July 6, 1937. F. B. SHERIDAN 2,086,242

DEVICE FOR CORRECTING FOOT TROUBLES

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FIG. 1

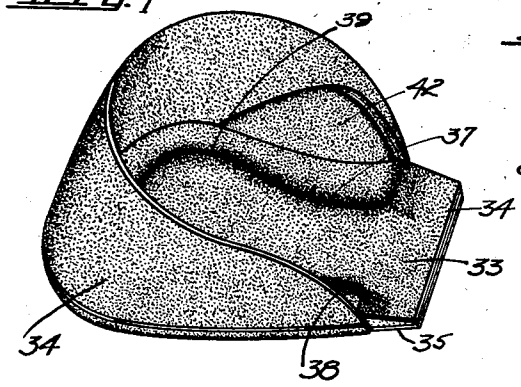


FIG. 2

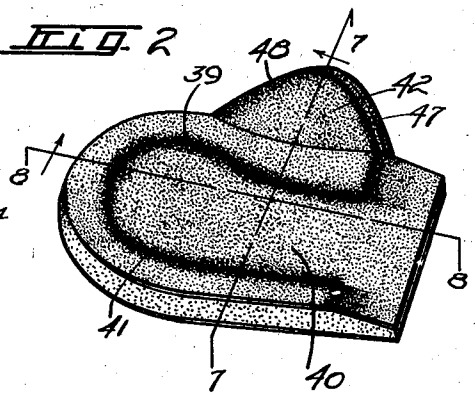


FIG. 3

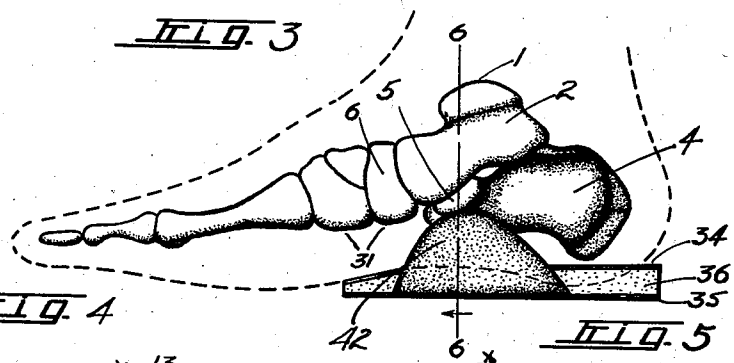


FIG. 4

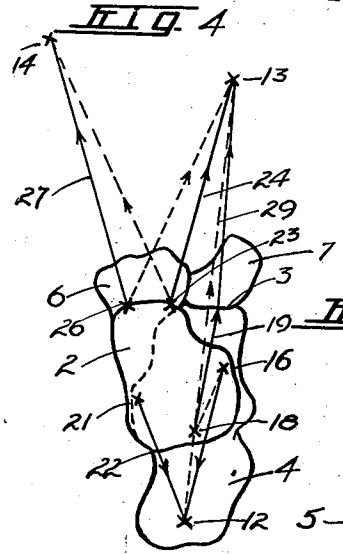


FIG. 5

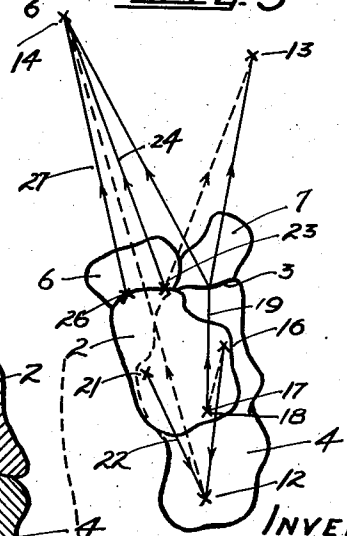
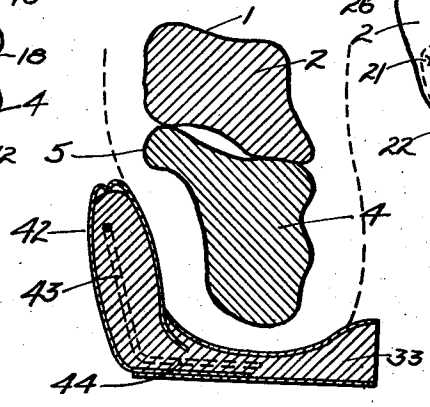


FIG. 6



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July 6, 1937. F. B. SHERIDAN 2,086,242

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FIG. 7

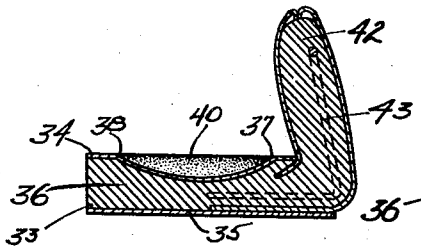


FIG. 8

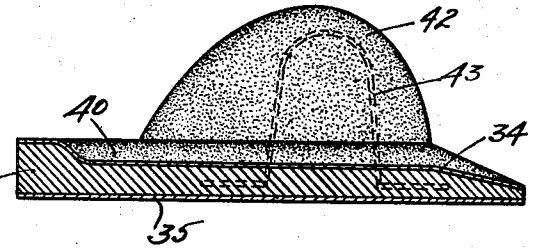


FIG. 9

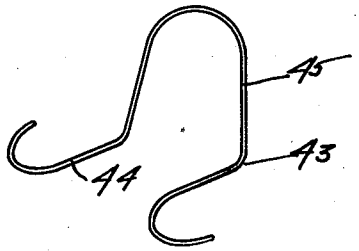


FIG. 10

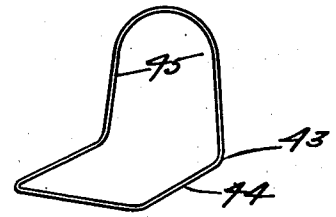
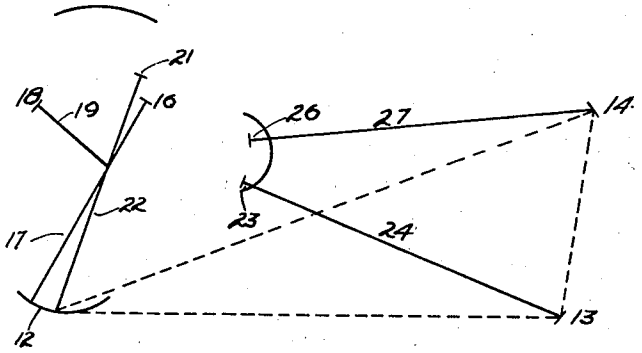


FIG. 11



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Patented July 6, 1937 2,086,242

UNITED STATES PATENT OFFICE

2,086,242

DEVICE FOR CORRECTING FOOT TROUBLES

Francis E. Sheridan, Syracuse, N. Y., assignor of one-half to William A. Jacobson, Syracuse, N. Y.; Rose M. Sheridan executrix of said Francis B. Sheridan, deceased

Application October 20, 1933, Serial No. 694,433

5 Claims. (Cl. 36—71)

This invention relates to new and useful improvements in appliances for the alignment and maintenance of the skeletal structure of the foot.

Among the objects of my invention are the provision of means for correcting foot troubles such as fallen arches and incidentally the disarrangements caused by such foot deformities as, for example, spinal troubles and incorrect posture.

My invention further contemplates the provision of an appliance for aligning the bones of the foot and maintaining them in such alignment that the weight of the body is distributed over the skeletal structure of the foot in the manner and proportions intended by nature.

A further object of my invention is to produce an anatomically and mechanically correct type of appliance which, by virtue of its features and construction, will cause a continual pressure to be brought to bear beneath and in front of the sustentaculum tali and, at the same time, will compel the calcaneum to assume an anatomically balanced position within the foot skeleton, a position such that its long axis is directed substantially in a line drawn from the calcaneal tuberosity to the head of the fifth metatarsal bone.

Other objects and advantages will be more apparent from the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a perspective view showing my foot-correcting appliance.

Figure 2 is a modified form of the structure shown in Figure 1.

Figure 3 is a view showing the bones of the feet with my appliance in position.

Figures 4 and 5 are diagrammatic views showing the weight distribution in a normal and an abnormal foot.

Figure 6 is a view taken on the line 6—6 of Figure 3.

Figure 7 is a view taken on the line 7—7 of Figure 2.

Figure 8 is a view taken on the line 8—8 of Figure 2.

Figures 9 and 10 illustrate two forms of springs which may be used in my device.

Figure 11 is a diagrammatic view which when taken in connection with Figures 4 and 5 illustrates more clearly the distribution of weight over the skeletal structure of the foot.

In order thoroughly to understand the functioning of applicant's appliance, it is necessary to review briefly the structure of the foot and the normal functional capacity of the bones. Body weight makes or breaks feet. The same weight that depresses arches, distorts articulations and destroys inherent resiliency when misapplied and misdirected, will, when properly applied and directed, relieve foot structures from all strain and build strength and functional capacity. The entire body weight is received by the trochlea, indicated by the numeral 1, or upper surface of the talus 2 and thence distributed by that bone through its articular contacts indicated diagrammatically in Figures 4, 5 and 11, to the three bearing points of the foot tripod, the calcaneal tuberosity, the fifth metatarsal head and the first metatarsal head indicated respectively by the numerals 12, 13 and 14.

These articular contacts or facets are located approximately as follows: First, a facet of considerable extent, the position of which is indicated approximately by the numeral 16 located in front of the sulcus tarsi whose surface looks downward, backward and slightly inward so that a perpendicular dropped from its midpoint will extend through to a point at or near the center of the inferior surface of the calcaneal tuberosity, as indicated by the line 17 of Figure 11 Second, a facet 18 of lesser extent located immediately behind the sulcus tarsi whose surface looks downward, forward and slightly outward so that a perpendicular dropped from its midpoint, as indicated by the line 19, will intersect the line 17 at approximately a right angle, thus imposing any stress flowing along its line upon this latter perpendicular and thereby achieving its partial reference to the calcaneal tuberosity as well as forward and downward in its own line of reference to the calcaneo-cuboid (3) juncture. Third, a facet 21 located upon the under surface of the head and neck of the talus looking downward, backward and outward so that a perpendicular 22 dropped from its midpoint extends through or near to the midpoint of the inferior surface of the calcaneal tuberosity, a perpendicular along which stress transmitted by that facet reaches the first or calcaneal pier 12. A facet 23 located upon the lateral aspect of the head of the talus which is directed forwardly, downwardly and lateralward so that a perpendicular 24 passed from its midpoint will intersect the inferior margin of the head of the fifth metatarsal bone at or near its midpoint, a perpendicular along which stress is referred directly to the fifth metatarsal pier 13 of the foot tripod. A facet 26 located substantially upon the medial aspect of the head of the talus which presents forward, downward and slightly medialward so

that a perpendicular 27 passed from its midpoint will intersect the midline of the under surface of the head of the first metatarsal bone at or near its midpoint and along which stress referred by this facet reaches the first metatarsal pier of the foot tripod.

Facets numbers 16 and 18 are applied for most of their extent to similar facets on the upper surface of the calcaneum (4) laterally to the center of gravity of that bone, that is, towards the outside. Facet 21 is applied to a similar facet upon the sustentaculum tali (5) almost entirely medial to the center of gravity of the calcaneum. Thus a preponderance of weight thrust normally operates against the calcaneum at all times lateral to its center of gravity or in other words, always operates to tip the calcaneum towards the outside. When the bones are in the proper position, approximately two-thirds of the weight distributed by facets 16, 18 and 21 is normally applied on the outside and approximately one-third on the inside of the heel.

In order to secure the proper weight distribution from facets 16, 18 and 21, it is necessary that the calcaneum be maintained in its anatomically correct working position so that its long axis is directed substantially within a line drawn from the calcaneal tuberosity 12 to the fifth metatarsal head 13. The calcaneum being a bone curved in two directions so that its lateral or outer surface is convex throughout and its medial or inner surface is more deeply concave throughout this preponderance of weight thrust will effect a positive, definite and sustained lift of its sustentacular contact and thus will impose thoroughly normal inversion and supination of the hinder aspect of the medial longitudinal arch.

Facet number 23 is applied to a similar facet upon the navicular (6) so that the stress it transmits travels diagonally forward, downward and outward and is received for bearing upon the metatarsal-cuboidal articulation and then is transmitted by way of the fourth and fifth metatarsal bones to the fifth metatarsal pier of the foot tripod. Facet number 26 is applied to a similar facet upon the navicular so that the stress it transmits travels directly along the inner column of the tarsal and metatarsal bones and is received for bearing by the first metatarsal pier of the foot tripod.

It will readily be seen, assuming that each of these facets is normally intended to transmit substantially the same amount of weight thrust which, in fact, is approximately correct, that by way of facets numbers 16, 18, 21 and 23, approximately 80% of the body weight is received for bearing upon the lateral longitudinal or outer longitudinal arch of the foot skeleton which arch alone can sustain it, and that the remaining 20% is normally all the stress transmitted to or received for bearing by the first metatarsal pier of the foot tripod 14. By the term "lateral longitudinal arch of the foot" I intend to designate that arch of the foot which consists of the calcaneum, the cuboid 7 and the fourth and fifth metatarsals, which arch normally is intended to have the major portion of the weight of the body. Thus whenever the stress transmitted by facet 23 is transferred for bearing by a withdrawal through pronation of the sustentacular support, the first instead of the fifth metatarsal pier receives it and an overloading of the medial longitudinal arch immediately follows which results in a progressive weakening of that arch to the ultimate extent of flat foot and further, causes pressure, irritation, inflammation and ultimate physical discomfort to all the articulations within it. The term "the medial longitudinal arch" as used herein, means the resilient shock absorbing arch which consists of the talus, the navicular, the three cuneiforms and the first, second and third metatarsals. Normally the medial longitudinal arch is approximately three times the height of the lateral longitudinal arch and one of the purposes of my invention is to retain approximately this height ratio between these arches.

The above will perhaps be clearer by reference to Figures 4 and 5 which have been exaggerated slightly for illustration purposes, the weight stresses in order to simplify the drawings having been indicated only approximately by straight direction lines instead of exact lines of force. The normal position for the calcaneum indicated by the numeral 28 is such that a line 29 of Figure 4 drawn through its long axis is directed substantially towards the fifth metatarsal pier 13 so that the major portion of the weight distributed from the facets is directed towards the fifth metatarsal pier. The position of the calcaneum if the bones of the foot are distorted through pronation of the sustentaculum tali is indicated in Figure 5. The calcaneum as shown in this figure has been permitted to rotate downwardly, rearwardly and outwardly, so that a line drawn through its long axis is directed more nearly towards the first rather than the fifth metatarsal pier of the foot tripod which, as indicated approximately by the lines of stress in Figure 5, directs a larger proportion of the weight of the body than intended by nature, toward the first metatarsal pier of the foot tripod resulting in flat feet.

In most devices of the prior art for correcting deformities of the feet, the arch is simply propped by an arbitrary elevation at a point approximately indicated by the numeral 31 in Figure 3, and this elevation is entirely dependent upon the resistance or compressibility of a mechanical feature for its maintenance. This merely has a tendency to relieve or palliate the condition for which the appliance is utilized and does not permanently correct it for the reason that the osseous or bony structures of the foot are not thus brought to and maintained in their normal interlocked anatomical positions. It will further be apparent that the ordinary arch supporter placed approximately at the point 31 will restrain the free movement of the articulations of the bones with which it contacts.

I have discovered that the bones of the foot may be brought into alignment and into position such that a line drawn through the long axis of the calcaneum is directed substantially towards the fifth metatarsal pier of the foot tripod and the weight is distributed over the skeletal structure of the foot in the manner intended by nature, by generating and applying a lateral as well as a rotatory pressure upon the side of the foot beneath and in front of the sustentaculum tali, which application of force effects a rocking action of the heel which, in turn, serves to tilt the calcaneum at its forward portion laterally and outwardly and thus to rotate its tuberosity medially inwardly. This mechanical alignment of the calcaneum serves by elevating the sustentaculum and directing it lateralward beneath the talus, to bring the head of the talus into a direct and proper position fully within the concave posterior

facet of the navicular which immediately distributes the flow of force received by the trochlea or upper surface of the talus exactly and with mathematical precision along the natural stress lines constructed by nature to receive and transmit them to their normal bearing points.

In Figure 1 I have indicated an appliance for carrying out my novel method of correcting foot distortions which comprise a base 33 and an upper portion 34 constructed in a manner more clearly described in a patent issued to Francis B. Sheridan and William A. Jacobson, No. 1,669,790. The base 33 comprises an upper and lower surface 34 and 35 of any suitable material which encloses a heel seat 36 made preferably of sponge rubber. The sponge rubber pad is tapered at its forward portion and grooved along lines indicated by the numerals 37 and 38 to form a depressed portion 40 substantially centrally of the pad which bulges or curves inwardly as at 39 towards the rear thereof. This groove forms a depression in which the calcaneum is adapted to seat and the bulging or enlarged portion 39, together with a ridge formed by the depression indicated approximately by the numeral 41, tends to rotate the calcaneal tuberosity inwardly and rearwardly so that its long axis is directed towards the fifth metatarsal pier of the foot tripod.

Extending upwardly from the base pad 36 is a pad or supporting arm 42 which is made of sponge rubber preferably integral with the base pad. The upper and lower coverings 34 and 35 for the base pad are extended upwardly and over the upstanding pad 42 and sewed beneath the base pad to form a complete and unitary structure. A spring 43 having a base 44 and an upstanding portion 45 is placed inside the covering for the base and upstanding portion 42, being preferably imbedded in the sponge rubber. This spring 43 serves to exert a continual and sustained lateral pressure against the inside of the foot in the region of the sustentaculum tali, and this lateral pressure together with the upward and forward pressure caused by the padded surface 46 tends to elevate and rotate outwardly the sustentaculum tali which is a forwardly and downwardly inclined shelf-like structure peculiarly adapted by reason of its formation, to receive the force of the upstanding sustaining arm 42 through the intervening flesh. It will be noted that the forward surface 47 of the pad 42 is rather sharply inclined and the rearward surface 48 is cut away so that the top portion of the pad in which the spring is imbedded is of comparatively slight extent. This top portion is effective to exert pressure laterally and upwardly on the sustentaculum tali while the flesh forwardly and rearwardly of the spring is not to any considerable extent pressed by the pad.

If desired the sponge rubber pad may be replaced by a resilient material of greater rigidity in which case it may be desirable to eliminate the use of a spring. The structure shown in Figure 1 is particularly adapted for use in old shoes or is intended to be worn by people who have relatively small heels so that the side members 34 will tend to fill the heel and support the pad in the proper position. The structure shown in Figure 2 may be either loosely or adhesively placed in the bottom of the shoe and is more particularly adapted to be worn in snugly fitting shoes and, if desired, may be built directly into the shoe by the manufacturer thereof in which case it may be found desirable to eliminate the base pad. In both devices the pressure of the sustaining member 42 may to a certain extent be regulated by lacing the shoes more tightly to bring the sides of the shoe against the sustaining pad 42 and cause it to press more tightly against the heel and, in fact, this method of obtaining the necessary pressure on the pad is sufficiently effective to obtain most of the benefit of applicant's device without the use of a spring.

From the description of the normal functioning of the bones of the feet as set forth above and by particular reference to Figures 4 and 5, it will be seen that the pressure of my device together with the reaction of the foot against the device in the normal use of the foot will cause a continual pressure to be applied beneath the sustentaculum tali to the end that that structure is encouraged to apply itself snugly and firmly to the facet on the inframedial surface of the neck and head of the talus. While the major portion of the foot correction is accomplished by the upstanding sustaining pad 42 and the benefits of my device may be to a certain extent secured by the use of this member alone without a padded base, it will be apparent that the depression formed in the heel pad, especially by reason of its contour, will supplement the action of the sustaining pad by causing the calcaneal tuberosity to be gently but positively urged inwardly so as to cause the calcaneum to assume its anatomically correct position. Thus, all the weight received by the trochlea of the talus is transmitted properly to its distributing facets, i. e. those between the talus and the calcaneum and between the talus and the navicular with the result that the weight is at all times referred preponderantly to the outer, rigid, self-contained and self-sustaining normal weight bearing arch of the foot skeleton which arch is ordinarily referred to as the laterial longitudinal arch.

The pressures adapted to be exerted by my device are preferably comparatively slight so as to cause no physical discomfort but use over a period of time will in most cases restore the normal functional capacity of the bones and result in a restoration of the arch to its normal position.

In Figures 7 and 8 I have indicated the approximate position of the spring in the upstanding pad 42, and in Figures 9 and 10, I have indicated two suitable forms of springs which may be used.

It will be apparent that I have provided a novel appliance for correcting foot distortions, and it is further obvious that various changes, especially because of foot peculiarities requiring a certain amount of individual treatment, may be made in the form and construction of the appliance without departing from the scope of my invention as set forth in the appended claims.

I claim:

1. In a device for correcting foot troubles by re-aligning the bones of the foot, means for causing the bones of the foot to assume their normal positions with relation to each other whereby the weight of the body is distributed over the skeletal structure of the foot in a normal manner, comprising a soft pliant pad arranged in the shoe at the inside of the heel of the foot and having an effective upper surface located beneath the sustentaculum tali of the foot, and said pad being so constructed and arranged that the weight of the body causes a localized yielding pressure to be exerted directly on the sustentaculum tali in an upward direction to rotate the calcaneum inward and bring the sustentaculum tali into supporting relation with the talus.

2. In a device for correcting foot troubles by

re-aligning the bones of the foot, means for causing the bones of the foot to assume their normal positions with relation to each other whereby the weight of the body is distributed over the skeletal structure of the foot in a normal manner, comprising a soft pliant pad arranged in the shoe at the inside of the heel of the foot and having an effective upper surface located beneath and directly adjacent the sustentaculum tali of the foot, and said pad being so constructed and arranged that the weight of the body causes a localized yielding pressure to be exerted directly and substantially only on the sustentaculum tali in an upward and inward direction to rotate the calcaneum inward and bring the sustentaculum tali into supporting engagement with the talus.

3. In a device for correcting foot troubles by re-aligning the bones of the foot, means for causing the bones of the foot to assume their normal positions with relation to each other whereby the weight of the body is distributed over the skeletal structure of the foot in a normal manner, comprising a base adapted to fit beneath the heel of the foot, and a soft pliant pad connected to and extending upward from said base at the inside of the heel of the foot, said pad having an effective upper surface located beneath the sustentaculum tali of the foot, and said pad being so constructed and arranged that the weight of the body causes a localized yielding pressure to be exerted directly on the sustentaculum tali in an upward direction to rotate the calcaneum inward and bring the sustentaculum tali into supporting relation with the talus.

4. In a device for correcting foot troubles by re-aligning the bones of the foot, means for causing the bones of the foot to assume their normal positions with relation to each other whereby the weight of the body is distributed over the skeletal structure of the foot in a normal manner, comprising a base adapted to fit beneath the heel of the foot, and a soft pliant pad connected to and extending upward from said base at the inside of the heel of the foot, said pad having an effective upper surface located beneath the sustentaculum tali of the foot, and said pad being so constructed and arranged that the weight of the body causes a localized yielding pressure to be exerted directly and substantially only on the sustentaculum tali in an upward and inward direction to rotate the calcaneum inward and bring the sustentaculum tali into supporting engagement with the talus.

5. In an orthopedic foot supporter comprising a plurality of pieces of flexible material secured together, means secured to the flexible material for exerting an upward and lateral pressure on the bones of the heel, and means for retaining said foot supporter in a fixed position on the heel.

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