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Reiman

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[54] **CHILDREN'S CORRECTIVE FOOT SPLINT**

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[52] **U.S. Cl.** ..... **128/80 A;** 128/80 J

[51] **Int. Cl.²** **A61F 3/00**

[58] **Field of Search** ..... 128/80 A, 80 R, 87, 83

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[57] **ABSTRACT**

The invention relates to a foot splint for correcting abnormalities and foot deformations that are sometimes found in newborn and young children. It includes relatively fixed, angularly related foot supports, each having lateral supports for applying a lateral inwardly directed force against the outer surface of the heel of a foot positioned on the foot support and strap means for supporting each foot to its respective foot support and for applying a laterally directed force opposing that of the force applied to the heel of the foot and to inhibit medial rotation of the forefoot.

3 Claims, 6 Drawing Figures

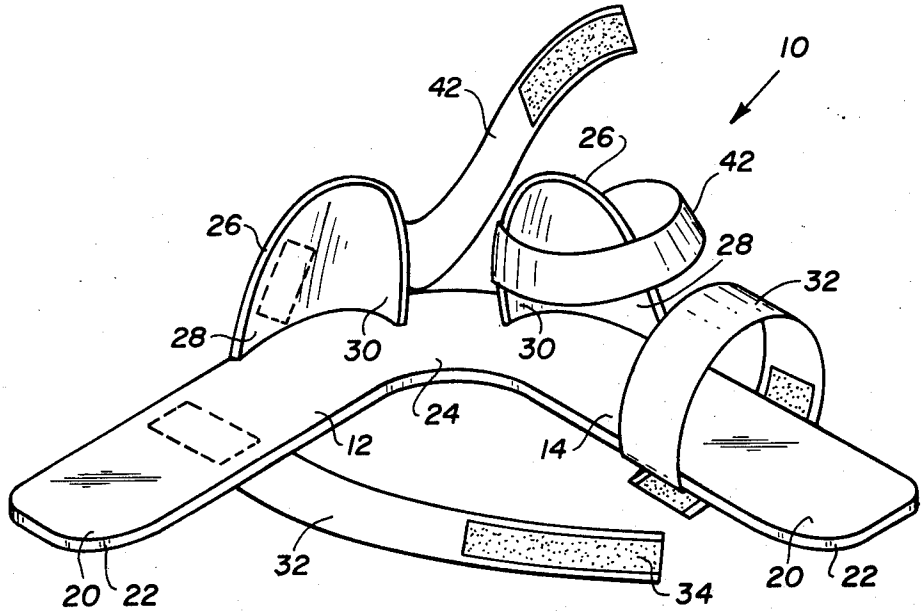
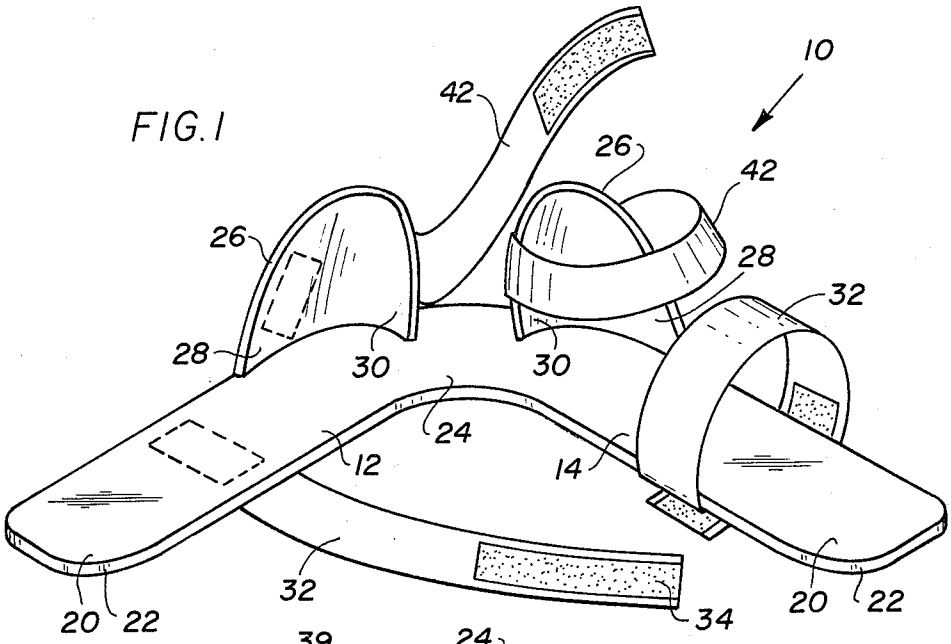


FIG. 1



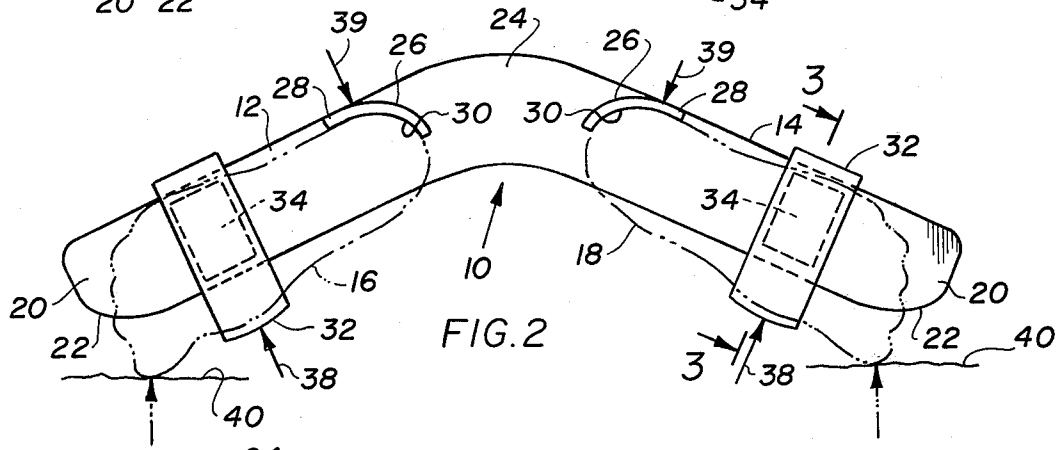


FIG. 2

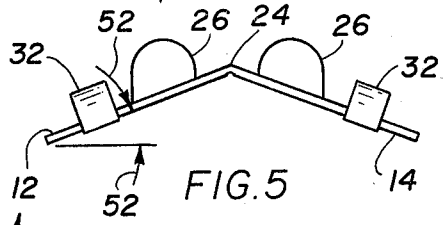


FIG. 5

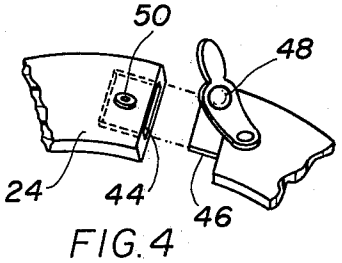


FIG. 4

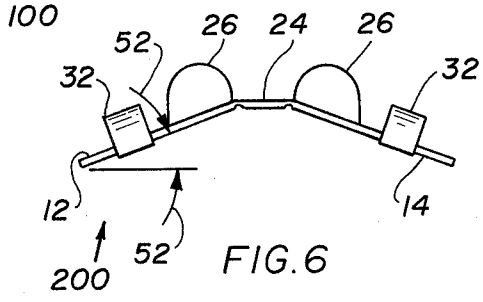


FIG. 6

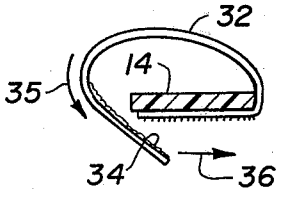


FIG. 3

CHILDREN'S CORRECTIVE FOOT SPLINT

BACKGROUND OF THE INVENTION

This invention relates to a foot splint for attachment to the feet of children for correcting such abnormalities and deformations as toe-in, "pigeon-toe-in," club feet, bowlegs and the like.

The general problems treated by the present invention and examples of prior art were discussed at length in applicant's prior application Ser. No. **374,477,** filed June **28, 1973,** now U.S. Pat. No. **3,812,850** and the same are incorporated herein by reference.

SUMMARY OF THE INVENTION

Although the objects of applicant's prior patent application, as set forth above, are still the objectives of the present application, it is also an object of the present application to take advantage of the physical forces exerted by a child suffering from the aforementioned abnormalities and deformations and to utilize the same to aid in the correction of such undesired conditions more effectively, more rapidly and more inexpensively than was heretofore enabled by prior art structures, all without the requirement of unusual training or skills.

The above description, as well as further objects, features and advantages of the present invention, will be more fully appreciated by reference to the following detailed description of a presently preferred, but nonetheless illustrative, embodiment in accordance with the present invention when taken in conjunction with the accompanying drawings wherein:

FIG. **1** is a perspective view taken at an angle of the front and top of a foot splint constructed according to the invention;

FIG. **2** is a top view;

FIG. **3** is a cross-section of FIG. **1** taken along line **3—3**;

FIG. **4** is a partial view of a modification of the foot splint;

FIG. **5** is a front view of a modified foot splint; and

FIG. **6** is a front view of another modified foot splint.

Referring to the drawing, the children's corrective foot splint, illustrated in FIGS. **1, 2** and **3,** is generally identified by the numeral **10.** It comprises a pair of foot support members **12** and **14** that are substantially planar at their upper surfaces to facilitate the positioning of the sole of a child's foot on each of such respective members. The support member **12** will accommodate the right foot of the child while the support member **14** will accommodate the left foot of the child. Each of the support members **12** and **14** is substantially identical to the other. They extend for at least and greater than the full length of the foot of the child to be positioned thereon and may be substantially equal to, but preferably less in width than the sole of the child's foot.

This is illustrated more clearly in FIG. **2** wherein the left and right feet respectively, shown in broken lines, are positioned on their respective foot supports **12** and **14.** It will be noted that the right foot **16** and the left foot **18** is substantially shorter in length than that of each of the foot support members on which they are positioned and substantially greater in width than such foot support members for a purpose to be described. For convenience, each of the foot support members **12** and **14** is provided with a toe portion that is identified by the numeral **20.** Each toe portion **20** is rounded on its inner portion or side as at **22** while the opposite side

of the toe portion **20** may be smoothly finished in any desired manner.

The foot support members **12** and **14** are generally fixed in a diverting angular relationship approximating an included angle of **105°,** to cause the feet of the child to assume the desired normal included angular diverging relationship of between **30°** to **40°.** Such foot support members **12** and **14** are retained in their generally fixed relationship by a central connecting means or portion **24.** In the embodiment shown in FIGS. **1** and **2,** the connecting means **24** is formed unitary and coextensive with the foot support members **12** and **14.**

Mounted on and forming an integral construction with each of the foot support members **12** and **14** is a respective lateral force applying support sometimes hereinafter referred to as a heel support member **26.** Each heel support member **26** has its major portion **28** extending along a lengthwise outer edge adjacent or bordering the rear of each of the foot support members **12** and **14** so as to provide a laterally disposed wall against which the heel of a child's foot may be butted and engaged. As a coincidental and added attribute of the heel support members **26,** each has a curve **30** directed inward for a minor portion of their extent to delineate and define the heel portion of their respective foot support members **12** and **14.** The minor curve portion **30** extends around and at least beyond the midline of the child's heel. This prevents swiveling action of the child's heel and thus prevents its escape from the support **26.**

Although the major extent **28** applies the lateral inward force to the heel of the child's foot, the minor portion **30** does enable the individual applying the foot splint **10** to the feet of a child to properly position the heel of each foot on the respective foot support surfaces properly against the major lateral support surfacce **28.** This may be seen more clearly in FIG. **2** wherein the broken lines, illustrasting the feet **16** and **18,** are shown tc be in position against the surfaces **28** and **30** of the heel support member **26.**

Mounted intermediate the heel portion of each support member **12** and **14** and the toe portion **20** thereof is an adjustable releasable strap securing means **32.** In practice, each such strap is provided with a VELCRO fastener **34** that enables the strap to be adjusted about the instep of the child's foot to inhibit medial rotation of the forefoot. Thus, in practice, when the feet of a child are positioned flat against the upper surfaces of the foot support members **12** and **14,** and abutted against the lateral force applying side walls **28,** and positioned against the heel portion **30** of each heel support member **26,** the strap **32** is then wrapped about the instep of the foot as illustrated in FIG. **2** and as shown in the intermediate position of FIG. **3** with the movement of the strap following the arrows **35** and **36** of FIG. **3.**

When the strap **32** is so secured about the instep of the child's foot, the foot is held firmly, but not uncomfortably, against the surface of the foot supports **12** and **14.** At the same time, the heel of each such foot is forcibly urged against and into engagement with their respective lateral force applying surfaces **28** of the heel support members **26.** To understand this better, each strap **32** applies a lateral force that restrict the foot from rotation relative to its support **12** or **14** and is directed against the inner surface of each foot in a direc-

tion that is laterally outward as illustrated by the arrows **38** in FIG. **2.**

The lateral outward force **38** counters and is opposed to the lateral inward force that is exerted against the lateral outer side of each foot heel at the surfaces **28,** such as is depicted by the force arrows **38** in FIG. **2.** The application of the outward forces applied to the foot at the straps **32** and the inward forces applied to the outer portion of the heel of each foot as demonstrated by the arrows **39** at the surfaces **28** should be apparent to those skilled in the art. A child who suffers from a toe-in abnormality or a bowleg deformation or other similar condition normally tends to toe in at the toes and outward at the heels.

By positioning the heel of each foot against the respective surface **28,** a laterally directed inward force is automatically applied against such outwardly directed heels of the child and, therefore, opposes the tendency of the child's heel to move outward. At the same time the forces applied to the child's instep at the straps **32,** such as in the direction of the arrows **38,** counter that force that is normally present in the child's abnormally inwardly directed toed feet. Hence, the forces **38** and **39** are opposed to each other and, in like manner, are opposed to the abnormal tendency of rotation of the child's feet that must be corrected.

By so positioning each of the feet of the child against the surfaces **28** and strapping the same in place against the foot support members **12** and **14** by the straps **32,** the inward forces **39** and the outward forces **38** tend to counteract the abnormal forces that are present in a child's feet that create the abnormality or deformation that must be corrected. Once the child's foot is strapped against the foot support members **12** and **14** in the manner discribed, the application of the forces **38** and **39** will cause the legs and the feet to assume the proper divergent angle corresponding to that of the foot support surfaces **12** and **14.**

In the illustration of FIG. **2,** it will be noted that the large toe of each foot is shown engaged against a surface such as the surface of a bed or mattress **40.** As a consequence, a further torqueing force is applied to the toes of each of the feet **16** and **18** causing them to further flex and rotate outward in the direction of the force applying arrows **38,** thereby also tending to straighten and correct the abnormality or deformation. Additional adjustable straps **42** connected with and extending from the heel support members **26** are adapted to engage about the circumference of the ankle of a foot positioned on each of the foot supports **12** and **14.**

The straps **42** function to retain the heel of the foot in position on each of the foot support members **12** and **14** and also to apply an outwardly directed lateral force to the ankle which is directed in opposition to the force **39** that is applied to the heel of the foot by the heel support members **26.** By so strapping the ankle of the foot to each of the foot support members **12** and **14,** the same assists in preventing lateral rotation of the child's heel relative to the foot support member and related structure.

Although the substantially planar foot support members **12** and **14** may be formed as a unitary continuous element made of any rigid or mildly flexible material, if desired, the planar foot support members may be made separable at the central connection means or portion **24.** By so doing, each foot **16** and **18** may be more easily fixed individually to its respective foot support **12** and **14.** Then, after being so fixed, the two support members **12** and **14** may be secured together in a manner to be described.

In this regard, reference is made to FIG. **4** wherein the connecting portion **24** is illustrated. One side of the connecting portion **24** may be provided with an interanl hole **44** while the other side may be provided with an engaging and positioning tongue **46.** When the torque is inserted into the hole **44,** the two parts of the central portion **24** are aligned and connected together with each other. The connection is made complete by a releasable fastener **48** engaging with a fastener button **50.** The releasable engagement between the fastener **48** and the button **50** enables each of the foot support members **12** and **14** to be connected together for conjoint use in the arrangement as shown in FIGS. **1** and **2.** However, for convenience of application to the feet of a child, the same may be separable from each other by disengaging the fastener **48** from the button **50** and separating the two foot support members from each other.

The natural tendency of the feet **16** and **18** afflicted with the deformations or abnormalities discussed previously is for the heels to rotate laterally outward and the toes laterally inward toward each other. That is to say, the right foot tends to rotate counterclockwise while the left foot tends to rotate clockwise. Thus, when each of these deformed feet are strapped to their respective support surfaces **12** and **14** and abutted against the lateral support surfaces **28,** the lateral support surfaces counteract the normal rotational forces effected by the anatomy of the feet to further aid in the counteracting of the natural tendency of the feet to rotate inward toward each other at the toes.

To aid in the correction of the feet, the foot support members **12** and **14** are made longer in length than the foot to be supported thereon as is illustrated in FIG. **2.** Although the feet **16** and **18** illustrated in FIG. **2** are shown wider in width than that of their respective support surfaces **12** and **14,** in the event the feet are approximately the same width as their respective support members, the rounded ends **22** of each longer foot support member **12** and **14** will engage against the bed or mattress surface **40** in the same manner as the toe of each foot **16** and **18** is shown to be in engagement with such surface **40.** During such engagement, there is an outward rotation or counteracting torqueing force applied, either to the toe of the foot directly as shown in FIG. **2** or to the rounded portion **22** of the respective foot support members **12** and **14** which produces an outward rotating force against the abnormal foot that tends to straighten and correct the abnormality. Thus, the longer members **12** and **14** add leverage to the torqueing effect of the angular divergence of the foot supports.

In this manner, advantage is taken of the counteracting torqueing forces that may be applied to the feet of the child when the child is lying prone on a bed or mattress or other surface. Such torqueing forces tend to correct the abnormality or deformation each time the child moves because the rocking motion that occurs at the rounded ends **22** tends to rotate and toe outward each of the child's feet.

Referring now to the embodiment of the invention illustrated in FIG. **5,** the same is generally identified by the numeral **100** that illustrated the same type of children's corrective foot splint as previously described

with respect to the embodiment **10** shown in FIGS. **1** to **4** inclusive. The embodiment illustrated in FIG. **5** differs from the previous embodiment **10** in the ability of the foot support members **12** and **14** to tilt downward at an angle of approximately **20°** as illustrated by the arrows **52.** This enables the foot support members to conform to the more natural "carrying angle" of the foot with respect to the leg. Those skilled in the art will readily recognize that when a child is carried at the waist or above the legs, the feet have a natural tendency to fall downward at the ankles. The angle which such feet assume relative to the legs is approximately **20°**. Thus, under certain conditions, it may be desirable to permit the foot support members **12** and **14** to fall downward or to assume an angle that more nearly approaches the natural carrying angle of the foot with respect to the leg.

In the embodiment **100** of FIG. **5,** inasmuch as all of the remaining structural details of the foot splint are the same as that previously described with respect to the embodiment **10,** a repeat of such description would be redundant and superfluous. Let it suffice to note that the connection **24** between the foot support members **12** and **14** may be a rigid connection if so desired with the previously formed natural carrying angle provided therebetween. On the other hand, **24** may be a substantially flexible connection wich will permit the foot support members **12** and **14** to fall into their natural carrying angle as illustrated in FIG. **5.** Moreover, the connecting means **24** may be provided with a separable arrangement of structural details such as that illustrated and described with respect to FIG. **4.**

In referring to the embodiment generally identified by the numeral **200** in FIG. **6,** the structural details thereof are the same as those described with respect to the embodiment **10** and, therefore, like parts are similarly numbered. Once again as in the description with respect to the embodiment **100** of FIG. **5,** it is desirable to permit the foot support members **12** and **14** to conform to the natural carrying angle of the foot with respect to the leg such as was previously described. To accomplish this the connecting portion **24,** like the connecting portion **24** is described with respect to the embodiment **100** of FIG. **5,** enables the foot support members **12** and **14** to assume their natural carrying angle.

However, in the present embodiment, the connecting portion or means **24** is elongated in length to provide a substantial flat between the foot support members, the expanse of which may be used more easily to accommodate the releasable connection of the type described with respect to FIG. **4,** thereby enabling the foot support members **12** and **14** to be separated and joined together as the case may be. Additionally, at the jointure or connections **54** between the connecting portion **24** and the foot support members **12** and **14,** there is provided a yieldable or flexible joint **54** that enables each such support to assume the desired carrying angle **52.**

Those skilled in the art will readily recognize that the present invention takes advantage of the natural tendency of the feet to assume their abnormality or deformation and thus utilizes these abnormal and deforming forces to counteract the abnormality or deformation and to straighten the feet or correct the undesired condition.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment thereof, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the invention, therefore, to be limited only as indicated by the scope of the claims appended hereto.

What is claimed is:

1. A foot splint for attachment to the feet of a child for correcting toe-in and related abnormalities comprising

an open unitary substantially planar support for the full length of each foot,

means between and unitary with said foot supports and connecting the same together at a fixed diverging angle.

a heel support unitary with and extending partially about each of said foot supports,

said heel supports having major and minor curved portions,

said heel supports having their major curved portions extending along and for a length of its respective foot support at the lateral outer portion thereof to apply a lateral inward force to the heel of a foot positioned thereagainst and said minor curved portions being directed inward about its respective foot support for a portion thereof and delineating the heel of its respective foot support,

each said heel support extending upward from said foot support for a height sufficient to apply a support agianst which the heel of a foot positioned thereagainst is restrained,

and instep strap means on each of said foot supports to engage about the instep of a foot positioned on a respective foot support to inhibit the medial rotation of the forefoot by applying a lateral outward force thereto in opposition to the lateral force of said heel support and ankle means on each of said heel supports for circumferential engagement about the ankle of a foot positioned on said foot support to apply a lateral outward force in opposition to the lateral inward force of said heel support, said foot supports being greater in length and lesser in width than that of a foot to be positioned thereon to enable said instep strap means to apply its lateral outward force to the foot.

2. A foot splint as in claim **1,**

said connecting means including means operable to release each of said foot supports from their connected fixed diverging angular relation and to connect the same together in said fixed diverging angular relation.

3. A foot splint as in claim **1,**

means connecting each of said foot supports such that said foot supports may tilt downward to conform to the natural carrying angle of a foot positioned on said foot supports with respect to the leg thereof.

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