March 7, 1961 E. KATTHOEFER 2,973,757

THERAPEUTIC AID

Filed Nov. 21, 1957

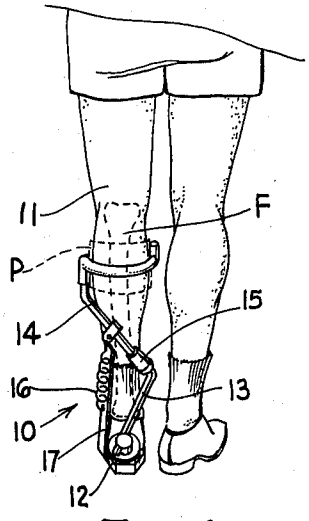


FIG. 1

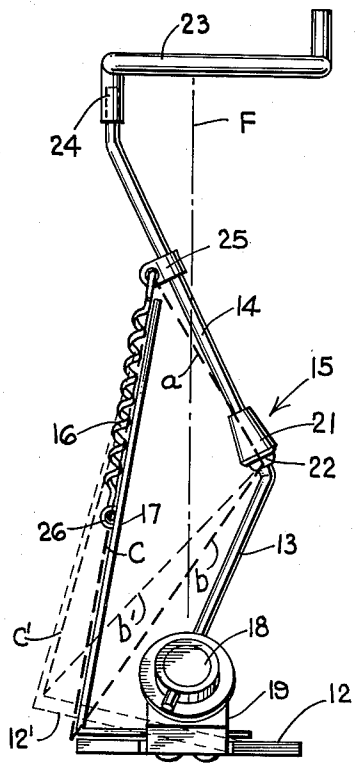


FIG. 2

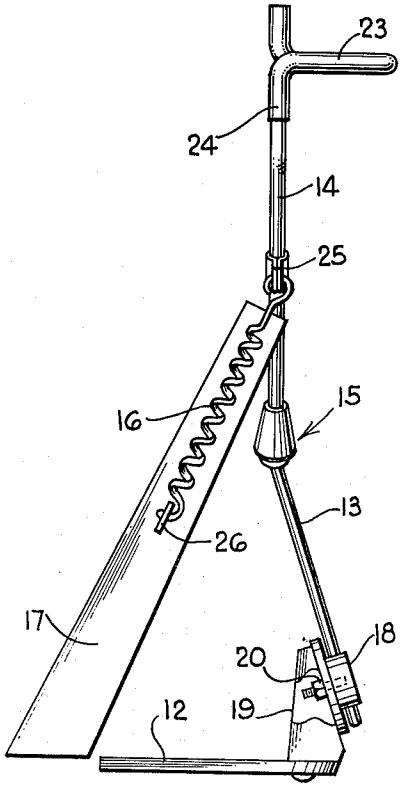


FIG. 3

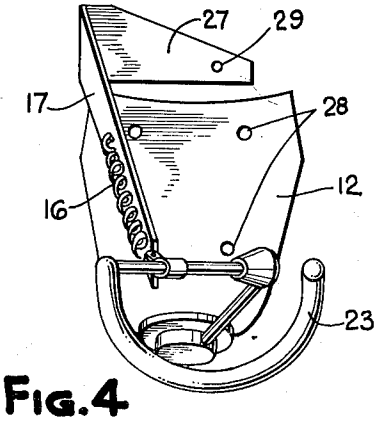


FIG. 4

INVENTOR.
ERIC KATTHOEFER
BY Elliott & Pastoriza
ATTORNEYS

United States Patent Office

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THERAPEUTIC AID

Eric Katthoefer, 4227 W. 105th St., Inglewood, Calif.

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5 Claims. (Cl. 128—80)

This invention relates generally to therapeutic apparatus and more particularly to an orthopedic device for stabilizing the foot and ankle.

Weakened or atrophied muscles of the lower leg, ankle, and foot itself can cause a condition or tendency for the foot to turn outwardly or inwardly. For example, an outward turning of the foot may result in a "pigeon-toed" characteristic. In other instances, a portion of the foot arch and similar areas may tend to turn inwardly as a consequence of weakened muscles adjacent the inside of the fibula and tibia bones. In severe cases of muscular disuse, a "drop foot" condition may exist.

Bearing the above in mind, it is a primary object of the present invention to provide an orthopedic device of considerable therapeutic value in helping to correct conditions resulting in either "drop foot" or the turning out or turning in of the foot and lower ankle.

More particularly, it is an object to provide a device of the above type which may be adjusted in accordance with the degree of muscular weakness such that by altering the adjustments periodically, the weakened condition can be gradually corrected.

Another object is to provide an orthopedic device for stabilizing a foot and ankle which will not hinder the normal functioning of the foot and ankle.

Still another object is to provide an orthopedic device which may be properly supported on the foot and ankle without contacting the shinbone, thus insuring a minimum of discomfiture.

Yet another object is to provide an orthopedic device which is extremely reliable and simple in construction and which is also relatively inconspicuous when placed on the wearer's foot.

These and many other objects and advantages of the present invention are attained, briefly, by providing a heel plate adapted to be secured directly to the heel of a wearer's shoe. A first rigid member extends upwardly from the rear portion of the heel plate at an acute angle to the leg fibula and terminates in a universal joint. A universal or movable member is coupled to the universal joint at one end and extends at another angle on the opposite side of the fibula, to terminate in a curved leg piece adapted to embrace a rear portion of the leg calf. Preferably, a suitable cushion or pad is supported by the curved leg piece to insure comfort. A biasing means in the form of a tension spring is then provided between an intermediate portion on the movable member and the heel plate or bottom of the shoe to exert a force such as to lift one side of the heel plate in a direction to aid the weakened muscles.

The arrangement of the above outlined basic elements may be modified so that the orthopedic device can be adapted to either leg and to either side of any one leg depending upon the particular weakened or deformed condition of the ankle and foot to be treated.

A better understanding of the invention will be had by referring to a preferred embodiment thereof as illustrated in the accompanying drawings, in which:

Figure 1 is a rear perspective view of the orthopedic device of the present invention secured to the left leg of an individual for curing the tendency of the outside of the left foot to turn outwardly or drop;

Figure 2 is an enlarged view taken in the same direction as in Figure 1 of the orthopedic device wherein the leg is omitted for purposes of clarity;

Figure 3 is a side elevational view of the apparatus illustrated in Figure 2; and

Figure 4 is a top or plan view of the device illustrated in Figure 2.

Referring first to Figure 1, the orthopedic device is designated generally by the numeral 10 as attached to the left leg 11 of an individual. As shown, the device comprises a heel plate 12 adapted to be rigidly secured to the heel of the wearer's shoe. A rigid member 13 extends generally upwardly from the heel plate 12 at an acute angle with respect to the leg fibula indicated in dotted lines at F. A universal or movable member 14 is secured at its lower end to the rigid member 13 as by a universal joint 15. Movable member 14 also extends generally upwardly at an acute angle to the fibula such angle being formed in an opposite sense to that of the rigid member 13. As shown, the member 14 terminates in a leg piece adapted to support a suitable cushion or pad illustrated in dotted lines at P.

Also shown in Figure 1 is a biasing means including a spring 16 and leg shield and strap 17 connected intermediate the ends of the movable member 14 and a lower portion of the shoe adjacent the heel plate.

The manner in which the foot and ankle are aided by the device illustrated in Figure 1 will be better understood by referring to the enlarged views in Figures 2, 3, and 4. As shown, a disc shaped screw head 18 serves to secure the rigid member 13 to an inclined bracket 19 on the heel plate 12. A nut 20 is threaded to the screw on the inside of the bracket as best seen in Figure 3. The arrangement is such that the nut 20 may be removed, the screw head 18 rotated through an angle to bring the rigid member 13 upwardly and to the left in an opposite sense to that shown in Figure 2, and the nut replaced. This latter procedure would be followed in the event the device were to correct a similar condition on the wearer's right foot.

In Figure 2, the universal joint 15 is shown in detail as comprising a ball socket 21 secured to the lower end of the movable member 14, and a ball 22 secured to the upper end of the rigid member 13. The leg piece on the upper end portion of the movable member 14 comprises a curved member 23 arranged to engage a partial circumferential rear portion of the leg calf. This curve can best be seen in the plan view of Figure 4. The attachment of the curved leg piece 23 to the upper end of the movable member 14 may be effected by a receiving socket portion 24 on the piece such that different shaped pieces may be substituted. The cushioning pad P is not illustrated in Figures 2, 3, and 4 but it will be understood that the same may be readily secured within the curved portion of the leg piece 23.

In the embodiment chosen for illustrative purposes, the spring 16 is secured at its upper end to a slidable bracket 25 which may be positioned at various points intermediate the ends of the movable member 14. The lower end of the spring connects at 26 to an intermediate position on the shield strap 17. As seen best in Figure 4, this strap includes a lower flange 27 adapted to fit under the sole of the shoe. The heel plate 12 is provided with suitable openings 28 for receiving screws to secure the same to the heel of a wearer's shoe. Similarly, the strap flange 27 may include an opening 29 for securing the strap 17 to the bottom of a wearer's shoe. The particular point at which the strap flange 27 is se-

cured may be varied in accordance with the point on the foot where it is desired to apply aiding forces.

The operation of the device may best be understood by referring again to Figure 2. If the dash-dot vertical line is considered the line of the fibula bone of the wearer's leg as shown at F in Figure 2, and if it is assumed that the wearer has weakened muscles in his ankle and foot such as to tend to cause the foot to turn outwardly, the angles formed by the members **13** and **14** with the line F as illustrated will help in correcting this condition. Essentially, it will be noted that with the various elements connected as shown, a triangle is defined by the movable member **14**, the rigid member **13** and heel plate, and the spring **16** and strap. This triangle is shown in dashed lines with sides *a*, *b*, and *c* respectively.

When the wearer has his full weight on the heel plate **12**, this plate will be held in a position parallel to the floor or ground. However, when the wearer lifts his foot from the ground, the side *c* defined by the biasing spring **16** and strap **17** will tend to contract and thus cause the triangle to assume the position illustrated by the dashed lines *a*, *b'* and *c'*. The universal joint **15** which forms one vertex of the triangle will accommodate this change in the triangle and as a consequence of the contraction of the side *c* to a new value *c'*, the heel plate **12** will tend to tilt inwardly to the dotted line position indicated at **12'**. Thus, the tension in the spring **16** tends to raise the outside of the wearer's foot and aid the weakened muscles in correcting the tendency of the foot to turn outwardly.

The strap **17** serves as a shield as well as a connecting portion to prevent the spring **16** from rubbing against the wearer's leg.

As mentioned heretofore, it will be evident that the relationship of the triangle can be reversed by simply removing the nut **20** as shown in Figure 3 and swinging the rigid member **13** to project upwardly and outwardly rather than upwardly and inwardly as shown in Figure 2. The strap **17** and spring **16** would then be positioned on the other side of the structure and the tendency would be to pull upwardly on the inside of the heel plate and sole of the shoe. This arrangement would be employed if the wearer's foot had a tendency to turn inwardly. Alternatively, this same arrangement would be employed if the right foot of the wearer had a tendency to turn outwardly and the device were to be positioned on the right foot rather than on the left.

As also mentioned heretofore, the strap flange **27** as seen in Figure 4 may be positioned at different distances from the heel plate so that the point where the tension by the biasing spring **16** is applied may be varied along the longitudinal outside of the wearer's foot to aid the functioning of certain muscles.

It is also to be understood that the application of the tension in the spring **16** may be altered by varying the position of the bracket **25** on the movable rod **14**. In other words, the direction of the tension force exerted by the spring is varied by varying the position of the bracket **25**. Changing the spring connection point **26** on the strap **17** will vary the tension in the spring itself and thus the correcting force applied may be periodically adjusted as the muscular condition improves.

The universal joint permits the above described forces to be applied without interfering with the normal functioning of the foot. In actual use, several heel plates alone may be affixed to different shoes and the bracket **19** and rest of the structure transferred from one shoe to the next.

It will be evident from the foregoing description that the present invention provides a greatly improved orthopedic device which is not only comfortable to wear and inconspicuous when worn under the trouser leg but also is extremely adaptable to aid therapeutically the correction of any of several different foot and ankle conditions.

Minor modifications that fall within the scope and spirit of the invention will readily occur to those skilled in the art. The orthopedic device is, therefore, not to be thought of as limited to the specific embodiment set forth for illustrative purposes.

What is claimed is:

1. A therapeutic aid for foot and ankle stabilization comprising, in combination: a heel plate; a first member secured to said heel plate and extending upwardly; a second member; a universal joint connecting one end of said second member to the free end of said first member, the other end of said second member terminating in a leg piece adapted to be held to a wearer's leg at a point above the ankle; and a biasing means coupled between said second member and said heel plate, said biasing means exerting a contracting force tending to swing said heel plate about said universal joint in a desired direction.

2. A therapeutic aid for foot and ankle stabilization comprising, in combination: a heel plate adapted to be secured to the bottom of the heel of a wearer's shoe; a flange member adapted to be secured to a lower side portion of said wearer's shoe forward of said heel plate; a rigid member secured to the rear portion of said heel plate and extending upwardly at an acute angle to the vertical, said member terminating in a universal joint; a movable member secured to said universal joint and extending further upwardly forming a second acute angle with the other side of said vertical to terminate in a leg piece adapted to be held against the rear portion of the calf of the wearer; and a biasing means secured between an intermediate portion of said movable member and said flange member to define a triangle with said rigid member and movable member, the side of said triangle defined by said biasing means tending to contract when the weight of said wearer is relieved from said heel plate and flange member.

3. The subject matter of claim 2, in which said biasing means includes a strap portion and a tension spring, said strap portion forming a part of said flange member, said part extending upwardly to terminate in a free end short of said intermediate portion of said movable member, said spring lying on the outside of said strap and connecting between said intermediate portion to a predetermined point on said strap.

4. The subject matter of claim 3, in which the securement point of the upper end of said spring to said movable member may be altered to adjust the direction at which the tension force is applied by said spring, and in which the securement point of the lower end of said spring to said strap may also be altered to vary the tension in said spring.

5. The subject matter of claim 2, in which the securement of said rigid member to said heel plate is reversible so that said member may extend upwardly on the other side of said vertical forming an opposite acute angle therewith.

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