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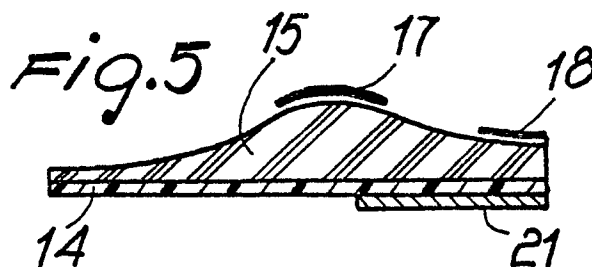
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(54) **Podotherapeutic aid.**

(57) A podotherapeutic aid comprising an insole member including a therapeutic curative means (16,17,18,23;44) and having an orthotic pattern (15,22,46) on its surface designed to face, in use, the sole of a foot, such a configuration being homothetically determined and axonometrically individually tailored by means of computer data processing.



PODOTHERAPEUTIC AID

The invention relates to podotherapeutic aid.

Hitherto available podotherapeutic aids are often inadequate and sometimes even prove themselves to be harmful, since they do not meet a multiplicity of specific requirements of the individual patient.

An object of the present invention is to provide a podotherapeutic aid, such as for example an insole or orthopaedic insert aid or an item of footwear or a band to be applied to different regions of the foot or of the leg, which constitutes a valid therapeutic means for rehabilitative treatments of functional alterations or anomalies which occur on the sole or in other parts of the foot, such as for example the dermoepithelial regions with muscle keratopathies, with osteoarticular myopathies, with bone arthropathies, with neurological osteoporosis, with vascular neuropathies, with vasculopathies and the like.

A further object of the present invention is that said podotherapeutic aid be suitable both for rehabilitative therapy and for sports therapy to allow optimum functional conditions to athletes.

Another object of the present invention is to provide a podotherapeutic aid which is particularly effective since it can be produced on the basis of data of an accurate and precise analysis of the foot, performed scientifically and possibly computerized so as to be individually made-to-measure.

These and other objects which will become more apparent hereinafter, are achieved, according to the invention, by a podotherapeutic aid comprising an anatomical multi-layered structure including a plate-like template, adapted to constitute a diaphragm-support supporting, on its face to be directed towards the sole of the foot, an orthetic structure having portions in soft and elastically deformable material, such as latex foam or foamed polyurethane and portions of material in magnetized sheet, and at least one corrective plate at the other side.

The configuration, the size and the thickness of the orthetic structure, and of the (or of each) corrective plate, are determined by selectively operating on basic patterns (orthetic diagrams) based on a podographic analysis capable of providing information as to the length of the foot, the resting surface of the toes and of the sole, the shape of the plantar imprint, the average pressure, the position of reference points, the morphology of the regions of the metatarsus, of the heel and of the calcaneum and the biomechanical functions.

Further characteristics and advantages of the invention will become better apparent from the following description of some preferred but not

exclusive embodiments thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a schematic plan or top view of an insole or orthopaedic plantar for a right foot with respective orthetic structure;

Figure 2 is a schematic bottom view of the orthopaedic plantar or insole of figure 1 with respective corrective plates or inserts;

Figure 3 shows an embodiment of a right orthopaedic plantar or insole, seen from above, that is to say from the part designed to face the sole of the foot;

Figure 4 is a sectional view along the lines IV-IV of figure 3;

Figure 5 is a sectional view along the line V-V of figure 3;

Figure 6 is a bottom view of the orthopaedic plantar or insole of figure 3;

Figure 7 is a view of a modification of an orthopaedic insole according to the invention;

Figure 8 is a sectional view along the line VIII-VIII of figure 7;

Figure 9 is a view of a footwear including a multi-layered aid according to the invention;

Figure 10 is a view of a layered band constituting another aid according to the invention;

Figure 11 is a perspective view of an axonometric isopodograph suitable for obtaining an isopodographic card;

Figure 12 illustrates an isopodographic card;

Figure 13 shows an isopodographic diagnostic card;

Figure 14 shows an axonometric diagram;

Figure 15 illustrates another embodiment of the plantar or insole device according to the invention; and

Figure 16 is a bottom view of the device of Figure 14.

Figure 1 illustrates the basic diagram of a podotherapeutic aid or orthetic structure comprising various areas or regions indicated respectively as region 1 which corresponds to the retrocapital rise for the metatarsal heads, as region 2 which corresponds to the rise of the medial plantar arch, as region 3 which corresponds to the rise of the base of the fifth metatarsal, as regions 4 and 5 corresponding to the resting seats of the metatarsal heads, as region 6 which corresponds to the calcaneal resting region. The regions 1 to 6 constitute the portion of orthopaedic insole in which the region 2 can protrude outwards and the region 1 can assume a raised ellipsoidal configuration, as indicated in broken lines.

Figure 2 illustrates the basic diagram related to

corrective inserts or plates and comprising regions 7, 8, respectively at the medial and lateral metatarsal regions, regions 9, 10 respectively at the medial and lateral tarsal region, regions 11, 12, respectively at the medial and lateral heel region. If required, a corrective plate may be provided in a region 13 at the toes.

The same is true for the other side of the orthotic structure, visible in figure 2, where a magnetic semicircular portion 13 b may be provided.

On the basis of these diagrams, and after performing a computerized podographic analysis, described hereinafter, on the patient, an orthopaedic insert specific for the patient can be manufactured.

Initially the patient is placed in orthostatic position and in orthodynamic position on an axonometric isopodograph described below plantar imprints of the right foot and of the left foot are obtained, which constitute both static and dynamic anatomical podograms; i.e. anatomical maps adapted to provide, as will become apparent hereinafter, a whole series of indications required for the diagnosis and the therapy of the case.

An axonometric isopodograph comprises a plurality of sheets held or hinged together along one side thereof, as is illustrated in Figure 11, e.g. a cover A, a front sheet B covered by an elastomer layer on which the feet of a patient are placed. The elastomer layer has printed on its upper surface an isopodographic card outline so as to provide guide lines for a correct positioning of the patient's feet, thereby obtaining by chalcoserigraphy a correct footprint on an isopodographic card C arranged underneath (Figures 12 and 13).

Instead of a front sheet B, use can be made of a two-layer isopodographic card the upper layer whereof is covered by pressure-sensitive carbon paper for obtaining footprints.

The isopodographic card bears reference points such as from P to W, that are marked, e.g. traced with a point-marker pen perpendicular to the surface of the podogram and in contact with the foot in the following positions:

- on the sagittal half of the five toes;
- next the first and fifth metatarsal-phalangeal articulation;
- next the midpoint of the medial malleolus and the lateral malleolus;
- next the sagittal half of the calcaneal tuberosity.

Two tangent lines, medial Lm and lateral Ll, connecting the outermost points of the podographic image, and an intermediate bisecting line x, between which the angle of valgoid and/or varus condition of the big toe remains delimited and pointed out, are also marked.

The complete podogram of the above specified indications allows to analyze the features listed hereinafter.

- Length of the foot: measured in millimeters from the reference point P at the calcaneum to the reference point U related to the longest toe, and the size is deduced from this length.

- Resting surface of the toes and of the sole: measured for example in square centimeters and compared with values considered normal according to statistical average values.

- Footprint: provides the configuration of the resting surface or sole of the foot, which may be arched, pre-arched, pre-arched, normal, pre-flat, pre-flat-flat, flat plus-flat.

- Average pressure: which is calculated for example in kilograms per square decimeter, and allows to evaluate any functional asymmetries and/or suspected conditions of overweight or overpressures.

- Anatomical anomalies: those situations on the podogram in which a distance greater than 6 mm from the normal position is detected are classified as such. The anomaly and its extent may be highlighted with a circumference the center whereof corresponds to the normal position and with a radius equal to the distance between said normal position and the detected point.

- Morphology of the metatarsal region. The classification is performed according to the general arrangement of the anatomical reference points of the metatarsal region, in both static and dynamic conditions. Thus, for example, if the set of points is predominantly rotated towards the outside, lateral side of the foot, this is due to an inversion morphology, or to induced supination; if the opposite occurs, it means that the anomaly is caused by a eversion morphology or by the induced pronation.

- Morphology of the heel region. The classification is referred to the position of the anatomical reference points proximate to the malleoli and to the position of the axis of the tibio-tarsal articulation. The morphology is considered anomalous if the sum of the displacements is greater than one centimeter and the axis of the tibio-tarsal articulation is rotated by more than 20° with respect to the normal.

- Morphology of the calcaneum. It is evaluated on the basis of any displacements of the intermediate bisecting line from normality in the static podogram and by accounting for other characteristics detectable from the dynamic podogram. Valgoid or varus conditions, and vitiated attitudes of the heel region, are thus determined.

- Biomechanical functions and asymmetry ratio. The ratio between the sum of the left front and rear right functional parts and the sum of the right front and left rear parts is considered, and if this exceeds 5% it is a indicator of difficulty in normal deambulation.

The isopodographic card obtained by means of

isopodograph can be fed into a suitably programmed computer which, by processing the input data on the isopodographic card, can print an individually tailored isopodographic diagnostic card such as that shown in Fig. 13 which may also include alphanumeric information and/or technical details, drawings, diagrams and other indications about the manufacture of an axonometric plantar or insole device.

Thus the foot imprints on the isopodographic card are analysed and processed by the computer that makes an objective diagnosis and can provide through a printer and a plotter a perspective and axonometric diagram (see Fig. 14) for both feet. Each pair of such diagrams can form a homothetimeter (when printed on transparent sheets or plates) and include a number of homothetic triangles TR having their base on the central bisecting line x extending outwardly towards the lateral bisecting lines. The height of such triangles is proportional to the degree of homothetic of the plantar arch, e.g. positive for flat feet and negative for the arched ones.

The above described computerized analysis makes it possible, as mentioned, to produce an orthopaedic insert of the type described by way of example with reference to figures 3, 4, 5 and 6.

In said figures, 14 indicates a template acting as diaphragm and provided in a plate of an elastically deformable material such as polythene or polyester or the like, advantageously transparent. The template 14 is adapted to support, on the face to be directed towards the sole of the foot, an orthotic structure obtained by acting selectively on the basic diagram of figure 1 and made of an elastically deformable soft material 15, such as latex foam or foamed polyurethane, suitably shaped as is shown in figures 4 and 5 and delimited by the lines 15a, 15b as well as by the contour of the template, on which portions of sheets of magnetized rubber, indicated respectively at 16, 17, 18, are applied. Similar portions of magnetized rubber sheets e.g. including a plurality of parallel magnetization lines, are applied directly to the template 14 and are indicated at 19 and 20 in the heel region.

These portions of sheets of magnetized rubber, which may have a thickness ranging for example from 0.5 to 10 mm, can be arranged at different orientations of their magnetic lines and create a relatively weak magnetic field, which may vary from a few thousandths to a few hundred gauss. A magnetic field of such intensity is useful in the anti-inflammatory prophylaxis of arthroses in general, and is particularly effective in the treatment of many affections, such as for example may be hyperkeratoses of the sole of the foot, haematomas, strains, sprains, foot pains in general.

Relatively weak magnetic fields are also a good adjuvant therapy in the vasoactivation of the sole of the foot and of the legs. On the side of the template 14 (Figure 6) to be directed towards the ground, a corrective insert plate 21 is present which can be provided monolithically obtained by using elastically deformable spongy elastomer material, but may be obtained with materials having different rigidity, such as magnetized rubber, cork or leather, according to the corrective, compensatory requirements or for the requirements of sport.

The plate 21 has been obtained by acting selectively, after performing the computerized analysis of the patient, according to the diagram of figure 2, bearing in mind that a plate in the region 7 corrects eversion and pronation, a plate in the region 8 corrects inversion and supination, and so on.

An orthopaedic insole such as the one described above can be externally covered for finishing with a covering layer, not illustrated in the drawings, for example made of silk or cotton fabric or leather or other suitable material.

Figures 7 and 8 illustrate an orthopaedic insole according to a modified embodiment of the invention and obtained as a monolithic body 22 in elastically deformable soft material, such as latex foam, conveniently shaped and configured as well as provided with portions of magnetized rubber sheet 23, 24, 25, 26 arranged in predetermined regions of a map indicated with broken lines. Said map also comprises sections 27a, 27b, 27c, at the medial and lateral metatarsal region, a section 28 at the medial plantar arch, and sections 29a and 29b at the heel region, which, if required, can be occupied by portions of magnetized sheet.

Figure 9 illustrates a podotherapeutic aid constituted by a shoe 30 with insole 31 conveniently shaped and provided with portions of magnetized rubber sheet and with a band 32 adherent to the upper and including portions of magnetized rubber sheet.

Figure 10 illustrates a band 33 in elastic fabric, adapted to embrace the foot or leg, which comprises regions 34a, 34b affected by magnetized rubber sheets. The band 33 is provided, at its ends, with portions 35a, 35b of tear-open tape for fixing in position.

Another embodiment of computerized orthotic plantar device 40 is diagrammatically shown in Figures 15 and 16. The plantar device 40 includes, in the order, a flat base sheet 41 made of leather or the like, a silk-screened transparent polyester sheet 42 resting on the sheet 41, a plurality of corrective inserts 43, a layer 44 of reflexogenics, aromatizers, sanitizers or the like, a layer of fabric 45, a casting 46 of a foamed material and a cover

sheath 47.

The main function of the transparent sheet 42 is to provide, by transferring a computerized axonometric technical card, indications as to the provision of notches, cushioning inserts, sensors for individually tailored orthosis, as well as to act as a reinforcing and resilient element. The inserts 43 can comprise pieces of leather, cork, wood, plastics material having a thickness ranging from 0,2 to 50 mm, rubber cushions inflated with air acting as sensors.

The layer 44 can include functional substances with relaxing, refreshing, decongestive, deodorant, dermopurifying, antifatigue and antimycotic effects.

Such functional substances, including additives with specific properties, provide a progressive and constant release of their properties and comprise: essential oils of mint, pine, eucalyptol, gomenol, lavender, camphor, thyme, sage, rosemary, camomile together with copolidiol 20 and captan to obtain the "slow release aromatic" effect.

To obtain a sanitizing action one can add: quaternary ammonium salts, salicylic acid, lysozyme, interferon, undecylenic amide, undecylenic acid, usnic acid.

By way of example the layer 44 can comprise medications and reflexogenic aromatizing agents in the following amounts: active vegetable coal 2 to 5 gr; chlorophyll 2 to 5 gr; quaternary ammonium salts 0.01 to 1 gr; salicylic acid 0.5 to 5 gr; lysozyme 0.2 gr to 1 gr; interferon 0.01 gr to 0.1 gr; undecylenic amide 1 to 5 gr; undecylenic acid 0.2 to 1 gr; usnic acid 0.2 to 1 gr; copolidiol 5 to 20 gr; captan, 1 to 10 gr; lavender essence 0.2 to 2 gr; rosemary essence 0.2 to 2 gr; menthol 0.5 to 2 gr; camphor 0.5 to 2 gr; eucalyptol 0.5 to 2 gr; thymol 0.5 to 2 gr; gomenol 0.5 to 2 gr; sage essence 0.2 to 2 gr; camomile essence 0.2 to 2 gr.

The foam material 46 can be polyurethane, latex foam, silicon or the like, whereas the cover sheath 47 can be made of leather, cotton, silk, plastics porous material.

The above described invention is susceptible to numerous modifications and variations within the scope of the claims.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. A podotherapeutic aid characterized in that it comprises an insole member including a therapeutic curative means (16, 17, 18, 23;44) and having an orthetic pattern (15;22;46) on its surface designed to face, in use, the sole of a foot, such a configuration being homothetically determined and axonometrically individually tailored by means of a computer data processing.

2. An aid as claimed in claim 1, characterized in that said curative means (16,17,18,23) comprises at least one portion of a sheet of magnetized material suitable for generating a magnetic field ranging from a few thousands to a few hundreds gauss.

3. An aid as claimed in claim 2, characterized in that it comprises a multi-layer structure including in sequence at least one corrective plate (21), a laminar template (14) acting as a diaphragm to one face of which the or each corrective plate is attached, a plurality of portions (15) of a soft and resiliently deformable material defining the said orthetic pattern secured to the other face of the template (14), and portions (16,17,18) of magnetized sheet material on said orthetic pattern.

4. An aid as claimed in claim 3, characterized in that the or each corrective plate (21) comprises a sheet of magnetized rubber material.

5. An aid as claimed in claim 3, characterized in that the said multi-layered structure comprises a sheet envelope or enclosure.

6. A footwear when including a podotherapeutic aid as claimed in claim 2.

7. An aid as claimed in claim 1, characterized in that said curative means (44) comprises show-release medicinal and reflexogenic aromatizing agents.

8. An aid as claimed in claim 7, characterized in that the said medicinal and reflexogenic aromatizing agents (44) include: active vegetable coal 2 to 5 gr, chlorophyll 2 to 5 gr, quaternary ammonium salts 0.01 to 1 gr, salicylic acid 0.5 to 5 gr, lysozyme 0.2 to 1 gr, interferon 0.01 to 0.1 gr, undecylenic amide 1 to 5 gr, undecylenic acid 0.2 to 1 gr, usnic acid 0.2 to 1 gr, copolidiol 5 to 20 gr, captan 1 to 10 gr, lavender essence 0.2 to 2 gr, rosemary essence 0.2 to 2 gr, menthol 0.5 to 2 gr, camphor 0.5 to 2 gr, eucalyptol 0.5 to 2 gr, thymol 0.5 to 2 gr, gomenol 0.5 to 2 gr, sage essence 0.2 to 2 gr, camomile essence 0.2 to 2 gr.

9. An aid as claimed in claim 7, characterized in that it comprises a multi-layered plantar or insole including, in sequence, a flat base sheet (41) of leather or the like, a transparent flexible sheet (42) resting on the base sheet, a plurality of corrective inserts (43) having a thickness ranging from 0.2 to 50 mm carried by the transparent flexible sheet,

medical and reflexogenic aromatizing agents (44), a fabric layer (45) covering the said medical and reflexogenic aromatizing agents, a cast orthotic pattern (46) of foamed material and a covering or enveloping sheath (47).

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10. A footwear when including a podotherapeutic and as claimed in claim 9.

11. An isopodograph device comprising a plurality of sheets held or hinged together along one side thereof and including a cover (A), a front sheet (B) covered by an elastomer on which the feet of a patient can be placed and bearing, printed on it, an isopodographic card outline to provide a guide means for correct positioning of the patient's feet, and an isopodographic card (C) arranged underneath the front sheet to receive footprints of the patient's feet by chalcography.

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Fig.2

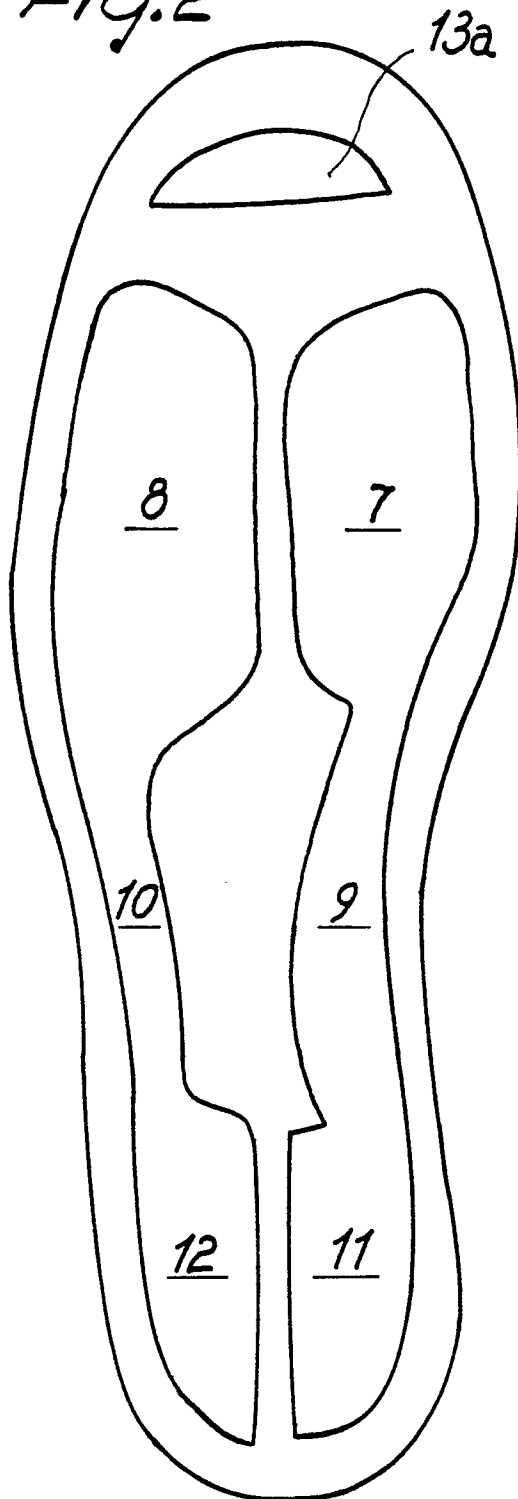
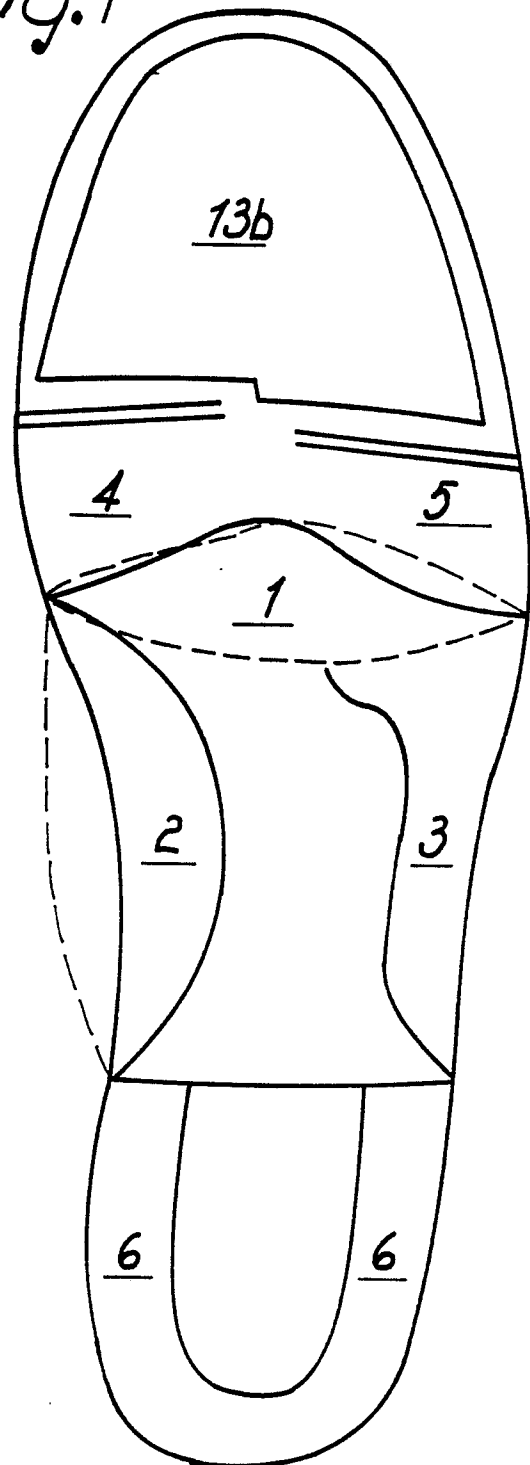


Fig.1



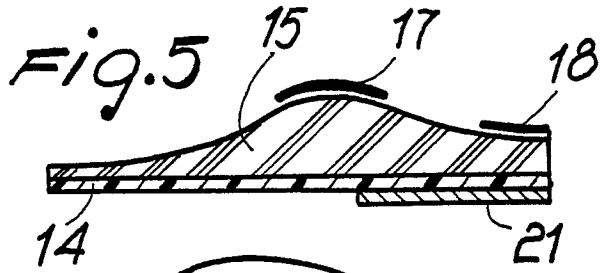


Fig.6

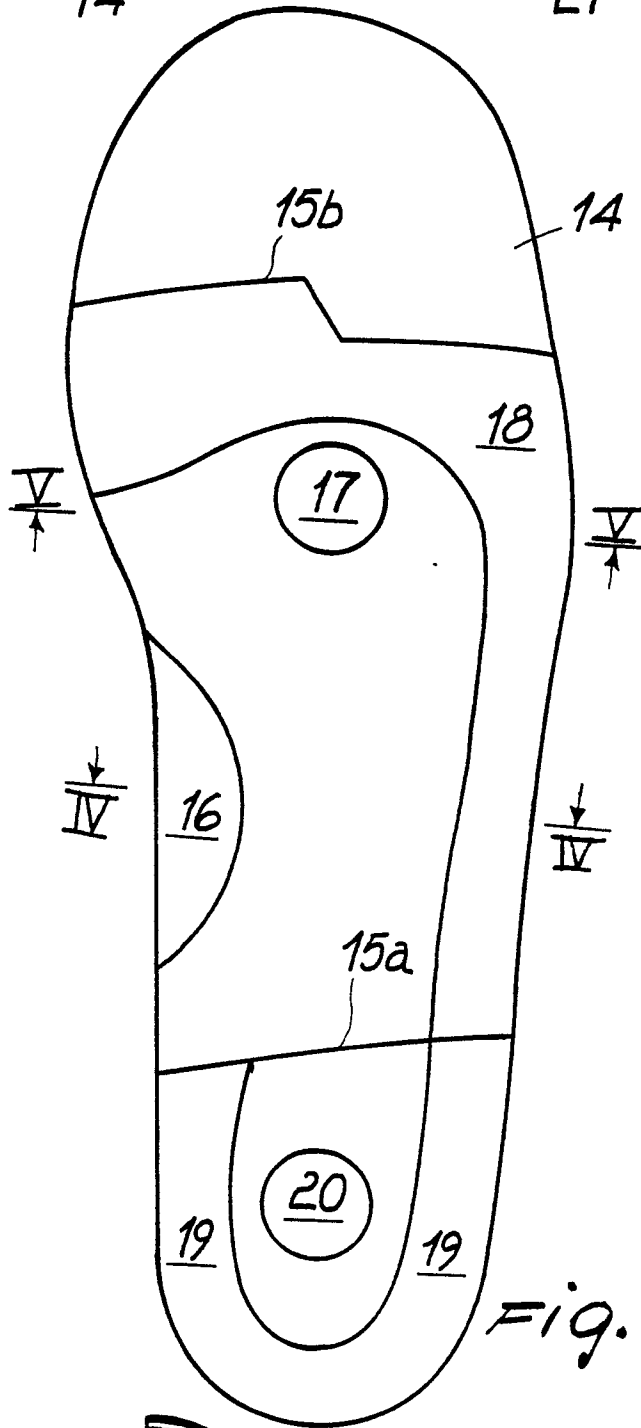
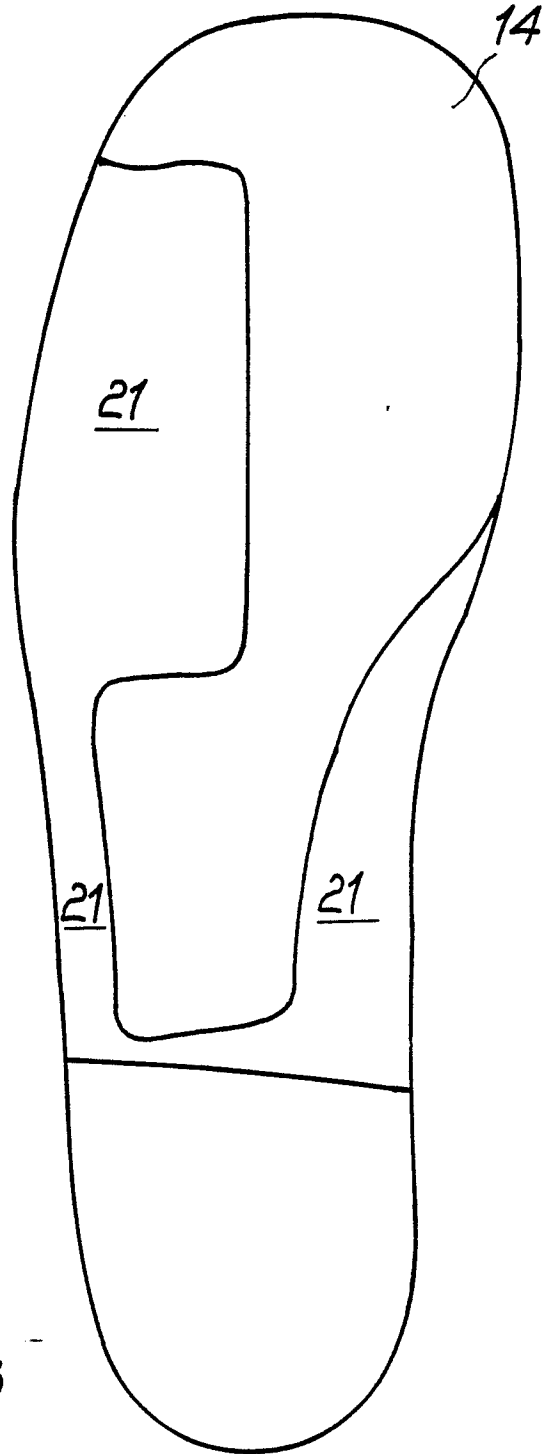


Fig.3

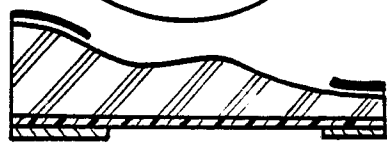
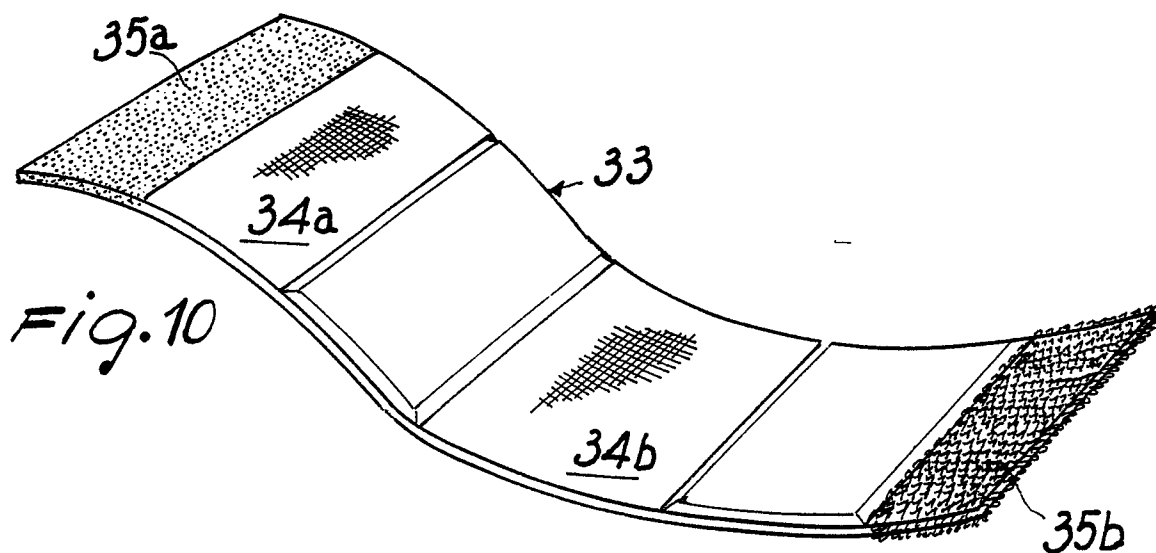
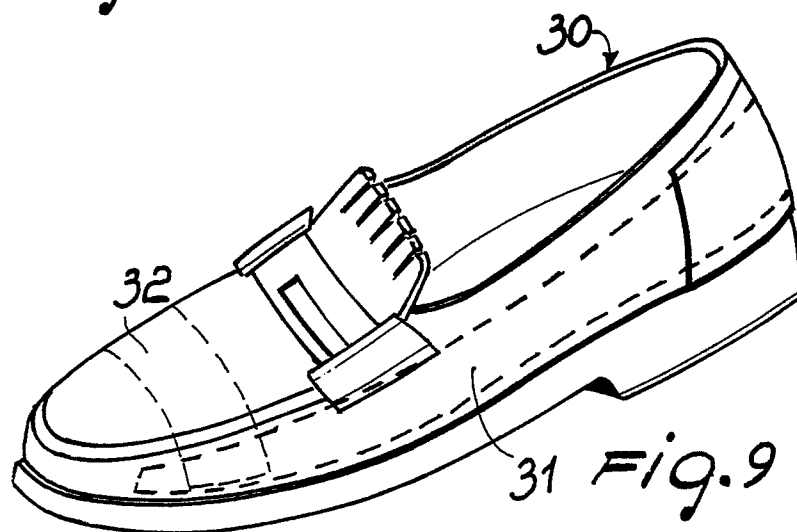
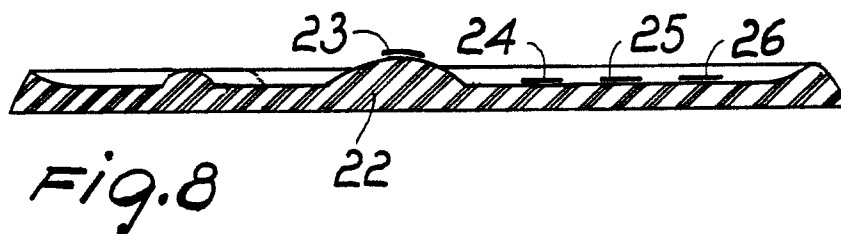
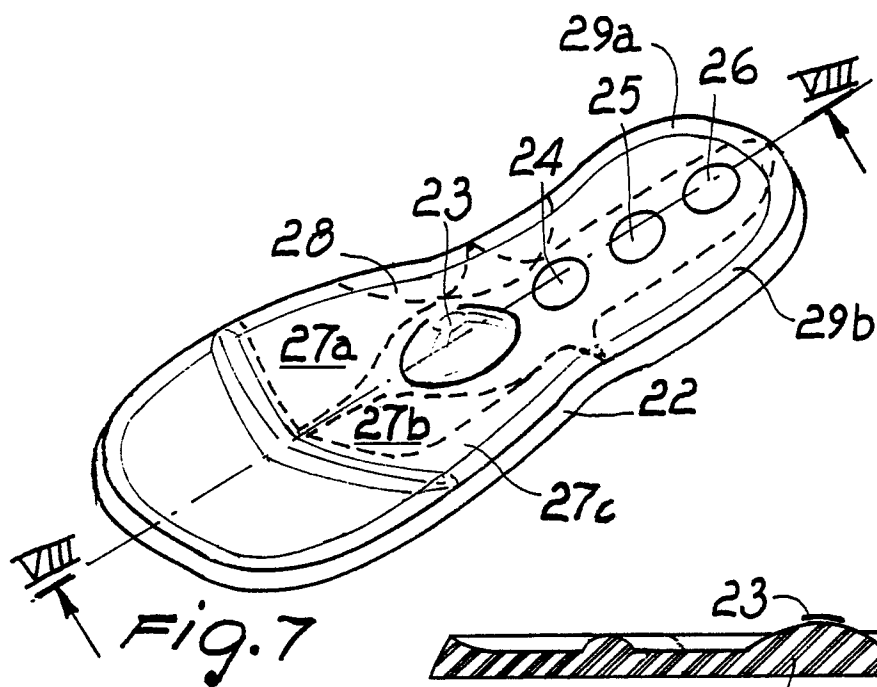


Fig.4



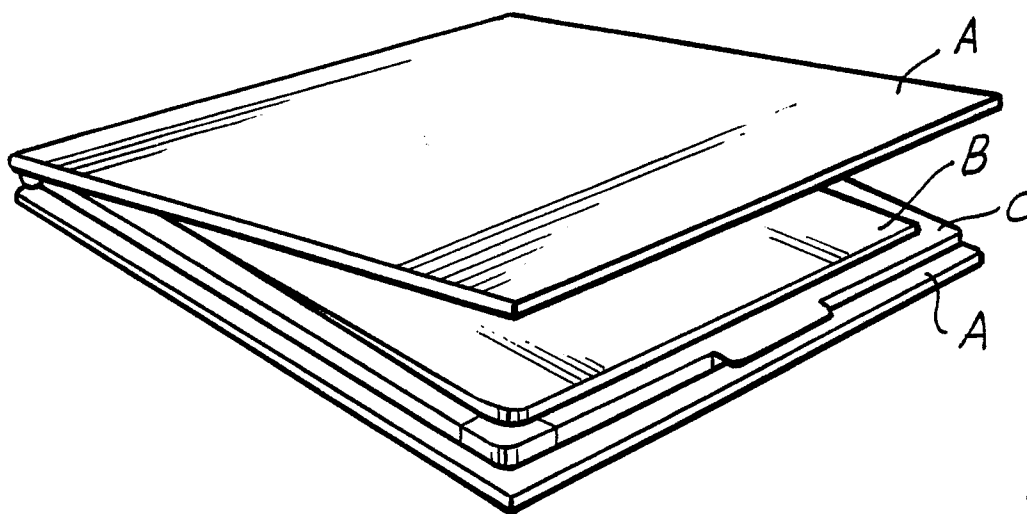


FIG. 11

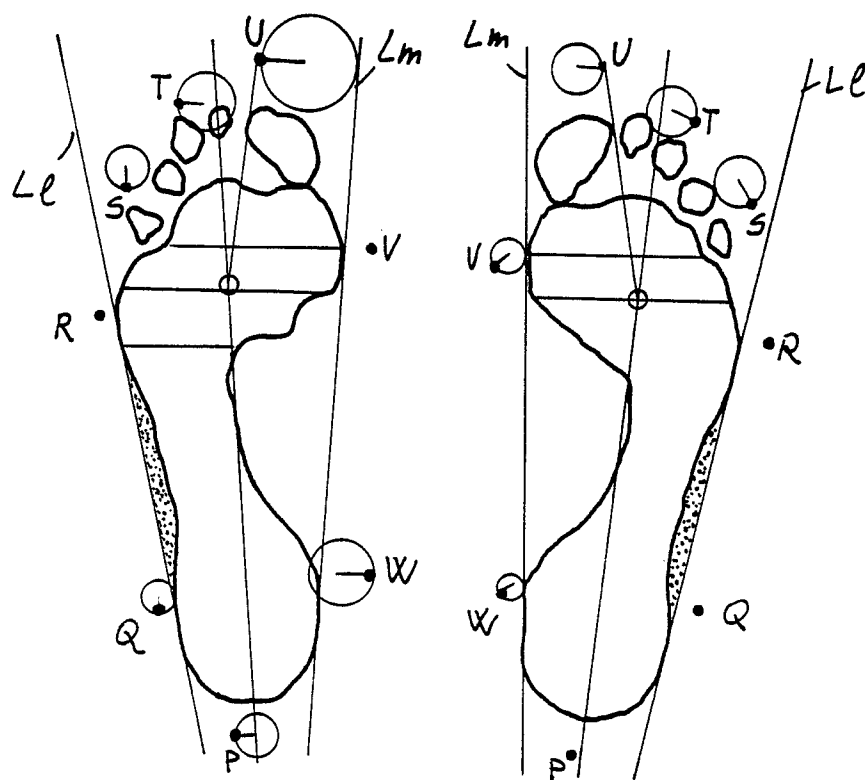


FIG. 13

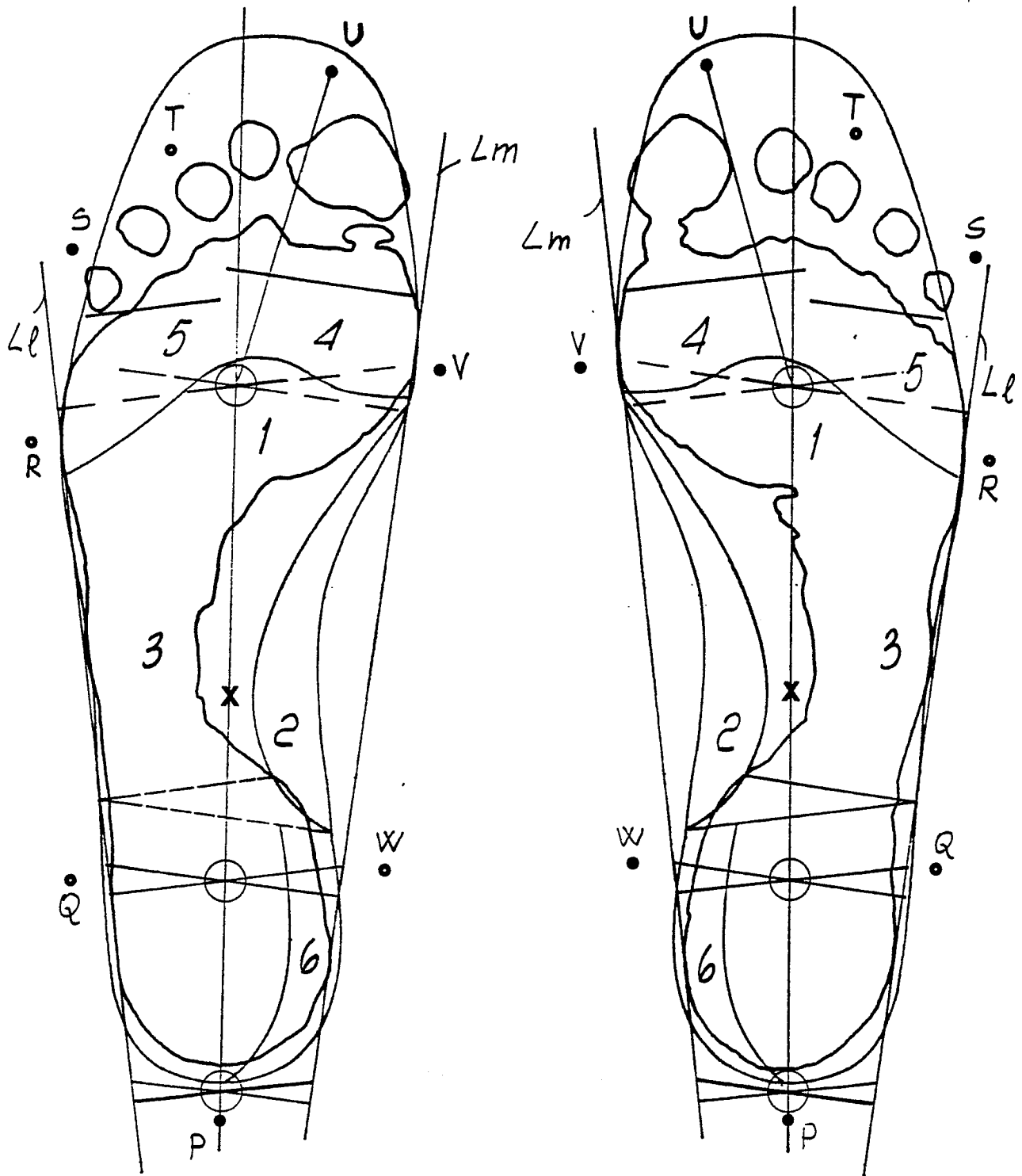


Fig. 12

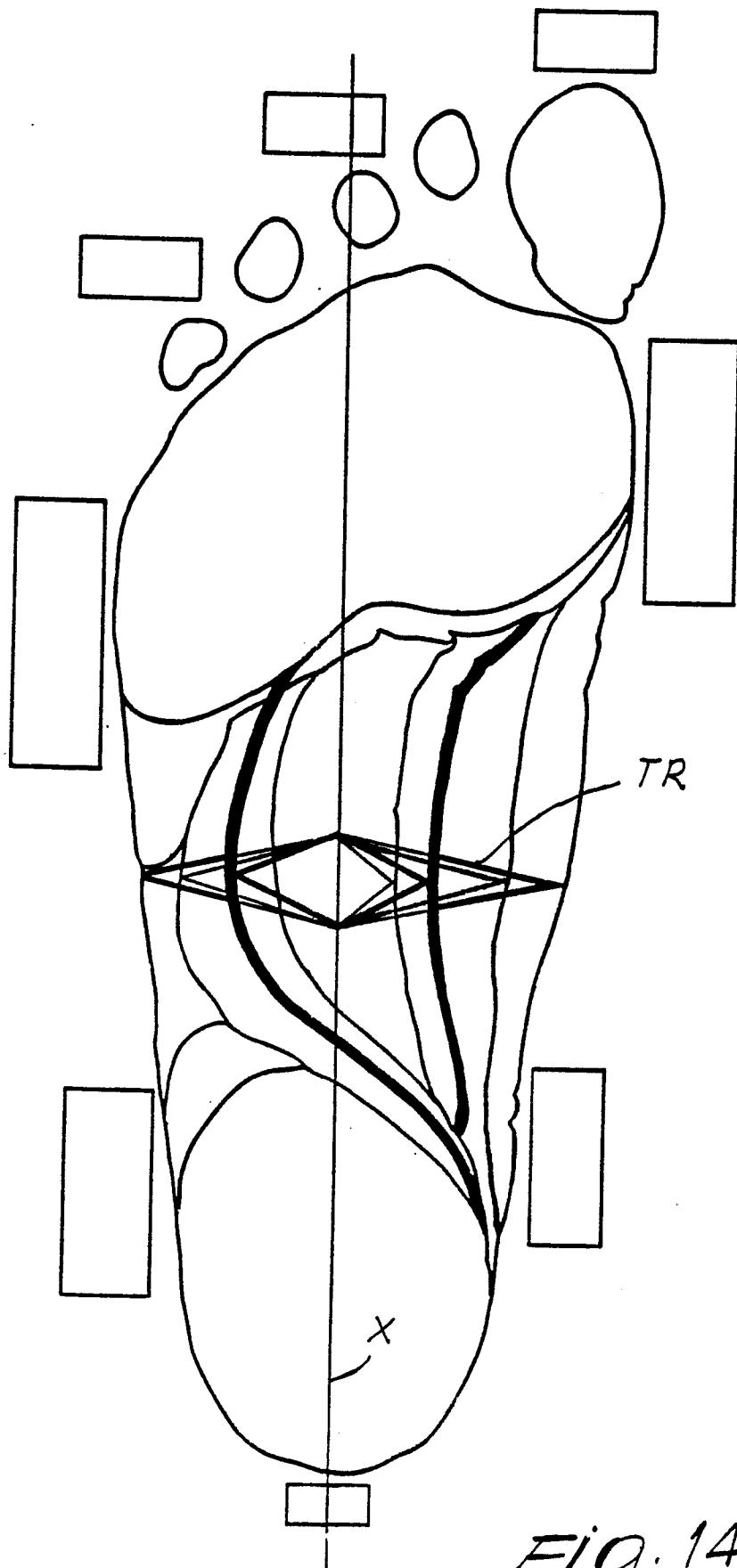


Fig. 14

