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INLAY FOR A SHOE

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(57) Claim

1. Inlay for a shoe, wherein:

(a) said inlay extends at least throughout substantially the entire forefoot region;

(b) said inlay comprises one piece of a hard, resilient plate material of uniform thickness;

(c) said plate material is formed with a profiling provided transversely to the longitudinal direction of a sole of the shoe;

(d) said transverse profiling extends at least throughout substantially the entire forefoot region; and

(e) said profiling has a cross-section consisting of periodically repeating cross-sectional profile elements, each of said cross-sectional profile elements comprising a ridge and a recess.

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Complete Specification for the invention entitled:
INLAY FOR A SHOE

The following statement is a full description of this invention, including the best method of performing it known to me:—*

* Note: The description is to be typed in double spacing, pica type face, in an area not exceeding 250 mm in depth and 160 mm in width, on tough white paper of good quality and it is to be inserted inside this form.

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The invention relates to an inlay for a shoe, in particular for a sport shoe, extending at least within the forefoot region of the sole, and preferably within the entire region of the foot. In addition, the invention relates to a sole provided with such an inlay and to a shoe having such a sole.

With shoes in general and in particular with sport shoes such as, for instance, shoes for light athletics, mountaineering shoes, golf shoes etc. it is important to design the shoe in such a manner that the risk of the foot snapping over towards the side and hence the risk of ligaments tearing or being strained is as small as possible. This risk of the foot snapping over towards the side is the larger, the higher is the laterally directed tilting movement acting upon the foot and the lower is, on the other hand, the resistance of the shoe to the lateral tilting moment. These two factors, i.e. the tilting moment on the one hand and the resistance of the shoe to the tilting moment on the other hand, are, leaving aside the extraneous conditions, determined above all by the design of the shoe:

(1) In the first place, the tilting moment is the larger, the higher is the force component directed towards the side, i.e. the tilting force acting upon the foot. This tilting force depends largely on the extraneous loading conditions, i.e. the loading conditions unaffected by the shoe, which, especially in sporting activities, are very pronounced, as a result of which sport especially leads with relative frequency to ligament tears of strains.

(2) In the second place, the tilting moment is the higher, the longer is, in physical terms, the lever arm, i.e. the greater is the distance between the foot and the ground. This means that all other conditions being equal the tilting movement increases with the thickness of the shoe sole.

(3) Whether a given tilting moment can in fact cause tilting and, as a result, snapping over of the foot towards the side, does not only depend on the absolute value of the tilting moment but also on the moment of resistance which the shoe opposes to a lateral tilting. This moment of resistance is the higher, the greater is the lateral stability of the shoe sole; i.e. the longer is the lever arm of the sole which opposes flexing in the transverse direction of the sole, by which is meant flexing about a flexing line parallel or roughly parallel to the longitudinal direction of the sole.

In the light of the above factors a very thin and stiff shoe sole would be ideal for making the risk of the foot snapping over to the side as low as possible. For if the shoe sole is very thin, the tilting moment is at a minimum, and if the shoe sole is very stiff there is a high moment of resistance which tends to prevent the tilting moment from actually causing lateral tilting. Such a shoe sole is, however, by no means ideal, since yet other requirements apply as regards the characteristics which a shoe should possess.

Whereas the wearer of such a shoe with a very thin and stiff sole would be able to stand well and safely on level ground, i.e. whereas such a shoe would ensure that the wearer's stability on level ground is good, the wearer of such a shoe could run with that shoe only with difficulty and insecurely, and in addition his stability on uneven ground would not be good, for the stiff sole of such a shoe would not adapt itself to uneven ground and make any roll-off motion of the shoe sole while running

on the ground impossible. So as to enable the wearer of the shoe to run well and safely as a result of a good roll-off motion of the shoe sole on the ground, the shoe sole must be soft and flexible. This requirement for making the shoe sole soft and flexible and not rigid, does however, for the reasons below, entail the further requirement that the shoe sole must not be designed so as to be thin, as is, according to the above explanations, desirable in order to reduce the risk of the foot snapping over, but that on the contrary it should be made thick:

For if a soft and flexible shoe sole is thin, point pressures acting from below on the sole of the shoe and caused, e.g. by little stones, unevennesses of the ground etc., are transmitted through the sole of the shoe point-by-point to the sole of the wearer's foot, which is of course extremely uncomfortable and even distressing. In order to alleviate as far as possible such a transmission of point pressures to the sole of the wearer's foot and if possible even prevent it, it is therefore necessary to make the shoe sole, which must be soft and flexible in order to ensure good roll-off motion, as thick as possible.

Hence there are two opposite requirements as regards the design of the shoe sole:

(a) On the one hand the sole should be as thin and rigid as possible in order to make the risk of lateral snapping over of the foot and hence the risk of ligament tears and strains as low as possible.

(b) On the other hand, the sole should be as soft, flexible and thick as possible in order to enable a roll-off motion as required for running as well as secure standing on uneven ground while preventing, to the largest possible degree, the transmission of point pressures due to the ground.

Whereas according to the state of the art shoe soles with a stiffening inlay are known, the proposals as regards these known stiffening inlays are neither intended to provide a shoe sole meeting the two above opposed requirements, nor do these inlays constitute a solution of this problem:

From the British patent GB-A-1 257 524 a stiffening inlay from metal or a plastic material and provided with spikes is known, which is embedded in the sole of the shoe and intended especially for golf shoes. The purpose of this stiffening inlay consists in solving the problems in respect of spike retention and isolation of the foot from the pressure of the spikes when use is made of relatively light, soft and flexible cellular sole materials. Furthermore, uncontrolled flexing of the shoe, in particular uncontrolled torsional flexing of the middle part is to be prevented with such sole materials in order to avoid a reduction of foot comfort and early deformation of the upper part of the shoe. The solution of this problem consists, to the extent to which it is of interest in the present context, in that the generally flat inlay extends over the entire length of the shoe sole and all spikes of the forefoot region are attached to it, whereby the points at which the spikes are attached to the inlay consist in slight indentations. As a result, said stiffening inlay brings about not only the required transverse stiffening within the forefoot region of the shoe sole but the forefoot region is at the same time stiffened also in the longitudinal direction of the sole, as a result of which the roll-off motion of the shoe sole when running is, in undesirable manner, made more difficult.

From the US patent US-A-4 439 937 a stiffening metal inlay is known, which extends from the middle part of the forefoot region of the shoe sole rearward towards the rear end of the heel region and is intended to act as a support in the waist or instep region. The front part of the forefoot region of the shoe sole is, on the other hand, specifically free of the stiffening inlay, so that it remains vertically flexible, which is

necessary for a good roll-off motion, but this has the disadvantage that with such a design the lateral stability is low.

Lastly, a moulded sole made of soft elastic plastic or rubber materials with a tread-through-proof, hard elastic inlay, e.g. made from steel sheet, is known from the European patent application EP-A-44 549, said sole being intended primarily for safety shoes in the construction industry, which are intended to be safe against the penetration of nails through the sole of the shoe. The stiffening inlay, which in the embodiment that is of interest in the present connection extends over virtually the entire length of the shoe sole, is so designed and embedded in the shoe sole that the toe region for supporting a steel toe-cap and the waist region for supporting the joint of the foot are each directly below the insole, whereas, on the other hand, the remaining part of the forefoot region and the heel region of this inlay are recessed so as to enable them to be covered throughout with a layer of soft elastic sole material in order to ensure higher foot comfort in the ball and heel regions than if use is made of a stiffening inlay extending at all points directly below the insole. These recessed regions of the stiffening inlay are brought about by the material of the inlay being bent in steps, along bending lines at right angles to the longitudinal axis of the sole where there is the transition from the given heightened to the given recessed region. However, these bending lines do not modify the stiffness conditions of the inlay significantly, as a result of which the inlay causes virtually the same degree of sole stiffening in the transverse as in the longitudinal direction, thus impeding the roll-off motion of the shoe sole to the same extent to which the transverse stiffness is increased.

On the other hand, the object of the invention consists in particular in providing an inlay for the production of shoes, with which the risk of lateral snapping over of the foot and hence the risk of ligament tears and strains is as low as possible, and which, at the same time, enables excellent roll-off motion of the shoe sole as required for running, in conjunction with optimal stability.

Furthermore, the invention is intended to provide a shoe sole and a shoe, in particular a sport shoe, with these characteristics.

According to the invention there is provided inlay for a shoe, wherein:

(a) said inlay extends at least throughout substantially the entire forefoot region;

(b) said inlay comprises one piece of a hard, resilient plate material of uniform thickness;

(c) said plate material is formed with a profiling provided transversely to the longitudinal direction of a sole of the shoe;

(d) said transverse profiling extends at least throughout substantially the entire forefoot region; and

(e) said profiling has a cross-section consisting of periodically repeating cross-sectional profile elements, each of said cross-sectional profile elements comprising a ridge and a recess.

A shoe sole according to the invention is characterised in that it has an inlay according to the invention, which is preferably firmly connected with the sole, i.e. preferably by moulding about said inlay a plastic material, by foaming, injection, casting or some other method, or by vulcanising it into a plastic material, said plastic material forming at least a part of the sole or the entire sole.

Lastly, the invention provides for a shoe having a sole according to the invention with an inlay according to the invention.

A particularly preferred embodiment of the inlay according to the invention is characterised in that the inlay extends over substantially the entire sole length and that the deformation capacity of said inlay in the longitudinal direction of the sole, from the heel to the large toe, is good. Such an inlay enables torsional movements of the foot, such as are necessary e.g. with many types of light athletics, when golfing, in tennis and with similar activities.

In addition, the inlay to the invention is made elastically resilient, this being quite especially preferred, as a result of which the shoe sole, time and again, substantially resumes, by itself, its initial position.

Lastly the inlay according to the invention is made, in its specially preferred embodiment, pressure-stiff against pressure at right angles to the plane of the sole, which is very important because as a result point pressures due to the ground are distributed over the entire area of the inlay, so that pressures caused by small stones, unevennesses of the ground etc. are not transmitted to the sole of the foot point-by-point.

A quite especially preferred and highly practicable embodiment of the inlay according to the invention, which possesses all the above advantageous properties, is characterised in that the inlay, in particular an inlay made in one piece, consists of hard, springy sheet material and is provided, at least within the forefoot region, and preferably within substantially the entire sole region, with transverse profiling at right angles to the longitudinal direction to the sole, and in particular vertically, whereby said transverse profiling preferably extends over the entire width of the inlay, and whereby the hard, springy sheet material is preferably metal and/or plastic sheet material, preferably steel sheet, and more especially spring steel sheet.

Such an inlay according to the invention, which is excellently suited for sole and shoe manufacture as carried out in practice, combines in itself, in particular, the following advantageous characteristics:

(1) High lateral stability since transverse profiling confers to the inlay a high stiffness against bending in the direction of profiling, i.e. in the transverse direction of the sole, especially in the given roll-off region;

(2) very good vertical flexibility in the longitudinal direction of the sole, especially during the roll-off motion, since transverse profiling confers to the inlay low stiffness against bending at right angles to the direction of profiling and at right angles to the plane in which the profiling extends;

(3) high torsional capacity about the longitudinal direction of the sole from the heel to the large toe, since transverse profiling enables torsion of the individual transverse profiles in respect of one another, about an axis vertical to the individual profiles and in the plane common to the profiles;

(4) good pressure distribution owing to the stiffness against pressure of the hard sheet material of which the inlay is made, such as steel, since this hard sheet material distributes pressures acting from below over the entire area of the inlay;

(5) excellent resilience since the springy sheet material reverts, owing to its springiness, into its initial position, as a result of which a shoe sole provided with the inlay according to the invention resumes its original shape time and again.

The high lateral stability of the inlay according to the invention enables, in conjunction with the good pressure distribution, very flat construction of the shoe soles provided therewith, i.e. the production of thin soles without substantial tilting effect, since the tilting moment is, owing to the low thickness of the sole, as low as possible, and the moment of resistance to tilting is, owing to the high lateral stability, as high as possible, a high degree of foot comfort being achieved at the same time, since point pressures emanating from the ground are not transmitted point-by-point to the sole of the foot and the roll-off motion of the foot while running is facilitated, while, in addition, a thin layer of soft-elastic sole materials on the underside of the inlay is sufficient for adaptation to unevennesses of the ground (high stability).

Investigations have shown that such an inlay according to the invention made from spring steel withstands a minimum of 5 million alternating bending operations without any loss of shape, which means e.g. that the inlay remains stable and suitable for use for about 650 golf tournaments.

An inlay in the form of a one-piece, profiled sheet, in particular with a sole-shaped contour, can, on the one hand, be as such made efficiently and economically, while, on the other hand, it is also possible to integrate it efficiently and economically with the sole of a shoe. These advantages are largely achieved also if the inlay according to the invention is made of a composite material consisting of different layers of material such as e.g. metal and plastic. Such an inlay may consist of strip-shaped zones separated in the transverse direction of the sole, which are connected by the plastic layer in flexibly resilient manner.

The torsional capacity of the inlay from the heel to the large toe can, if required, be further increased by the inlay having, instead of transverse profiling, longitudinal profiling within the waist region and/or the heel region, said longitudinal profiling being in line with the longitudinal direction of the sole. Such longitudinal profiling in the waist region is also advantageous for supporting the joint of the foot.

Although, as already mentioned, it is preferable to design the inlay in such a way that it extends over substantially the entire area of the sole, it may in certain cases be also sufficient for the inlay to extend over substantially the entire width and/or over substantially the entire length of the forefoot region, since this alone yields most of the advantages explained above.

The hard, resilient sheet material may have a thickness between 0.1 mm and 1.5 mm, and preferably between 0.3 mm and 0.8 mm.

The transverse and/or longitudinal profiling may have, in particular, a grooved, fluted, ribbed, channelled, undulating, furrowed or bead-shaped, and preferably a corrugated, zig-zag-shaped or corrugation-like cross-section.

In this connection profiling direction means the direction in which such

profiling is rolled, drawn, extruded etc., i.e. in case of profiling with grooved cross-section the longitudinal direction of every individual groove.

The width of the periodically repeating profile cross-section elements is preferably 3 mm to 20 mm, more especially 6 mm to 16 mm, and by way of special preference 8 mm to 13 mm.

With a view to increasing the anchoring capacity of the inlay in a sole further, it is possible to design the profiling in such a way that it is, in the profiling direction, undulating, serrated, grooved, fluted or furrowed, or has some other secondary profiling at right angles to the direction of profiling, although owing to profiling the inlay according to the invention already has excellent anchoring capacity and such an increase is not required in most of the cases.

For the pressure of the foot to be transmitted to the ground even better, the inlay, especially if it is a one-piece sheet, can be provided, within a predetermined region of the foot or in several predetermined regions of the foot, with a recess in the direction of the ground, preferably within range of the large toe, of the ball of the foot and/or of the heel, whereby said recess has, preferably, a flat or plane bottom, so as to enable the above function to be carried out particularly well.

In order to ensure that, in the course of foaming in etc., the plastic can spread well on both sides of the inlay, the latter can be provided with through-holes for the plastic material, said holes being distributed over the surface of the inlay and provided with one or several injection ducts through which to inject the plastic material, and/or with a multitude or plurality of penetration apertures, which may, in particular, be penetrations.

The inlay according to the invention makes it outstandingly possible for knobs or spikes to be fitted in a non-separable manner or to be replaceably fitted by means of fastening means provided on or within the

inlay. This virtually eliminates all attachment and fastening problems, which otherwise occur when fitting knobs or spikes to a normal sole.

As a point of detail, the above fastening means may be threaded holes provided within the inlay or threaded inserts mounted on the inlay. Particularly stable, especially directionally stable, attachment of knobs or spikes to the inlay can be brought about, according to the invention, by the foot sections of the knobs or spikes or the fasteners such as e.g. threaded inserts being secured within recesses in the inlay and supporting themselves against the side walls of the recesses, that they match the adjacent side walls of the recesses, preferably in positive manner, and/or are firmly attached to said side walls, whereby said recesses are preferably the profile recesses produced by transverse and/or longitudinal profiling. The spikes can also be secured in other ways, e.g. by riveting or welding.

The inlay according to the invention may also consist of a composite sheet material comprising several layers joined with one another so as to produce an integrated composite structure, at least one of said layers being provided with the transverse profiling and preferably consisting of the transverse profiling. Such a composite structure makes it possible to link the advantages of different materials.

It is possible, for instance, for the composite sheet material to have a first layer consisting of a plane, preferably non-profiled flexible and resilient sheet material, and of a second layer designed as a profiled layer and consisting e.g. of individual profiles arranged next to one another, which are connected by bonding, vulcanising etc. with the resilient sheet material, as a result of which the first and the second layer are integrated so as to form a composite material.

This type of construction makes it possible to use for the first layer, the function of which is to act as an elastic flexible bond of the

profiles, a material which is, in particular, resiliently flexible and thin, such as Teflon or, in particular, thin spring steel, while using for the second layer, the special function of which is to confer a high degree of lateral stability to the inlay, a particularly stiff and pressure-resistant material such as special steel or rigid plastic material.

By using a composite sheet material it is also possible to confer special properties to the inlay according to the invention, which cannot be achieved at all or only with great difficulty if use is made of a single-layer sheet material. It is possible, for instance by producing, with the aid of closely adjacent rectangular profiles or U-profiles by way of transverse profiling on a composite sheet material, an inlay which permits flexing of the sole only in the upward direction but not downward, thus e.g. conferring particularly good kicking characteristics to football shoes.

Although the inlay according to the invention can in principle also be used as an "inlaid sole" or inlaid intermediate sole, it is preferable to develop it as an insole or join it firmly with the sole, in order to integrate it, in stable fashion, with the overall structure of the sole and hence the entire shoe, this being possible both by bonding to the sole or vulcanising on to or in the sole, as also by moulding the sole material about the inlay.

The inlay according to the invention can be developed in accordance with the invention as an insole in that the profiling cavities and/or intermediate spaces of the transverse profiling and the longitudinal profiling optionally provided in certain embodiments and other recesses or the like are filled by a filler material preferably firmly connected with the inlay in such a way that inlay and filler material are preferably combined to give a composite material whose upper and/or lower surface is plane.

The invention furthermore provides a sole for a shoe having an inlay according to the invention which is firmly connected with the sole or

forms a component of the sole or in which the sole is an insole of the above-mentioned kind or is firmly connected with such an insole. In such a sole according to the invention a plastic may be foamed, injected, cast or moulded in any other way about the inlay or it may be vulcanised into a plastic material, this plastic material forming at least part of the sole or the filler composition or the entire filler composition.

The inlay, insole or sole according to the invention is suitable for shoes of virtually any kind, whereby the concept "shoes" within the scope of the present invention and claims relates, apart from shoes in the narrow sense such as low shoes, high shoes etc., also to boots, in particular high boots, rubber boots etc. Incidentally, by using the inlay, insole or sole according to the invention the shoes can be produced very economically. Apart from the above advantages, the high lateral stability of the inlay, insole or sole according to the invention causes all shoes to be supported and the plantar arch to be protected while at the same time protecting the ball region, in particular against burn when running, while the elastic resilience of the inlay ensures, inter alia, that the foot is less prone to fatigue.

The inlay, insole or sole according to the invention is advantageous for normal shoes such as street or running shoes, and it is particularly advantageous for sport shoes such as, in particular but by no means exclusively, shoes for light athletics, jogging shoes, shoes for indoor sports, sport shoes for lawn sports, golf shoes, tennis shoes, high-jump shoes, mountaineering shoes etc., while, owing to the outstanding characteristics which it confers to the shoe, its effects are not only such as to make it more useful and protect health but also such as to increase performance, whereby said effects result from the various characteristics such as increased stability, torsional capacity, elastic resilience etc. In the case of golf shoes for instance, to mention but one example, the quality of the strokes is, inter alia, improved owing to improved stability, high roll-off mobility and good torsional capacity. In the high jump it is possible, as has been shown by tests, to achieve greater heights. With

mountaineering shoes the transmission of pressures from below, which in this case is particularly critical owing to the ground conditions such as slopes of boulders, is reduced to a very substantial degree, while owing to the fact that the flat sole construction is possible, the close contact with the ground is, at the same time, considerably improved and the danger of injuries to the feet significantly reduced. This significant reduction of the risk of injury and improvement of close contact with the ground is, incidentally, a very important advantage of the invention whatever the type of sport.

The above as well as other characteristics and advantages of the invention are described in detail below, with reference to especially preferred embodiments and figures 1 to 14 of the drawing, in which such embodiments and details thereof are illustrated:

Figure 1 A top view of a first embodiment of an inlay according to the invention, which extends over the entire area of the sole and is provided with transverse profiling throughout (e.g. at a scale of 1:1 with shoe size 42), as well as an enlarged partial view in perspective of the transverse profiling;

Figure 2 a top view of a second embodiment of an inlay according to the invention, which is similar to the embodiment shown in figure 1, in which however the transverse profiling is characterised by a somewhat larger width of the individual profiles and is provided with through-holes for plastic serving to coat the inlay as it is embedded into a sole with foam or to encase it in some other manner;

Figure 3 a top view of a third embodiment of an inlay according to the invention as well as a cross-section through said inlay, which is similar to the embodiment according to figure 1, but differs from said embodiment in particular in that it has through-holes for fitting spike fasteners and in

that, in the waist region, the transverse profiling partly passes over into longitudinal profiling;

Figure 4 an excerpt from a rectangular corrugated profile which may be provided by way of profiling in various embodiments;

Figure 5 an excerpt of a trapezoidal corrugated profile provided with secondary profiling;

Figure 6 an excerpt of a zig-zag profile provided in the embodiments according to figure 3 and figure 7;

Figure 7 a fourth embodiment of an inlay according to the invention which is provided with transverse profiling only in the forefoot region but has a torsional bridge with transverse profiling and/or longitudinal profiling in the waist region (in the present case profiling is provided in the waist region, which extends in longitudinal direction of the torsional bridge extending at an acute angle to the longitudinal direction of the sole) and is provided with longitudinal profiling in the heel region, furthermore through-holes are available for attaching spikes;

Figure 8 a fifth embodiment of an inlay according to the invention, which is provided with recesses for improved transmission of the foot pressure to the ground and with continuous longitudinal profiling in the waist region;

Figure 9 a partial cross-section along the line M-N in figure 8;

Figure 10 a top view of a sole with an inlay indicated by means of a dashed line, which extends only over the area of the forefoot;

Figure 11 a section according to line S-T in figure 10, in which the plastic material by means of which the inlay is foamed into the sole, is, for presentational reasons, not shown;

Figure 12 a longitudinal section of the sole of a sport shoe according to the invention with flat sole and wedge-heel inlay;

Figure 13 a longitudinal section in accordance with figure 12 of a different embodiment of a sport shoe with heel according to the invention;

Figure 14 a much enlarged partial cross-section, not necessarily to scale, of a sheet-type inlay made with a composite inlay comprising several layers which are connected with one another so as to form an integrated unit;

Figure 15 an enlarged partial longitudinal section of a first embodiment of an insole formed of an inlay by filling the profiling cavities and/or intermediate spaces with a filler material so as to form upper and lower, plane surfaces;

Figure 16 an enlarged partial longitudinal section of another embodiment of an insole formed by an inlay with filler composition, the filler composition covering the profiling on both sides; and

Figure 17 an enlarged partial longitudinal section of still another embodiment of an insole consisting of an inlay made plane on both sides by means of a filler composition and a thin inlaid sole (inlay) bonded on one side or lying loosely.

In the figures of the drawing identical or similar components bear the same reference numbers so that as regards such components which bear a reference number in a figure but are not explained reference should be made to the explanations of these parts as given in relation to previous figures.

To begin with, reference is made to figure 1 showing a top view of a first embodiment of an inlay 1 according to the invention. This inlay is made in one piece of hard, resilient sheet material, i.e. preferably spring steel, and extends over the entire area of the sole, that is to say its contour is substantially that of an inlay sole, as shown.

Inlay 1 is provided on its entire surface with transverse profiling which extends in transverse direction Q of the sole and at right angles to longitudinal direction L of the sole. In the left-hand bottom part of figure 1 there is a partial view in perspective of said transverse profiling 2. According to this view said transverse profiling has a trapezoidal corrugated profile with rounded profile edges. These profile edges 3 are drawn in figure 1 in order to characterise the profile direction and the profile period P, whereby the distance between two profile edges 3 in figure 1 corresponds to half a profile period 1/2 P since the flanks of the trapezoidal transverse profiling 2 deviate only slightly from the vertical so that the two profile edges 3, each of which limits one profile flank, coincide in the top view of figure 1 so as to form virtually a single line.

It will be appreciated that in figure 1 and also in the other figures only some of the profile edges shown bear a reference number.

As can be seen in figure 1, the term "profile period" signifies the width of the periodically repeating cross-sectional profile elements, i.e. in this case the width of a trapezoidal ridge A plus a trapezoidal recess B.

Figure 2 shows a further embodiment of an inlay 1 differing from the inlay according to figure 1 substantially by the fact that profile period P of transverse profiling 2 is larger and that the inlay is provided with through-holes 4 designed, in particular, as penetrations. These through-holes 4 distributed over the surface of inlay 1 serve as through-holes

for plastic material when moulding, by foaming, injection, casting or some other method, plastic about the inlay with a view to integrating the inlay into a shoe sole.

In addition, the longitudinal axis C-D, the roll-off axis E-F and the transverse axis G-K of the sole, into which inlay 1 is integrated, are drawn in figure 2.

Transverse profiling 2 of inlay 1 according to figure 2 has preferably the profiling form shown at the bottom of figure 1, but any other profiling form is also possible, for instance one of the profiling forms shown in figures 4, 5 and 6.

Figure 3 shows a top view of a third embodiment of inlay 1 according to the invention as well as a longitudinal section through this inlay which differs in various ways from the embodiments according to figures 1 and 2:

(a) Whereas both in forefoot region 5 and in heel region 7 transverse profiling 2 is provided by way of profiling, waist region 6 is provided with longitudinal profiling 8 extending in the longitudinal direction of inlay 1, whereby said longitudinal profiling passes at the two longitudinal ends of heel region 6 via transitional transverse profiling 9 gradually into transverse profiling 2 of forefoot region 5 and heel region 7.

(b) Transverse profiling 3 as well as longitudinal profiling 8 and also transitional transverse profiling 9 is designed as a zigzag profile, as shown in the cross-sectional view of figure 3. A partial view of this profile is shown, in perspective manner, in figure 6.

(c) Lastly, inlay 1 of the embodiment according to figure 3 has through-holes 10 for the attachment of threaded lugs or inserts

11 for screwing in knobs or spikes 12 (see figure 3, right, top). So as to be able to attach the threaded lugs or inserts 11 with a wide base 14 in a particularly stable manner to inlay 1 in figure 3, flat regions 13, i.e. regions without transverse profiling 2, are provided about through-holes 10. The method of attaching knobs or spikes described in the specification is only one example for the numerous ways in which these can be attached both permanently or detachably to the inlay according to the invention.

As already mentioned, figures 4, 5 and 6 show partial perspective views of profiles which can be used instead of the profile shown in figure 1, bottom left, by way of transverse profiling 2 and/or longitudinal profiling 8 as well as possibly transitional profiling 9. In this connection it should be noted that the profiles shown are only a few profiles in a multitude of all kinds of profiles suitable for the inlay according to the invention.

Figure 4 shows in particular a rectangular corrugated profile, whereas figure 5 shows a trapezoidal corrugated profile with secondary profiling 15, which is smaller than the trapezoidal corrugated profile and has a profiling direction at right angles to the profiling direction of the trapezoidal corrugated profile. Figure 6 shows, as already mentioned, a zig-zag profile. Profile edges 3 may be rounded to a greater or lesser extent so that the profiles according to figures 4 and 6 can in consequence pass into grooved profiles with grooves of half-round or oval or arch-shaped cross-section, if this is required.

Profile period P is preferably in the range between 3 mm and 20 mm, more especially in the range between 6 mm and 16 mm and by way of special preference in the range between 8 mm and 13 mm, whereas profile height H is preferably in the range between 1 mm and 5 mm, more especially in the range between 2 mm and 3 mm, the hard resilient sheet material of which

inlay 1 is made consisting preferably of metal or plastic material, and, by way of special preference, of spring steel. The thickness of this sheet material depends on the type of material and is in general preferably in the range between 0.5 mm and 1.5 mm.

Figure 7 shows an inlay 1 with transverse profiling 2 in the forefoot region, whereas in the waist and heel regions continuous longitudinal profiling 8 is provided, and with through-holes 10 for direct attachment of spikes or for attaching fastening means for spikes.

Figure 8 shows a top view of a further embodiment of inlay 1 according to the invention, with transverse profiling 2, which is provided in the forefoot region and in the heel region between longitudinal profiling 8 in the waist region, is interrupted by several recesses 16 facing the ground. The recesses can be of circular shape. The three recesses 16 in the forefoot region are in the region of the large toe and the ball of the foot, whereas rear recess 16 is in the region of the heel.

These recesses 16 serve for better transmission of the foot pressure to the floor. As can be seen in figure 9, which shows a cross-section along line M-N in figure 8 of one of the recesses, base 17 of recess 16 is flat or level and, as a result, at the lowest profiling level closest to the floor.

Figure 10 shows a sole 18 with an inlay 1 indicated by dashed lines, which extends only over the forefoot region and is provided throughout with transverse profiling 2. In figure 11, the longitudinal section along line S-T of the sole in figure 10 shows only the outsole of sole 18, whereas the plastic material in which inlay 1 is foam-embedded and which is firmly connected with the outsole, has been omitted for presentational reasons.

Figures 12 and 13 show in diagrammatic manner how an inlay 1 is

preferably integrated into the overall structure of a sole, i.e. between outsole 19, on the one hand, and the interior sole 20 as well as orthopaedic sock 21, on the other hand, whereby heel component 22 may, with a flat sole 18 as shown in figure 12, be a wedge insert.

Both inlay 1 of sole 18 according to figure 12 and the sole according to figure 13 are provided with continuous transverse profiling in the forefoot region and in the heel region, whereas in the waist region longitudinal profiling 8 is provided. With the heeled shoe according to figure 13, this longitudinal profiling is designed in the form of a rising arch, as shown at 23, and it passes via a steep downward wedge 24 of inlay 1 at the start of the heel into transverse profiling 2 of the heel region.

With the sole according to figure 12 spikes 12 are pushed through corresponding through-holes of inlay 1 into transverse profiling 2 of the forefoot region and the heel region, the base parts 25 thereof, which are laterally supported against the vertical flanks of transverse profiling 2, being, for instance, welded to inlay 1 or attached in some other manner to said inlay. To make the soles provided with an inlay according to the invention use may be made of any conventional material, whereby other conventional inlays, such as the heel wedge with the wedged shoe according to figure 12 can be foam-embedded into the sole, together with inlay 1.

Lastly, figure 14 shows a partial cross-section of an inlay according to the invention, which consists of a composite sheet material consisting of several layers 26, 27 and 28, which are combined by bonding so as to form an integral composite material:

The lowest layer 28 in figure 14 consists of adjacent square box profiles 29 arranged at a very small distance U of, for instance, 0.1 mm or less from one another or even closely next to one another. These box profiles

29 are firmly connected, by means of layer 27 which consists of adhesive, with layer 26 consisting of a resiliently flexible, flat sheet material.

The special advantage of inlay 1 according to figure 14 consists in the fact that the inlay can bend only in the direction of arrow X in an upward direction but not in the opposite direction, since in the latter case the side parts 30 of adjacent box profiles 29 support themselves against one another. A shoe, the sole of which is provided with such an inlay, is, for instance, particularly suitable as a football shoe, since this inlay prevents undesirable downward bending of the sole when kicking a ball. e.g. when shooting at the goal.

The sheet material forming layer 26 may consist, for instance of spring steel or Teflon and have a thickness V, depending on the type of material, between preferably 0.1 mm and 2 mm, whereas the box profiles 29, which may, for instance. be extrusions of a high-strength aluminium alloy, may have a side length W in the range of preferably 3 mm to 5 mm. If required, box profiles 29 or any other profiles provided in such a composite sheet material, may, if they consist of metal, be provided with a soft plastic coating which largely attenuates the noises caused as the profiles knock against one another.

Figures 15, 16 and 17 show much enlarged partial longitudinal sections, not necessarily to scale, of three embodiments of an insole 31 comprising an inlay 1 with transverse profiling 2 and a filler composition 33 (shown in hatching) filling up the profiling cavities and/or intermediate spaces 32. This filler composition 33 fills up the profiling cavities and/or intermediate spaces 32 in such a way that the upper surface 34 and the lower surface 35 of the insole are level.

The inlay 1 and the filler composition 33 are preferably connected with each other in firmly adhesive manner to give a component, e.g. by bonding and vulcanising, when consisting of metal the inlay being preferably provided with a primary coat for improving adhesion. The filler composition may be or contain plastic and/or felt and/or other filler material.

While in figure 15 the thickness of the insole 31 equals the height H of the inlay 1, in the insole 31 according to figure 16 the thickness R of the filler composition 33 is greater than the height H of the inlay 1, so that on both sides of the insole thin layers Y and Z of filler composition cover the inlay 1. Layer Y may also only be provided on one side, preferably on the side facing the foot, in particular to improve the comfort for the foot.

In the embodiment according to figure 17 the comfort for the foot is even much improved by bonding or loosely applying a thin inlaid sole 36 to the upper side 34 of the composite article formed of the inlay 1 and the filler composition 33.

The inlay 1 shown in figure 15 having cross-sectionally rounded trapezoidal transverse profiling 2 may be for example the inlay shown in figure 1. In this figure the inlay consists for example of spring steel sheet having a primary coating and a material thickness of preferably 0.2 mm and a profile period P of 5 mm and a height H of 2.0 mm and is levelled on both sides by a filler composition made of soft elastic plastic.

The inlay 1 shown in figure 16 having groove-like transverse profiling may be for example the inlay shown in figure 2. The inlay 1 shown in figure 17 having zig-zag-like transverse profiling may be for example the inlay shown in figure 3 but preferably without the spike holes 10 and without the plane regions 13 of figure 3. Basically the insole 31 may be made of any inlay according to the invention, whereby in the case of the inlays according to figures 8 and 9 the recesses 16 may also be filled withthe filler composition 33 which may also have shock-absorbing properties.

It is self-evident that the filler composition has a hardness considerably reduced as compared to that of the inlay material, e.g. is soft elastic and possibly also shock-absorbing, so that the properties of the inlay according to the invention are highly effective in spite of the filler composition. The same also applies to the plastic material by which an inlay according to the invention can be surrounded by moulding.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Inlay for a shoe, wherein:

(a) said inlay extends at least throughout substantially the entire forefoot region;

(b) said inlay comprises one piece of a hard, resilient plate material of uniform thickness;

(c) said plate material is formed with a profiling provided transversely to the longitudinal direction of a sole of the shoe;

(d) said transverse profiling extends at least throughout substantially the entire forefoot region; and

(e) said profiling has a cross-section consisting of periodically repeating cross-sectional profile elements, each of said cross-sectional profile elements comprising a ridge and a recess.

2. Inlay according to claim 1, wherein said ridge has the same width as said recess.

3. Inlay according to claim 1 or 2, wherein said periodically repeating cross-sectional profile elements have a width which is in the range from 3mm to 20mm.

4. Inlay according to claim 1, 2 or 3, wherein said periodically repeating cross-sectional profile elements have width which is in the range from 6mm to 16mm.

5. Inlay according to any one of claims 1 to 4, wherein said periodically repeating cross-sectional profile elements have a width which is in the range from 8mm to 13mm.

6. Inlay according to any one of claims 1 to 5, wherein said transverse profiling has a cross-section selected from the group consisting of grooved, fluted, ribbed, channelled, undulated, furrowed, bead-type, corrugation-like, trapezoidal and zig-zag-shaped cross-section.

7. Inlay according to any one of claims 1 to 6, wherein said hard, resilient plate material is selected from the group consisting of metal, plastics, steel, spring steel.

8. Inlay according to any one of claims 1 to 7, wherein said hard resilient plate material has a thickness between 0.1mm and 1.5mm.

9. Inlay according to claim 8, wherein said hard resilient plate material has a thickness between 0.3mm and 0.5mm.

10. Inlay according to any one of claims 1 to 9, wherein said inlay extends over substantially the entire area of the sole.

11. Inlay according to claim 10, wherein said transverse profiling is provided throughout substantially the entire sole area.

12. Inlay according to any one of claims 1 to 11, wherein said inlay is provided in at least one of the region of the waist and the region of the heel with longitudinal profiling extending in the longitudinal direction of the sole.

13. Inlay according to any one of claims 1 to 12, wherein said transverse and/or longitudinal profiling has a secondary profiling, said secondary profiling being selected from undulating, serrating, fluting, grooving and furrowing said

first mentioned profiling in its profiling direction; and/or said secondary profiling being selected from providing said first mentioned profiling with some other secondary profiling at right angles to the profiling direction of said first mentioned profiling.

14. Inlay according to any one of claims 1 to 13, wherein said inlay has, in a predetermined region of the foot or in several predetermined regions of the foot a recess facing the ground, with a view to better transmission of the foot pressure to the ground.

15. Inlay according to claim 14 wherein said several predetermined regions comprise one or more of the regions of the large toe, the ball of the foot and/or the heel.

16. Inlay according to any one of claims 1 to 15, wherein knobs or spikes are attached in non-detachable manner to the inlay, or can be replaceably attached with the aid of fastening means provided on or within the inlay.

17. Inlay according to claim 16, wherein base parts of the knobs or spikes or the fastening means are secured in recesses in the inlay and support themselves against the side walls of the recesses, said base parts or fastening means match the adjacent side walls of the recesses in positive manner, and/or are firmly attached to said side walls.

18. Inlay according to claim 17, wherein recesses into which the base parts of the knobs or spikes or fastening means comprising threaded inserts are inserted, are recesses

in the transverse and/or longitudinal profiling.

19. Inlay according to any one of claims 1 to 18, wherein said inlay is provided with through-holes for plastics materials, which are distributed over the surface of the inlay.

20. Inlay according to claim 19 wherein said through-holes comprise one or several injection ducts through which the plastics material is injected, and with a plurality of smaller through-holes.

21. Inlay according to any one of claims 1 to 20, wherein said inlay consists of a composite sheet material having several layers combined with one another so as to form an integrated composite structure, at least one of which possesses transverse profiling, at least in the region of the forefoot.

22. Inlay according to claim 21, wherein said composite sheet material comprises a flat layer of flexible, resilient material and a profile layer.

23. Inlay according to any one of claims 1 to 22, wherein said inlay is developed as an insole by filling the profiling recesses with filler composition in such a way that the upper and/or lower surfaces of the inlay provided with the filler composition is or are plane.

24. Sole for a shoe, wherein said sole has an inlay according to one of claims 1 to 22, which is firmly connected to the sole or forms part of the sole or said sole is an insole according to claim 21 or is firmly connected with such an insole.

25. Sole according to claim 24, wherein a filler composition comprising a plastics material is foamed, injected, cast or moulded around the inlay or it is vulcanised into a plastics material which forms at least part of the sole or the filler composition or forms the entire filler composition.

26. Shoe, wherein said shoe has an insole according to claim 21, or a sole according to claim 24 or 25.

27. Sport shoe, characterized in that the sport shoe comprises a shoe according to claim 26 or is a shoe according to claim 26.

28. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 1.

29. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 2.

30. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 3.

31. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 4.

32. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 5.

33. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Figs. 3 and 6.

34. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Figs. 6 and 7.

35. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 7.

36. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Figs. 8 and 9.

37. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 10.

38. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Figs. 10 and 11.

39. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 12.

40. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 13.

41. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 14.

42. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 15.

43. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 16.

44. An inlay for a shoe as hereinbefore particularly described with reference to what is shown in Fig. 17.

45. A sole for a shoe wherein said sole has an inlay according to any one of claims 28 to 44.

46. A shoe including the sole according to claim 45.

47. A sport shoe including the sole according to claim 45.

Dated this 25th day of March, 1992.

HELMUT MAYER,

Patent Attorneys for the Applicant:

PETER MAXWELL & ASSOCIATES

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Fig. 1

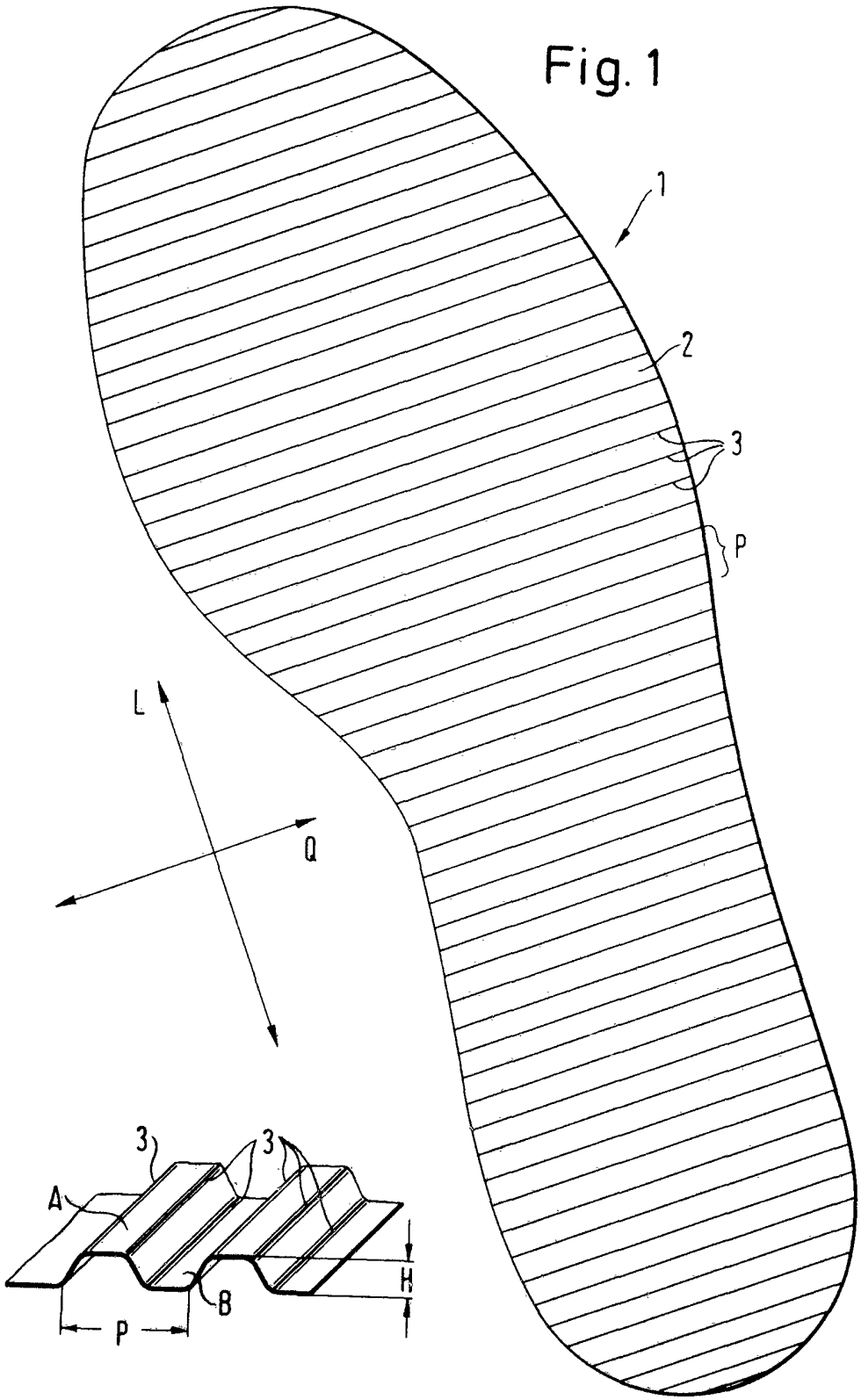


Fig. 2

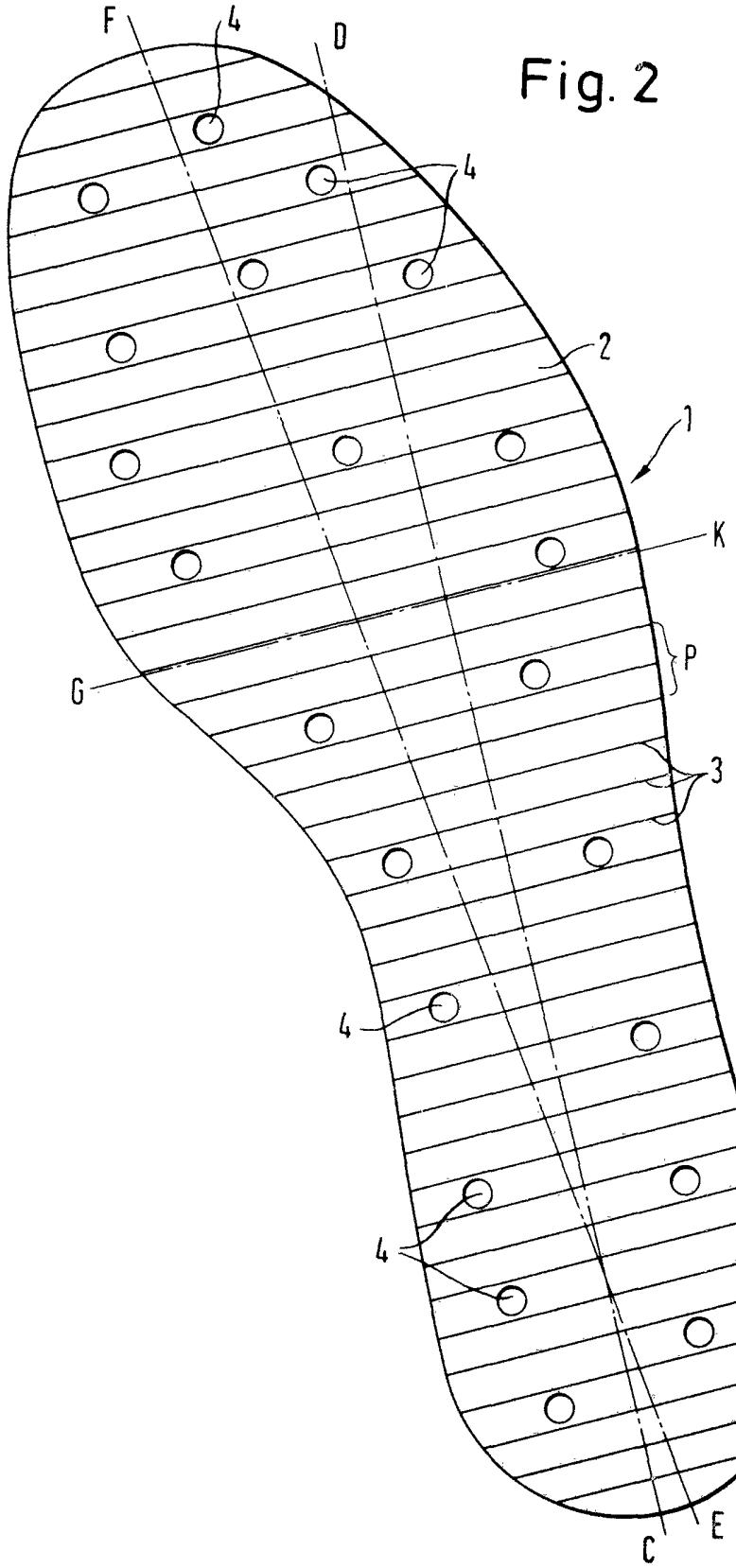


Fig. 3

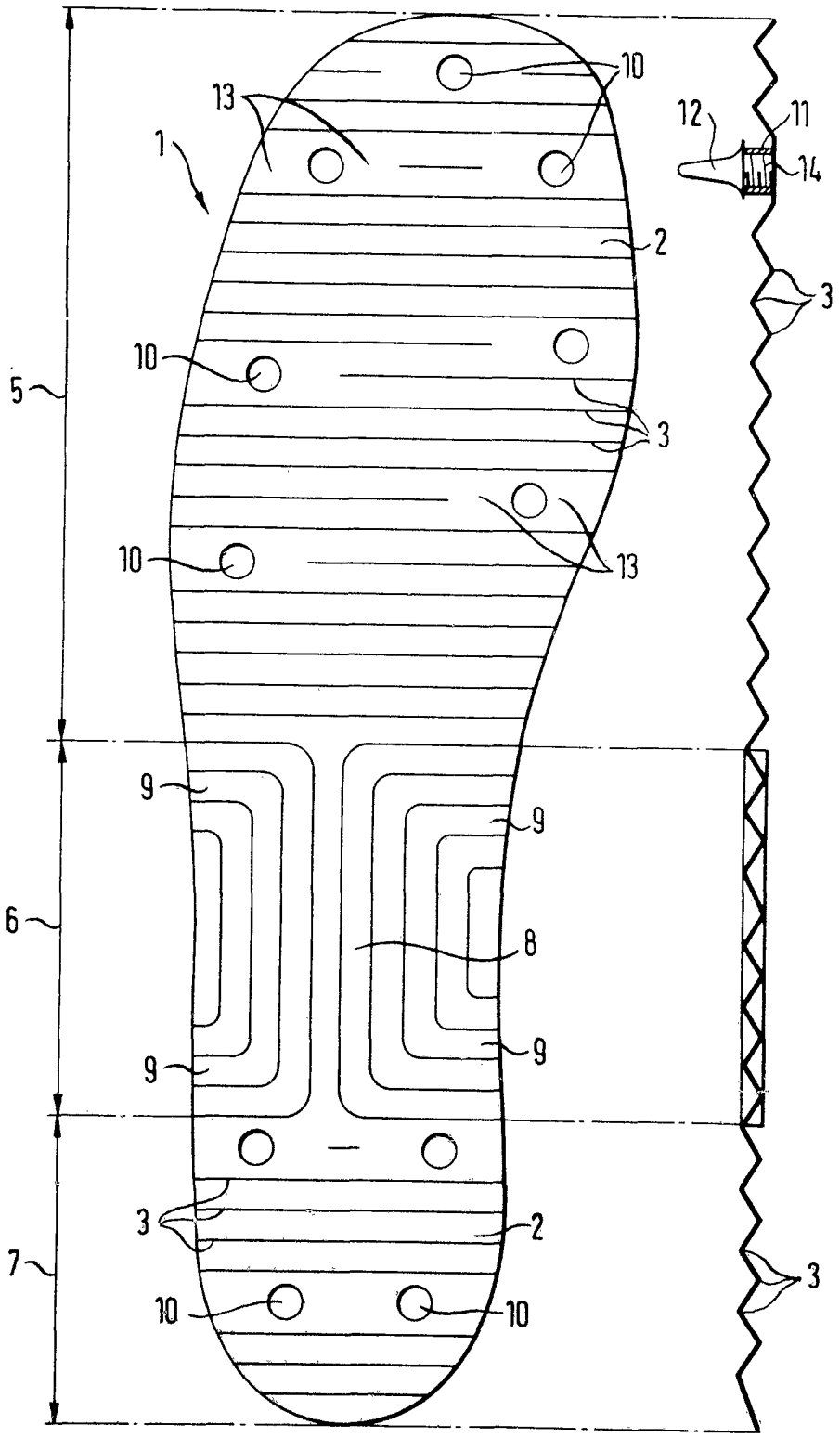


Fig. 4

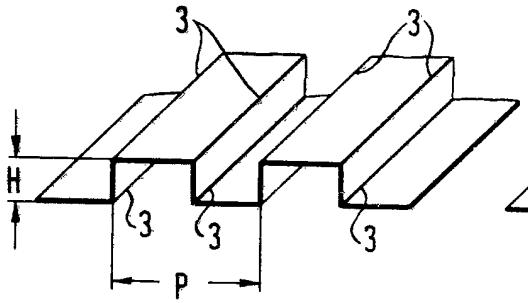


Fig. 5

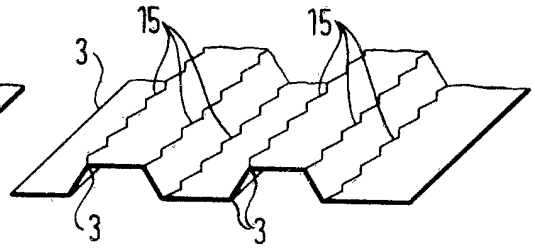


Fig. 6

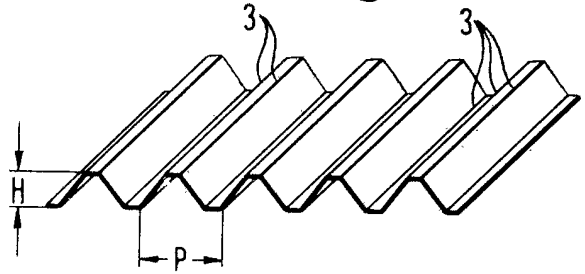


Fig. 7

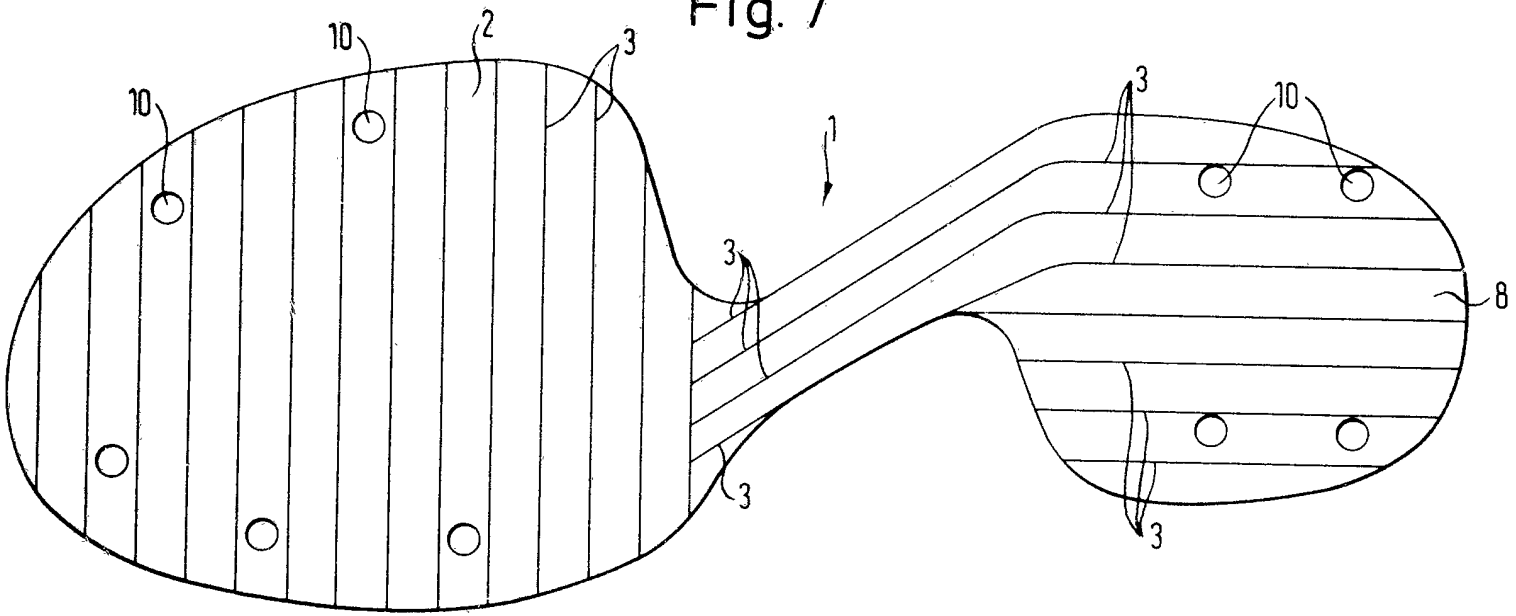


Fig. 8

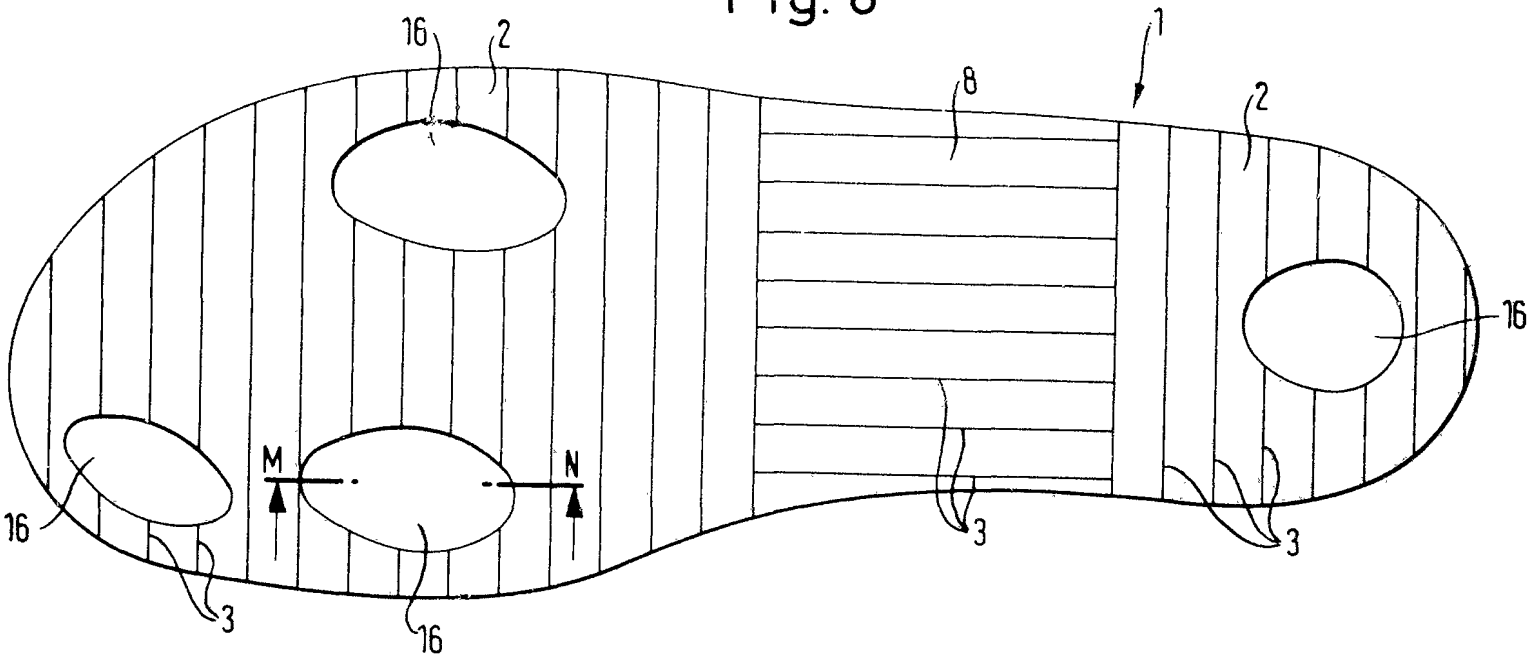


Fig. 9

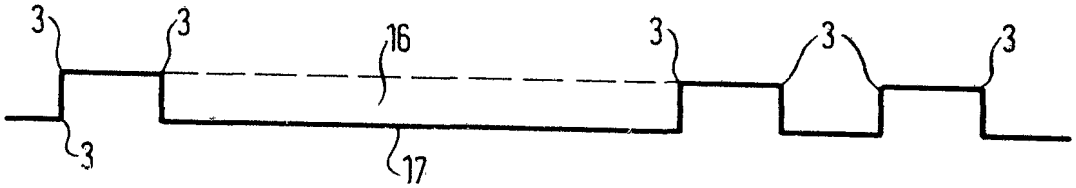


Fig. 10

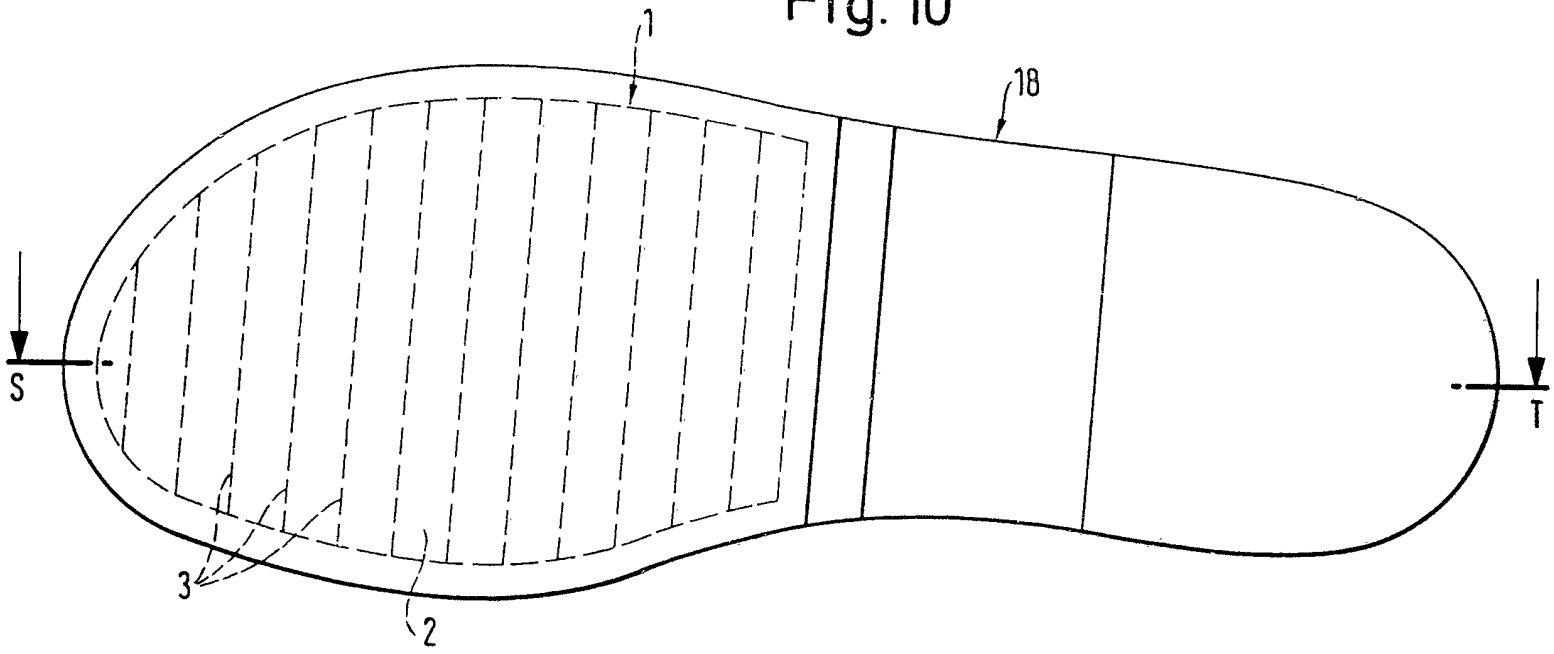


Fig. 11

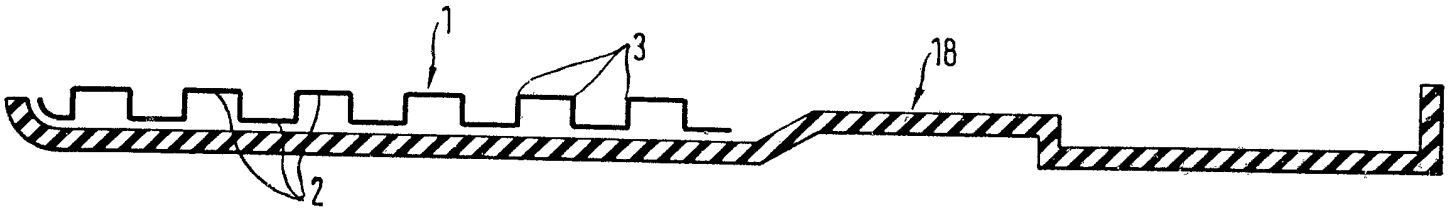


Fig. 12

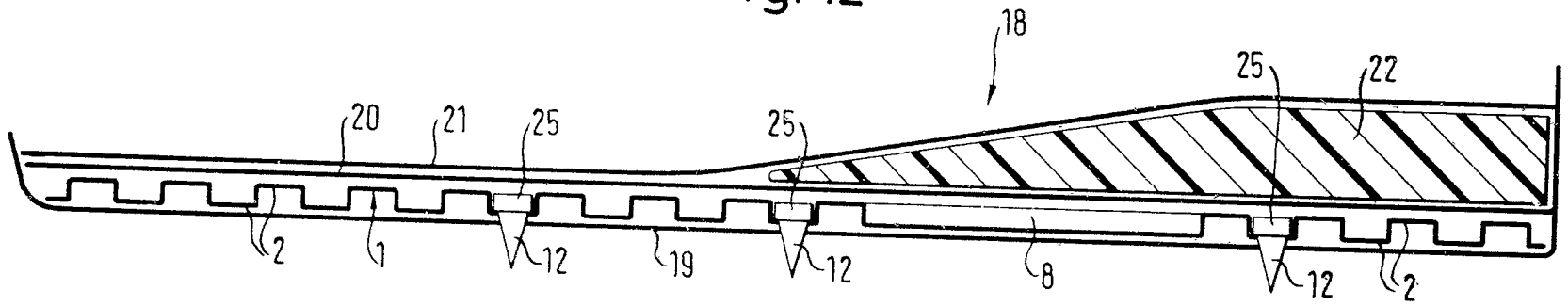


Fig. 13

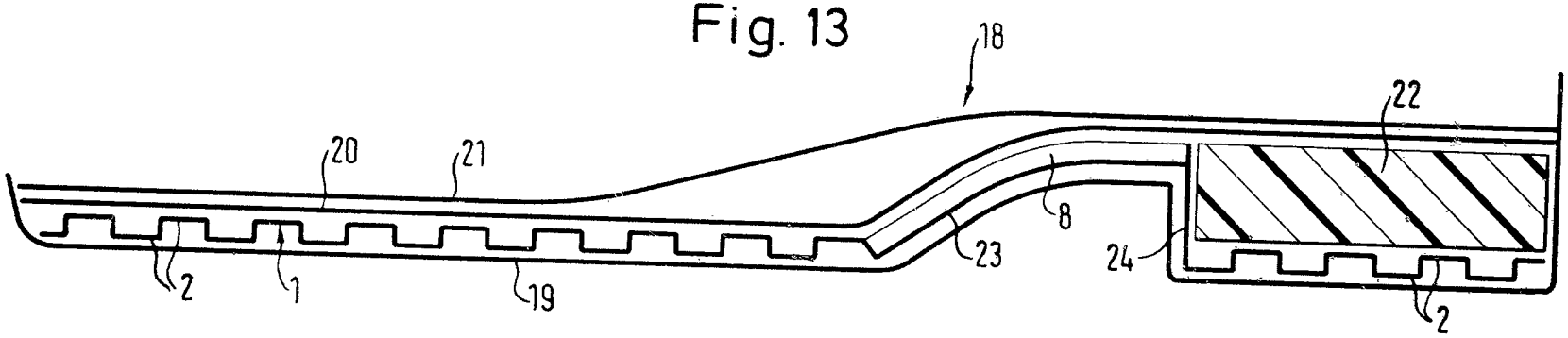
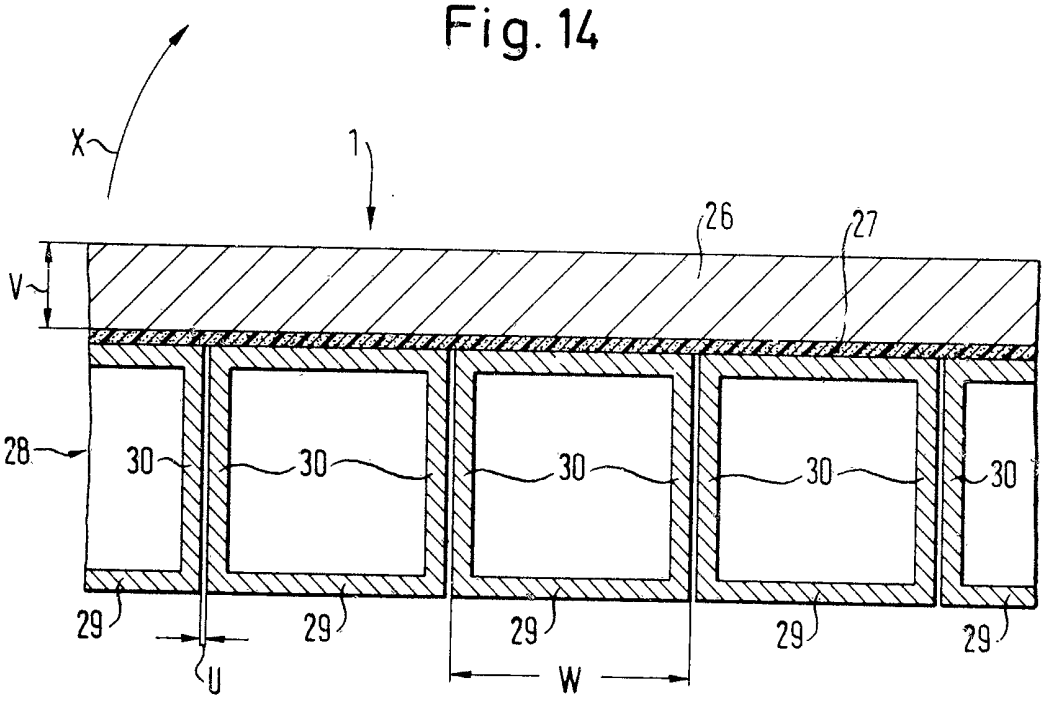


Fig. 14



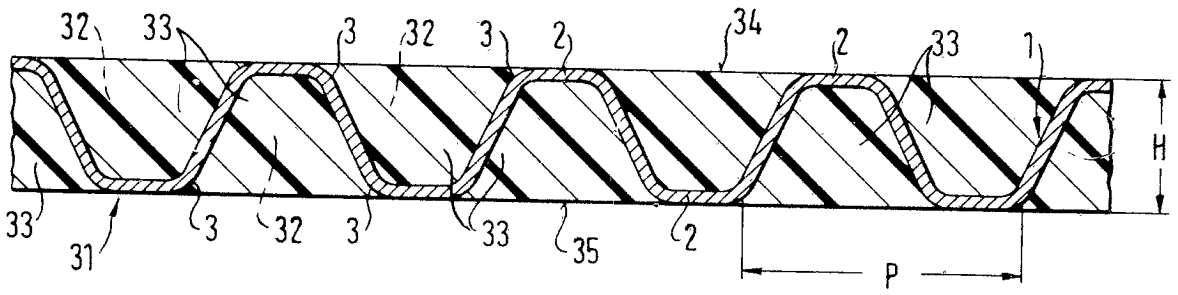


Fig. 15

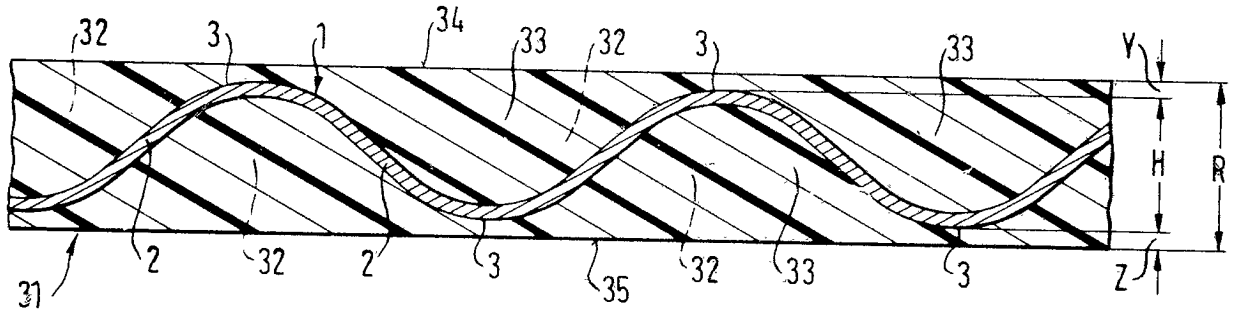


Fig. 16

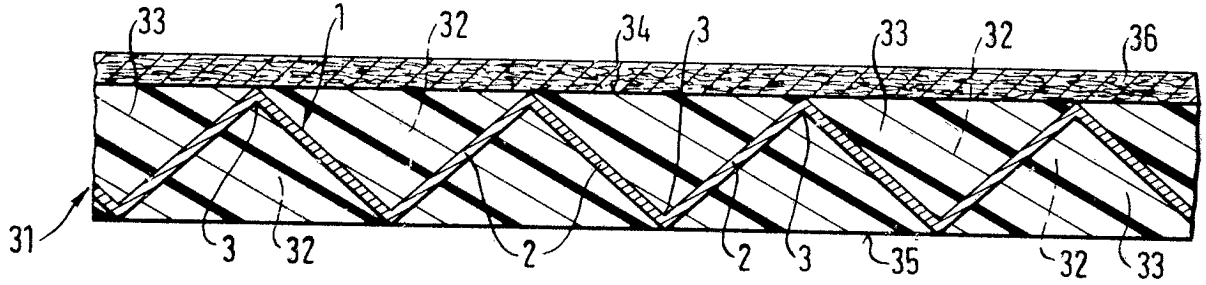


Fig. 17