Sept. 22, 1964 I. R. SCHMIDT 3,149,630

FOOT SLING

Filed July 11, 1962

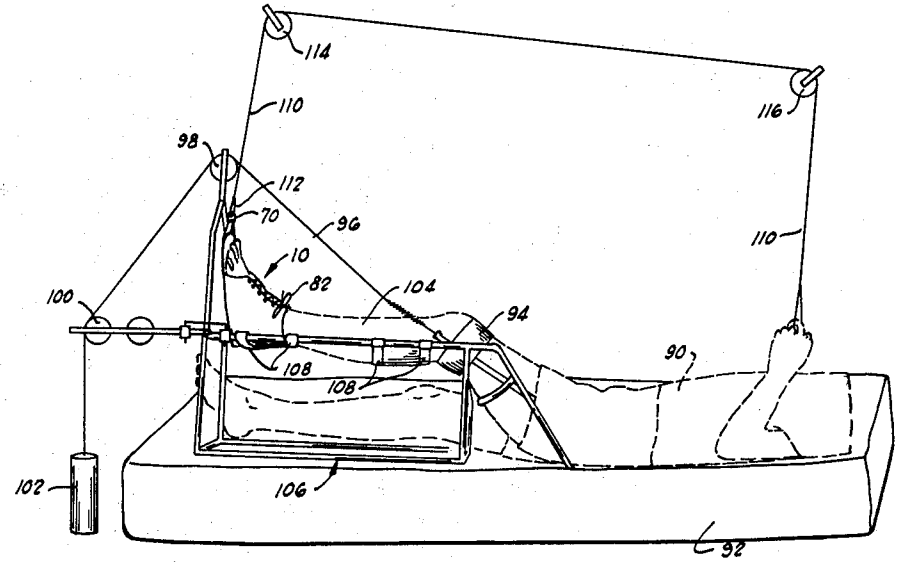


Fig. 5

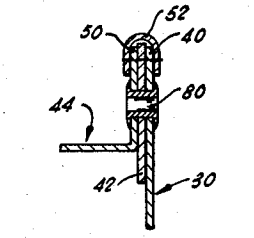


Fig. 3

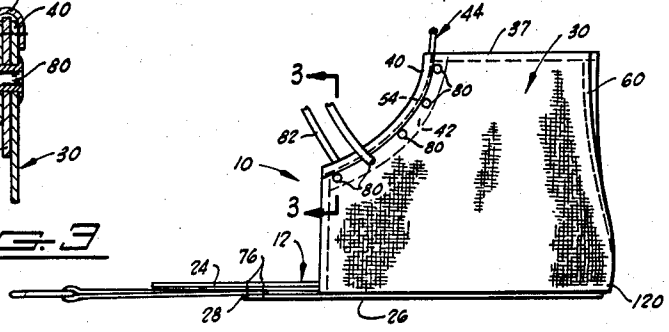


Fig. 1

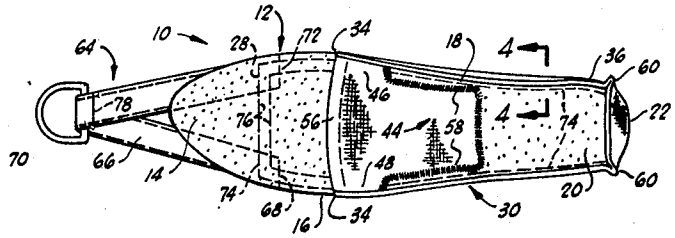


Fig. 2

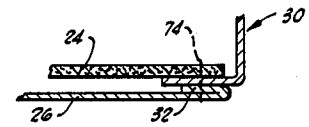


Fig. 4

INVENTOR.
IRENE R. SCHMIDT

BY

Dunlap, Laney & Hubbard
ATTORNEY

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FOOT SLING

Irene R. Schmidt, 208 N. 13th St., Ponca City, Okla.

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The present invention relates to an improved surgical accessory and more particularly, but not by way of limitation, relates to a sling for suspending the foot, toe upward.

In cases where a patient is placed in skeletal traction for treatment of a fractured femur, it is desirable and customary to position the patient on his back with the injured thigh inclined upwardly to raise the foot from the bed so that the limb may be placed in traction. The calf is then usually supported in a generally horizontal position by some suitable means. It is also highly desirable to place the foot in a sling which can be raised and lowered by the patient through an arrangement of pulleys for purposes of flexing the knee and ankle, as well as for supporting the foot in an upright, rested position. Patients being treated in this manner usually suffer the most discomfort around the foot and ankle, primarily because of pressure points on the heel and on the dorsum of the foot as the result of the foot sling.

Various types of foot slings have been heretofore devised for suspending the foot in the manner described, but in general these foot slings have not been as comfortable as would be desired because of relatively small areas of contact with the foot, by improper fitting of the sling to the foot, and because of the inability to adjust the foot slings to fit differently sized and shaped feet. This is particularly true in one type of foot sling which utilizes a heel pocket with a pair of straps extending from opposite sides of the heel pocket around the dorsum of the foot and buckled to the sole of the heel pocket. The heel pockets of this type of sling have been designed in such a manner as to have a small supporting area at the back of the heel. This is the result of the fact that the member forming the back of the heel is disposed at an angle less than 90° so that the heel will not slip from the pocket. In many cases, the upper edge of the heel pocket will then tend to "cut into" the back of the patient's heel. The straps extending across the dorsum of the foot also constitute high pressure contact points due to the relatively small area of the straps. Further, due to the construction of the heel pocket, the sole member of the sling extends below the base of the patient's heel, so that if the patient's heel comes in contact with the bed or other support, the sole member is moved upwardly relative to the plantar of the foot to thereby cause abrasion and possible blisters. Of course it will be appreciated that each movement of the patient and subsequent vibration of the bed causes rubbing contact between the sole member of the sling and the patient's foot.

The present invention contemplates an improved foot sling construction which will substantially reduce the discomfort experienced by patients using the sling. Without intending to limit the invention, the foot sling may be summarily described as comprising a flexible sole member having a general outline of the sole of the foot, including a heel portion, a restricted instep or metatarsal portion, an enlarged portion corresponding to the ball of the foot, and a toe portion. A flexible heel member extends from one side of the ball portion of the sole around the heel portion to the opposite side of the ball portion of the sole and is connected to the sole member, preferably by sewing, at substantially a right angle to the sole member at each point, except of course in the region of the instep where the cloth may be considered as generally tapering outwardly and then upwardly at 90°. The heel member is preferably wide enough to extend above the

ankle and is provided with one or more darts at the back or bottom of the heel to conform the curvature of the heel member to the curvature of the patient's heel. The free corners of the heel member are cut out along a quarter circle line and a tongue member is sewn between the corners. A lacing string is then provided to draw the corners of the heel member tightly around the dorsum of the patient's foot and the tongue member will then protect the foot from the lacing string. A suspension strap means is connected to the sole member, preferably at a point approximately beneath the ball of the patient's foot, and extends beyond the toe of the sole member where it can be connected to a suitable suspension cable. The suspension strap means preferably comprises a flat strap sewn to opposite sides of the sole member and looped through a suitable rigid ring.

Therefore, the primary object of the present invention is to provide a foot sling of the type described which is more comfortable to a patient.

Another object of the present invention is to provide a foot sling having increased contact area with the heel of the patient's foot.

Still another object of the present invention is to provide a foot sling of the type described which does not create pressure points across the dorsum of the patient's foot.

Still another object of the present invention is to provide a foot sling of the type described which has improved fit around the point of the patient's heel and the plantar surface of the foot so as to eliminate friction and blisters when the foot comes in contact with its supporting bed.

Yet another object of the present invention is to provide a foot sling of the type described which may be adjustable to a very large degree so as to fit feet of different sizes and shapes without establishing wrinkles and pressure points, and which when adjustably tightened distributes the tightness over the entire foot and ankle.

A further object of the present invention is to provide a foot sling of the type described which allows easy flexion of the ankle for exercise as well as a means of exercising the knee with greater comfort to the patient.

Another very important object of the present invention is to provide a foot sling of the type described having all the advantages set forth above, yet which may be economically manufactured.

Many additional objects and advantages of the present invention will be evident to those skilled in the art from the following detailed description and drawings, wherein:

FIG. 1 is a side elevation of a foot sling constructed in accordance with the present invention;

FIG. 2 is a top view of the foot sling of FIG. 1;

FIG. 3 is a sectional view taken substantially on lines 3—3 of FIG. 1;

FIG. 4 is a sectional view taken substantially on lines 4—4 of FIG. 2; and

FIG. 5 is a side elevation showing a patient in dotted outline being treated for a fractured femur by skeletal traction, and illustrating the application of the foot sling shown in FIG. 1.

Referring now to the drawings, a foot sling constructed in accordance with the present invention is indicated generally by the reference numeral **10**. The foot sling **10** comprises a sole member indicated generally by the reference numeral **12**, which has the general outline of the sole of the foot including a toe portion **14**, an enlarged portion corresponding to the ball of the foot and hereafter referred to as the ball portion **16**, a restricted instep portion **18** corresponding to the instep or metartasal zone of the foot, and a narrower heel portion **20** having a back end **22**. The sole member **12** is preferably fabricated from an inner sole **24** and an outer sole **26**. The inner

sole 24 may conveniently and economically be a conventional padded inner sole used in conventional leather street shoes. The outer sole 26 is preferably formed from a flexible woven material and extends only from the back end 22 of the sole member 12 to a point at the forward end of the ball portion 16 which will be referred to as the front end 28 of the outer sole 26. The inner sole 24 and outer sole 26 are sewn together to secure a heel member which will presently be described in greater detail.

A heel member, indicated generally by the reference numeral 30, is fabricated from a rectangular sheet of flexible woven cloth which may be of the same type used for the outer sole 26. The lower edge of the heel member 30 is inserted between the inner sole 24 and the outer sole 26, as best seen in FIG. 4, and extends from one side of the ball portion 16 around the heel portion 20 to the opposite side of the ball portion 16 of the sole member 12. In this respect it will be noted that the heel member 30 extends from the sole member 12 generally at right angles at any point around the periphery of the sole member. However, it will be noted that in the inwardly curved zone of the instep portion 18, the heel member 30 will extend outwardly slightly before turning upwardly at 90° in order to establish a somewhat straight line between the front edge 34 to the point 36 of the heel portion 20. This provides an added quantity of cloth to be smoothed around the instep of the patient's foot as hereafter described in greater detail. The height of the heel member 30 is preferably sufficient to extend an inch or so above the ankle. A convenient method of measuring this distance is to note that the height of the heel member 30 from the sole member 12 to the upper edge 37 is approximately equal to the distance from the front edge 34 of the heel member to the back end 22 of the heel portion.

The free corners of the heel member 30 are preferably cut out to provide a quarter circular edge 40 which approximates the curvature of the dorsum of the foot. A quarter circular facing strip 42 may conveniently be placed around the edge 40. A tongue member, indicated generally by the reference numeral 44, may have a generally T-shaped outline as best seen in FIG. 2, including two wing portions 46 and 48. The outermost edges of the wing portions 46 and 48 may then be turned upwardly along the edges 50 and placed against the quarter circular facing strip 42, as best seen in the partial view of FIG. 3. A binding strip 52 may then be placed around the quarter circular edge 40, the outer edge of the quarter circular facing strip 42, and around the edge 50 of the wing 48 of the tongue 44 and securely stitched along the entire quarter circular edge 40, as represented by the dotted line 54 in FIG. 1. The front edge 34 as well as the upper edge 37 of the heel member 30 may be hemmed in the conventional manner. The lower edge 56 of the tongue member 44 may also be hemmed while the remainder of the free edge may conveniently be provided with a blanket stitch 58 to prevent fraying.

A pair of darts 60 in the back of the heel member 30 on opposite sides of the back end 22 of the heel portion 20, as best seen in FIG. 2, constitute an important aspect of the present invention. The darts 60 provide a means for contouring the heel member 30 to fit the curvature of the heel of the foot. This contour is of extreme importance in that the major portion of the surface which supports the weight of the foot and leg is in this area. In this respect, it will be noted that the darts provide a means for also fitting the high-topped heel member 30 to the curvature of the upper ankle and lower leg so as to greatly increase the contact area and thereby reduce the contact pressure; further, by extending the effective supporting area of the foot sling above the ankle, a substantial portion of the weight is removed from the patient's heel and is transmitted directly to the lower portion of the leg, thereby resulting in far greater comfort to the patient. It will also be noted that placement of the darts 60 on either side of the back end 22 of the heel portion 20 is of considerable importance because this greatly reduces the likelihood that the thickened lump of one of the darts may be positioned under the heel in the event the heel comes to rest on the mattress or other objects which would produce a high pressure point conducive to discomfort and even blisters.

A suspension strap means is indicated generally by the reference numeral 64 and comprises an elongated flat strap 66 which may be conveniently fabricated from a length of the same woven material as that from which the heel member 30 and outer sole 26 are fabricated. In forming the strap 66, the material may be folded in the middle and then folded under at the outer edges and stitched along each resulting edge to provide a very strong, flat strap. Then one end 68 of the strap 66 is inserted between the inner sole 24 and the front end 28 of the outer sole 26, as shown in dotted outline in FIG. 2. The strap 66 is then threaded through a metallic ring 70, preferably having a flattened side as illustrated, is folded back at an angle and the end 72 disposed between the inner sole 24 and the end 28 of the outer sole 26 adjacent the other edge of the sole member 12.

The inner and outer soles and the heel member may be sewn together by a line of stitching 74 around the rear periphery of the outer sole member 26, in which case the stitching will pass through the inner sole 24, the in-turned edge 32 of the heel member 30, and the outer sole 26. Also, a second line of stitching 76 is preferably provided in the zone of the ball portion 16 substantially as illustrated to more securely connect the ends 68 and 72 of the suspension strap 66 between the inner sole 24 and the outer sole 26. A line of stitching 78 may be made across the fold of the strap 66 to securely fasten the ring 70 in place.

A plurality of conventional eyelets 80, as best seen in FIGS. 1 and 3, may pass through the heel member 30 at equally spaced points around the quarter circular edges 40 and through the facing strips 42 and edges 50 of the wing portions 46 and 48. A suitable drawstring 82 may then be threaded through the eyelets 80 to draw the heel member 30 securely and with uniform tension around the ankle and instep and across the dorsum of the patient's foot.

Referring now to FIG. 5, a patient, indicated generally by the reference numeral 90 and shown in dotted outline, is shown reclining on his back on a bed 92. As illustrated, the patient is being treated for a fractured femur and is placed in skeletal traction by a harness 94 and a cable 96 which passes over pulleys 98 and 100 to a suitable weight 102. The calf 104 of the patient's injured leg is supported by a cradle, indicated generally by the reference numeral 106, having a plurality of supporting straps 108. The patient's foot and ankle are placed in the improved foot sling 10, and a cable 110 is connected to the ring 70 by a suitable catch 112. The cable 110 passes over a pair of overhead pulleys 114 and 116 to a point within easy access of the patient. By pulling on the cable 110, the patient may raise his foot to flex and exercise his knee during the period of time he is bedridden. In some cases, it may be desirable to remove the supporting straps 108 of the cradle and permit the foot to be lowered to the bed 92 in such a manner as to permit greater latitude of movement of the lower portion of the injured limb.

From the above detailed description, it will be evident to those skilled in the art that an improved foot sling has been described. The darts 60 provide a highly economical means whereby the high-topped heel member 30 may be contoured to fit the curvature of the patient's heel, ankle and lower portion of his leg so as to greatly increase the supporting contact area and thereby reduce the resulting pressure. However, the darts 60 are in such a position as not to cause excessive pressure upon the

point 120 (see FIG. 1) of the patient's heel when the heel of the foot sling 10 is resting on the cradle straps 108 or other supporting surface. The darts 60 also provide a means whereby the foot sling 10 can be snugly contoured to the point 120 of the patient's heel so as to prevent rubbing of the inner sole 24 against the planter surface when the patient's foot is resting upon the bed 92.

The combination of the sole and heel members 12 and 30, respectively, with the drawstring 82 provides a means whereby the entire sling may be drawn securely and uniformly about the entire area of the patient's foot, ankle and lower leg to equally distribute the pressure over the entire surface area without causing any wrinkles or concentrated pressure points, regardless of the shape of the particular patient's foot. Further, the adjustability provided by the drawstring 82 and associated construction provides these advantages while simultaneously reducing the number of sizes of foot slings which must be manufactured and stocked, because a relatively wide range of foot sizes can be accommodated in a single size foot sling.

The suspension strap means 64 provides a unique construction for distributing the weight to opposite sides of the sole member 12 so that the lines of force will be more evenly distributed through the edges of the sole member 12 and then to the front edge 34 of the heel member 30, rather than through the center line of the sole member 12 directly to the back end 22 of the heel portion 20 and thence to the point 120 of the patient's heel. Therefore, it will be noted that this construction has a tendency to distribute the weight and pressure higher upon the ankle rather than upon the point 120 of the heel. The suspension strap means 64 also provides a highly economical construction.

In connection with the discussion of the manner in which the drawstring 82 tightens the heel member 30 around the ankle of the patient's foot, it will also be noted that the tongue member 44 effectively protects the dorsum of the foot from sharp, cutting pressure from the drawstring 82. At the same time, the heel portion of the heel member 30 adjacent the instep portion 18 can be stretched firmly, but as gently as desired, around the instep of the foot to assure that the sole member 12 is fitted firmly against the plantar surface of the foot and thereby tend to prevent rubbing. Similarly, the drawstring 82 pulls, with a substantially equal force, in such a manner as to insure that the foot sling 10 is fitted uniformly and snugly around the point 120 of the patient's heel. Also, the drawstring insures that the contoured heel member 30 is pressed uniformly against the back of the patient's heel throughout the length of the heel member to thereby evenly distribute the pressure over the entire surface area.

Having thus described a particular embodiment of the present invention, it is to be understood that various changes, substitutions and alterations can be made therein without departing from the spirit and scope of the present invention as defined by the appended claims.

I claim:

An improved foot sling comprising:

a flexible sole member having the general outline of the plantar surface of the foot including a heel portion, a ball portion and a toe portion;

a flexible heel member connected to the edge of the sole member and extending from a point adjacent the ball portion on one side around the periphery of the heel portion to a point adjacent the ball portion on the other side;

the flexible heel member being connected at right angles to the sole member around the heel portion and having a height substantially as great as the distance from the ball portion to the end of the heel portion so as to extend to a point above the ankle;

at least one dart in the heel member adjacent the back of the heel portion for providing a curvature corresponding to the curvature of the heel of the foot;

the free corners of the heel member each having a quarter circular edge corresponding approximately to the curvature of the dorsum of the foot between the toes and the shin;

a tongue member interconnecting the free corners for covering the dorsum of the foot;

a plurality of eyelets in the quarter circular edges of the heel member;

a drawstring threaded through the eyelets for drawing the heel member around the foot; and,

suspension strap means comprising an elongated, flat strap connected to the sole member adjacent one edge thereof at the ball portion and extending beyond the toe portion where it is folded over and extended back to and connected to the other side of the sole member, and a ring around the strap for connecting the foot sling to a tension member.

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