard, together with the DIN standard 18032/2, enables a parameter, KA (an abbreviation of the German word Kraftabbau), to be defined. This coefficient corresponds substantially to a characterisation, in percentage terms, of the behaviour of the flooring when subjected to a weight of standardised dimensions falling onto it, with reference to the behaviour manifested as the result of the same stress on a rigid surface, typically made of cement.

[0012] Flooring for sporting use, especially for athletics tracks, usually have a KA coefficient lying between about 35 and 50%. This range of values is particularly required by the text "Track and Field Facilities Manual", edited by the International Amateur Athletic Federation (1995 edition). The lower value of the aforesaid range corresponds to flooring characterisable as rather "hard", while the upper limit corresponds to flooring that is rather "soft" when comparing the stresses of walking or running.

[0013] Referring, for simplicity, to the production of athletics tracks (it is, however, noted once again that the

applicability of the invention is not limited to this field), flooring according to the prior art, as illustrated in Figure 1, behaves in a substantially uniform manner independently of the specific way in which stress is applied or, more specifically, of its interaction with the body of the athlete.

[0014] The interactions are usually very different, for example, depending on the discipline practised and/or the style of running adopted. For example, a long or middle distance runner usually adopts a running style in which each step involves a complete cycle of contact (heel-sole-toes) of the foot. On the other hand, the sprinter or jumper, such as the long jumper or triple jumper, adopts a running profile that is extended forward with an interaction of the foot with the track that is practically limited to the toes only, with a very short foot-track contact time in comparison with the contact time typical of the long distance runner.

[0015] It follows from this that, for example, an athletics track formed with flooring of the type illustrated in Figure 1 must necessarily reconcile the various requirements in terms of flexibility, having to match the requirements of, for example, long or middle-distance runners, who generally like a fairly soft flooring so as to limit fatigue of the joints consequent on a long run, and the demands of sprinters or jumpers who, on the other hand, tend to like a fairly hard track to optimise the transmission of the propulsion forces exerted by the athlete on the ground. In general, however, all athletes like to be able to carry out their warm up runs on a very soft base so as to avoid tiring their joints and muscles.

[0016] The object of the present invention is to produce flooring of the type indicated above that is fully capable of satisfying these requirements that are, in themselves, contradictory.

[0017] According to the present invention, this object is achieved by flooring having the characteristics defined in the following claims.

[0018] The invention will now be described, purely by way of non-limitative example, with reference to the accompanying drawings, in which:

Figure 1, which concerns the prior art, has already been described above;

Figure 2 illustrates, in a sectional view substantially corresponding to the sectional view of Figure 1, the characteristics of flooring produced according to the invention; and

Figures 3 to 5 illustrate different kinds of interaction between the flooring according to the invention and an athlete walking or running on the flooring itself.

[0019] In Figures 2 to 5, the same reference numerals as have already been used with reference to the description of Figure 1 have been used to indicate parts or elements that are identical or functionally equivalent to those already described with reference to Figure 1.

[0020] An exception is made for the different elements referred to specifically in the following description, where the same considerations as indicated above in relation to the flooring of Figure 1, especially as regards the different intended uses and the possible variants in production, apply in identical manner to the flooring according to the invention.

[0021] Therefore, it can be easily be appreciated from a comparison of Figure 1 and Figure 2 that the salient characteristic of the arrangement according to the invention is the fact that at least some of the support formations 3, and especially the ribs 5 (defined above as "transverse"), are not disposed with their principal direction of extension orthogonal to the tread layer 2, but are generally inclined with respect to this plane. The term "direction of extension" naturally means the direction along which the ribs 5 (or, more precisely, their profile in transverse section) extend away from tread layer 2. In particular, the ribs 5 extend with their respective direction of extension - monotonically - oblique with respect to the plane of the tread layer. The term " monotonically" is intended to indicate the fact that the ribs 5 are inclined in the same direction and not in alternate directions.

[0022] More precisely, the ribs 5 are disposed with their general direction of extension X5 forming an angle α with respect to the direction of the normal N with respect to the general plane of extension of the tread layer 2.

[0023] The value of the angle α is chosen from a range which is typically between approximately 25° and 50°, and preferably between approximately 35° and 40°.

[0024] The values indicated above correspond to choices identified following a first set of experimental tests made by the Applicant. The exact value from time to time adopted (to be understood in general terms as an average value of inclination, in that, variations in the value of the angle α from rib to rib 5 can arise in the production process) can be determined selectively as a function of the specific manners of use envisaged for the flooring.

[0025] The precise criteria for this choice can be better understood by referring to the different user/flooring interactions, illustrated with reference to Figures 3 to 5.

[0026] It will be recalled that flooring of the type illustrated in Figure 2 can be produced using the same materials as are currently used to produce similar floorings according to the prior art, utilising a simple calendering procedure or a multi-stage procedure generally identical to those utilised for the production of floorings according to the prior art. The result of providing the ribs, in particular, the longitudinal ribs 5 (in the embodiment illustrated here, it is supposed that the longitudinal ribs 6 maintain their generally orthogonal extension with respect to the tread layer 2) with the desired angle can be obtained, according to an arrangement tested satisfactorily by the Applicant, simply by providing the calendering roller for embossing the design on the support ribs 3 with channels or tracks corresponding with and complementary to the ribs 5, with their principal direc-

tion of extension, in the sense of their depth, oriented in a direction at least generally inclined with respect to the respective diameter of the calendering roller.

[0027] In general, for the production of flooring according to the invention, reference can be made to the criteria and principles conventionally adopted for the production of sports floorings. In this respect, reference may usefully be made, for example, to the appendix entitled "I.A.A.F. Performance Specifications for Synthetic Surfaced Athletics Tracks (Outdoor)" contained in the manual edited by the I.A.A.F., already indicated above, and to the technical requirements of the DIN standard 18035/6. These criteria and principles do not require explicit explanation here.

[0028] By way of non-limitative example, the flooring 1 illustrated in Figure 2 can have the following characteristics:

- depth (measured between the surface 4 of the tread layer 2 and the foundation L in the absence of stress): 13mm;
- depth of the tread layer: typically 6-7mm;
- number of ribs 5 per unit of length: 80-100/metre;
- width of the section of the ribs (measured orthogonally to the median axis): approximately 7mm.

[0029] Figure 3 illustrates schematically the response of flooring according to the invention to a force applied in a generally vertical direction. This may be, for example, the force applied by an athlete running on the flooring 1, adopting the pace usually adopted by long or middle distance runners. In particular, Figure 3 illustrates the interaction of the heel of the foot of such an athlete, which descends vertically onto the flooring 1, compressing it against the rigid substrate L on which the flooring is laid. Substantially similar behaviour is also seen when the entire sole of the foot is set down vertically on the flooring 1.

[0030] The consequent elastic deformation (the resilient behaviour) of the flooring 1 is significantly determined more by the flexing of the ribs 5 with respect to their principal axis of extension, than by the longitudinal compression thereof. This fact is entirely understandable since, in the situation illustrated in Figure 3, the deformation stress of the flooring 1 translates into a bending moment applied to the ribs 5 constituting the transverse grid of the support formations 3.

[0031] The rather soft nature of the flooring derives from this.

[0032] For example, tests conducted by the Applicant show that flooring produced according to the invention (therefore, with the main ribs 5 inclined with respect to the tread layer 2) using dimensions of the ribs 5 corresponding to those of a flooring according to the prior art, but with the ribs 5 orthogonal with respect to the tread layer 2, has, with respect to this latter, a value for the coefficient KA that is approximately 5% greater in absolute terms. In other words, if flooring according to the prior art (Figure 1) has a value for KA equal to approximately 35-37%, flooring formed according to the invention with transverse ribs 5 substantially of the same size but inclined with respect to the tread layer has, with respect to the tread layer, a value of KA (always measured according to the DIN standard 18035/6) equal to 40-42%.

[0033] On the other hand, Figure 4 illustrates schematically the behaviour of flooring 1 according to the invention when subjected to a force of the type imparted by a sprinter or jumper running on the flooring 1. This is usually at a very fast pace such that the athlete in practice runs on his toes, applying to the flooring 1 (by means of the friction of the sole of the shoe, possibly enhanced by the spikes that are usually present on the athlete's shoes penetrating the body of the flooring) a stress that is no longer orthogonal, but inclined with respect to the plane of the tread layer 2.

[0034] The aforesaid values of the possible inclination of the ribs 5 (values of the angle α of Figure 2) correspond in a complementary manner to the typical values of the inclination of the aforesaid stress deriving from the forward inclination adopted by the athlete while running.

[0035] Due to the consequent alignment - or substantial alignment - of the direction of the force applied by the athlete with the direction of inclination of the ribs 5, the force deforming the flooring 1 translates substantially into a longitudinal force along the ribs 5. Longitudinal force naturally means a force substantially aligned with the direction of maximum extension (of the section profile) of the ribs 5.

[0036] When subjected to a force as illustrated in Figure 4 (that is, in practice, with a direction of running such that the ribs 5 extend from the tread layer 2 "backwards" with respect to the direction of running), the flooring 1 is generally harder than when the force is applied according to the modality of Figure 3.

[0037] In practice, tests conducted by the Applicant show that the same flooring which, when subjected to a force according to the typical manner of the DIN standard 18035/6 (in practice, according to the manner of use of Figure 3) has a value of KA equal to approximately 40-42% while, if utilised according to the modalities illustrated in Figure 4, characterised of resilience substantially comparable to that shown experimentally by running on a flooring produced according to the prior art with a value of KA equal to approximately 35-37%.

[0038] From the above, it can be concluded that the flooring according to the invention has characteristics of differential resilience, demonstrating the desired "softness" to the step of a long or middle-distance runner, and the desired "hardness" to the rapid pace of a sprinter or jumper who takes a run up, for example, for a long jump or triple jump.

[0039] Figure 5 illustrates the behaviour of flooring 1 according to the invention when subjected to stress in yet further different ways, in particular, with a direct run

in the opposite direction to the direction referred to in Figure 4.

[0040] Figure 5 illustrates a method of running substantially similar to that of Figure 4 but in the opposite direction, that is, such that the ribs 5 extend from the tread layer 2 "forwards" with respect to the direction of running. Consequently, Figure 5 also relates to running "on toes". In this case, however, the stress applied to the flooring is inclined with respect to the tread layer 2 in a direction which tends to be substantially orthogonal with respect to the principal direction of extension (of the section profile) of the ribs 5.

[0041] Under these conditions, the aforesaid ribs are stressed more or less exclusively flexed, with a bending stress preferably localised at the base or proximal part of the ribs 5 themselves. According to the preferred embodiment of the invention, this is the zone in which the ribs 5 have the smallest transverse section. This fact can clearly be seen in the various figures, and particularly in Figure 2 where the "tear-drop" shape of the section of the ribs 5 is illustrated.

[0042] In the conditions of use of Figure 5, the flooring 1 is at least slightly softer than that in the stress conditions of Figure 3, while being stressed in ways typical of a fast run. The modality of use demonstrated in Figure 5 lends itself to being used in excellent manner, for example, during warm up runs when the athletes wish to limit the fatigue of the joints. To this end, it is possible to envisage laying, next to a track for the competitions (with the ribs facing "backwards" with respect to the direction of running), a portion of warm up track in which the ribs 5 are facing in the opposite direction. Alternatively, in an even simpler manner, the athletes can utilise the same competition flooring as a warm up track by running it in the opposite direction to the direction of running adopted during the competitions.

[0043] It is entirely clear that the effect of providing the flooring 1 qualities of differential flexibility can be achieved in different ways from that adopted in the particular embodiment illustrated here, in which this effect is obtained by inclining the principal direction of extension (of the transverse section profile) of the ribs 5. Therefore, to give by way of example some possible embodiments of the invention, the inclined support formations could take the form, at least in part, of individual feet having their axes inclined with respect to the tread layer, or they could be constituted by shorter ribs, for example, distributed in a stepped arrangement on the lower face of the tread layer. Again, although the above description referred to the possibility of providing a variation in the flexibility of the flooring in a single direction (in practice, orthogonal to the direction of extension of the ribs 5), the same effect could be pursued in several directions. It follows that, with the principle of the invention remaining the same, the details of construction and the embodiments can be widely varied with respect to that described and illustrated, without by this departing from the ambit of the present invention.

Claims

1. Flooring (1) comprising a tread layer (2) extending in a given plane and support formations (5, 6) extending from the said tread layer (2) in respective directions of extension (X5), characterised in that at least some of the said support formations (5) extend with their respective direction of extension (X5) monotonically inclined with respect to the plane of the tread layer (2).

2. Flooring according to Claim 1, characterised in that at least some of the said support formations (5) extend with their respective direction of extension (X5) forming an angle of between approximately 25° and 50° with respect to the normal (N) to the tread layer (2).

3. Flooring according to Claim 2, characterised in that at least some of the said support formations (5) extend with their respective direction of extension (5) forming an angle of between approximately 35° and 40° with respect to the normal (N) to the tread layer (2).

4. Flooring according to any preceding claim, characterised in that the said support formations (5, 6) are distributed as at least a first and second grids, respectively transverse (5) and longitudinal (6) with respect to a principal direction of use of the flooring (1), and in that at least some of the said support formations (5) extending with their respective direction of extension inclined with respect to the plane of the tread layer (2) are comprised in the said transverse grid (5).

5. Flooring according to any preceding claim, characterised in that the at least some of the said support formations (5) are produced in that form of ribs extending from the said tread layer.

6. Flooring according to Claim 5, characterised in that the said ribs are substantially continuous ribs.

7. Flooring according to Claim 4 and Claim 6, characterised in that the said substantially continuous ribs (5) are comprised in the said transverse grid, while the said longitudinal grid (6) comprises elements extending in the form of bridges between adjacent ribs.

8. Flooring according to Claim 7, characterised in that the said elements extending in the form of bridges (6) are arranged as respective longitudinal ribs.

9. Flooring according to Claim 4, characterised in that the support formations of the said longitudinal grid (6) have a height, with reference to the said given

plane of the tread layer (2), less than the comparable height of the support formations of the transverse grid (5).

10. Flooring according to any preceding claim, characterised in that the said at least some of the said support formations (5) have a proximal part constituting a portion with a smaller transverse section than the support formations (5) themselves.

11. Flooring according to any preceding claim, characterised in that at least the said support formations (5, 6) are constituted by an elastomeric mass.

12. Flooring according to Claim 11, characterised in that both the said tread layer (2) and the said support formations (5, 6) are constituted by an elastomeric mass.

13. Flooring according to any preceding claim, characterised in that at least the said tread layer is constituted by a mass of calendered material.

FIG. 1 *PRIOR ART*

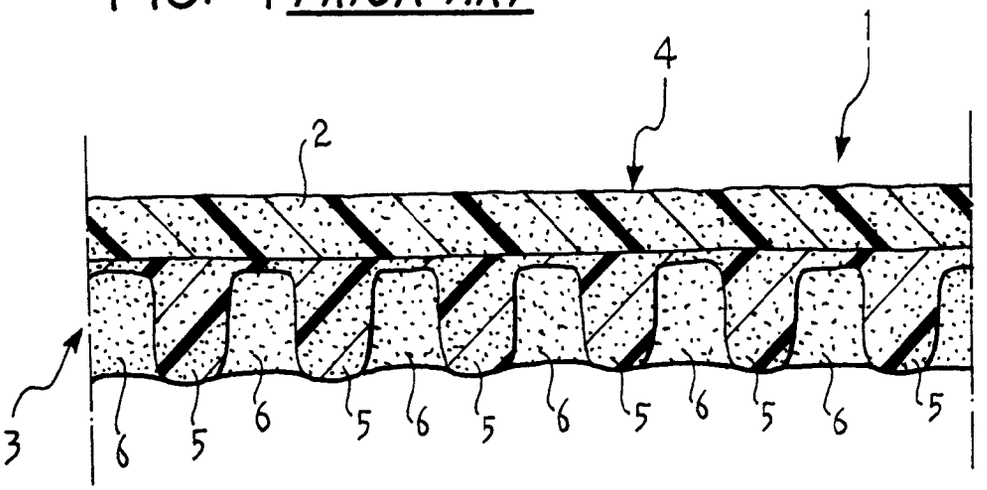


FIG. 2

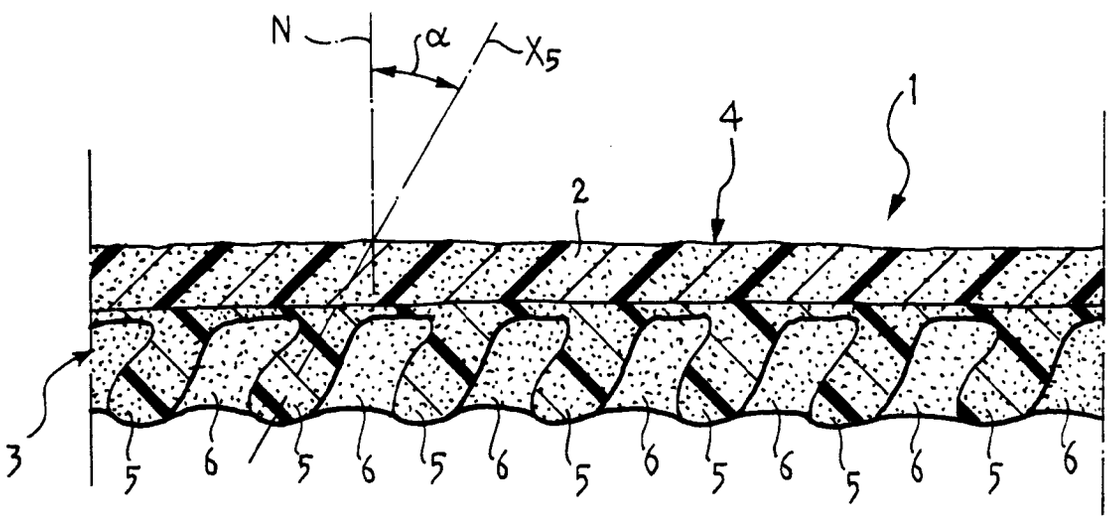


FIG. 3

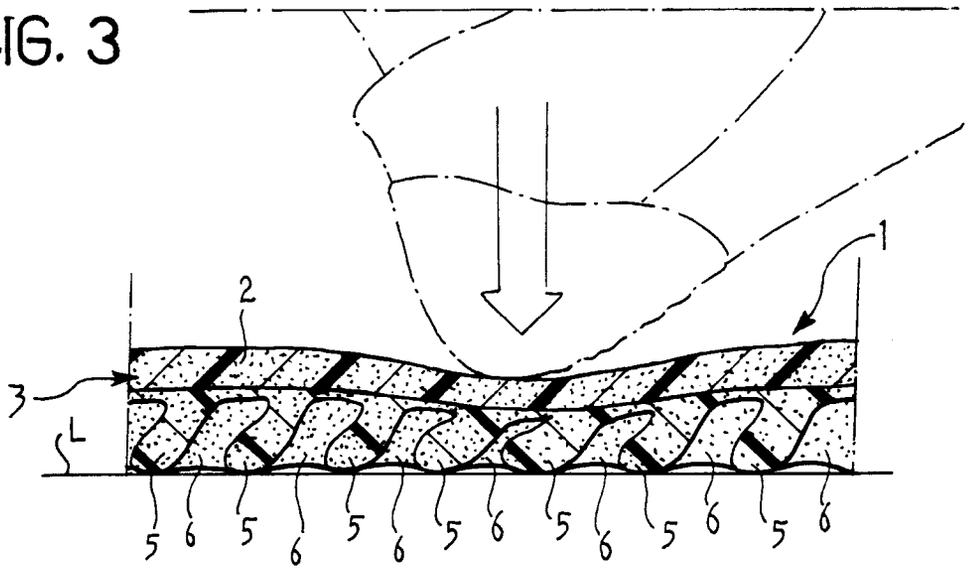


FIG. 4

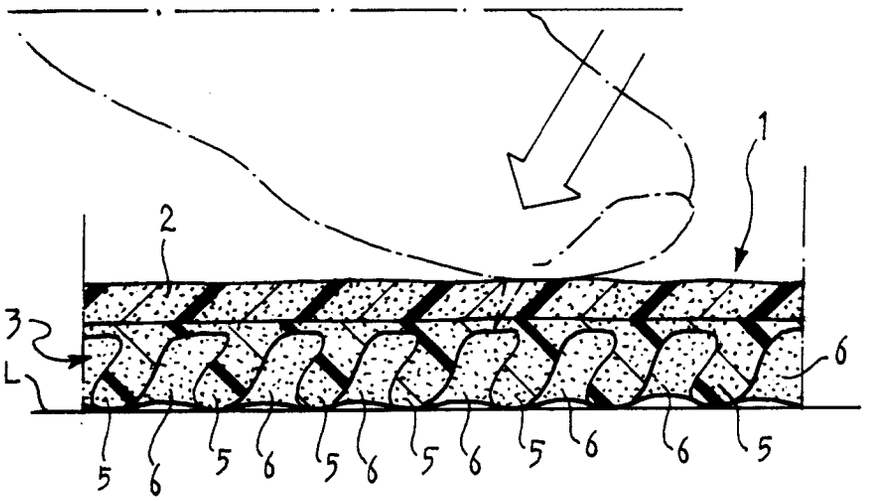
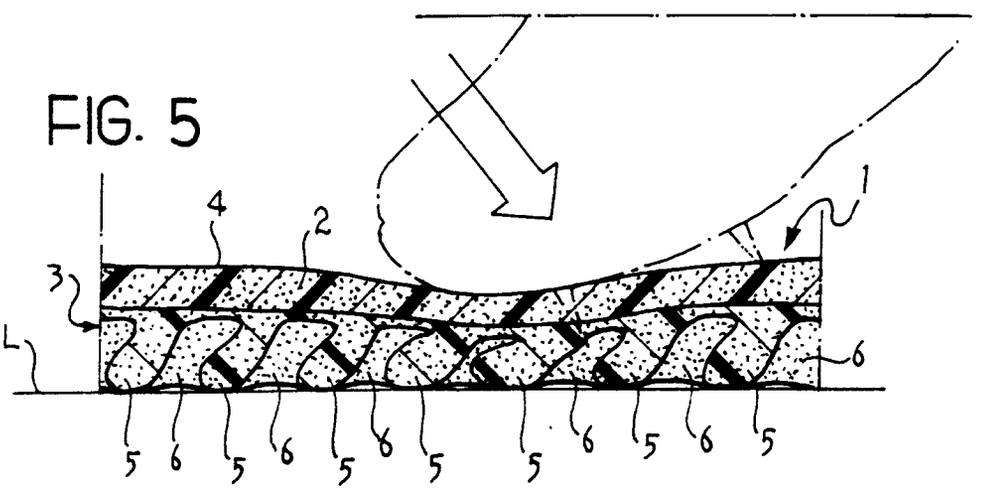


FIG. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 98 12 0552

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.6)
X Y	US 1 628 090 A (WEISS) 10 May 1927 * the whole document *	1,2,5,6, 11,12 4,7-10, 13	E01C13/04
Y	US 3 795 180 A (LARSEN R) 5 March 1974 * figures *	4,7-9	
Y	US 5 234 738 A (WOLF TOM H) 10 August 1993 * figure 2 *	10	
Y A	DE 28 25 956 A (TBS SARL) 4 January 1979 * page 8, line 16 - line 26 *	13 1,11,12	
A	WO 95 19822 A (AMARIT AG ;JANK WERNER A (CH)) 27 July 1995 * the whole document *	1,2	
A	EP 0 140 354 A (KEMPE WALTER) 8 May 1985 * figure 5 *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

E01C
E04F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	4 February 1999	Dijkstra, G

CATEGORY OF CITED DOCUMENTS

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04-02-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 1628090 A	10-05-1927	NONE	
US 3795180 A	05-03-1974	NONE	
US 5234738 A	10-08-1993	NONE	
DE 2825956 A	04-01-1979	FR 2408686 A	08-06-1979
		FR 2411267 A	06-07-1979
		BE 868075 A	02-10-1978
		CH 624166 A	15-07-1981
		LU 79802 A	07-12-1978
		NL 7806259 A	18-12-1978
WO 9519822 A	27-07-1995	CH 687715 A	31-01-1997
		AT 155354 T	15-08-1997
		AU 1309095 A	08-08-1995
		DE 59500386 D	21-08-1997
		EP 0690737 A	10-01-1996
		ES 2108562 T	16-12-1997
		US 5749787 A	12-05-1998
EP 0140354 A	08-05-1985	DE 3339553 A	15-05-1985
		AT 33412 T	15-04-1988
		DE 3470333 A	11-05-1988

EPO FORM P0459

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