Oct. 30, 1951 H. E. HIPPS ET AL 2,572,860

FOOT SUPPORT

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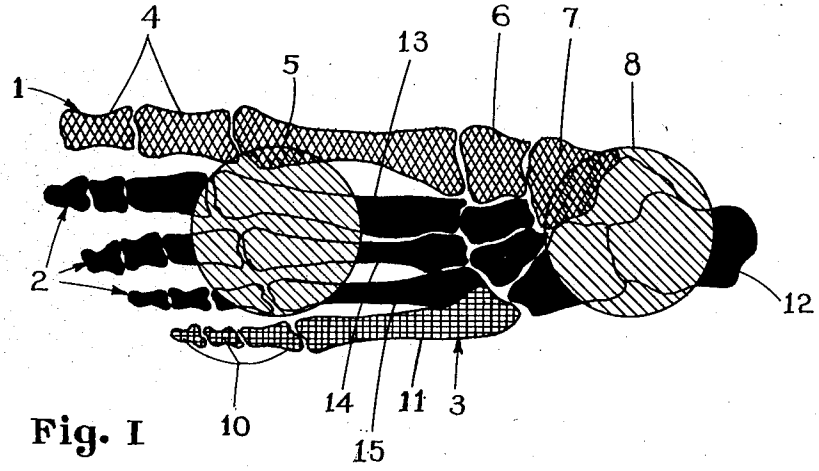


Fig. I

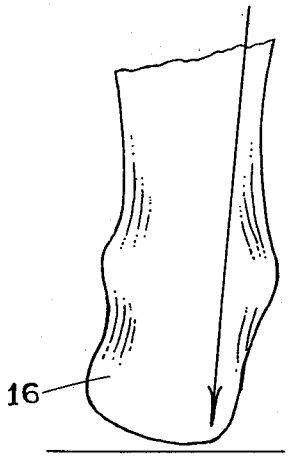


Fig. II

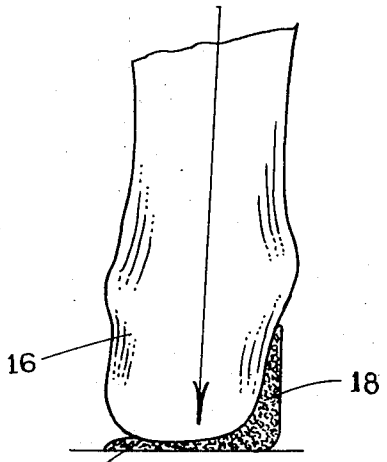


Fig. III

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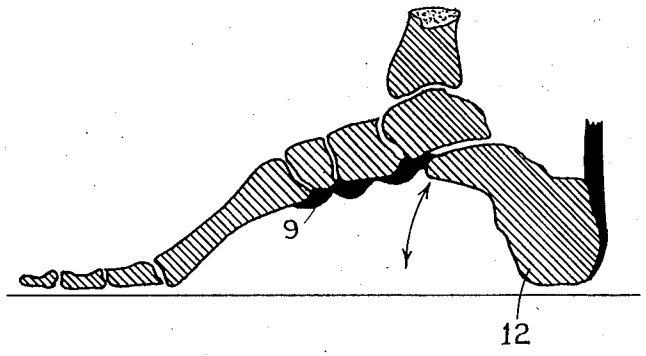


Fig. IV

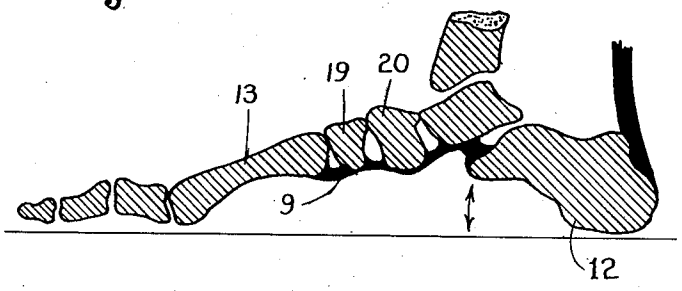


Fig. V

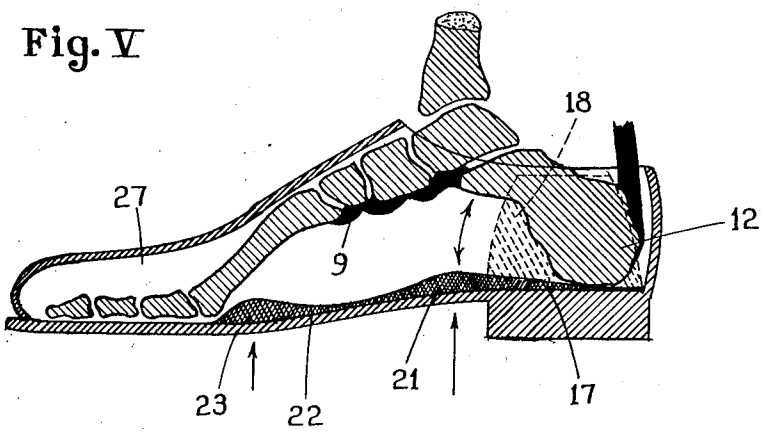


Fig. VI

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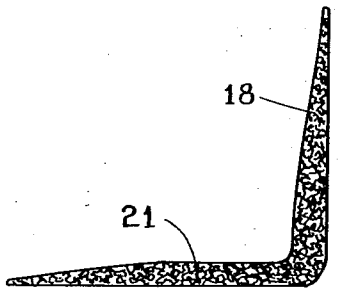


Fig. VII

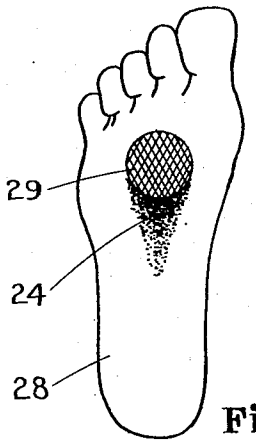


Fig. X

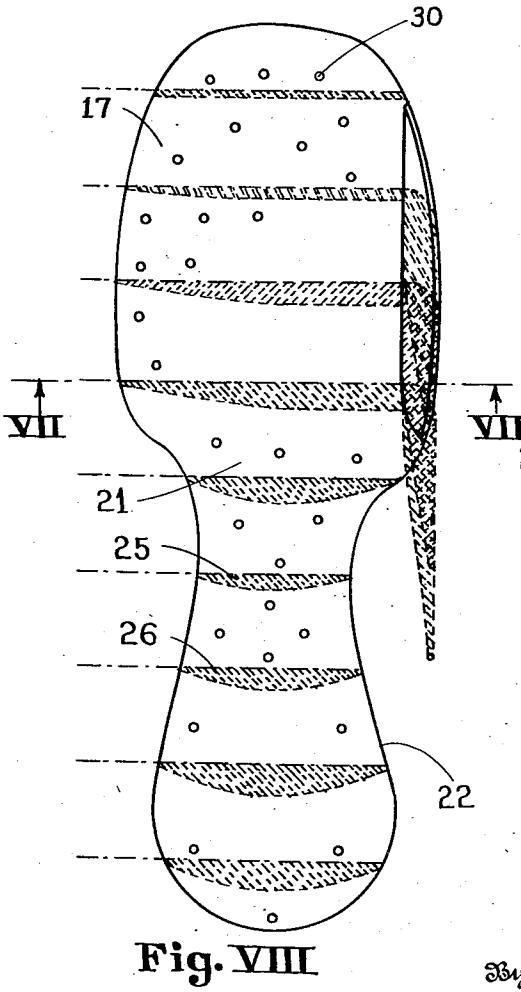


Fig. VIII

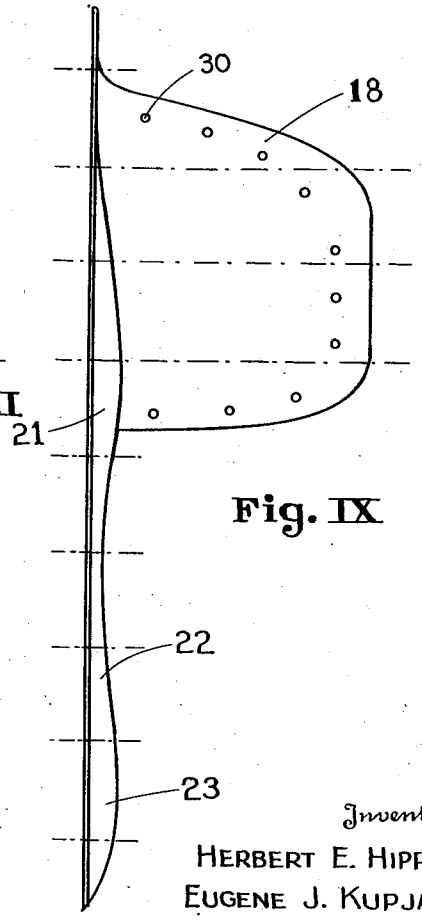


Fig. IX

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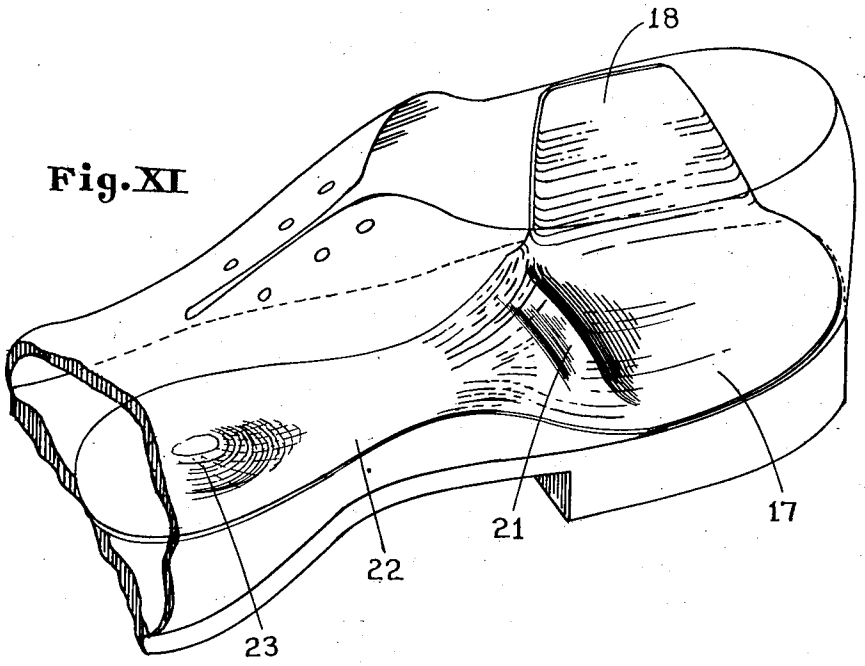
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FOOT SUPPORT

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Fig. XI



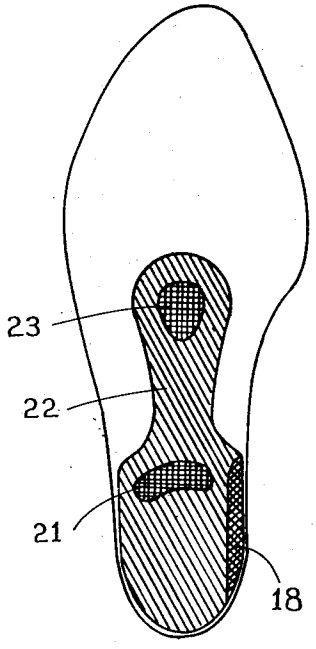


Fig. XII

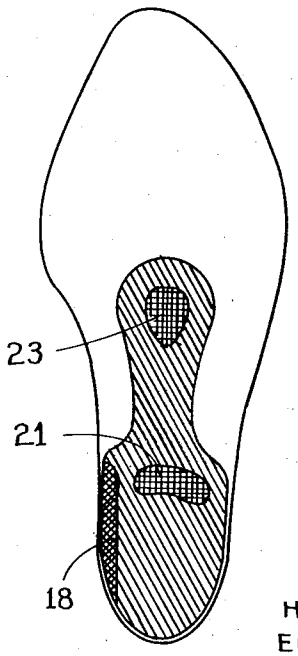


Fig. XIII

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2,572,860

UNITED STATES PATENT OFFICE

2,572,860

FOOT SUPPORT

Herbert E. Hipps, Waco, Tex., and Eugene J. Kupjack, United States Navy

Application May 23, 1946, Serial No. 671,717

7 Claims. (Cl. 36—71)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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This invention relates to foot supports and more particularly to a new and improved type of orthopedic foot support. Its principal object is to relieve foot discomfort by holding or placing certain bones of the foot in a position so as to reduce any abnormal weight on the mobile sections of the foot.

Another object of this invention is to provide an orthopedic foot support containing a vertical portion adapted to rotate the heel so that body weight comes down through the middle of the heel instead of being concentrated on the medial margin.

A still further object of this invention is to provide an orthopedic foot support constructed in a manner to raise the anterior portion of the os calcis and thereby place the arch bones in a better position for supporting weight stresses and relieving some of the stretch and excessive strain on the arch dome ligaments.

A feature of this invention is to provide an orthopedic foot device adapted to support the head (forward) portions of the middle three metatarsals at an elevation above the level of the inner sole of the shoe.

Another object of this invention is to provide an orthopedic foot support which will afford a comfortable resting surface for the heel and which will help keep the foot from sliding forward in the shoes with each step thus preventing such conditions as toe-flexion or hammer toes.

Other objects and advantages of this invention will become apparent from the description and drawings which follow:

Fig. 1 represents a plan view of the foot showing its bony structure.

Fig. 2 is a back view of the left heel in an abduction stance.

Fig. 3 shows a back view of the left heel resting on the foot support, and rotated into proper alignment.

Fig. 4 represents an elevational view of a plane taken through the central metatarsal segment showing arrangement of bones in a normal foot which is not supporting any weight.

Fig. 5 is the same as Fig. 4 showing relative movements of bones and stretch imposed on the ligaments with weight bearing.

Fig. 6 represents a pictorial view of a foot in section showing the restoring influence of the orthopedic foot support.

Fig. 7 represents a transverse section through the foot support in its heel area showing the vertical upwardly projecting portion.

Fig. 8 represents a plan view of the foot support

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showing various sectional thicknesses throughout its length.

Fig. 9 represents an elevational view of the foot support indicating the general outline of the vertical projecting portion.

Fig. 10 represents a bottom view of a foot showing the contact area of the head portions of the middle three metatarsals.

Fig. 11 represents a pictorial view of the orthopedic foot support placed in position within a shoe.

Fig. 12 represents a simplified plan view of the support installed in the left shoe.

Fig. 13 represents a simplified plan view of the support installed in the right shoe.

Referring to Fig. 1 the medial segment of the foot is composed of the big toe **4**, the first metatarsal **5**, the first cuneiform **6**, and the navicular **7** and is called the hallucal segment **1**. The hallucal segment is fairly mobile and has very little inherent weight bearing strength in its structure. Likewise, the lateral segment **3** composed of the little toe **10**, and the fifth metatarsal **11** is fairly mobile and its strength like that in the hallucal segment depends directly on the ligaments and muscles that are attached to it. Clinical and experimental work has demonstrated that the strongest weight supporting part of the foot is the central bony segment **2** which is composed of the os calcis **12**, and the three metatarsals **13**, **14** and **15**, with their small intervening bones. This central segment is strong and stable because of the architectural and anatomical design of the bones making up that segment.

The lateral segment **3** composed of the little toe **10**, and the fifth metatarsal **11** is likewise fairly mobile and has very little inherent strength in the anatomical arrangements of its bones. Its strength, too, depends chiefly on its ligamentous attachments.

Experience, experimentation and the accumulated evidence from observation has indicated that the central segment of the foot can support body weight for long periods of time without discomfort, whereas the hallucal segment **1** and the fifth metatarsal segment **3** cannot do so. If a preponderance of weight is carried by the hallucal segment, it begins to weaken and causes pain since its ligaments cannot support weight as long or as well as can the stable structure of the central segment.

Predicated upon the theory that the central bony segment is the strongest weight supporting part of the foot, this present invention tends to rebalance the weight distribution by rotating

the heel so that body weight comes down through the middle of the heel 8 Fig. 1 instead of being concentrated on the medial margin 1. As the heel is rotated into a more correct position there is a corresponding rotation and alignment of the bones of the forefoot so that weight becomes concentrated on the heads of the middle three metatarsals, see encircled area of this portion in Fig. 1. Thus the faulty distribution of too much body weight on the medial margin is corrected.

Fig. 2 shows the rear view of a left foot 16 in an abduction stance. Fig. 3 shows the same foot 16 restored to a correct alignment by the orthopedic foot support. This is accomplished by the tilting action of the wedge-shaped heel portion 17 and by the medial supportive action of the vertical projecting portion 18 extending upwardly from an edge of the heel decreasing in thickness from its base to its top portion and which fits between the heel and the counter of the shoe.

Fig. 4 illustrates an elevational view of a normal foot in which the hallucal segment 4 has been removed. This foot is not bearing any weight. Note the position of the forward portion of the os calcis 12 with relation to the other bones and its elevation from the bottom of the foot. Fig. 5 illustrates the same foot loaded under body weight. Observe the stretch of the ligaments 9, shown solid under the second metatarsal 13, the second cuneiform 19, and the second cuneiform navicular 20. A spreading apart of these joints occurs with excessive and prolonged weight bearing.

The correcting influence of this invention is shown in Fig. 6. The foot of the wearer and the orthopedic foot device are shown diagrammatically within a shoe 27. The foot device is positioned in such a manner as to restore the bones of the foot to their proper relationship. The ridge portion 21, which decreases in slope transversely away from the vertical projecting portion 18 see Fig. 7 rests beneath the forward portion of the os calcis. The remainder of the heel is shown resting on the wedge-shaped heel portion 17 of the support. Note that the os calcis 12 is not only lifted but is tilted backwards by the heel portion 17 and the ridge portion 21. In addition, the vertical projecting portion 18 tends to rotate the os calcis to help bring it into correct position. It should be observed that this correcting action is accomplished by a combination of lifting, tilting, and rotating and is not accomplished by supporting the cuneiform 19, the navicular 20 and the metatarsal 13. It is common practice in other foot devices to support these bones by mechanical means; however, the muscles and ligaments of this section of the foot are not normally of weight bearing quality and become irritated by the constant pressure of a mechanical support.

A horizontal tongue-like portion 22 formed integral with said wedge-shaped heel portion 17 rests beneath the three middle metatarsals 13, 14, and 15, and is provided with a raised crown-like portion 23 at its forward end of sufficient area and elevation to carry some of the weight that would ordinarily be borne by the heads of the three middle metatarsals alone. The encircled area 29 Fig. 10 represents the contact zone of the heads of these three middle metatarsals. All the weight which they carry is transmitted to the shoe through a skin area of an approximate size as shown. The shaded area 24 behind encircled area 29 shows the additional skin area

comfortably receiving some of this same weight when the support is worn thus diffusing or spreading the weight borne over the combined areas. By reducing the top to bottom thickness of the neck of the horizontal tongue 22, Figs. 8 and 9 at sections 25 and 26 this device would be suitable for women's shoes with a moderately high heel. Small holes 30 may be spaced throughout the thinner edge portions of the foot device as shown as a means for providing a circulation of air to keep the foot in a dry and sanitary condition. Upon close examination of Figs. 8 and 9 it is observed that the wedge-shaped heel portion 17 increases in thickness from its rear edge, forwardly, reaching its highest elevation upon contacting ridge 21 which lies transversely across the forward heel area. Wedge-shaped heel portion 17 also increases in thickness from its outer edge to the edge containing the vertical portion 18. The vertical portion 18 in turn is greater in thickness at its base than at its top as shown in Fig. 7 and its length corresponds substantially with the length of the heel as shown in Figs. 9 and 11. The length of the horizontal tongue 22 depends, of course, on the size of the foot of the wearer. Its surface is of a rough texture so as to reduce friction on the side of the heel while the foot is in motion and its entire height should not exceed beyond the top of the shoe counter. The under surface of the heel support and the back of the vertical portion have an adhesive coating applied to afford a means for holding the support in place within the shoe.

Figs. 12 and 13 illustrate top plan views of foot support in place showing the space relationship of the raised crown portions 23 and the ridge 21 and the vertical projecting portion 18. Slight modifications of the positioning of the elevated portions might be necessary during the first few fittings so as to compensate for callouses and corns etc., and when these growths disappear the standard type of support may be used.

This invention is very advantageous in that a highly effective foot device is provided for supporting and cushioning the foot. Its greatest field of usefulness is with feet that are only mildly flat, feet that are only in a moderate degree of valgus, or in a normal foot which begins to decompensate from the abnormal concentration of the weight over the medial margin. It may be constructed of a resilient, flexible, form sustaining material such as felt, leather, rubber, sponge rubber, plastics, and elastomers and is of one piece construction.

Although this invention has been described in much detail, it is apparent that certain other modifications and changes may be employed, for instance, this foot device may be superimposed upon and attached to an inner sole or it may be part of the shoe design and built into the shoe at its manufacturing stage.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. A flexible resilient orthopedic foot device comprising a heel portion inclined upwardly and graduated in thickness from the rear forwardly and culminating in a transverse ridge under the anterior portion of the os calcis, and a connected tongue with a gradually raised and rounded crown spaced from the ridge, said tongue including a

reduced neck tapering and decreasing in height from the ridge forwardly and gradually rounded upwardly from the neck to the top of the crown.

2. A flexible resilient orthopedic foot device comprising a heel portion inclined upwardly from the rear forwardly and culminating in a transverse ridge under the anterior portion of the os calcis, and a connected tongue with a gradually raised and rounded crown spaced from the ridge under the head portions of the middle three metatarsals and an intermediate portion between the ridge and crown thinner than the ridge and the crown.

3. A flexible resilient orthopedic foot device comprising a heel portion inclined upwardly from the rear forwardly and culminating in a transverse ridge under the anterior portion of the os calcis, and a connected tongue directly forward of the transverse ridge being of reduced thickness, the said heel portion having a transverse wedge shaped section higher at the inside of the heel inclining downwardly to the outside of the heel.

4. A flexibls resilient orthopedic foot device comprising a portion inclined upwardly from the rear forwardly and culminating in a transverse ridge under the anterior portion of the os calsis while leaving the metatarsal arch free of support, and an integral upwardly projecting portion at the inside of the heel rearwardly of the transverse ridge.

5. In a flexible resilient orthopedic device, an upwardly inclined heel supporting portion with a front raised transverse ridge, said heel supporting portion being higher at the inside of the heel inclining downwardly to the outside of the heel, an extension of the heel directed forward of the transverse ridge and being of reduced thickness, and an integral upwardly projecting portion at the inside edge of the heel rearwardly of the transverse ridge decreasing in thickness vertically from the base to the top.

6. A flexible resilient orthopedic foot device comprising a heel portion inclined upwardly from the rear forwardly and culminating in a transverse ridge under the anterior portion of the os calcis, a connected tongue with a gradually raised and rounded crown spaced from the ridge, the heel portion having a transverse wedge shape higher at the inside of the heel inclining downwardly to the outside of the heel, and an integral upwardly projecting side portion at the inside edge of the heel rearward of the transverse ridge decreasing in thickness vertically from the base to the top for supporting the heel in a vertical position.

7. A new article of manufacture comprising a unitary orthopedic foot support of flexible, resilient, form-sustaining material having a heel portion with a transverse ridge across the forward end smoothly graduated downwardly in height toward the rear of the heel, a tongue connected with the heel portion by a neck reduced in width and thickness, a metatarsal pad having a gradually raised and rounded crown spaced from the ridge for supporting the heads of the middle three metatarsals, the neck being smooth and graduated in thickness downwardly from the transverse ridge and upwardly to the crown, the said heel portion having a transverse wedge shaped portion higher at the inside of the heel inclining downwardly to the outside of the heel, and an integral upwardly projecting side portion at the inside edge of the heel rearward of the transverse ridge decreasing in thickness vertically from the base to the top for supporting the heel in a vertical position.

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