

[54] ADJUSTABLE LEG BRACE

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[57] ABSTRACT

An adjustable leg brace for rapid attachment to the leg of an individual, as desired.

The lowermost member of the brace is secured to the heel of the user's shoe. Also secured to this member is a horizontal adjustment member to allow for horizontal adjustment of the lower angle upright. The upper angle upright is vertically secured to the lower upright, and between the two, the lowermost member is adjusted for the specific vertical location of the user's ankle joint.

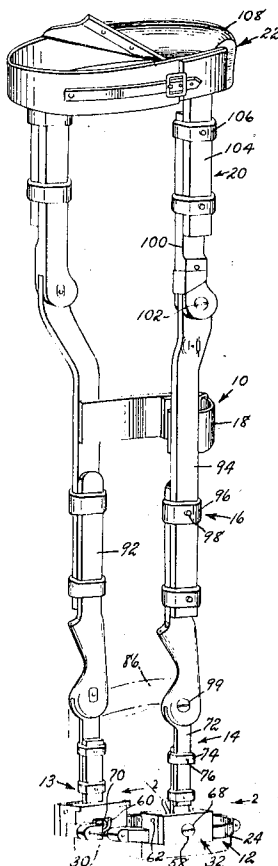
A removable Tee-strap bar provides an anchor for an ankle support strap.

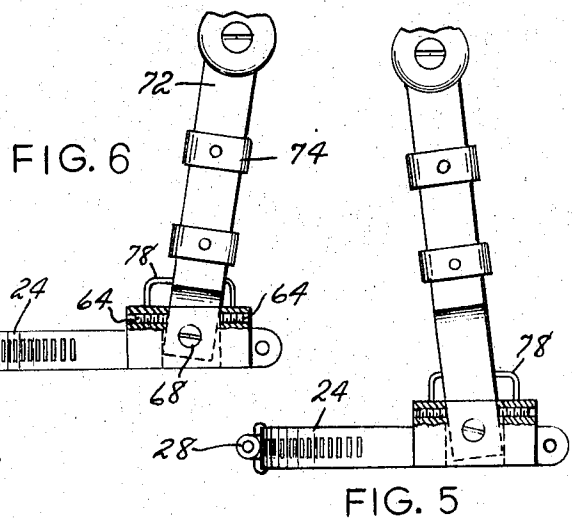
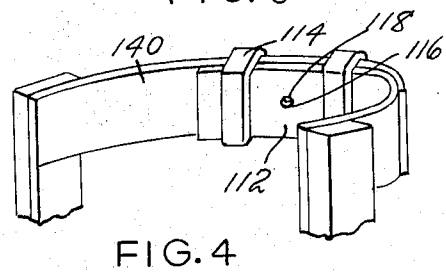
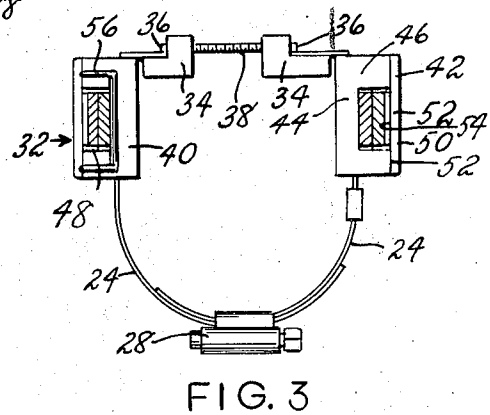
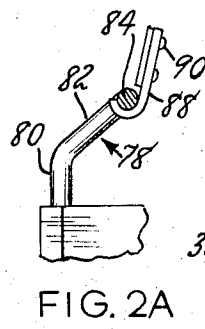
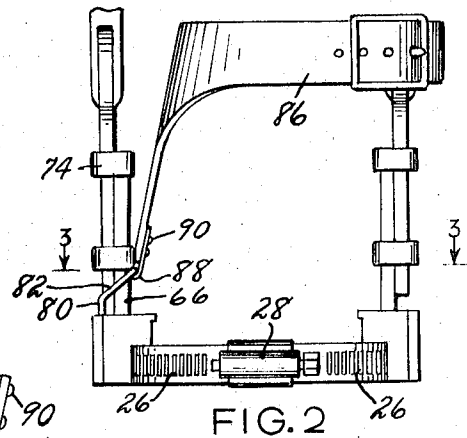
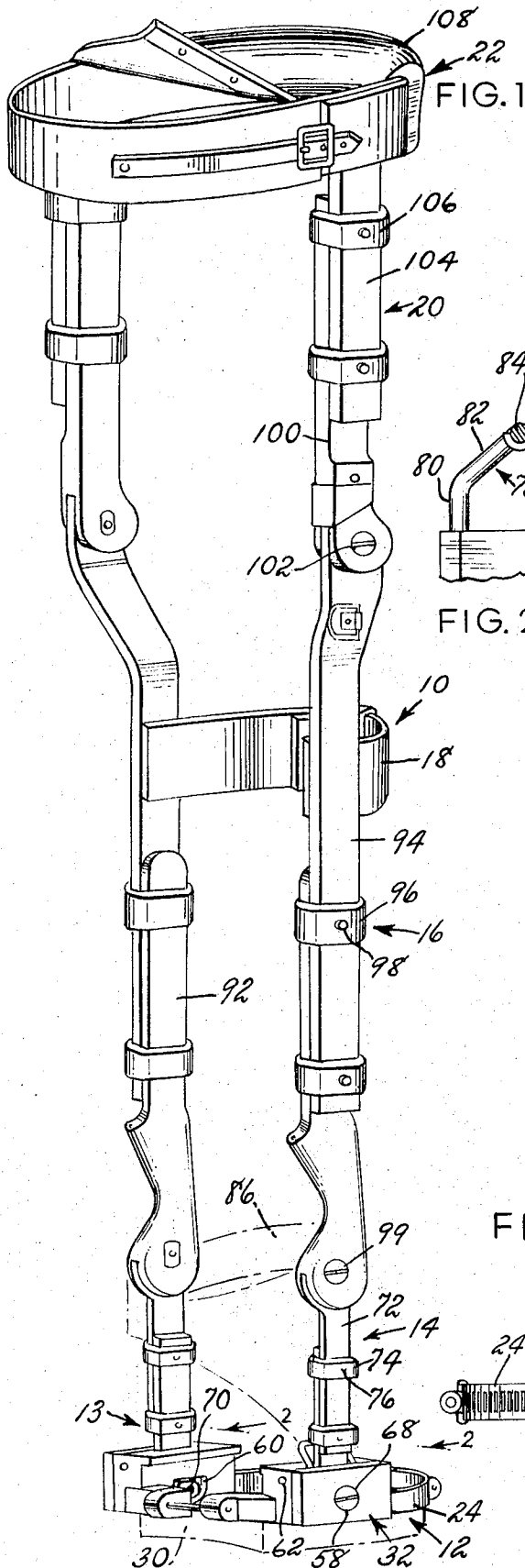
Calf and thigh uprights may also be individually adjusted in the same manner as the ankle uprights to accommodate the vertical variation of the user's leg.

Adjustable cuffs are secured to the calf and thigh at appropriate locations with means to accommodate the circumference of the particular user.

The brace may be used either to support the whole leg or just the lower leg, alone.

12 Claims, 7 Drawing Figures





ADJUSTABLE LEG BRACE

BACKGROUND OF INVENTION

The present invention relates to leg braces, and more particularly to an adjustable leg brace which may be rapidly and easily fitted to the specific requirements of one individual.

Leg braces are used for a variety of physical problems, both of a temporary and a chronic nature. Many times following a stroke (CVA — cerebral vascular accident), a patient requires a brace, due to a non-functioning lower extremity. Quite often as the patient starts to recover, he could go from a long-leg brace to a short-leg brace; and in some cases no brace at all. It is the purpose of this invention to get the proper brace on the patient as soon as needed without prohibitive cost to him, and also to easily adjust the brace down as required. With this invention used in rehabilitation centers, hospitals, etc., it can be utilized as a trial device before final bracing is determined.

Some examples of cases where bracing is usually required are: Multiple Sclerosis, Cerebral Palsy, Paraplegia, Hemiplegia, Neuropathies, Traumatic Lower-Extremity injuries and Birth Defects.

The fitting of a brace is a very specialized job, and requires a highly skilled technician. These people are few in number and are very busy. When they are available to fit a brace, the initial measurement session is lengthy, and the time to make the brace often runs into weeks and months. Thus, it may be a considerable length of time until a brace is actually available for use. Because of the delay quite often atrophic changes take place in the patient's limb; consequently the brace has to be re-adjusted to accommodate these changes.

As a result of the expertise that is required for such work, the costs of these braces are quite expensive.

OBJECTS AND ADVANTAGES

Accordingly, it is among the principal objects of the present invention to provide an adjustable leg brace which may be rapidly secured to the leg of any individual without requiring any specialized skills, as well as taking the guesswork out of prescribing the brace.

Still another object of the present invention is to provide an adjustable brace which duplicates the majority of permanent-type braces now used so that when the patient receives his permanent brace, the carry-over of skills learned through rehabilitation could be about 100 percent. This eliminates retraining and consequently shortens rehabilitation time.

Another object of the present invention is to provide an invention of the character described which may be rapidly adjusted and secured to the leg of the user, also eliminating delay in starting rehabilitation.

Still yet a further object of the present invention is to provide an adjustable leg brace which may be reusable, thus further cutting the expenses involved.

Still yet a further object of the present invention is to provide an adjustable leg brace which may be for the entire leg or just the lower leg portion.

Still yet a further object of the present invention is to provide a device of the character described which allows simple yet precise vertical and horizontal adjustment to locate the exact anatomical axis of the user's ankle.

Still yet another object of the present invention is to provide a device of the character described which may be simply, yet securely adjusted for the vertical length of the lower and upper leg and the exact anatomical axis of the knee.

Still yet another object of the present invention is to provide an adjustable leg brace with means to accommodate varying circumferential sizes of calves and thighs.

Still yet another object of the present invention is to provide an adjustable leg brace which may be secured to different shoes, thus varying the aesthetic appearance of the shoes worn with the brace.

Still yet a further object of this brace is to provide a detachable medial or lateral Tee strap for stabilizing the ankle joint to accommodate exact anatomical axis.

Still yet a further object of the present invention is to provide an adjustable leg brace of the character described which will be relatively simple and inexpensive to manufacture, simple and inexpensive to fit, and yet be durable to a high degree in use, in addition to being reusable.

BRIEF DESCRIPTION OF THE INVENTION

The present invention contemplates an adjustable leg brace having, as its lowermost member, a heel pivot clamp which includes two flexible metal bands which may be bent around the heel of the shoe of the user and which are secured in the rear by means of a clamp. The front of the heel pivot clamp consists of two separated dog ear angle irons having threaded bores receiving a bolt to vary the distance between the two elements.

Clamped on the sides of the metal bands are horizontal adjustment members which include an inner and outer element. The inner element has two outwardly extending vertical shoulders and the outer element has an outwardly extending vertical platform to be received within the receptacle formed between the shoulders. The shoulders and the abutting surfaces have vertical grooves, which when assembled form cylindrical receptacles.

Positioned within the rectangular receptacle are two lower angle uprights which may be pivotally secured to the horizontal adjustment members by means of bolts. The horizontal length of the lower angle upright is less than the length of the receptacle, thus allowing pivotal movement. Transversely positioned oppositely depending aligned bores have positioned therein threaded bolts with interior screw heads to allow horizontal adjustment of the position of the lower ankle upright. A Tee-bar may be positioned in the cylindrical receptacles.

An upper ankle upright carrying an ankle joint may be strapped to the lower ankle upright, the position depending upon the vertical height of the ankle joint of the individual user. Thus, the vertical and horizontal adjustment for the exact anatomical ankle axis of the user may be rapidly ascertained and fixed into the brace.

An ankle support strap may be detachably hooked to the Tee-bar in the well-known manner, either medially or laterally.

A lower calf upright may be secured to the upper ankle upright at the ankle joint in the well-known manner. Furthermore, in a similar manner upper calf uprights may be secured to the lower calf uprights, the vertical distance depending upon the vertical height of

the anatomical knee axis of the user. Again, in a similar manner, lower and upper thigh uprights may be secured to the upper calf uprights.

A calf cuff containing prepositioned holes may be secured to the upper calf upright, with the cuffs being joined at mating holes, depending upon the circumference of the calf of the user. The cuffs are covered with a protective cover, such as leather or plastic. In a similar manner, similar cuffs may be applied to the thigh portion of the brace.

The brace may extend the full length of the leg, or may only extend through the calf in a shortened version.

The above description and objects of the present invention will become apparent from a reading of the following description taken with reference to the accompanying drawings, wherein:

FIG. 1 is a perspective view of the adjustable leg brace embodying my invention, showing the ankle support strap in phantom;

FIG. 2 is an enlarged, rear elevational, fragmentary view of the lower portion of the brace;

FIG. 2a is an enlarged fragmentary view showing the coupling of the ankle strap to the Tee-bar;

FIG. 3 is a cross-sectional view taken along the lines 3-3 of FIG. 2;

FIG. 4 is an enlarged, fragmentary view of the thigh cuff with the cover removed;

FIG. 5 is an enlarged, fragmentary view showing the ankle upright, showing a rear horizontal adjustment and an extended vertical adjustment; and

FIG. 6 is a view similar to FIG. 5 showing a forward horizontal adjustment and a shortened vertical adjustment.

Referring in detail to the drawings, and in particular to FIG. 1, there is shown an adjustable leg brace 10 basically including a heel pivot clamp 12, including horizontal adjustment means 13, ankle upright means 14, calf upright means 16, calf securement means 18, thigh upright means 20, and thigh securement means 22.

Turning particularly to the heel pivot clamp member 12 or the lowermost member FIGS. 1-3), there are shown two bands 24 of pliable metal or plastic, having centrally located thereon a plurality of louvres 26. These louvres are engaged by a hose clamp 28. The clamp is commercially available from Ideal Corp. of Brooklyn, N.Y., and joins the metal bands, varying their lengths within the clamp. This allows the accommodation between the bands of various sizes of heels, such as the one 30 shown in phantom in FIG. 1. The forward portions of the clamp are secured to two horizontal adjustment members 32, which will be described in detail below. Mounted forwardly of the members 32 are two oppositely disposed angle dog ears 34 having aligned threaded bores 36. A threaded bolt 38 is received within the bores and allows for adjustment of the distance between the parallel alignment portions of the bands. Thus, complete adjustment for securement to any size heel of the shoe of the user is possible.

As mentioned above, the horizontal adjustment means 13 is secured along the forward portions of the bands 24 and are in parallel alignment to each other. The members consist of an inner element 40 and an outer element 42. The inner element 40 consists of an inner wall portion 44 and vertical shoulders 46 forming a channel 48. In a similar manner the outer element 42 consists of an outer wall portion 50 inwardly extending

vertical shoulders 52 forming a channel 54. The shoulders 52, 54 form a receptacle of the channels 48, 54. Also centrally located on the abutting surfaces of the shoulders 46, 52 are semi-cylindrical channels which when joined form cylindrical channel 56. The forward portions of the bands 24 are secured to the means 13 in any well known manner and does not form a part of the present invention.

Bores 58, 60 extend through both the outer and inner elements for the purpose hereinafter appearing. A threaded through bore 62 extends the entire length of the inner element 40 and is so positioned that what would otherwise be a portion of the bore is located within the channel 48. Both ends of the bores are designed to receive mating internal headed screws 64 (FIG. 6).

The receptacle formed by the channels 48, 54 are designed to receive the lower ankle upright members 66 of the ankle upright 14. The lowermost portion of the member 66 has an opening to which a bolt 68 may be passed with an appropriate nut 70 to anchor the lower upright within the receptacle.

The upper ankle upright member 72 may be secured to the lower ankle upright member by any well-known means. An example is shown in the drawings as being straps 74 with connecting pins 76. For added support two straps may be used to secure the lower and upper upright members together.

It should be noted that the length of the ankle uprights is less than the length of the receptacles formed within the members 32, and thus the ankle uprights may be pivoted about their pivotal axis established by the bolt 68.

As better seen in FIGS. 2A, A Tee-bar 78 having no legs 80 and an intermediate portion 82 joined by an anchoring portion 84, is received within the receptacles and held in place when the inner and outer elements 40, 42 are tightly secured together. The anchoring portion 84 receives an ankle strap 86 which is designed in the well-known manner, but which has a lower lip 88 secured to the strap, for example, by rivets 90. The lip easily is detachably secured to the anchoring portion 84 and provides additional support for the ankle of the user.

The upper member 72 of the ankle upright is secured to the lower member 92 of the calf upright 16, which is in turn secured to the upper member 94 in the well-known manner, such as by straps 96 held in place by pins 98. The ankle joint 99 at the upper end of member 72 is standard brace construction, and is well-known in the art. The joint 99 is positioned at the exact anatomical axis of the ankle. Secured to the upper calf upright 94 is the calf cuff 18.

The upper ankle upright is secured to the lower thigh upright 100 as at the lesser joint 102, again in the well-known manner. And also in a similar fashion, the upper thigh upright 104 is secured to the lower thigh upright by the straps 106, again in the well-known manner. Secured to the top of the upper thigh upright is a thigh cuff 22, covered with a leather or a plastic covering 108 to avoid chafing.

Turning to FIG. 4, the construction of the calf cuffs 18 and the thigh cuff 22 is shown. Metal bands 110, 112 are joined together with straps 114 all in the well-known manner. The bands 110, 112 may have holes 116 which are mated and through which a pin 118 may pass to assist in the securement of the bands. The bands

are adjusted depending upon the circumferal dimensions of the calf and thigh of the individual user.

In order to simply and accurately secure the brace to the leg of a specific user, the lower member 12 is secured to the heel 30 of the shoe of the user by adjusting the bands 24 and retaining the adjusted position in place by the clamp 28, and at the same time adjusting the threaded bolt 38 for the forward width of the heel. The lower ankle uprights 66 are then secured to the horizontal adjustment member 13. The screws 64 are then adjusted within their bores 62 to position the lower ankle upright either towards the rear (as shown in FIG. 6) or towards the front (as shown in FIG. 5) depending upon the horizontal location of the ball joint of the user. The screws 64 are then firmly wedged against the lower ankle upright to maintain it in the proper position. The upper ankle upright is then secured to the lower ankle upright 72 by means of the straps 74 and the pin 76. The vertical height is determined by the vertical height of the ankle ball joint of the user. As shown in FIG. 6, the adjustment has been made for a low vertical ankle joint, while in FIG. 5 the adjustment has been made for a high ankle ball joint. Thus, the exact anatomical axis of the ankle is located.

The Tee-bar 78 may be positioned within the receptacles 86 upon assembly of the horizontal adjustment member 13, and the ankle strap may be secured thereto. As shown in FIG. 2, the ankle strap may be securely adjusted around the ankle of the user by means of the buckle and the lip 88 may engage the anchoring post 84 to properly anchor the strap to the brace. This provides additional support for the user.

The lower calf uprights may be then secured to the top most portion of the upper ankle upright members in the well-known manner, and the upper calf uprights 94 may be secured to the lower calf uprights again by means of straps or any other well-known manner. The vertical adjustment is made so that the uppermost portion of the knee joint 102 of the upper ankle uprights are adjacent to the anatomical axis of the knee of the user.

The calf covers are secured on the upper calf upright 94 and the bands 110, 112 are adjusted to the approximate circumference of the calf at that particular point. The bands are joined by means of the pin 118 passing through the openings 116, and are further held in place by the straps 114. The cuff is then covered by a cover 108 made of either leather or plastic.

The lower thigh upright 100 is secured to the upper ankle upright 94 at 102, also by well-known means. In addition, a knee pad may be provided, as shown.

The upper thigh upright 104 is secured to the lower upright again by straps 106, or in any well-known manner.

Finally, the thigh cuffs 22 are again adjusted with a pin being positioned through the openings 116 and then the cuffs being covered by the leather or plastic covering.

Thus, there is shown a leg brace which may be rapidly and simply assembled according to the specific dimensions and requirements of the user. It is obvious that the brace may be just as easily disassembled for reuse by another individual with different specific requirements.

I claim:

1. An adjustable leg brace for rapid and precise attachment to the leg of a user, which comprises:

- a. clamping means to engage the foot of the user;
- b. a horizontal adjustment member mounted on the clamping means and having a receptacle defined therein;
- c. ankle upright means received within the receptacle the horizontal length of the upright means being less than the horizontal length of the receptacle; the ankle upright means including means to vary its vertical height;
- d. the horizontal adjustment member including means to secure the ankle upright means at a precise desired longitudinal position with the receptacle;
- e. an ankle joint secured to the upper end of the ankle upright means, the vertical adjustment and the horizontal positioning of the ankle upright means locating the ankle joint at the exact anatomical axis of the ankle;
- f. calf upright means secured to the ankle upright means at the ankle joint;
- g. calf engagement means attached to the calf upright means grasping the calf of the user;
- h. a T-bar, said horizontal adjustment member having means receiving said T-bar; and
- i. an ankle support strap including a buckle and lip portion to be adjustably secured to the ankle of the user, said lip secured to the lower edge of the support strap, the lip engaging the T-bar to provide additional support.

2. An adjustable leg brace comprising:

- a. clamping means for engaging the foot of a user;
- b. a horizontal adjustment member mounted on the clamping means and having an open topped recess and front and rear tapped bores communicating with said recess;
- c. ankle upright means having a lower portion of lesser width than said recess and engaging said recess;
- d. a pivot member projecting transversely into said recess and engaging said ankle upright means for swinging about a transverse axis offset from the axis of said tapped bores;
- e. adjusting means including a screw engaging each of said tapped bores and registering with a respective opposing edge of said ankle upright means lower portion;
- f. calf upright means swingably connected to said ankle upright means at an ankle joint;
- g. means for vertically adjusting said ankle joint on said ankle upright means; and
- h. calf engagement means positioned on said calf upright means.

3. The leg brace of claim 2 wherein said clamping means comprises a band of adjustable length engaging the rear and side periphery of the shoe heel of a user and means for adjustably connecting the forward ends of said bands.

4. The brace according to claim 2, the ankle upright means including a lower ankle upright member, an upper ankle upright member vertically adjustably secured to the lower ankle upright member and the means including at least one strap secured around the two members.

5. The brace according to claim 2, the calf upright means including a lower member pivotally secured to

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the ankle joint and an upper member, vertically adjustably secured to a lower member.

6. The brace according to claim 5, the calf engagement according means including at least two middle bands secured to the upper calf upright member, the bands having means for adjustably securement to allow variation in their total length, and means to cover the bands.

7. The brace according to claim 5, the calf engagement means including at least two middle bands secured to the upper calf upright member, the bands having means for adjustably securement to allow variation in their total length, and means to cover the bands.

8. The brace according to claim 2, the calf engagement means including at least two middle bands secured to the upper calf upright member, the bands having means for adjustably securement to allow variation in their total longitudinal length, and means to cover the bands.

9. The brace according to claim 2 comprising a knee joint secured to the upper end of the calf upright means, knee upright means secured to the calf upright means at the knee joint, means for vertically adjusting the calf upright means to locate the joint at the anatomical axis of the user's knee joint, and thigh engagement means attached to the thigh upright means grasping the thigh of the user.

10. An adjustable leg brace comprising a mounting

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member attached to the shoe of a user, an ankle joint, a first upright connected to said mounting member and supporting said ankle joint proximate the upper end of said first upright, means for adjusting the position of said ankle joint vertically and forwardly and rearwardly relative to said mounting member, a second upright extending upwardly from said first upright and connected thereto by said ankle joint for swinging about a transverse axis, and means on said second upright for engaging the user's leg above the ankle.

11. The brace of claim 10 wherein said first upright comprises a lower arm connected at its lower end to said mounting member means for angularly adjusting said lower arm about a transverse axis proximate its lower end and an upper arm connected to and longitudinally adjustable along said lower arm and having said ankle joint located proximate its upper end.

12. The brace of claim 10 wherein said second upright comprises a lower section of adjustable length connected at its lower end to said ankle joint and an upper section of adjustable length connected at its lower end to the upper end of said lower section for swinging about a transverse axis, said second upright carrying engaging means including calf engaging means on said lower section and thigh engaging means on said upper section.

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