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(54) Title: FOOTWEAR EQUIPPED WITH A DEVICE TO VARY THE ELASTICITY OF THE SOLE

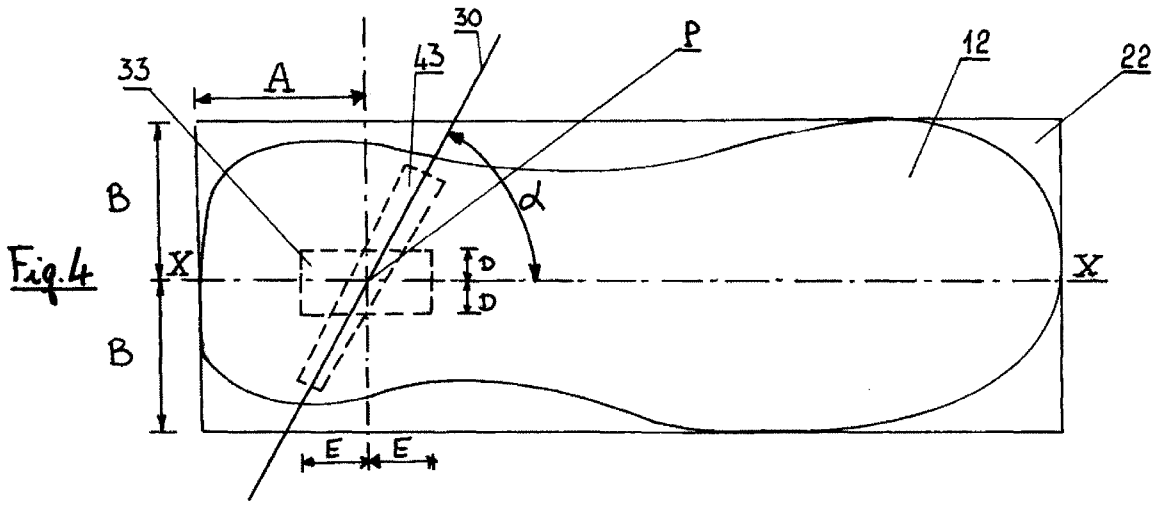

Fig.4

(57) **Abstract:** Footwear provided with a device to vary the elasticity of the sole comprising an upper (11), a sole (12) and a tread (13), wherein said device comprises at least one shim (43) inserted in the rear area of the sole in the direction inclined with respect to the longitudinal axis (X-X) of the sole itself, wherein said inclined direction is highlighted by an axis (30) passing through a point (P) inside the sole at a dimension (A) of approximately one fifth of its length, starting from its rear end, where the axis (30) meets the internal lateral surface of the sole in a point (32) and the external lateral surface of the sole in a point (31).

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Footwear equipped with a device to vary the elasticity of the sole

This invention relates to a shoe with elastic response adjustment, through a device that varies the elasticity of the sole, in particular arranged in the rear part of the sole.

In nature, soft ground provides proper support to the foot, as if the foot itself were inside a plaster cast while, on hard ground, this does not happen and it is therefore necessary to look for the most appropriate solutions to make the foot work correctly and thus avoid damage to the joints of the legs and back. The correct transfer of pressure on the support surface progressively affected during walking/running depends, however, to a significant extent on the shape of the footwear sole, on the consistency of the material with which it is made as well as on the shape, material and hardness of the tread.

Different types of footwear are known on the market that try to overcome the problem by using different materials with inserts placed inside the sole and made of materials of different consistencies such as, for example, rubber or gel. Alternatively, insoles that are particularly shaped according to the needs of the individual are used inside the footwear.

In traditional footwear with soles made of rigid materials, however, there is little deformation of the sole and, therefore, the foot struggles to adapt to surfaces and perform its functions.

The purpose of this invention is to obviate the aforementioned drawbacks by providing a sole for footwear with a device capable of allowing the adjustment of the support of the foot according to the needs of the person. Hence, a shoe is made with, in the rear area of the sole, an adjustable device that modifies the elastic response of the shoe itself, as if the foot were inserted into its own

plaster cast. In practice, the shoe, during walking, helps the propelling movement of the foot.

The sole, according to this invention, has a device which varies its elastic response.

The proposed invention includes a device, inserted in the rear area of the sole, in an inclined position with respect to the longitudinal axis X-X of the sole itself. In a preferable solution, said device is a shim made preferably in the shape of a truncated cone with an elasticity that varies by adjustment, but it can be made in many ways including, by way of example only, injection of material into a suitable cavity or by injecting gas under pressure into plastic pockets.

In a second preferable solution, the device is preferably a cylindrical shim.

The axis, on which the device exerts its pressure, is located at a distance from the rear end of the sole, equal to about one fifth of the length of the latter and about half the width of the rectangle circumscribed to the projection of the sole on the horizontal plane of the sole.

This forms on the horizontal plane, with respect to a longitudinal axis, an angle preferably between 70 and 55 sexagesimal degrees oriented towards the inside of the sole, while it forms, on the transverse vertical plane, with respect to a horizontal transverse axis, an angle preferably between 4 and 10 sexagesimal degrees, oriented downwards and towards the outside of the sole.

For the purposes of this invention, to facilitate the definition of the geometric characteristics of the sole, given the infinite possibilities of different geometric shapes, this will be represented in the figures as a parallelepiped with a rectangular base.

The characteristics of the invention will be better understood by means of the description of the attached figures which refer to an embodiment cited only by way of non-limiting example, where:

Figure 1 represents the external lateral profile of the sole of a right shoe according to this invention;

Figure 2 represents the external side view of the rectangular parallelepiped in which the sole according to this invention is inserted;

Figure 3 represents the internal section along the X-X axis of Figure 4 of the rectangular parallelepiped into which the sole according to this invention is inserted;

Figure 4 represents the plan view of the sole of Figure 1 inserted inside the rectangle parallelogram according to this invention;

Figure 5 represents a transverse vertical section of the rectangular parallelepiped in which the sole is inserted according to the plane IV-IV of Figure 1;

Figure 6 represents the side view of the wedge of this invention;

Figure 7 represents the front view of the wedge of Figure 6;

Figure 8 represents the side view of a first embodiment of the elasticity adjustment device according to this invention;

Figure 9 represents the front view of the device of Figure 8;

Figure 10 represents the side view of a second embodiment of the elasticity adjustment device according to this invention;

Figure 11 represents the front view of the device of Figure 10;

Figure 12 represents the side view of a second embodiment of the wedge of this invention;

Figure 13 represents the front view of the wedge of Figure 12;

Figure 14 represents the top view of the wedge of figure 12;

Figure 15 represents the side view of a third embodiment of the wedge of this invention;

Figure 16 represents the front view of the wedge of Figure 15;

Figure 17 represents the top view of the wedge of Figure 15;

Figure 18 represents the side view of a fourth embodiment of the wedge of this invention;

Figure 19 represents the front view of the wedge of Figure 18;

Figure 20 represents the top view of the wedge of Figure 18;

Figure 21 represents the side view of a fifth embodiment of the wedge of this invention;

Figure 22 represents the front view of the wedge of Figure 21;

Figure 23 represents the top view of the wedge of Figure 21;

Figure 24 represents the longitudinal section of the device according to the alternative embodiment of the cylindrical shim in expandable rubber equipped with a closure cap;

Figure 25 represents the front view of the device of Figure 24;

Figure 26 represents the longitudinal section of the device according to the alternative embodiment of the cylindrical shim in expandable rubber without a closing cap;

Figure 27 represents the front view of the device of Figure 26;

Figure 28 represents a partial longitudinal section of the device according to the alternative embodiment of the truncated cone-shaped shim, in expandable rubber equipped with a closing cap;

Figure 29 represents a partial longitudinal section of the device according to the alternative embodiment of the truncated cone-shaped shim, in expandable rubber without a closing cap.

In Figure 1, the shoe 10 (right) comprises an upper 11, a sole 12 and a tread 13.

For the purposes of this invention, it should be noted that a right shoe is illustrated, but similar symmetrical positioning and indications are provided for a left shoe.

The sole 12 is shown as inscribed in a parallelepiped 20 with a rectangular base whose external lateral face 21 is illustrated in Figure 2; the projection of its horizontal face 22 is shown in Figure 4; the projection of its inner face 23 is shown in Figure 3 and its transverse vertical section is shown in Figure 5.

According to a preferable solution of the invention, the sole 12, in its rear region, envisages a device for varying the elasticity of the sole comprising at least one wedge 43 also in the form of a truncated cone with adjustable thickness, arranged in the inclined direction (with respect to the longitudinal axis X-X of figure 4 of the sole) highlighted by axis 30, which crosses the sole 12 passing through a point P inside the sole itself, located approximately one fifth of the length of the sole, starting from the rear end of the sole. itself, as indicated by the dimension A in Figure 4 and at about half of the transversal dimension of the parallelepiped 20, as indicated by the dimensions B in Figures 4 and 5 and at about half the height of the parallelepiped 20 (and therefore of the sole), as indicated from the dimensions C of Figure 5. The dimensions C can, however, be different since it is important to leave as much material as possible between the wedge 43 and the foot.

The position of the point P can vary, in one way and the other, in one direction and the other, around the position indicated in Figure 4, and defined above,

even up to about a tenth of the width of the sole, transversely, and even up to one twentieth of the length of the sole, longitudinally, as indicated by the dimensions D and E of the dashed rectangle 33 in Figure 4. The axis 30, which highlights the direction of insertion of the device, meets the internal lateral surface of the sole in a point 32 and the outer lateral surface of the sole at a point 31. As shown in Figure 5, the axis 30 forms an angle ß in the transverse vertical plane with a horizontal transverse axis Y-Y. This angle ß is between 4 and 10 sexagesimal degrees. The axis 30 of the adjustable wedge 43 forms an angle α in the horizontal plane with the longitudinal horizontal axis X-X passing through the point P.

The angle α is preferably comprised between 70 and 55 sexagesimal degrees and faces the inner side of the sole and, therefore, to the left for the right sole and to the right for the left sole.

At points 32 and 31 there will therefore be the inlet and possibly outlet holes of the adjustable device indicated schematically by its axis 30.

The position of the axis 30 of the adjustable device has so far been defined through the position of the point P and through the angles α and ß but can be defined in any other equivalent way, for example through the coordinates of points 31 and 32.

The aforementioned device preferably has a circular section and therefore appears as a thin truncated cone. It is made of a material with a different elasticity than the sole where it is embedded.

This device could also be made of a different shape, for example, with a quadrangular cross-section, preferably rectangular, or with a polygonal section.

With reference to Figure 8, a first possible solution of the adjustable device according to the invention is indicated, in which said device comprises a bolt

41 which is screwed along the longitudinal axis of the wedge 43 made of elastic material in an internal thread 42 and which protrudes from the wedge itself so that a nut 53, equipped with a washer 45, can screw onto it. Another washer 46 is held firm by the head 44 of the bolt 41 at the opposite end of the wedge 43. The bolt 41, therefore, when screwed, brings the two washers 45, 46 arranged at the opposite ends of the wedge itself closer, compressing it, widening the central part of said wedge 43. It, therefore, presses the parts of the sole 12 adjacent to it, causing an increase in the local thickness of the sole itself in that area.

The adjustment is achievable by means of a tool acting on the head 44 of the bolt.

With reference to Figure 10, the device is formed by an adjustable wedge 43 equipped with a traditional type screw anchor 50 inserted inside the wedge 43.

The screw anchor 50 is therefore formed by a bolt 51 and, preferably, at least three fins 52 which open by screwing said bolt 51. The nut 53, in fact, approaches the head of the bolt 51 and the at least three fins 52 go to press the walls of the wedge 43 adjacent to them by widening its side walls which, in turn, press the adjacent part of the sole 12, thus causing an increase in the local thickness of the sole itself in that area.

In order to avoid possible discomfort to the foot due to the presence of the device according to this invention, it is advisable to make the inner sole of the shoe with anti-shock materials.

For the sake of completeness, it is noted that the shim according to the present invention may have various embodiments as shown by way of example in Figures 12-23.

In a second preferred embodiment, the adjustment device consists of a shim with a preferably cylindrical shape (Figures 24, 25, 26 and 27) or truncated cone (Figures 28 and 29).

Said shim of preferably cylindrical or truncated cone shape comprises a storage vessel 60, made of elastic material (for example rubber), to contain air, gas or liquids, capable of deforming and resisting a high pressure of up to 4 atmospheres thus to withstand the pressure generated on the sole of the shoe by a person walking or running. Said storage vessel 60 is equipped, at one end of it, the one placed towards the outside of the sole, with an inlet and seal valve 61 with relative closing cap 62 and, at the other end, with closing cap 63.

In a further preferable embodiment (Figures 26 and 27), the storage vessel 60 is completely similar to the one shown in Figures 24 and 25 but without, at the second end, a closing cap as it is made in a single piece equipped only with the sealing and inlet valve 64 equipped with the valve closing cap 65.

The device, therefore, according to said latter solutions, can be loaded with air, gas, liquids and, once put under pressure, it will expand inside the special hole made in the sole, stiffening to the desired extent and this expansion will modify, consequently, the elasticity of the sole.

The embodiments described in this description and the configurations shown in the drawings are the preferable embodiments of this invention but also the technical variants that fall within the concept expressed above of this invention are to be considered protected by the patent.

CLAIMS

1. Footwear provided with a device to vary the elasticity of the sole comprising an upper (11), a sole (12) and a tread (13), wherein said device comprises at least one shim (43) inserted in the rear area of the sole in the direction inclined with respect to the longitudinal axis (X-X) of the sole itself, characterised by the fact that said inclined direction is highlighted by an axis (30) passing through a point (P) inside the sole at a dimension (A) of approximately one fifth of its length, starting from its rear end, where the axis (30) meets the internal lateral surface of the sole in a point (32) and the external lateral surface of the sole in a point (31).

2. Footwear according to claim 1, wherein said device comprises at least one wedge-shaped shim (43).

3. Footwear according to claim 2, wherein said wedge (43) preferably has a truncated cone section.

4. Footwear according to claim 2, wherein said wedge (43) has a circular cross-section or of any other shape.

5. Footwear according to the preceding claims, wherein the device comprises a bolt (41) and a nut (53) wherein said bolt (41) is screwed along the longitudinal axis of the wedge itself into an internal thread (42) and in the nut (53) and brings two washers (45, 46) close to the opposite ends of the wedge (43), compressing it and increasing its width by effect of tightening of the bolt (41) so as to determine the increase in the thickness of the sole in that area.

6. Footwear according to claim 5, wherein the adjustment of the bolt (41) is carried out by means of a tool which acts on the head (44) of the bolt itself.

7. Footwear according to the preceding claims, wherein the device is formed by an adjustable wedge (43) equipped inside with a traditional type screw

anchor (50) formed by a bolt (51) and by at least three fins (52) which are opened when a nut (53) approaches the head of the bolt (51), increasing the width of the wedge (43) which causes the thickness of the sole to increase in that area.

8. Footwear according to claim 1, wherein said shim (43) is cylindrical or truncated cone in shape and made of elastic material.

9. Footwear according to claim 8, wherein said shim (43) of cylindrical or truncated cone shape comprises a storage vessel (60) for containing air, gases or liquids, capable of deforming and resisting high pressure, equipped, at one end of it, the one placed towards the outside of the sole, with an inlet and seal valve (61) with relative closing cap (62) and, at the second end, with closing cap (63).

10. Footwear according to claim 9, wherein said storage vessel (60) is made in a single piece and equipped, at a first end thereof, the one located towards the outside of the sole, with an inlet and seal valve (64) with relative closing cap (65).

11. Footwear according to claims 9 and 10, wherein said shim (43) comprehends a storage vessel (60) which is able to expand inside the special hole made in the sole so as to modify its elasticity.

12. Footwear according to claims 1 and 8, wherein said axis (30) passes through a point (P) located at about half thickness (C) of the sole, preferably as close as possible to the tread (13) of the sole (12) and to a dimension (B) of approximately half the local width of the sole.

13. Footwear according to claims 1 and 8, wherein the projection of said axis (30) in the horizontal plane forms an angle (α) of between 70 and 55 sexagesimal degrees with the horizontal longitudinal axis (X-X) of the sole,

and is facing the inner side of the sole and then to the left for the right sole and to the right for the left sole.

14. Footwear according to claims 1 and 8, wherein the projection of said axis (30) in the vertical transverse plane forms, with a horizontal transverse axis (Y-Y) an angle (β) of between 4 and 10 sexagesimal degrees, an angle facing downwards lower than the outer side of the shoe sole.

15. Footwear according to claim 12, wherein the position of the point (P) varies up to a dimension (D) of about one tenth of the local width of the sole, transversely, and up to a dimension (E) of one twentieth of the length of the sole longitudinally.

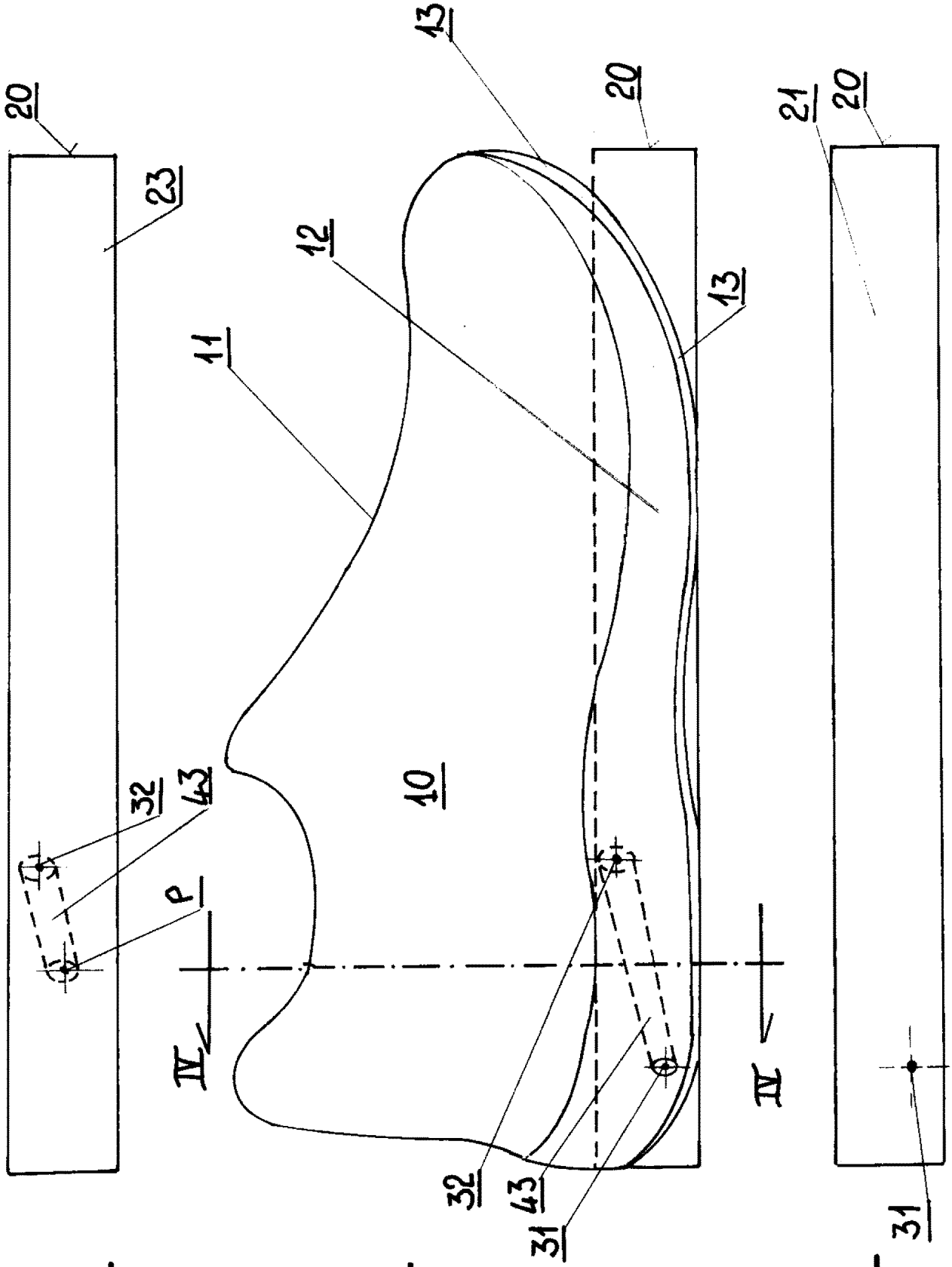

Fig.3

Fig.1

Fig.2

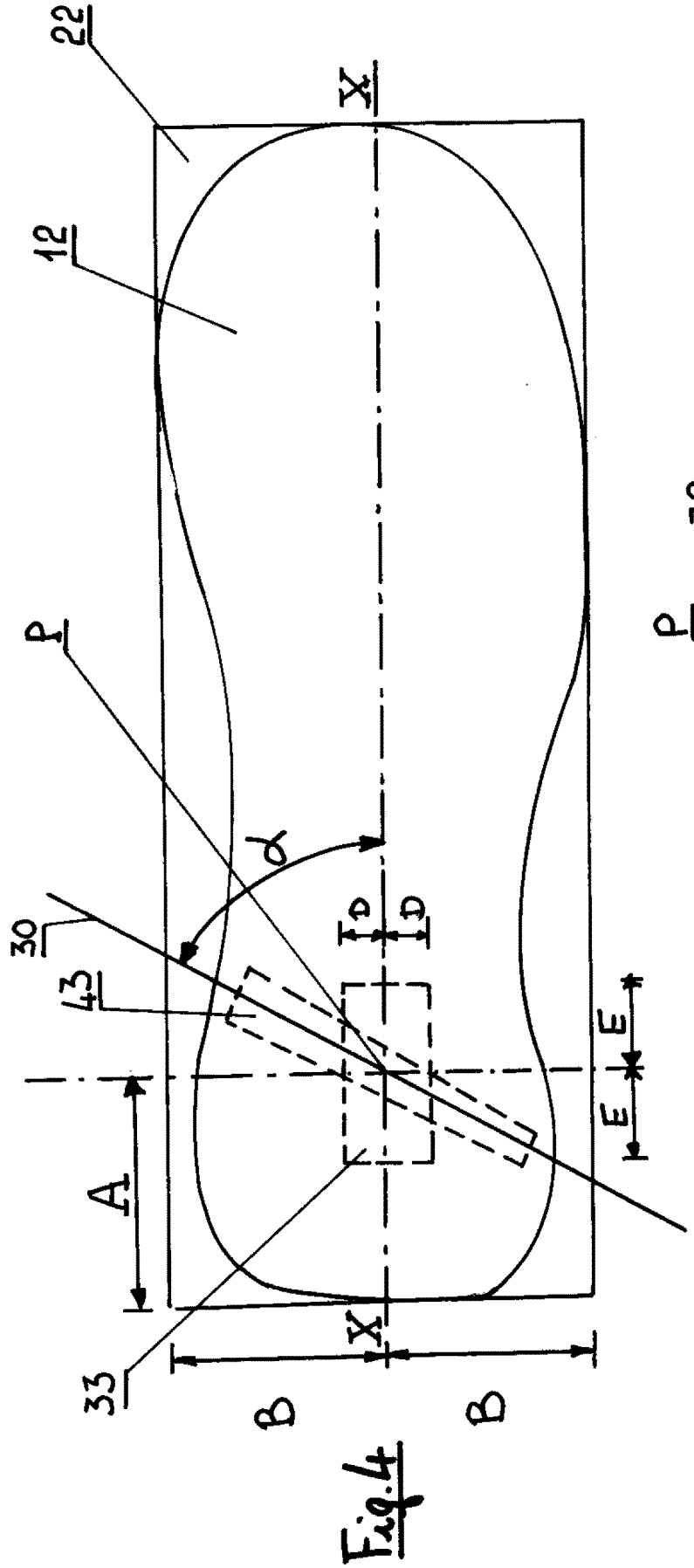

Fig.4

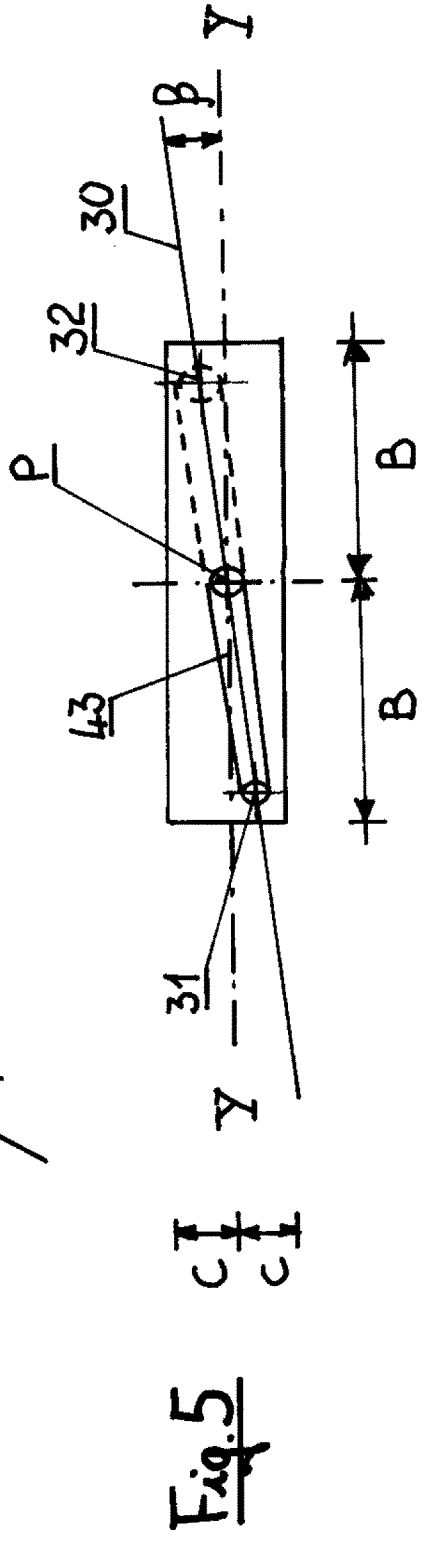

Fig.5

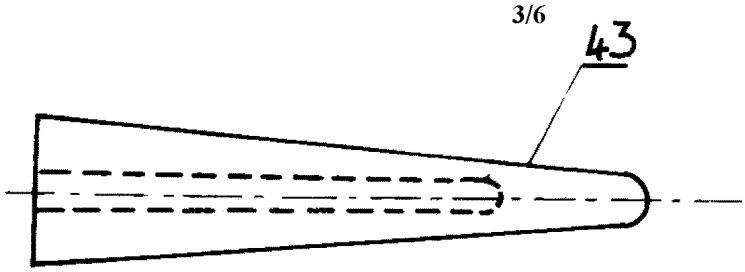

Fig.6

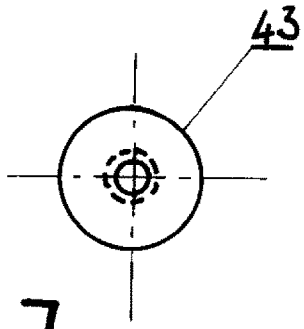

Fig.7

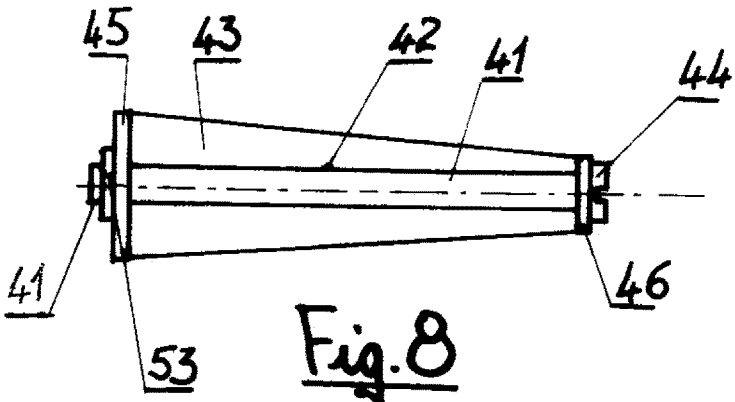

Fig.8

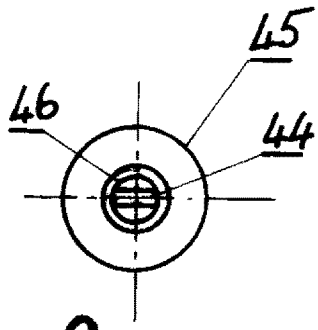

Fig.9

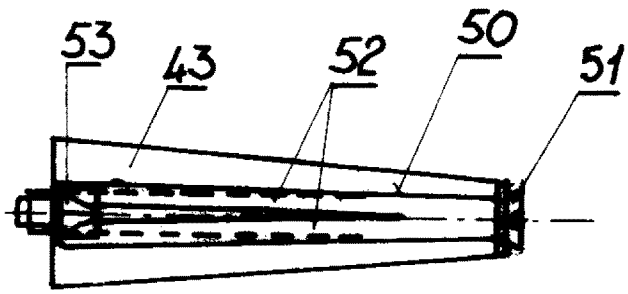

Fig.10

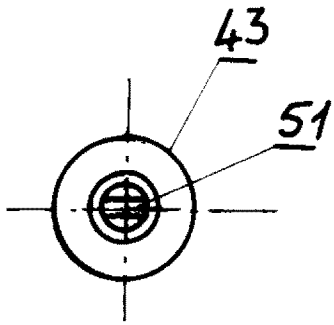

Fig.11

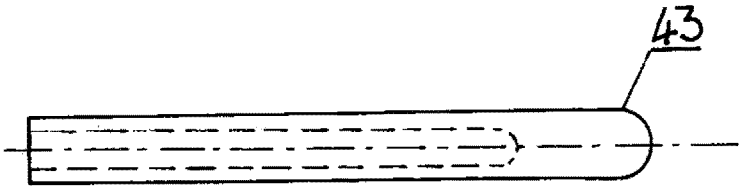

Fig.12

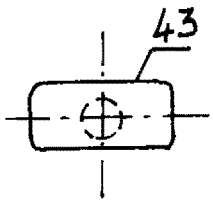

Fig.13

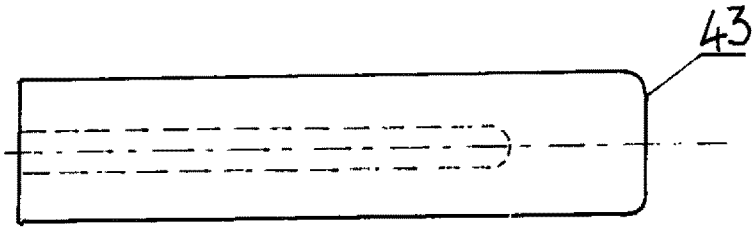

Fig.14

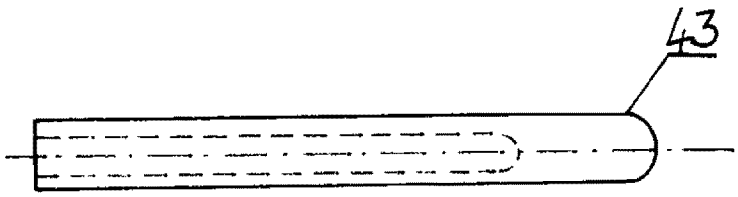

Fig.15

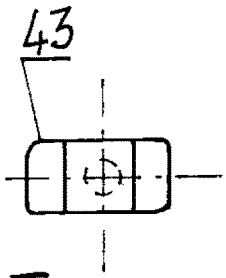

Fig.16

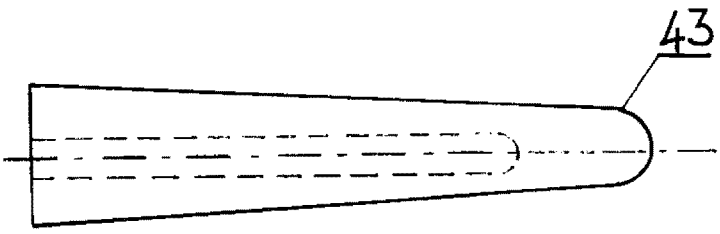

Fig.17

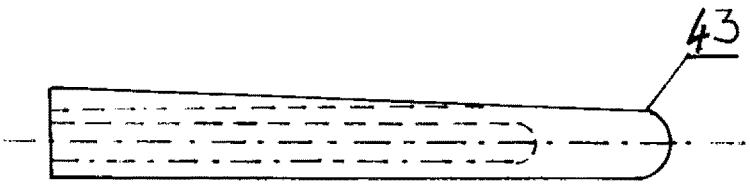

Fig.18

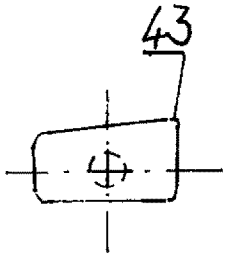

Fig.19

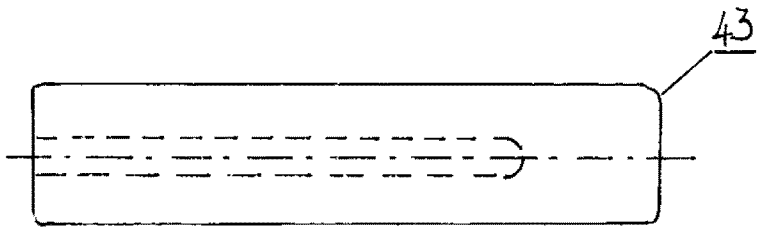

Fig.20

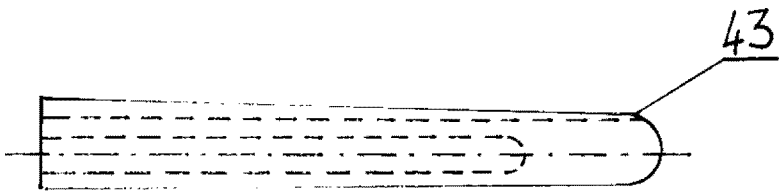

Fig.21

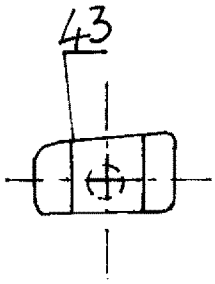

Fig.22

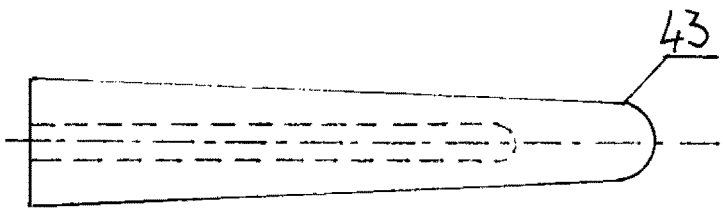

Fig.23

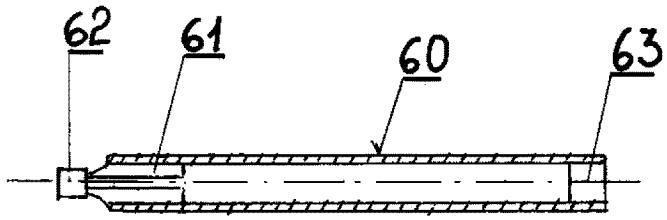

Fig24

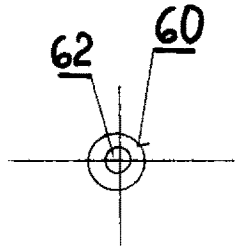

Fig.25

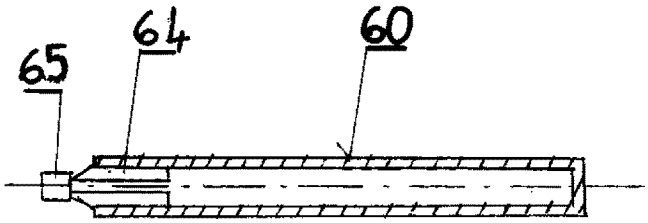

Fig.26

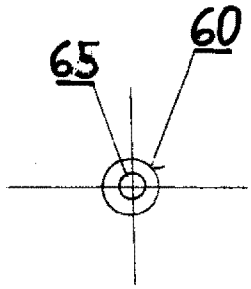

Fig.27

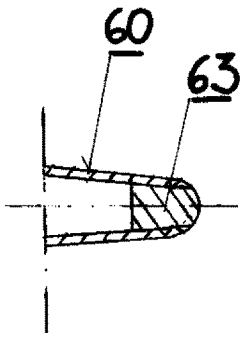

Fig.28

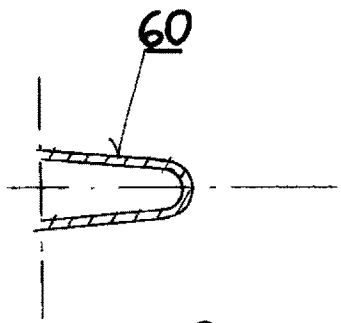

Fig.29

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2021/025284

A. CLASSIFICATION OF SUBJECT MATTER
INV. A43B13/14 A43B7/14 A43B13/18
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A43B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2016/150854 A1 (HOCKERSON STANLEY GEORGE [US] ET AL) 2 June 2016 (2016-06-02) figures -----	1-15
A	WO 00/76335 A1 (ROSEN HENRI E [US]) 21 December 2000 (2000-12-21) figures -----	1-15
A	WO 2017/196899 A1 (VICIS INC [US]) 16 November 2017 (2017-11-16) figures -----	1-15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 October 2021	02/11/2021

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Gkionaki, Angeliki

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2021/025284

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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