Dec. 6, 1960 J. H. MORAN 2,963,020

ORTHOPEDIC BRACE

Filed May 14, 1958

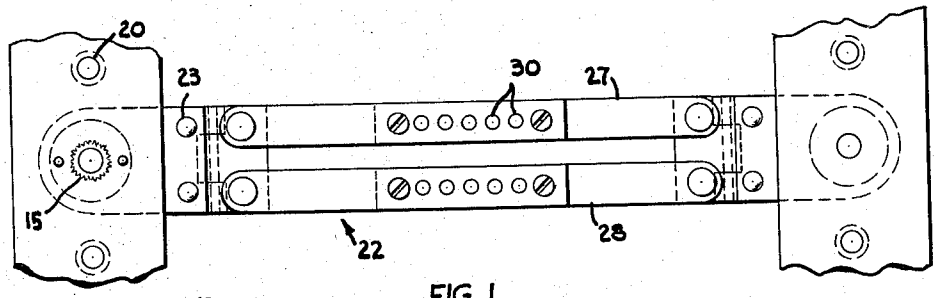

FIG. 1

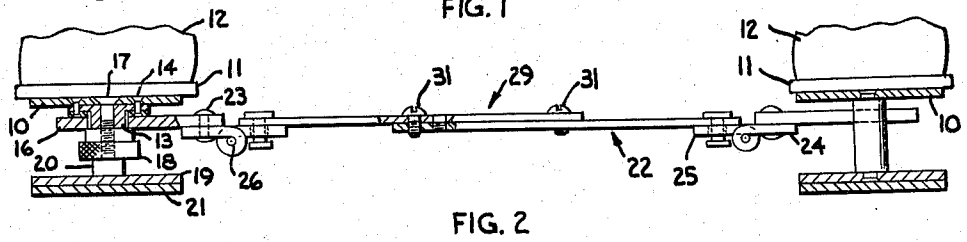

FIG. 2

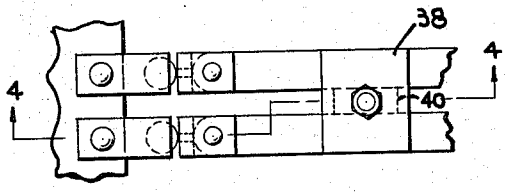

FIG. 3

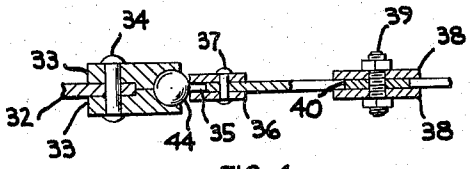

FIG. 4

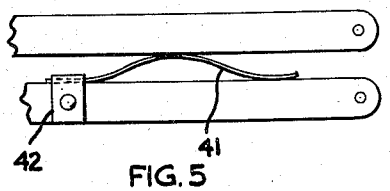

FIG. 5

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ORTHOPEDIC BRACE

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10 Claims. (Cl. 128—80)

This invention relates to orthopedic braces, one object being to provide an improved brace mechanism for supporting and steadying the feet in suitably adjusted positions, while enabling the wearer to move and exercise them more freely and naturally in stance and gait. More specifically stated, it is an object of the invention to provide such a mechanism by which the feet of the wearer may be effectively braced in such a way as to allow freedom of movement approximating normal functioning in stance and gait, including relative movements between the feet either forwardly and rearwardly, or up and down, or both, to enable the wearer to walk on a level surface or up and down steps.

A further object is to provide a mechanism having the above advantages in a construction which is practical and light in weight and adapted to be readily and economically manufactured and applied to the shoes of the wearer.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a top plan view of a brace mechanism embodying the above invention partly broken away and before application to the shoes;

Fig. 2 is an elevation of the same with parts in section and showing attachment to the shoes;

Fig. 3 is a fragmentary plan view of a modified construction of the parallelogram linkage;

Fig. 4 is an elevation substantially on the line 4—4 in Fig. 3, and

Fig. 5 is a fragmentary plan view of a further modification of the parallelogram linkage.

The preferred embodiment of the invention, herein disclosed by way of illustration, comprises a pair of members for attachment, respectively, to the shoes of the wearer, the members carrying parts which are connected by a parallelogram linkage to afford movement of each shoe, relative to the other, in forward and rearward directions, as in walking, while the members attached to the shoes are connected to the ends of the linkage by joints affording pivotal movements about axes extending forwardly and rearwardly so as to permit the wearer to step upwardly and downwardly as well as to walk forwardly in approximately normal stance and gait.

Referring more particularly to the drawings, the construction comprises a pair of plate-like members **10** for attachment, respectively, to the soles **11** of the shoes **12** of the wearer, as by means of rivets or other suitable attaching means (not shown). Each member **10** preferably extends from the heel to the ball portion of the foot and is of substantial width so as to afford stable support for the shoe and foot.

Each member **10** has secured to its bottom, under the instep region of the shoe, a cylindrical boss **13**, as by means of rivets **14** secured through the flanged base of the boss and member **10**. The periphery of boss **13** is serrated, notched, or toothed in any suitable manner, as indicated at **15**, for engagement in an opening with a similarly formed periphery in a plate-like part **16**. A screw **17** is passed through member **10** and boss **13** and carries at its lower end a nut **18** for securing the part **16** on boss **13**. It is apparent from this construction that part **16** may be removed from its boss and replaced and secured in a different angular relation with the longitudinal axis of the shoe, to adjust each shoe independently to a desired angular position with relation to a direction extending forwardly and rearwardly of the wearer. A wear plate **19** is preferably secured in spaced relation to the underside of member **10**, as by posts **20**, for stable contact with the ground, to facilitate walking and to protect the elements of the brace, and the under surfaces of plates **19** are preferably surfaced with leather, rubber or other suitable material **21** to cushion the contact with the ground and prevent slipping.

The parts **16** of the shoe supporting members **10** are pivotally connected to the ends of the parallelogram linkage indicated generally at **22**. For this purpose, the inner ends of parts **16** are secured as by rivets **23** to the half portions **24** of hinge type joints, the other half portions of which **25** serve as the end links of the linkage. The shoe supporting members **10** are thus pivotally jointed with the ends of the linkage for movement about horizontal axes **26** to enable the wearer to raise and lower one foot relative to the other as in stepping up and down stairs.

The linkage comprises connecting links **27** and **28** pivotally connected at their ends with the hinge parts **25** for movement parallel with each other in the advancing movement of one foot relative to the other. Each connecting link is preferably made in two parts having overlapping ends, as indicated generally at **29**, such ends being formed with longitudinal series of holes **30** for the reception of screws **31** threaded into one of the links, and it is apparent from this construction that each link may be adjustably varied in length. Such adjustment of the length of one link relative to the length of the other provides a second way of altering the position of the members **10** and shoes in their angular relation to the forward and rear direction and while such adjustment tends to alter the parallel relation of the connecting links, it may be employed in a limited way, temporarily or intermittently, to thus vary the angular relation of the feet, as particular cases may require. Such alteration of both links may also be employed to vary the distance between the shoes. Such angular relation may be accomplished by the adjustment between parts **16** and members **10**, as described above, or by such alteration of the lengths of the connecting links **27** and **28**, or both, as circumstances may indicate.

It is apparent from the above description of the construction that it enables the wearer to move each foot forwardly and rearwardly as in walking, as well as up and down as in mounting stairs, in ways closely approximating normal stance and gait, with the beneficial exercise which has been found to aid in the restoration of

normal functions, as in the treatment of derangements of the lower limbs or feet and serves as well in restoring to the wearer the conveniences and comforts of natural locomotion.

A modified construction is shown in Figs. 3 and 4, in which the parts 16 of the above construction are replaced by plate-like members 32 each having a pair of lugs 33 fixed thereto as by means of rivets 34. Lugs 33 have their inner faces recessed to provide sockets for the reception therebetween of balls 44 carried on stems 35 clamped between lugs 36 fixed to the ends of the connecting links of the parallelogram as by means of rivets 37, thus providing joints of the universal type between the ends of the links and the parts 16 of members 10.

A further modification is shown in Fig. 3 by which means are provided for clamping the connecting links of the parallelogram against relative movement, where found to be temporarily desirable, or for intermittent use as particular cases may require. Such means comprises a pair of plates 38 removably clamped to the sides of the connecting links of the parallelogram as by means of a small bolt 39. A lug 40 is secured between the plates 38 and between the adjacent edges of the connecting links so as to clamp the same securely together and prevent relative movement therebetween, as may be found desirable, for example, at particular times for progressive treatment in particular cases.

In cases where it is found desirable to assist the wearer in bringing the feet back to positions of uniform advancement with each other, resort may be made to the modification shown in Fig. 5, in which a leaf spring 41, of the bowed shape shown, is secured between the connecting links of the parallelogram as by attachment of one of its ends to one of the links by a suitable clamping clip 42, so that with the spring under some initial tension, it tends to press the links apart and thus restore the parallelogram to a rectangular shape, with the feet of the wearer in uniformly advanced or neutral positions.

The invention thus provides an orthopedic brace mechanism which effectively positions, steadies and supports the feet while permitting the motions of both walking and stepping up and down, as in substantially normal stance and gait and as found highly effective in restoring the normal functions and convenience and comfort of the wearer in the prevention or correction of abnormal positioning or functioning of the lower limbs or feet.

It will thus be seen that the invention accomplishes its objects and while it has been herein disclosed by reference to the details of preferred embodiments, it is to be understood that such disclosure is intended in an illustrative, rather than a limiting sense, as it is contemplated that various modifications will readily occur to those skilled in the art, within the spirit of the invention and the scope of the appended claims.

I claim:

1. An orthopedic walking brace device comprising a pair of members for affixation, respectively, to the bottoms of the soles of the wearer's shoes, means movably joining said members for movement freely therebetween forwardly and rearwardly of the said members, a pivotal connection between said joining means and each of said members for movement freely therebetween about axes extending forwardly and rearwardly of the wearer's body, and means for holding said members against turning transversely to the longitudinal axes of said shoes to afford free relative motion, forwardly and rearwardly and upwardly and downwardly, between said members and enable said wearer to walk and to step upwardly and downwardly in approximately normal gait.

2. An orthopedic brace device comprising a pair of members for affixation, respectively, to the bottoms of soles of the wearer's shoes, a parallelogram linkage comprising pairs of opposed links with the links of one of said pairs pivotally connected with the links of the other of said pairs, said linkage extending between and having opposite links thereof positioned adjacent said members, respectively, and means movably connecting said opposite links and respective members for movement of said members relatively to said linkage and to each other substantially about axes extending longitudinally of said members and shoes, to provide relative motion forwardly and rearwardly and upwardly and downwardly between said shoes to enable said wearer to walk in approximately normal gait.

3. An orthopedic brace device comprising the combination of elements specified in claim 2 in which said parallelogram linkage is positioned substantially at the level of said members.

4. An orthopedic brace device comprising the combination of elements specified in claim 2 in which said opposite links and members, respectively, are connected together by hinges having pivotal axes extending longitudinally of said members and shoes.

5. An orthopedic brace device comprising the combination of elements specified in claim 2 in which said members are provided with parts adjustably connected to said opposite links of said parallelograms for adjusting the angular relation of the longitudinal axes of said members and said shoes to each other.

6. An orthopedic brace device comprising the combination of elements specified in claim 2 in which said members are provided with wear plates positioned below said linkage, for contact with the ground to facilitate walking and protect the parts of said device.

7. An orthopedic brace device comprising a pair of members for affixation, respectively, to the bottoms of the soles of the wearer's shoes, a parallelogram linkage comprising pairs of opposed links with the links of one of said pairs pivotally connected with the links of the other of said pairs, said linkage connecting said members to enable relative motion forwardly and rearwardly between said shoes, connections between said linkage and said members, affording relative motion, upwardly and downwardly between said shoes to enable said wearer to walk and to step upwardly and downwardly in approximately normal gait and means for adjusting the relative lengths of opposite links of said linkage to provide adjustment in the angular relation of said shoes to each other.

8. An orthopedic brace device comprising a pair of members for affixation, respectively, to the bottoms of the soles of the wearer's shoes, a parallelogram linkage comprising pairs of opposed links with the links of one of said pairs pivotally connected with the links of the other of said pairs, said linkage connecting said members to enable relative motion forwardly and rearwardly between said shoes, connections between said linkage and said members, affording relative motion, upwardly and downwardly between said shoes to enable said wearer to walk and to step upwardly and downwardly in approximately normal gait and means for releasably securing opposite links of said linkage together against relative movement therebetween to secure said members and shoes against relative forward and rearward movement.

9. An orthopedic brace device comprising a pair of members for affixation, respectively, to the bottoms of the soles of the wearer's shoes, a parallelogram linkage comprising pairs of opposed links with the links of one of said pairs pivotally connected with the links of the other of said pairs, said linkage connecting said members to enable relative motion forwardly and rearwardly between said shoes, connections between said linkage and said members, affording relative motion, upwardly and downwardly between said shoes to enable said wearer to walk and to step upwardly and downwardly in approximately normal gait, and spring means between opposite links of said linkage tending to resiliently press said opposite links apart to move said members and shoes to relative positions of substantially equal advancement.

10. An orthopedic brace device comprising a pair of members for affixation, respectively, to the bottoms of

the soles of the wearer's shoes, a parallelogram linkage comprising pairs of opposed links with the links of one of said pairs pivotally connected with the links of the other of said pairs, said linkage connecting said members to enable relative motion forwardly and rearwardly between said shoes, connections between said linkage and said members, affording relative motion, upwardly and downwardly between said shoes to enable said wearer to walk and to step upwardly and downwardly in approximately normal gait, and universal joints connecting the links of said linkage to provide universal movement therebetween.

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