June 12, 1956 G. C. RIDDLE 2,749,557

ADJUSTABLE ANKLE JOINT FOR AN ARTIFICIAL LIMB

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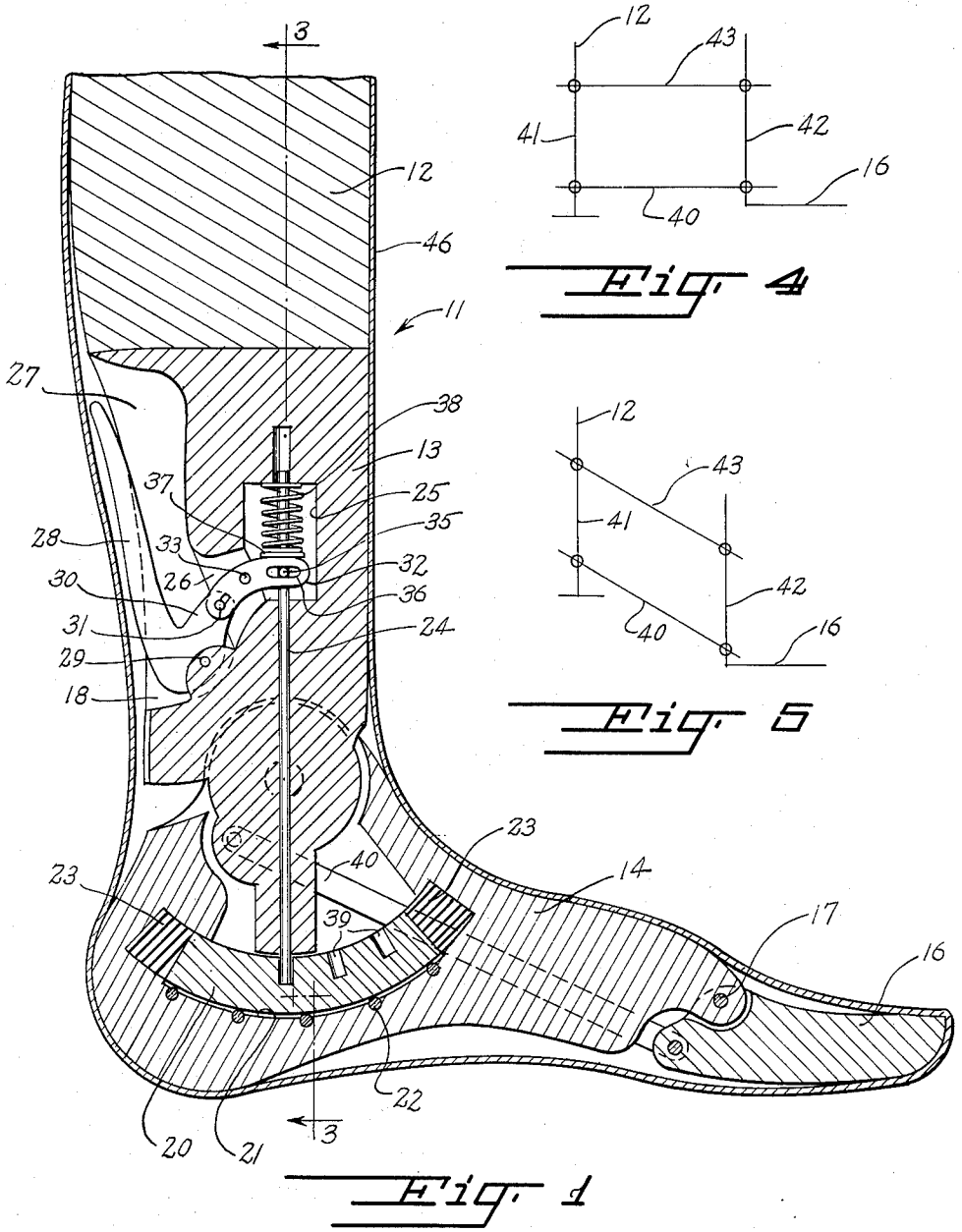


Fig. 1

Fig. 4

Fig. 5

INVENTOR.
Grant C. Riddle
BY

McMorrow, Berman & Davidson
Attorneys

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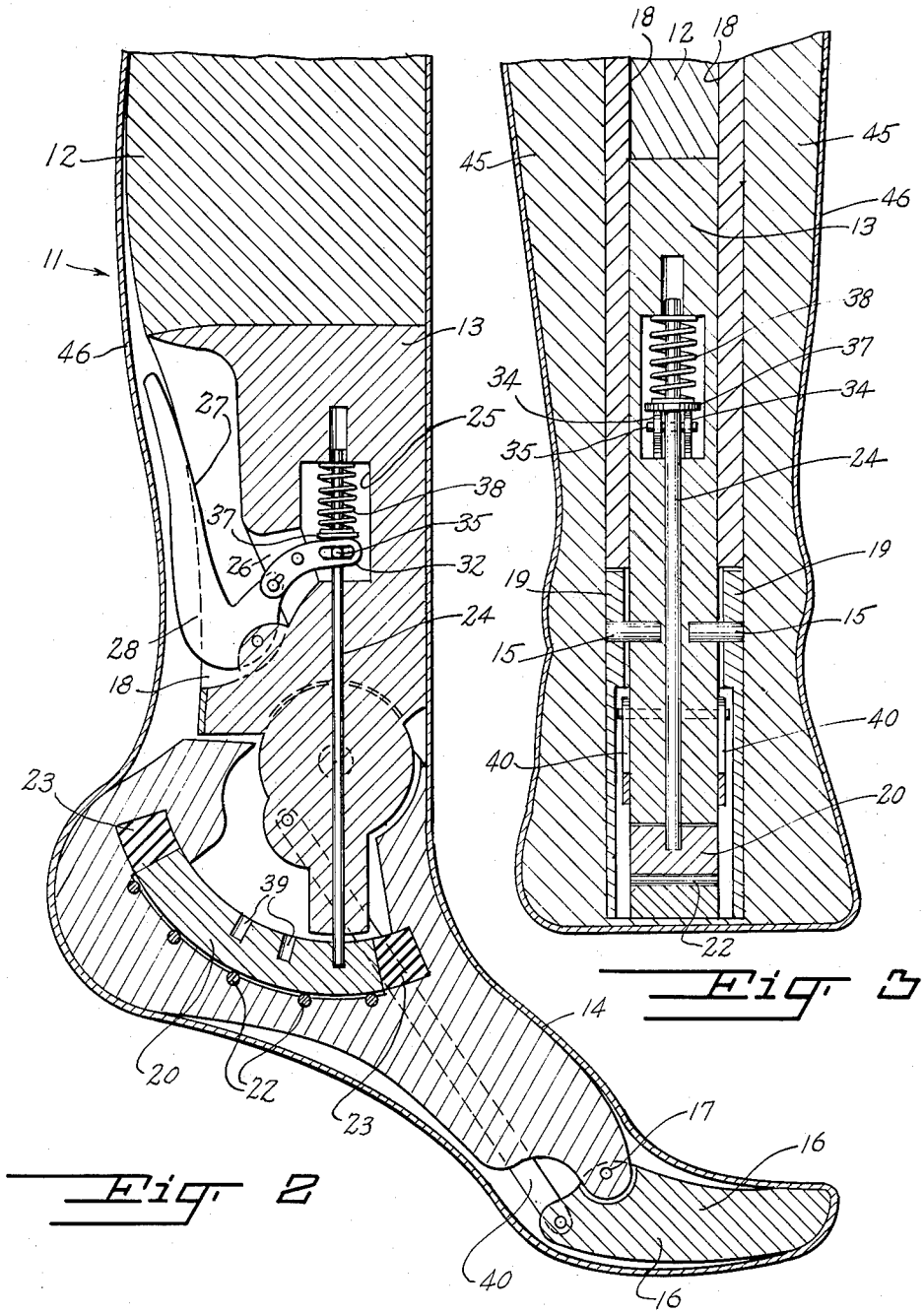


Fig. 2

Fig. 3

INVENTOR.
Grant C. Riddle
BY
McMorrow, Berman + Davidson
Attorneys

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ADJUSTABLE ANKLE JOINT FOR AN ARTIFICIAL LIMB

Grant C. Riddle, Penn, Pa.

Application April 15, 1955, Serial No. 501,577

3 Claims. (Cl. 3—33)

This invention relates to artificial limbs, and more particularly to adjustable joint structure for an artificial limb of the type embodying leg and foot portions connected together for relative movement and a toe element hinged to the foot portion.

A main object of the invention is to provide a novel and improved artificial limb of the type including a leg, a foot portion hinged to the leg and a toe portion hinged to the foot portion, the improved artificial limb being simple in construction, being easy to adjust, and maintaining the angular relationship of the toe portion thereof to the leg portion thereof substantially constant at all positions of adjustment.

A further object of the invention is to provide an improved artificial limb structure comprising a leg portion, a foot portion hinged to the leg portion and a toe portion hinged to the foot portion, the improved structure involving a minimum number of parts, enabling the angular position of the foot portion to be readily adjusted with respect to the leg portion of the limb, and maintaining the angular relationship of the toe portion with respect to the leg portion substantially constant at all positions of adjustment, whereby the height of the limb may be adjusted and the configuration of the foot and toe may be adjusted to conform with shoes of any predetermined heel height while keeping the calf section of the artificial limb vertical and the toe portion of the limb horizontal under all conditions of adjustment.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is a vertical cross sectional view taken through an improved artificial limb constructed in accordance with the present invention with the foot portion thereof shown in horizontal position.

Figure 2 is a vertical cross sectional view similar to Figure 1 showing the foot portion of the limb adjusted to its maximum downwardly inclined position.

Figure 3 is a transverse vertical cross sectional view taken on the line 3—3 of Figure 1.

Figure 4 is a diagram illustrating the angular relationship of the elements of the parallel linkage defined by the limb structure in the position of Figure 1.

Figure 5 is a diagram illustrating the angular relationship of the components of the parallelogram structure defined by the artificial limb in the adjusted position of Figure 2.

Referring to the drawings, the artificial limb is designated generally at **11** and comprises a leg portion **12** to the lower end of which is secured an ankle joint member **13**. Designated at **14** is a foot portion which is pivoted to the ankle joint portion **13** for rotation around a horizontal transverse axis defined by a pair of aligned horizontal studs **15**, **15**, as shown in Figure 3. Pivoted to the end portion of the foot element **14** is a toe portion **16**, said toe portion being hinged to the end of the foot element **14** by a transverse hinge pin **17** extending through suitable overlapping hinged lugs provided on foot portion **14** and toe portion **16**.

As shown in Figure 3, the leg portion **12** may include the parallel vertical wall elements **18**, **18**, between the lower portions of which is secured the ankle joint member **13**. The foot portion **14** is provided with the upstanding pivot lugs **19**, **19** between which the lower portion of the ankle joint member **13** is received. The stud elements **15**, **15** are centrally secured in the rounded pivot lugs **19**, **19** and are received in suitable aligned pivot recesses formed on the opposite sides of the ankle joint member **13**.

Designated at **20** is an arcuate locking bar which is slidably supported in a suitably shaped arcuate recess **21** formed in the foot portion **14**, said arcuate member **20** engaging cylindrical bearing elements **22** secured transversely in the bottom wall of the recess **21**, whereby the member **20** may freely slide endwise in the recess **21**. Interposed between the ends of the arcuate bar **20** and the end walls of the recess **21** are respective rubber cushioning blocks **23**, **23** which act to resiliently secure the block **20** in a centered position in the recess **21** but which at times allow said block **20** to move slightly endwise to provide a slight yielding action.

Designated at **24** is a locking rod which is slidably mounted in the ankle portion **13** and which is located centrally between the ends of the studs **15**, **15**, said rod **24** extending vertically, as shown in Figures 1 and 3. The top portion of the rod **24** extends through a recess **25** provided in the upper portion of the ankle joint member **13**, and said ankle joint member **13** is formed with a passage **26** connecting the recess **25** to an enlarged outer recess **27** at the rear portion of the ankle joint member **13**.

Designated at **28** is a lever member which is pivoted at **29** to the lower portion of the ankle joint member **13** at the lower end of recess **27**, said lever **28** extending upwardly for a substantial portion of the height of said recess. The lever **28** is provided with the inwardly extending arm portion **30** which is slidably and pivotally connected at **31** to the end portion of a lever **32**. The lever **32** is pivoted at its intermediate portion in the passage **26**, as by a transverse pivot pin **33** extending through said passage. The inner end of the lever **32** is formed with a pair of vertical, parallel slotted fingers **34**, **34** between which the rod **24** is received, said rod being provided with a transversely extending connecting pin **35** slidably engaging in the slot **36** of the fingers **34**, **34**.

Surrounding the rod **24** and bearing on the top edges of the fingers **34**, **34** is a washer **37**. A coiled spring **38** surrounds the rod **24** above washer **37** and bears between said washer and the top wall of recess **25**, biasing the rod **24** downwardly toward locking engagement with a selected recess **39** provided in the top surface of the arcuate bar **20**.

As shown in Figures 1 and 2, a desired number of recesses **39**, for example three recesses, are spaced longitudinally along the bar **20** and the rod **24** may be engaged in any one of the recesses **39** to lock the foot portion **14** of the limb in any selected position of angular adjustment with respect to the leg portion **12**.

As will be readily apparent, when the lever **28** is rotated clockwise, as viewed in Figure 1, the inner lever **32** is rotated counterclockwise, causing the rod **24** to be lifted, and freeing the foot portion **14** for angular rotation to a different adjusted position with respect to the leg portion **12**. When the lever **28** is released, the spring **38** causes the rod **24** to descend into interlocking engagement with the selected locking recess **39**.

Designated at **40**, **40** are respective flat link bars which connect the opposite sides of the lower portion of the ankle joint member **13** to the opposite sides of the lower

inner portion of the toe member **16**. The bars **40** are equal in length to the distance between the pivot pin **17** and the pivot studs **15**, and the pivotal connections of the ends of the link bars **40** are spaced equal distances from pivot pin **17** and the pivot studs **15**, whereby a parallelogram linkage is defined, shown diagrammatically in Figures 4 and 5, wherein the reference numerals **41** and **42** designate the respective distances between the rear and forward ends of the link bars **40** from the pivot studs **15** and from the pivot pin **17**. The reference numeral **43** designates the distance between the pivot studs **15** and the pivot pin **17**, forming the arm of the parallelogram linkage opposite the link bars **40**. As will be readily apparent from Figure 4, in the position illustrated in Figure 1 the toe portion **16** is subtantially perpendicular to the leg portion **12**. When the foot element **14** is adjusted to the inclined position thereof of Figure 2, the toe portion **16** remains perpendicular to the leg portion **12** because of the parallelogram linkage. Thus, the toe portion **16** remains substantially horizontal regardless of the different angular adjustments of the foot portion **14** with respect to the vertical leg portion **12**.

A suitable folding material **45** is provided on the opposite sides of the wall members **18**, and a suitable flexible artificial skin covering **46** of suitable sheet plastic material or the like, is provided around the components of the limb. The material comprising the artificial skin covering **46** is sufficiently flexible to allow the lever **28** to be readily manipulated, whenever it is required to elevate the locking rod **24** and to remove the rod from the locking recess **39** with which it is engaged.

While a specific embodiment of an improved artificial limb structure has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore, it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. In an artificial limb comprising a leg portion, a foot portion hinged to said leg portion, and a toe portion hinged to said foot portion, means slidably mounted in said leg portion and being lockingly engageable with said foot portion to releasably secured said foot portion in an adjusted position, and means connecting said toe portion to said leg portion and being arranged to maintain a substantially constant angular relation of said toe portion to said leg portion.

2. In an artificial limb comprising a leg portion, a foot portion hinged to said leg portion, and a toe portion hinged to said foot portion, a locking rod slidably mounted in said leg portion, spaced recesses in said foot portion located to receive the end of said locking rod in different adjusted angular positions of said foot portion relative to said leg portion and arranged to releasably secure said foot portion in an adjusted position, and means connecting said toe portion to said leg portion and being arranged to maintain a susbtantially constant angular relation of said toe portion to said leg portion.

3. In an artificial limb comprising a leg portion, a foot portion hinged to said leg portion, and a toe portion hinged to said foot portion, a locking rod slidably mounted in said leg portion, said foot portion being formed with spaced recesses located to receive the lower end of said locking rod in different adjusted angular positions of said foot portion relative to said leg portion and being arranged to releasably secure said foot portion in an adjusted position, and a link bar connecting said toe portion to said leg portion at points spaced substantially equal distances from the hinge connections of the foot portion and toe portion and being substantially equal in length to the distance between said hinge connections, said link bar being arranged to maintain a substantially constant angular relation of said toe portion to said leg portion.

No references cited.