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 a part interest

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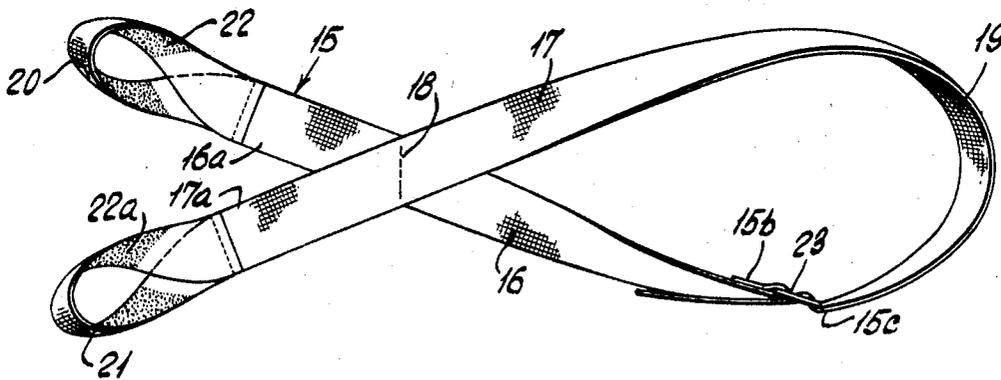
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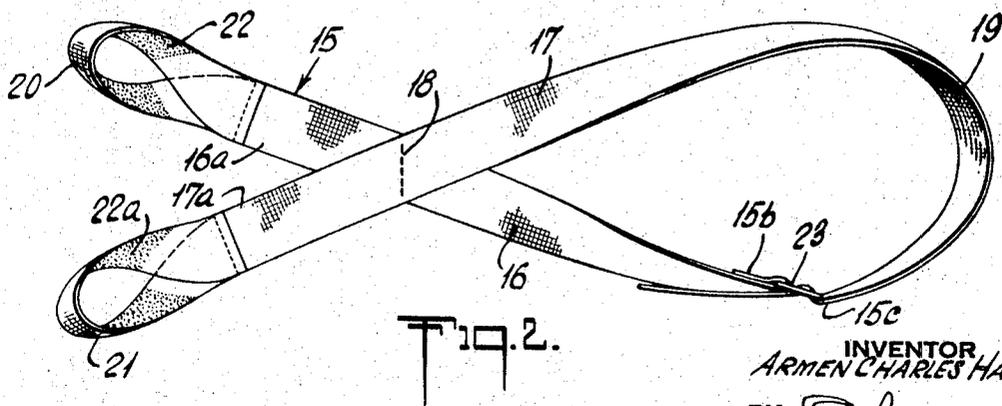
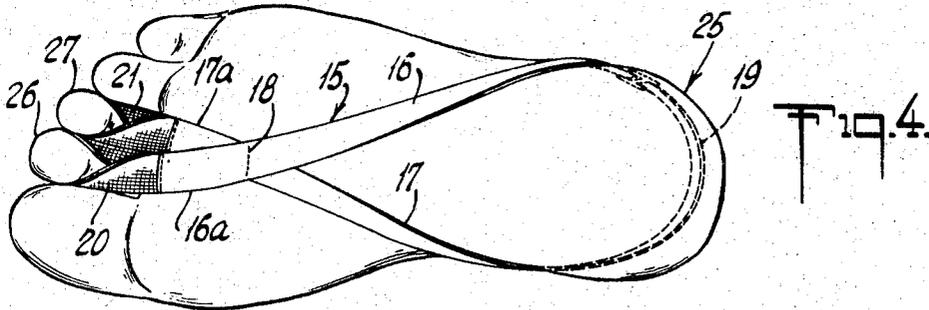
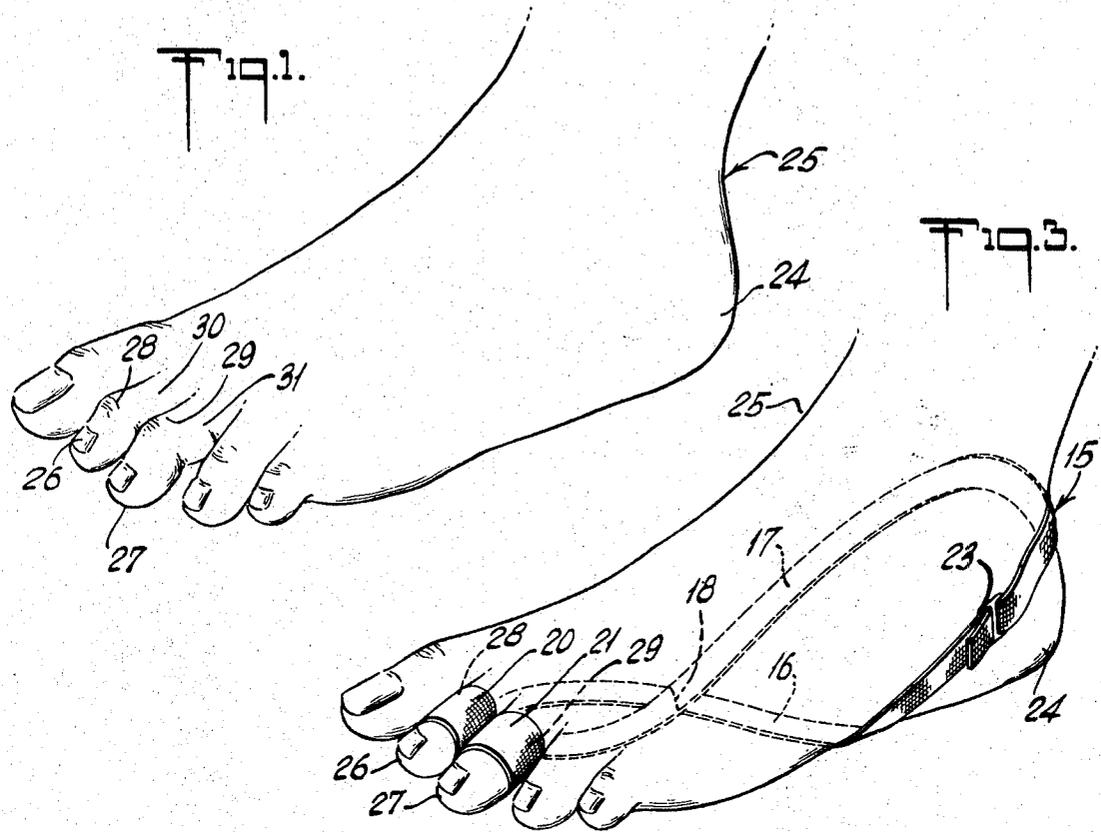
[54] **FOOT CORRECTIVE DEVICE FOR REPLACING THE FUNCTION OF WEAKENED INTRINSIC MUSCULATURE**
 4 Claims, 12 Drawing Figs.

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 128/153
 [51] Int. Cl..... A61F 5/00
 [50] Field of Search..... 128/87,
 153, 26

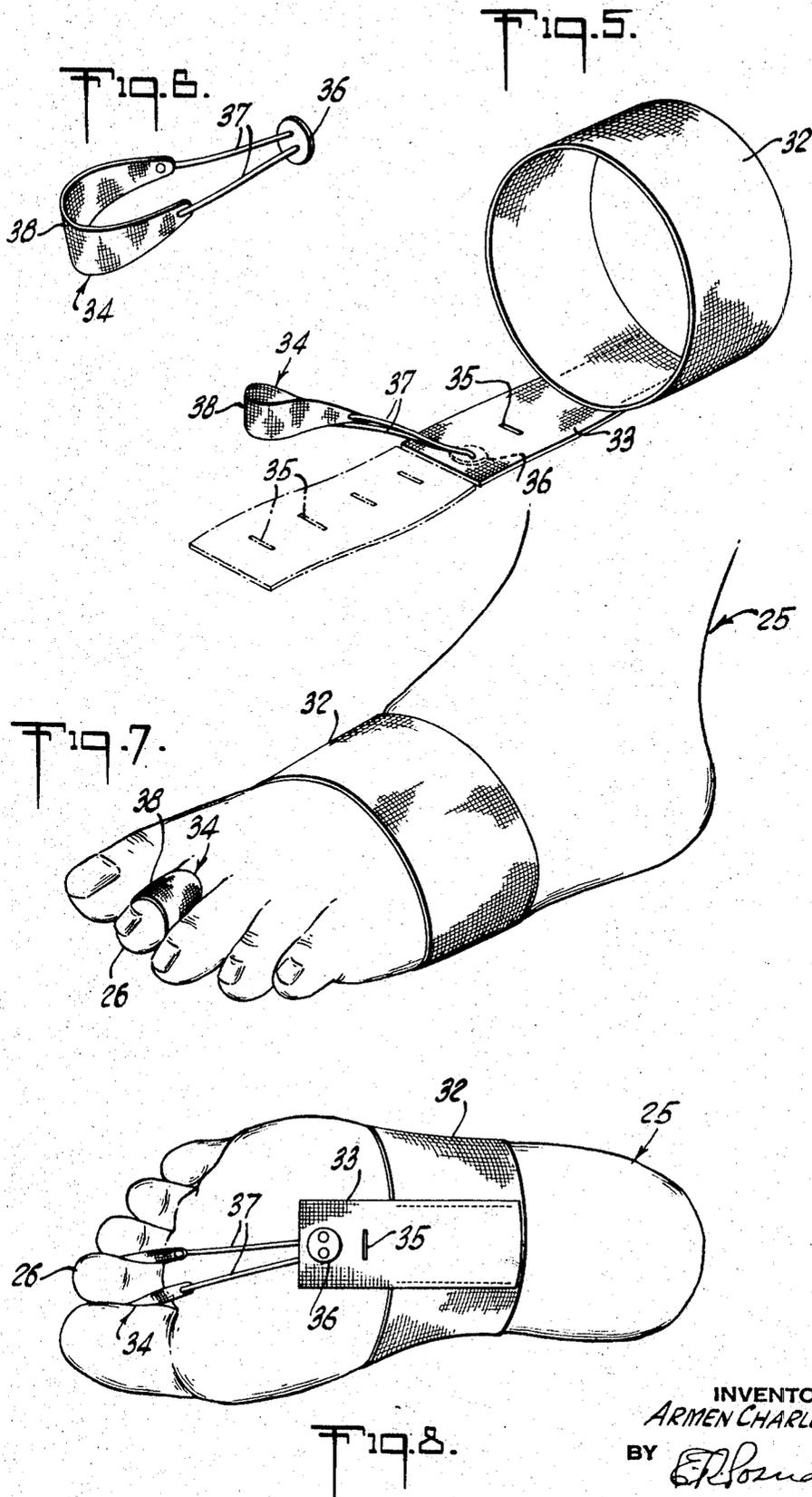
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ABSTRACT: A foot-corrective device for augmenting weakened intrinsic musculature of the toes. The device employs one or more flexible loops positioned around a corresponding number of toes, the loops being connected to a supporting portion which is anchored either to a rearwardly disposed part of the foot or to the shoe, whereby a downward and rearward pull is applied to the proximal phalanx of the engaged toe or toes to produce the actions and effects normally accomplished by the short intrinsic muscles, to wit, the flattening of the toes, the elevation of the metatarsal heads and the relatively even distribution of weight-bearing stresses to the toes and the metatarsal heads.





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Fig. 10.

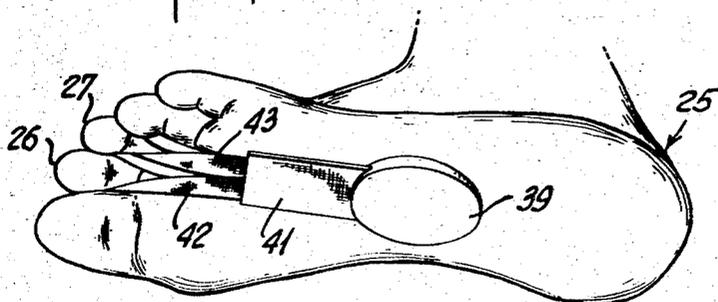


Fig. 9.

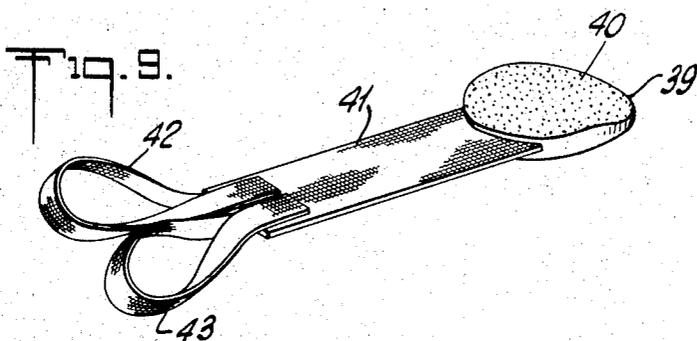


Fig. 11.

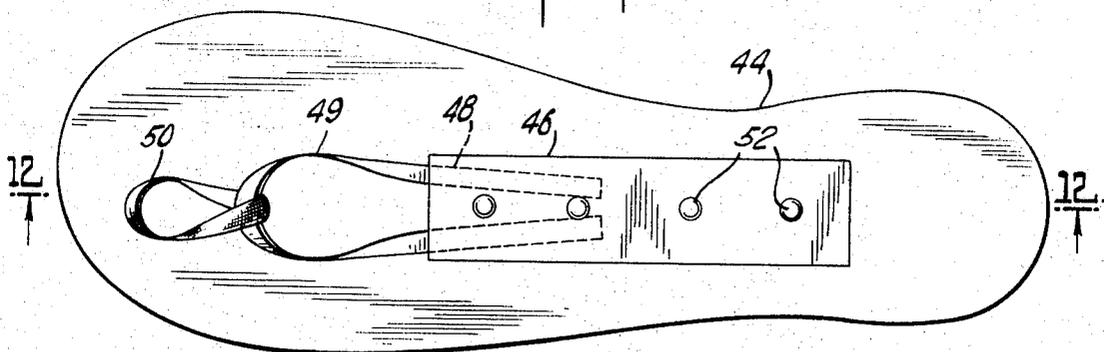
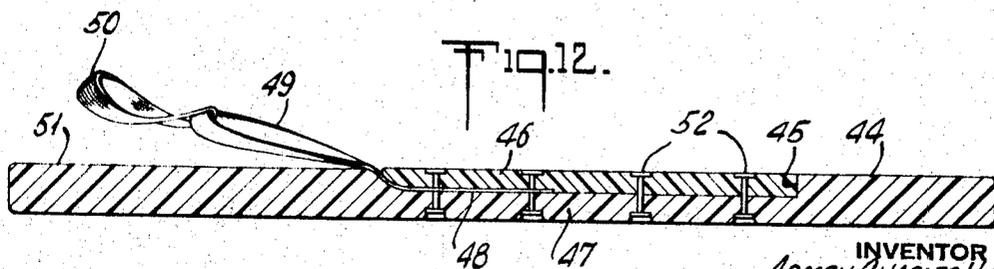


Fig. 12.



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FOOT CORRECTIVE DEVICE FOR REPLACING THE FUNCTION OF WEAKENED INTRINSIC MUSCULATURE

BACKGROUND OF THE INVENTION

1. The Field of the Invention

This invention relates to foot-corrective devices, and is particularly directed to the correction of static deformities of the forefoot and toes due to weakened intrinsic musculature.

One of the common reason for pain in the foot, especially that type of pain which occurs with fatigue and long standing, is the attrition and wasting of the muscles of the forefoot. Such conditions are know to result from the rigid encasement of the foot in a shoe, the short intrinsic muscles being restricted against development. It is an acknowledged fact the average person with "normal" feet is hardly able to flex the metatarsophalangeal joints of his toes beyond 20°. A great deal of pain is thus generated under the metatarsal heads due to the loss of ability of the weakened intrinsic muscles to flex these joints. Moreover, the consequent loss of flexion of the metatarsophalangeal joints of the four lateral toes is a prime factor in the development of corns and calluses of the dorsum of the proximal interphalangeal joints of the toes as well as of the distal interphalangeal joints.

More specifically, when toes are in a raised claw position due to the loss of tone and overstretching or tensioning action of the intrinsic muscles, there are two effects that are anatomically undesirable, the raised claw-positioned toes (1) causing the metatarsal heads to be lowered or pushed down, so that such heads bear against the sole of the shoe and cause pain, and (2) come into frictional engagement with the relatively unyielding toe box of the shoe, resulting in the formation of corns, bunions, calluses, blisters and abrasions.

2. The Known Art

The conditions above described are well recognized by orthopedists, but the general remedies for these abnormal conditions are in the nature of protective or alleviate means. Among these are medicinal means, pads and the method of applying a metatarsal bar behind the metatarsal head to elevate the head and relieve it some of the body weight. None of these expedients, however, provide a flexion movement of the metatarso-phalangeal joint and the concomitant straightening of the interphalangeal joint.

OBJECTIVES OF THE INVENTION

It is an objective of the present invention to remedy the conditions above-mentioned by providing a mechanical substitute for the short intrinsic muscles of the foot that have lost their effective muscle tone. This objective is accomplished, in a preferred embodiment of my invention, by an elastic suspension type of device which simulates the action of a normal functioning intrinsic muscle and dorsalhood expansion mechanism.

Another object is to provide a device of the above category that will be of value not only when the wearer is walking, but also then he is at rest, whereby the intrinsic muscles are given a chance to regain their function by a stretching of the contractures of the joint capsule of the metatarso-phalangeal joint and a shortening of the excursion length of the overstretched muscles.

Further objects of this invention are the provision of an easily applied, lightweight and comfortable device, one that is simple in construction, readily fabricated and inexpensive, and capable of effectively performing the functions above described.

Other objects, features and advantages will appear from the drawings and the description hereinafter given.

SUMMARY OF THE INVENTION

The present invention in essence comprises a toe loop portion connected to a rearwardly extending anchoring portion secured to the heel or other portion of the foot, or to the shoe, the connecting means underlying the foot.

A preferred structural embodiment includes a flat elastic flexible band looped around and anchored on the heel and extending forwardly along the plantar surface of the foot, said band being connected to one or more loops of soft material which extend to the dorsal aspect of the individual toes, each loop being applied to the proximal phalanx of the enveloped toe.

The arrangement of said preferred embodiment, as well as that of other embodiments, is such that the proximal phalanx of the toes is brought down into any one of a number of semiflexion positions depending on the tension of the suspension on the plantar surface of the foot. By bringing the proximal phalanx into moderate flexion the rest of the toe may be gradually straightened, thereby to relieve pressure on the dorsum of the toe where a corn or blister is produced.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a foot showing two toes in raised claw position prior to the application of the device of this invention.

FIG. 2 is a perspective view of one form of this invention adapted for being anchored to the heel of the foot for correcting the deformity illustrated in FIG. 1.

FIG. 3 is a view of the foot of FIG. 1 showing the embodiment illustrated in FIG. 2 in operative position.

FIG. 4 is a bottom view of FIG. 3.

FIG. 5 is a perspective view of another form of this invention comprising a circular band adapted for embracing engagement with the instep of the foot and containing a disposable toe loop member, the dot-dash lines indicating an excessively long portion that was severed.

FIG. 6 is a perspective view of the toe loop member detached from the device of FIG. 5.

FIG. 7 is a perspective view of a foot with the device of FIG. 5 operatively applied thereto.

FIG. 8 is a bottom view of FIG. 7.

FIG. 9 is a perspective view of another form of this invention adapted for attachment to the underside of the arch of the foot.

FIG. 10 is a bottom perspective view of a foot with the device of FIG. 9 which is operatively applied thereto.

FIG. 11 is a plan view of another embodiment of this invention comprising the insole of a shoe operatively supporting a toe loop member.

FIG. 12 is a section of FIG. 11 taken along line 12-12

DESCRIPTION OF PREFERRED EMBODIMENTS

In the form of my invention illustrated in FIGS. 2 to 4, a flat band 15 or preferably elastic material is bent back upon itself to form two sections 16 and 17 with intermediate portions thereon in crossing relation, the intersecting portions being secured together at 18 by suitable means, such as by stitching. The arrangement is such as to form a rear heel loop 19 adapted for being anchored to a heel in a manner to be hereinbelow described. The respective forward branches 16a and 17a of said sections 16 and 17 support the respective toe loops 20 and 21 preferably made of soft pliable material, said loops being proportioned for enveloping engagement with selected toes of the foot. The said sections 16 and 17 thus constitute the connecting means between the toe loops and the heel loop. In the preferred construction illustrated, the respective inner surfaces 22 and 22a of said toe loops are coated with adhesive material adapted for temporary attachment to the skin, whereby the loops when operatively applied to the toes will be held against slipping from their selected optimum positions. The band 15, in the form shown in the drawings, is composed of two section 15b and 15c connected in the rear region by the buckle 23 in conventional manner, whereby adjustments as to size can readily be made by varying the distance between the said heel loop 19 and the toe loops 20 and 21.

In operatively applying this device to the foot 25, the said heel loop 19 is brought around the back of the heel 24 and

thereby anchored thereto, sections 16 and 17 being positioned under the foot to extend forwardly along the plantar surface as illustrated in FIGS. 3 and 4. The toe loops 20 and 21 are then operatively brought into enveloping engagement with the deformed toes 26 and 27. As shown in FIG. 1, the said toes 26 and 27 are in raised claw position — the deformity which my invention is designed to correct. The said toe loops 20 and 21 are positioned for enveloping engagement with the proximal phalanges 28 and 29 of the said raised toes, as illustrated in FIG. 3. The proportions of the sections 16 and 17 of this device are such that they will be under tension when the said toe loops and the heel loop are in place. Since sections 16 and 17 underlie the foot, the tension therein causes a downward and rearward yieldable pull on the said proximal phalanges 28 and 29 of said toes 26 and 27, thereby flexing downwardly the metatarso-phalangeal joints at the regions 30 and 31. This in effect produces a flattening of the toes by the substantial concomitant straightening of the interphalangeal joints.

By adjusting the buckle at 23, the tension in sections 16 and 17 can be varied, whereby the proximal phalanges of the engaged toes can be brought downward to any one of a number of semiflexion positions. It has been observed that by bringing the proximal phalanges of each toe into moderate flexion, the rest of the toe may be gradually straightened to produce the desired effects above-mentioned.

The above-described rearward and downward pull on the loops and the engaged toes corresponds to the rearward and downward pulling action of a normally functioning intrinsic muscle -- this device accordingly substituting for weakened intrinsic muscles which result in deformities such as that of the claw-positioned toes 26 and 27 shown in FIG. 1. The operative use of this invention thus effects both the raising of the involved metatarsal heads and thereby eliminating the pain resulting from the pressure of said heads against the sole of the shoe, and the lowering of the proximal phalanges of the engaged toes, thereby eliminating a common cause for the formation of corns, bunions etc.

In the form of my invention illustrated in FIGS. 5 to 8, an in-step elastic looped member 32 is provided, this having attached thereto the forwardly extending band 33 to the front of which is detachably secured the toe loop member generally designated 34. In the particular illustrated embodiment of this form of my invention, the band 33 contains a number of buttonholes 35 in longitudinally spaced alignment. These buttonholes are adapted to receive the button 36 to which is attached the rubberband member 37 to the outer ends of which is secured the toe loop 38. The arrangement of several buttonholes 35 is for purposes of size adjustment by cutting off an unneeded part of the band 33, like the portion thereof indicated by dot-dash lines.

The use of a detachable toe loop 34, either with button arrangement as above illustrated or any other detachable fastening means, enables such toe loops to be made of inexpensive disposable material. Hence, if this device is to be worn over a period of time, new toe loops 34 can be applied after discarding used ones.

The said looped member 32 is yieldably applied over the in-step portion of the foot as illustrated in FIG. 7, whereby the toe loop element 38 of member 34 extending forwardly along the bottom of the foot is operatively applied to the toe 26. The elastic element 37 exerts a downward and rearward pull substantially in the manner of the elastic band members of the form first above described.

In the form of my invention illustrated in FIGS. 9 and 10, a pad member 39 with an adhesive surfacing 40 is adapted for attachment to the plantar portion of the foot in the region of the arch as shown in FIG. 10. The forwardly extending elastic band 41 carries the two toe loops 42 and 43 for attachment to the toes in the manner aforesaid. These loops exert the same downward and rearward pull on the applied toes as the toe loops of the other forms of my invention hereinabove described.

FIGS. 11 and 12 show a form of my invention which is anchored to the shoe of the wearer, rather than to the foot.

The insole of a shoe 44 has a cavity 45 into which fits the anchoring strip 46. Between said anchoring strip and the base 47 of the insole 44 is inserted the band 48 to which is secured the elastic member 49 supporting the toe loop 50. The said elastic member 49, as indicated in FIGS. 11 and 12, extends upwardly above the upper surface 51 of the insole and forwardly towards the toe portion. The parts are so proportioned and positioned that the toe loop 50 is adapted to envelop a selected toe in the manner aforesaid, the elastic member 49 exerting a rearward and downward pull, whereby the loop member 50 causes a flattening of the toe for the corrective purposes above mentioned. In the form illustrated, the said strip 46 is secured in place by fasteners 52, although other securing means known to the art may be employed if desired.

Each of the various devices above described and illustrated constitutes substitutes for a weakened intrinsic muscle, and performs the function of such muscle to remedy the abnormal toe conditions above described. The devices are all relatively simple, easy to fabricate and relatively inexpensive.

In the above description, the invention has been disclosed merely by way of example and in preferred manner; but obviously many variations and modifications may be made therein. It is to be understood, therefore, that the invention is not limited to any form or manner of practicing same, except insofar as such limitations are specified in the appended claims.

I claim:

1. An orthopedic device for correcting deformities of the toes and forefoot due to weakened intrinsic musculature, comprising a plurality of adjacent toe loops proportioned for embracing engagement with the respective proximal phalanges of corresponding toes, anchoring means disposed rearwardly of said loops, and connecting means attached to said respective loops and positioned and proportioned to underlie the foot, whereby downwardly and rearwardly directed pulls will be exerted on said loops and the engaged toes towards the common flexor at a predetermined operative position of said anchoring means, said plurality of toe loops comprising two loops, said anchoring and connecting means being formed from a band of material bent into the form of a rear loop with intermediate sections in intersecting relation and two branches extending forwardly from said intersecting intermediate sections, said intersecting sections being secured together, said two toe loops being attached to the forward portions of said respective branches, said two branches being proportioned and positioned for underlying engagement with the foot at laterally opposite portions, whereby a transverse walking platform is established upon a raising of the heel, said rear loop being proportioned for enveloping engagement with the heel of the wearer.

2. An orthopedic device for correcting deformities of the toes and forefoot due to weakened intrinsic musculature, comprising a plurality of adjacent toe loops, each loop being of substantial width for embracing engagement with a respective proximal phalange of corresponding toe, anchoring means in the shape of a loop disposed rearwardly of said loops, and connecting means attached to said respective loops and being disposed between said loops and said anchoring means and positioned and proportioned to underlie the foot for exerting downwardly and rearwardly directed pulls on said loops and thereby on the engaged toes towards the common flexor at a predetermined operative position of said anchoring means to flatten the toes, said connecting means and toe loops being of substantially uniform width, said plurality of toe loops comprising at least two loops, said connecting means having a plurality of forwardly extending branches connected to said respective toe loops, said branches being proportioned and positioned for underlying engagement with the foot at laterally opposite portions, whereby a transverse walking platform is established upon a raising of the heel.

3. An orthopedic device according to claim 2, said connecting means having an elastic portion positioned between said respective loops and said anchoring means.

4. An orthopedic device according to claim 2, wherein said branches are in overlapped adjoining relation at said anchoring means.