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(72) Inventor; and
(71) Applicant : **HANAK, Josef** [CZ/CZ]; Snovidky 126, 68 334 Nemotice (CZ).

(74) Agent: **MUSIL, Dobroslav**; Cejl 38, 602 00 Brno (CZ).

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— *of inventorship (Rule 4.17(iv))*

[Continued on next page]

(54) Title: THE INSOLE

(57) Abstract: The insole (1) from the upper side provided with shaping corresponding to the form of impression of bottom part of a human foot sole with recess (5) for the big toe joint with smooth toe section (10), and from the bottom side with shaping corresponding to the bottom part of a human foot sole with smooth toe section (10), while it in a flexible manner supports all parts of the foot sole between the toe section (10) and the heel section (1000). In the heel section (1000) there is performed recess (1201) or depression (120), in which the heel recession (12) is performed.

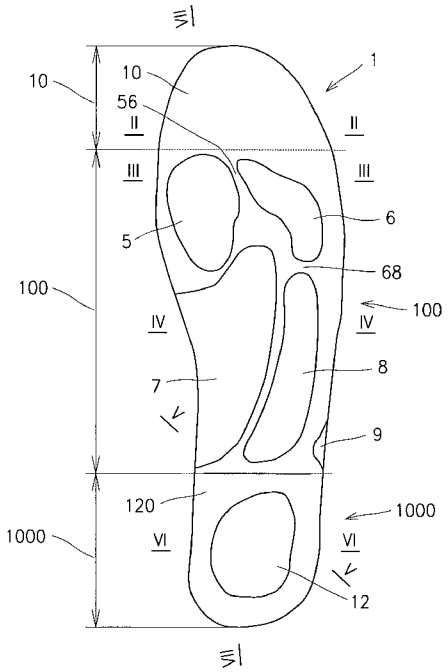

Fig. 1A

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The insole

Technical field

The invention relates to an inserting insole from the upper side provided with shaping corresponding to the form of impression of bottom part of a human foot sole with smooth toe section, and from the bottom side with shaping corresponding to bottom part of a human foot sole with smooth toe section.

The invention also relates to a stretching insole from the upper side provided with shaping corresponding to the form of impression of bottom part of a human foot sole with smooth toe section.

Background art

At present, several different types of inserting or stretching insoles are used, which should in a most comfortable and suitable manner act upon the human foot, to render it the most ideal support, and in some cases also to stimulate some of the ceptors being in the foot sole.

The solution according to DE 3406504 belongs to representatives of this group, where the insole besides others comprises a layer formed by a cork pulp with a soft binding, which during wearing adjusts to the form of a bottom section of user's foot. Also JP 2001299408 deals with a similar solution, where one of the insole layers is made of cork, which after a longer wearing adjusts to the form of bottom surface of the human sole. Nevertheless both these solutions have their disadvantages when to the most substantial belongs the fact that if the user has a foot which is unsuitably shaped, e.g. the flat-foot, or he treads fully on one's foot in an unsuitable manner etc., the insole shapes itself so that at a further wearing it impairs this defect instead to eliminate it, or at least not to support this defect, and so to improve the quality of user's tread.

Another way how to adjust the insole to the form of a human foot is to create a relief on an upper surface of the insole which is in contact with a human foot, at the same time this relief by its form and arrangement rather

corresponds to the form of the sole. The solution according to GB 1491489 or according to JP 7039402 belongs among such solutions, when a surface of the insole is shaped by means of a system of protrusions and dimples. The disadvantage of such solutions is that these insoles are shaped in accordance with a unified form of human foot, hence disregarding an individual shaping, which features especially in a diversity of forms and inclination of toes so that in this case the toes of a foot adjust to the structure of the insole while it should happen, in fact, vice versa. Usage of such insoles is therefore not suitable, moreover not comfortable.

The structure of insoles of both described types results in that during their usage – during walking, but also during sporting all the muscles of lower limbs are not engaged ideally, neither the weight of a human body is not distributed ideally between the big toe joint, little toe joint and the heel bone. Weight of the body at these embodiments on each leg is distributed into three supports, among the big toe joint, little toe joint and the heel bone, as represented in the Fig. A by means of crosses. In the points of supports of the foot sole created on the insole the foot sole is supported in a fixed manner. Due to this even at a healthy man with normally shaped foot this leads to an excessive loading of some muscles or ligaments of a foot sole, thus to atrophy and shortening of other not used muscles, to an excessive loading of the big toe joint, and in some cases also to an injury of vascular system in a transversal and longitudinal instep of the bottom sole of a foot, the result of which is not only an abnormal tiredness, but also further physical, possibly even psychic problems, that become worse with the age.

These disadvantages are remedied by the insole according to the CZ patent 298894, or according to analogical application of European patent EP 07466013.5, which from the upper side is provided with shaping corresponding to the shape of impression of bottom part of a human foot with recess for the toe joint and with a smooth toe section and from the lower side with shaping corresponding to a shape of bottom part of a human foot sole with smooth toe section. This shaping ensures to the user a correct full tread and simultaneously natural engagement of all muscles and ligaments of foot sole, and implicitly also

of the whole lower limb, without excessive loading of bones of the foot sole, its blood system or in it positioned nerves, as the body weight during walking is spread into seven supports, which consist of the toe and all fingers, of the outside lateral section of the foot sole and the heel as it is represented in the Fig. B by means of crosses. The planar toe section at the same time accommodates to individual shaping and sloping of toes, which further considerably increases the quality and comfort of walking. Nevertheless it appears recently, that this insole is advantageous first of all at the user's motion, when the foot sole us dynamically loaded by the weight of a human body – during walking, running or sporting. Its positive effects vice versa partially or totally disappear in cases when the foot sole is loaded statically, thus especially in situations, when the user stands or sits for a longer periods, possibly when he changes periods of sitting or standing with shorter periods of walking, etc. This is typical first of all for sedentary occupations, especially for officials, professional drivers, but also for handicapped people, possibly for standing attendants of various devices, etc. At this static loading there is a different load of the foot sole and its sections when compared with situation with dynamic loading during walking or running, at the same time the Achilles tendon and to it connected peroneuses are released, and on the contrary against it positioned muscles and ligaments of the foot sole are extremely loaded and indirectly also the front tibialis muscle, etc. Hence, during sitting the insole according to the CZ patent 298894 behaves in the same or similar manner as the other to date known insoles and the effects which are acting during walking are not effective in this case.

All the time a greater portion of population suffers ankle offset, problems with knees, hips and similar which are healed operatively. The offset of ankle at children causes walking disability when the child is confined to a wheelchair.

The goal of the invention is to reduce or totally remedy the shortcomings of the background art and to create a suitable insole destined for situations, when the user's foot sole is loaded statically only for a longer time. At the same time the requirement is that this insole does not support an offset of ankle, possibly at least its partial elimination.

Principle of the invention

The goal of the invention has been achieved by the insole according to the invention whose principle consists in that in the heel section of the insole the recess or reduction is performed in which the heel bone depression is created.

Thanks to this the user's heel is positioned under the level of other parts of the foot sole, and so at static loading it is partially stretched which causes loading of Achilles tendon and of other to it related muscles and ligaments, and on the contrary reduction in loading of against it arranged muscles and ligaments of the foot sole. Thanks to this all muscles and ligaments involved are loaded naturally and uniformly, so that the foot sole and ankle and implicitly also the knee are maintained in a natural position without any offset, possibly they through effect of forces between the said muscles and ligaments action in vertical direction.

Further features of the invention are obvious from the dependent claims.

Description of the drawing

Example of embodiment of the insole according to the invention is schematically represented in the enclosed drawings where Fig. 1A shows a view to the upper side of insole provided with depression in the heel section, Fig. 1B a view to upper side of insole provided with recess in the heel section in the place and vicinity of the heel recession, Fig. 2 cross-section II – II of the insole according to Fig. 1, Fig. 3 cross-section III–III through the insole according to Fig. 1, Fig. 4 cross-section IV–IV through the insole according to Fig. 1, Fig. 5A cross-section V–V through the insole according to Fig. 1A, Fig. 5B cross-section V–V through the insole according to Fig. 1B, Fig. 6A cross-section VI–VI through the insole according to Fig. 1A, Fig. 6B cross-section VI–VI through the insole according to Fig. 1B, Fig. 7A cross-section VII–VII through the insole according to Fig. 1A, Fig. 7B cross-section VII–VII through the insole according to Fig. 1B.

The drawings A and B represent a layout of supports of the foot sole at the insoles according to the background art, Fig. A is a common insole, Fig. B is the insole according to CZ 298894.

Examples of embodiment

Execution of the insole will be described on example of embodiment of the independent inserting insole, nevertheless the principle of the invention may fully be applicable also at reconstruction of stretching insoles, possibly also other shoemaker's products.

The insole **1** in its ground plan represented in the Fig. 1 by its shape and size is similar to the shape and size of a human foot sole, it comprises the toe section **10**, which in the represented variant is planar and smooth both from the upper as well as bottom side. The toe section of the insole continues to form the middle section **100**, which further continues to form the heel section **1000** of the insole **1**. The toe section **10** of the insole **1** provides support for toes of the foot sole. The middle section **100** of the insole **1** provides a flexible support both for transversal as well as longitudinal instep of the foot sole, for joints of individual toes and for other parts of the foot sole, and the heel section of the insole provides support to the heel.

As it is obvious from Fig. 2 to 8, the insole **1** in the represented example of embodiment consists of four layers, while the most important is the carrying layer **2**, which is formed of a pressed cork, and in which the shaping of the insole **1** is performed. The carrying layer **2** in the represented embodiment from the bottom side is strengthened with a layer **21** of textile, which is bonded to it. On upper side of the carrying layer **2** there is positioned the dilatation layer **3** made of flexible, easy deformable material, which is further covered with covering layer **4**. The covering layer **4** forms the full-tread section of the insole **1**, which is in contact with the foot sole, and preferably it is made e.g. of genuine leather or other similar material, which is pleasant to touch, and which simultaneously is able to drain away humidity into other sections of the insole and/or footwear, etc. The dilatation layer **3** may also be formed of fibrous

formation of carbon filaments or such formation may be inserted as another layer into the insole.

Through recess in the carrying layer **2** on the upper side **11** of the middle section **100** of the insole **1** there is performed recession **5** of big toe joint, whose positioning and shape correspond to positioning and shape of a big toe joint of human foot sole. The recession **5** of the big toe joint at the same time merges via the elastic support **56** of the transversal instep into the recession **6** of little toe joints, whose positioning and shape correspond to positioning and shape of joints of other toes of a human foot sole, so that it features approximately a kidney-like shape. The recession **6** of little toe joints may in further not represented examples of embodiment be replaced by several recessions, being shaped individually for each joint of other toes of a human foot sole or e.g. for couples of these joints, etc. Due to the arrangement of the big toe joint and joints of other toes on bottom surface of a human foot sole, the recession **5** of the big toe joint is positioned with respect to the tip of the insole **1** higher than the recession **6** of little toe joints, and it is deeper. Greater depth of the recession **5** of big toe joint is mostly created by incurvation of the carrying layer **4**, which in further examples of embodiment may be added by a hole performed in dilatation layer **3** of the insole **1** in a place of the recession **5** of big toe joint or by means of a change in thickness of dilatation layer **3** or by means of another suitable manner.

Bottom portion of the recession **5** of big toe joint, inner edge of the recession **6** of the little toe joints and between them created support **56** of transversal instep merge continually into the support **7** of longitudinal instep, which is formed by a convex deflection of a corresponding section of carrying layer **2** of the insole **1**. Shape and dimensions of the support **7** of longitudinal instep are selected taking into account the longitudinal instep of a human foot sole.

The recession **6** of little toe joints further in its bottom section via the elastic support **68** of splint bone created by a continuous heightening of the common edge merges into the recession **8** of splint bone, whose size and shape are derived from the size and shape of the longitudinal splint bone of a

human foot sole. The recession 8 of splint bone is formed of a concave deflection of a corresponding section of the carrying layer 2 and it is arranged along the support 7 of longitudinal instep, into which along its length it continuously merges. In its bottom section the recession 8 of longitudinal splint bone in direction externally the insole 1 merges into the protrusion 9 of the support of cuboid bone.

Due to the fact that the carrying layer 2 of the insole 1 in the toe as well as middle section of insole is of a constant thickness, the bottom side 110 of the insole1 is shaped negatively with respect to its upper side 11. The bottom side 110 of the insole represented in the Fig. 2 thus comprises the planar toe section 11010, to which the middle section 110100 merges, in which under the recession 5 of big toe joint of the upper side 11 of the insole 1 the protrusion 51 of the big toe joint is performed, under the protrusion 56 of the support of transversal instep the deflection 561 of the support of transversal instep is performed, and under the recession 6 of little toe joints the protrusion 61 of little toe joints is performed. The protrusion 61 of little toe joints is usually lower than the protrusion 51 of big toe joint. Under the protrusion 68 of the support of splint bone there is further performed deflection 681 of splint bone, under the recession 8 of longitudinal splint bone there is performed deflection 81 of longitudinal splint bone, under the protrusion 7 of the support of transversal instep there is performed deflection 71 of the support of transversal instep, under the protrusion 9 of the support of cuboid bone there is performed deflection 91 of the support of cuboid bone.

On upper side 11 of the heel section 1000 of the insole 1 there is further performed by means of a concave deflection of the carrying layer 4 the heel recession 12, under which on the bottom side of the insole 1 the heel protrusion 121 is performed.

The thickness of the insole 1 moreover in the area of the heel section 1000 in direction from the upper side of the insole 1 is lowered with respect to other sections of the insole 1, especially towards the recession 8 of splint bone and the support 7 of transversal instep. As it is apparent from Fig. 6, reduction 120 in thickness of the insole 1 in the represented example of embodiment is

achieved by reducing the thickness of the carrying layer **2**. Nevertheless this may in another not represented examples of embodiments be replaced or added through reducing the thickness of the dilatation layer **3** and/or covering layer **4** in the heel area 1000 of the insole **1**, possibly through creation of a hole in some of them or through omitting some of the layers in this section of the insole **1**. In example of embodiment according to Fig. 1A thickness of the insole **1** is reduced along the whole width of the heel section **1000** and the heel recession **12** is created in this reduced heel section.

At embodiment according to the Fig. 1B in the heel section **1000** of the insole **1** the recess **121** is created in the place of the heel recession **12**, while in the top view the recess **1201** is greater than the size of the heel recession **12**, which is performed inside of this recess **1201**.

At the same time it is preferred if the transitions between the heel recession **12**, the depression **120** or recess **1201** and the adjacent sections of the insole **1** are smooth.

The size of the depression **120** or the recess **1201** of the heel section **1000** of the insole varies from 1 to 8 mm, while the optimum effects are achieved in the range from 2 to 5 mm.

On the bottom side of the insole **1** there is preserved the required height of the heel protrusion **121** towards further sections of the insole **1**, and this serves together with the protrusion **51** of the big toe joint and the protrusion **61** of the little toe joints as one of the main supports of the insole.

On condition a horizontal underlay is available, the user's heel is positioned lower than other parts of the foot sole, through which at immobility of the foot sole e.g. during sitting or standing a permanent stretching and loading of Achilles tendon occurs, and also of other muscles, which directly or indirectly relate to it. These are especially the peroneuses, the surae triceps, and the inner as well as outer flexors. At the same time the loading of muscles and ligaments arranged against the Achilles tendon is reduced, especially of the deep protractors of the leg and toes (extensors) and of the front tibialis muscle. Thanks to this the foot sole and ankle are fixed in an axial position, when their loading is evenly and naturally distributed between the corresponding muscles

and ligaments. Thanks to this there is no wilful either unconscious correction of their position which is usual upon usage of common shoemaker's products, which leads even to permanent off-axis positioning of heel and/or ankle in outwards direction or to other important changes in structure of the lower limb, that are accompanied by a physical pain, lowered concentration ability and other symptoms reducing the quality of life. A suitable distribution of loading in area of the foot sole and ankle causes a similar effect also in the area of the knee, where again occurs a partial release of to date extremely stressed muscles and ligaments, and on the contrary loading of those so far not loaded or those loaded insufficiently and unevenly. The insole **1** according to the invention thanks to its effect is suitable for application in situations, when the foot sole is mostly loaded in static manner, thus when the user is sitting or standing for a longer periods, possibly when he changes sitting and/or standing with shorter intervals of walking or other motion. At the same time it is preferred if this insole **1** is inserted freely or in a removable manner in the footwear, thus it is exchangeable with other types of insoles, e.g. with the insole according to the CZ patent 298894, or according to the analogic application of European patent EP 07466013.5, which shows similar wholesome effects on the foot sole and the whole lower limb during motion and upon the dynamic loading.

In another not represented example of embodiment lessening in thickness of the insole **1** in area of the heel recession **12** has been achieved by omitting the carrying layer **4**, possibly by removing a whole heel section of the insole **1**, when the support for heel is created by an outsole or a stretching insole. The heel of the user is then lowered towards other sections of its foot sole just by the thickness of the insole **1**.

The above mentioned wholesome effect of the insole **1** according to the invention is further enhanced in embodiment represented in Fig. 7, when on the bottom side of the toe section **11** of the insole **1**, in the area of support for toes of the foot sole the toe support 99 is arranged, which in correspondence with the preceding example of embodiment further enhances loading of Achilles tendon and the to it directly or indirectly connected muscles and ligaments. At the same time it is preferred if the toe support on the bottom side of the insole is

arranged in a removable manner, which enables its replacement in case it is worn, possibly replacement for toe support from another material and/or of another dimensions, thus also with other degree of effect.

In another not represented examples of embodiment the toe support creates an integral part of the insole **1**, when it is e.g. formed of an increment in material on the carrying layer **4**, through its bending or by means of another suitable manner.

Whatever embodiment of the insole according to the invention may further be supplemented by appropriate number of next suitable layers, among others e.g. by an absorbing layer, whose task is to lead off and/or deposit the moisture, or a biologically active layer eliminating occurrence and vegetation of micro-organisms in structure of the insole **1**, creation of odours, etc.

CLAIMS

1. The insole (1) from the upper side provided with shaping corresponding to the form of impression of bottom part of a human foot sole with recess for the big toe joint with smooth toe section (10), and from the bottom side with shaping corresponding to the bottom part of a human foot sole with smooth toe section (10), while it in a flexible manner supports all parts of the foot sole between the toe section (10) and the heel section (1000), **characterised in that** in the heel section (1000) there is performed recess (1201) or depression (120), in which the heel recession (12) is performed.

2. The insole (1) from the upper side provided with shaping corresponding to the form of impression of bottom part of a human foot sole with recess for the big toe joint with smooth toe section (10), while it supports all parts of the foot sole between the toe section (10) and the heel section (1000), **characterised in that,** in the heel section (1000) there is performed the recess (1201) or depression (120), in which the heel recession (12) is performed.

3. The insole (1) according to the claim 1 or 2, **characterised in that, the** depression (120) is performed along the whole width of the insole (1) in the heel section (1000).

4. The insole (1) according to the claim 1 or 2, **characterised in that, the** recess (1201) is performed in vicinity of the heel recession (12).

5. The insole (1) according to any of the previous claims, **characterised in that, the** recess (1201) or depression (120) is created by means of shaping the carrying layer (2).

6. The insole (1) according to any of the claims 1 to 4, **characterised in that, the** recess (1201) or depression (120) is created by changing the thickness of the carrying layer (2).

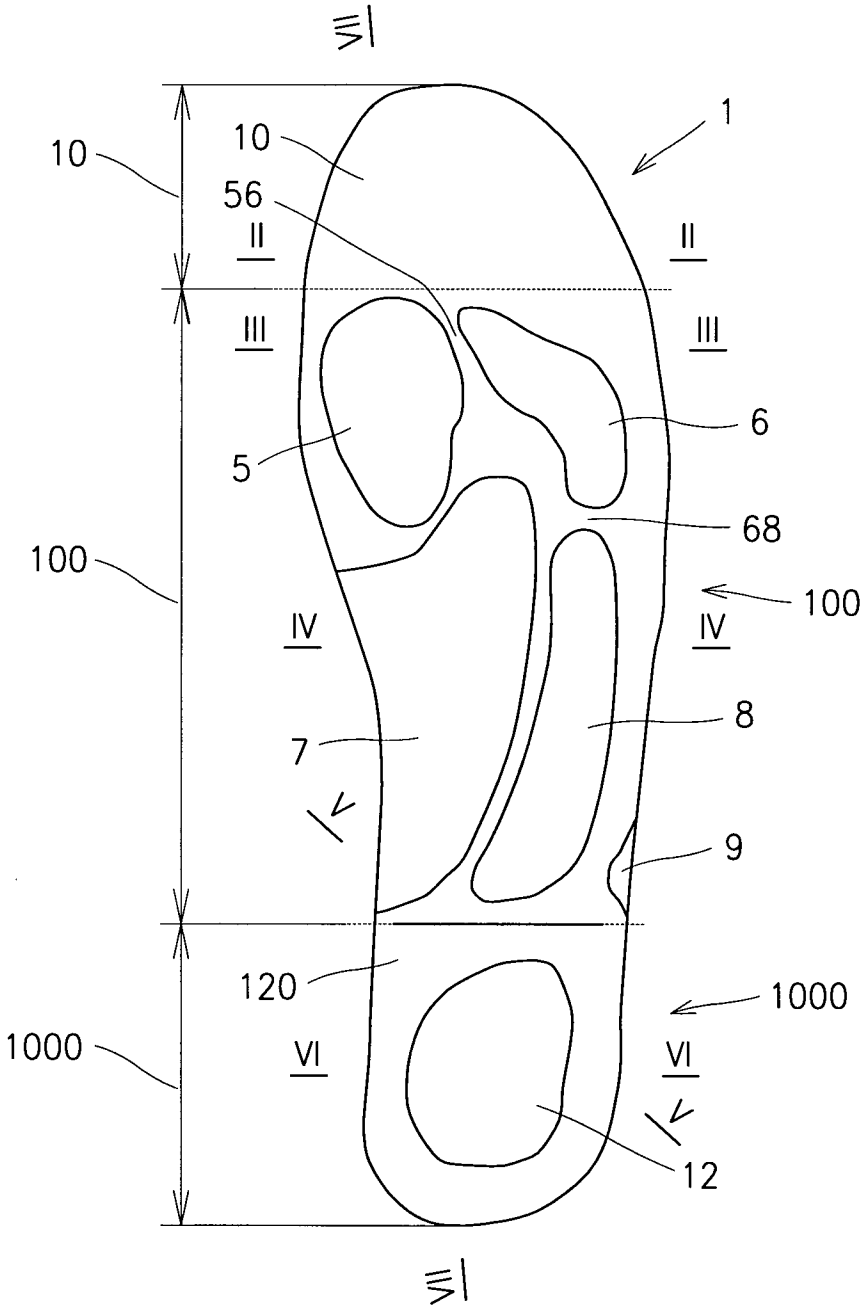
7. The insole (1) according to any of the claims 1 to 4, **characterised in that, the** recess (1201) or depression (120) is created by omitting the dilatation layer (3).

8. The insole (1) according to any of the previous claims, **characterised in that, the** recess (1201) or depression (120) is performed along the whole length of the heel recession (12).

9. The insole (1) according to any of the previous claims, **characterised in that, the** recession (1201) or depression (120) is greater or equals to 1 mm and smaller than 8 mm.

10. The insole (1) according to any of the previous claims, **characterised in that** on the bottom side of the toe section (10) of the insole (1) there is arranged the toe support (99).

11. The insole (1) according to the claim 10, **characterised in that, the** toe support (99) is removable.


I
10
10
1
56
II
II
III
III
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IV
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9
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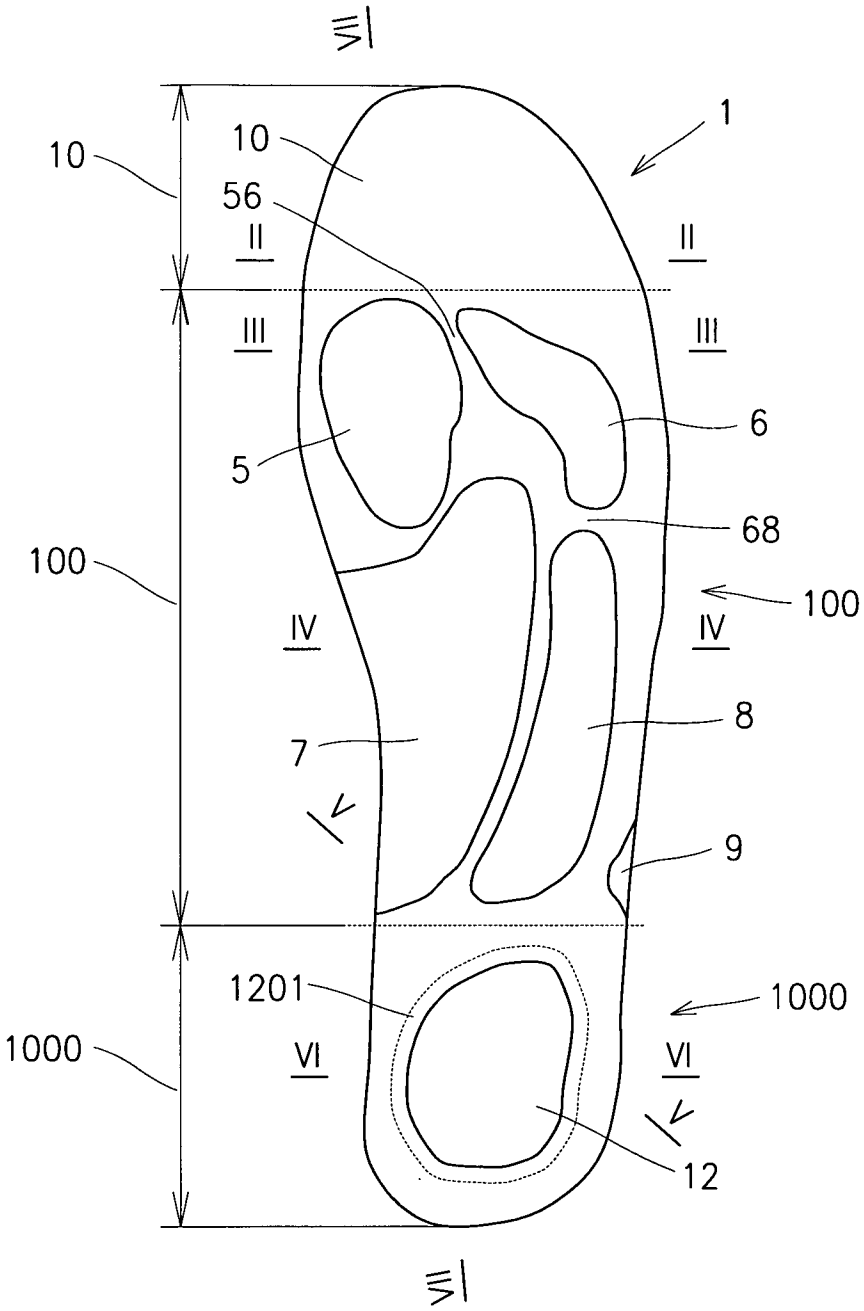
1000
VI
VI
12
I

Fig. 1A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1201
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VII

Fig. 1B

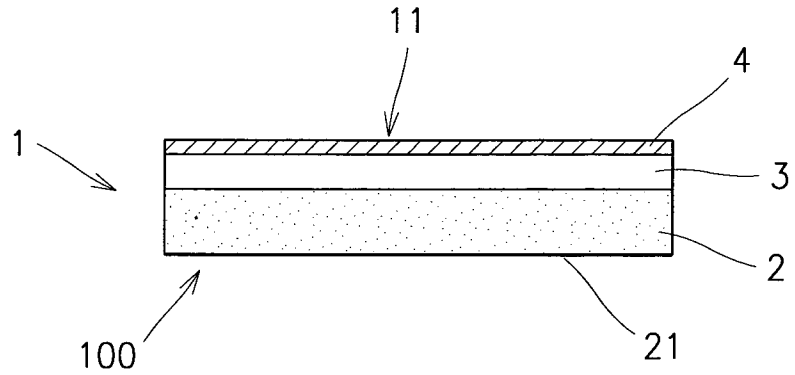

Fig. 2

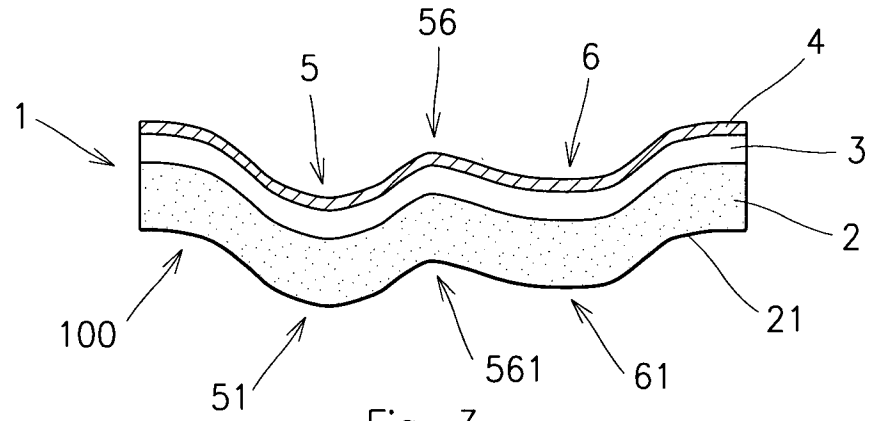

Fig. 3

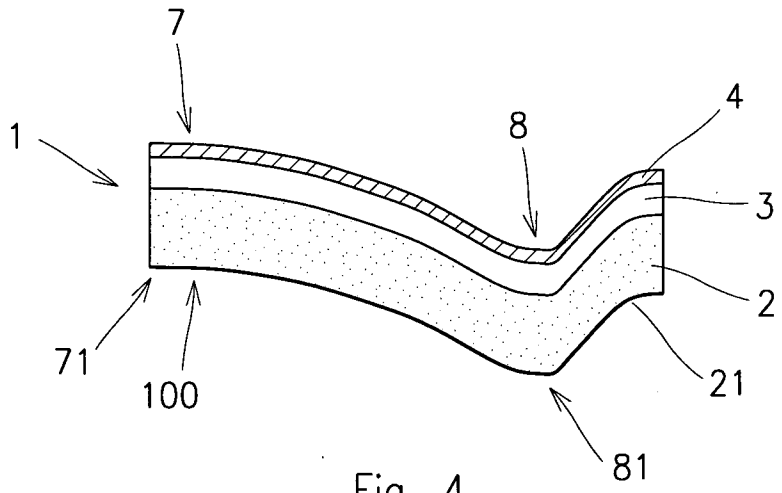

Fig. 4

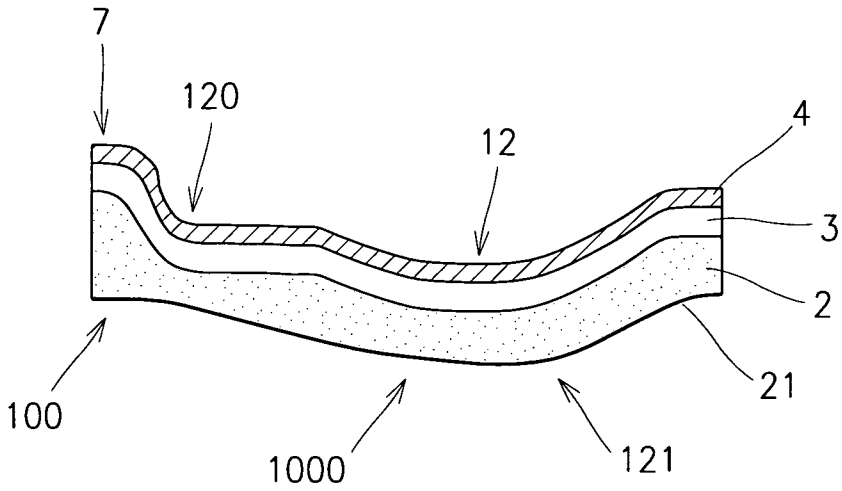

Fig. 5A

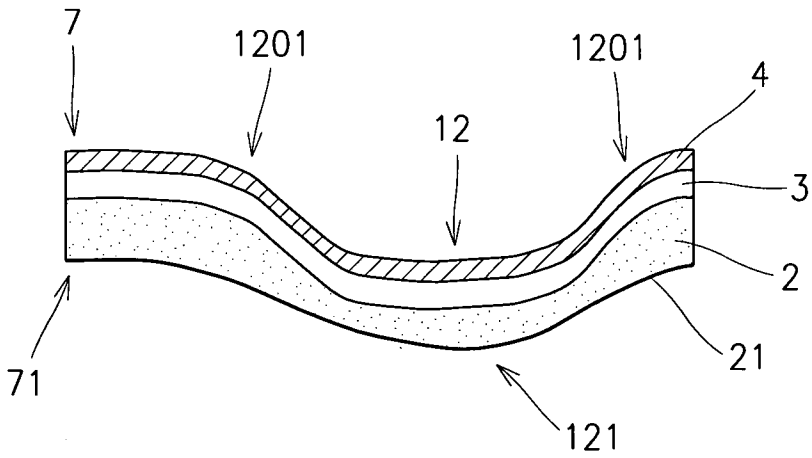

Fig. 5B

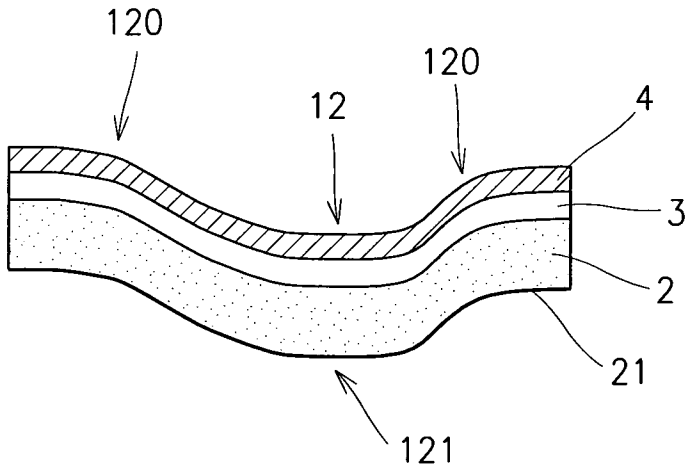

Fig. 6A

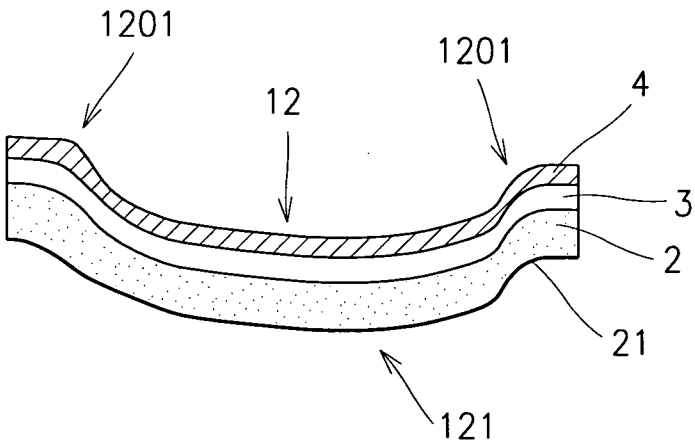

Fig. 6B

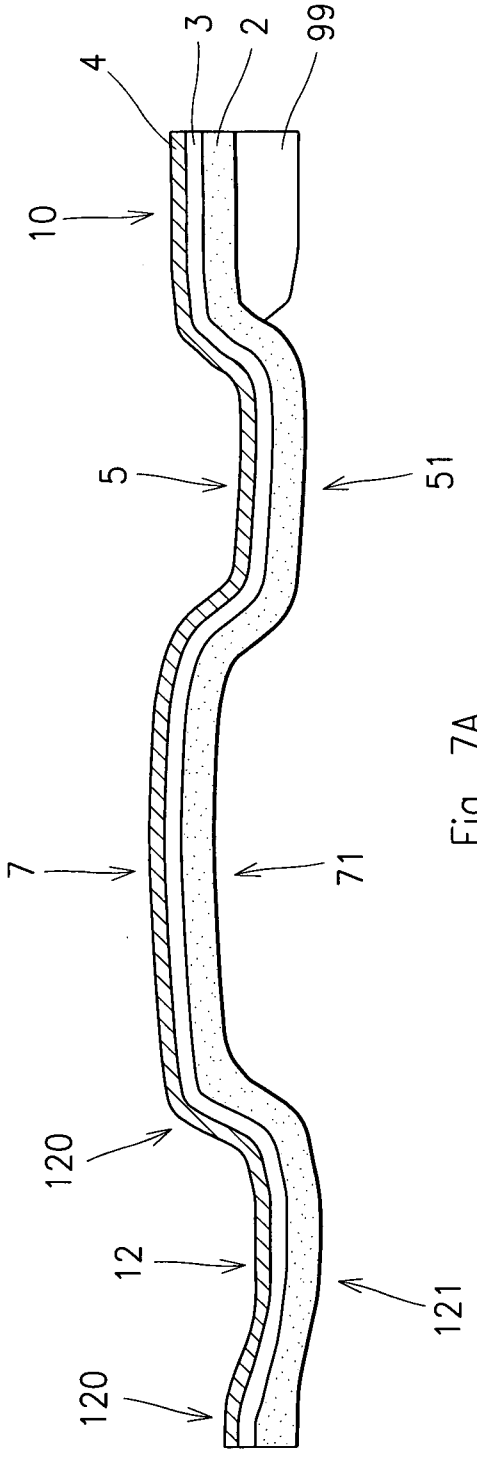
4
3
2
99
10
5
51
7
71
120
12
121
120

Fig. 7A

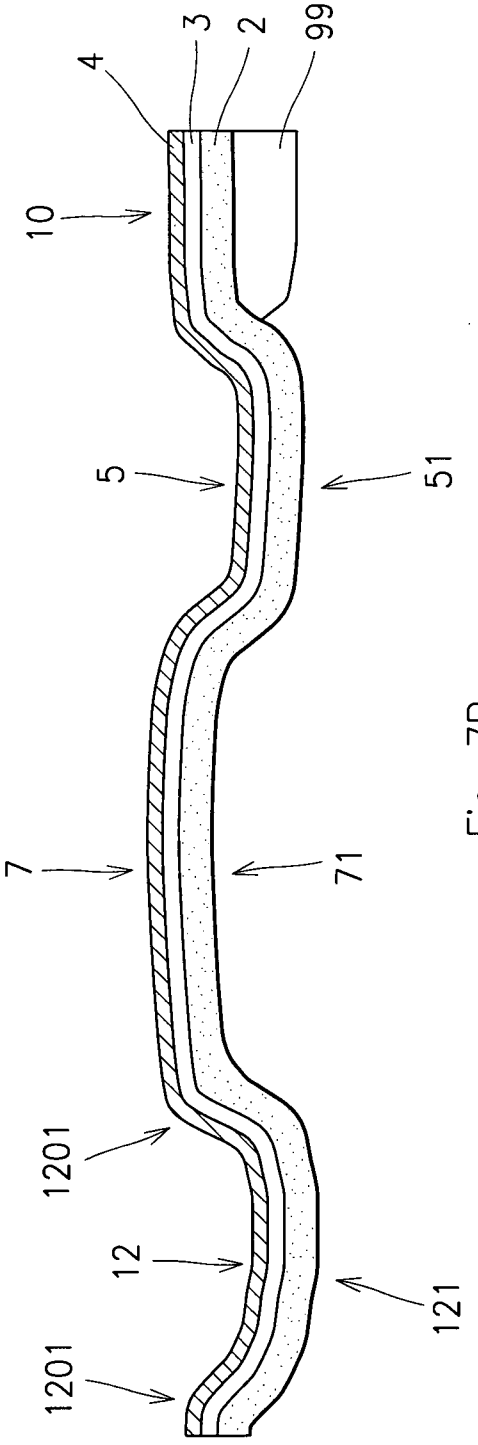
4
3
2
99
10
5
51
7
71
1201
12
121
1201

Fig. 7B