

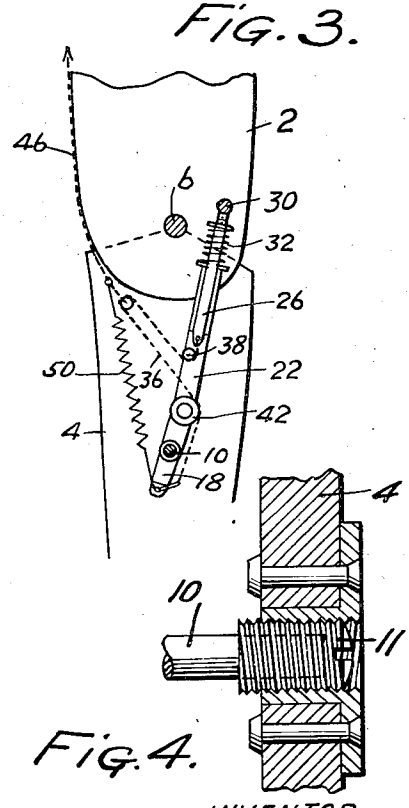
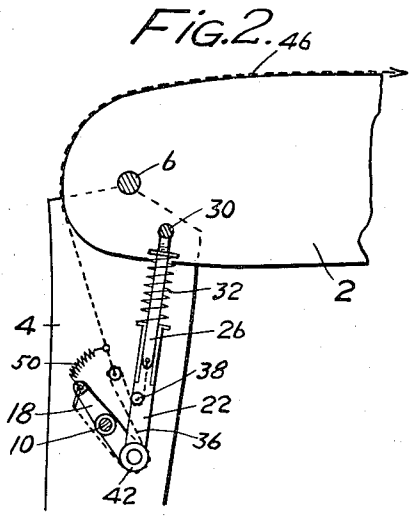
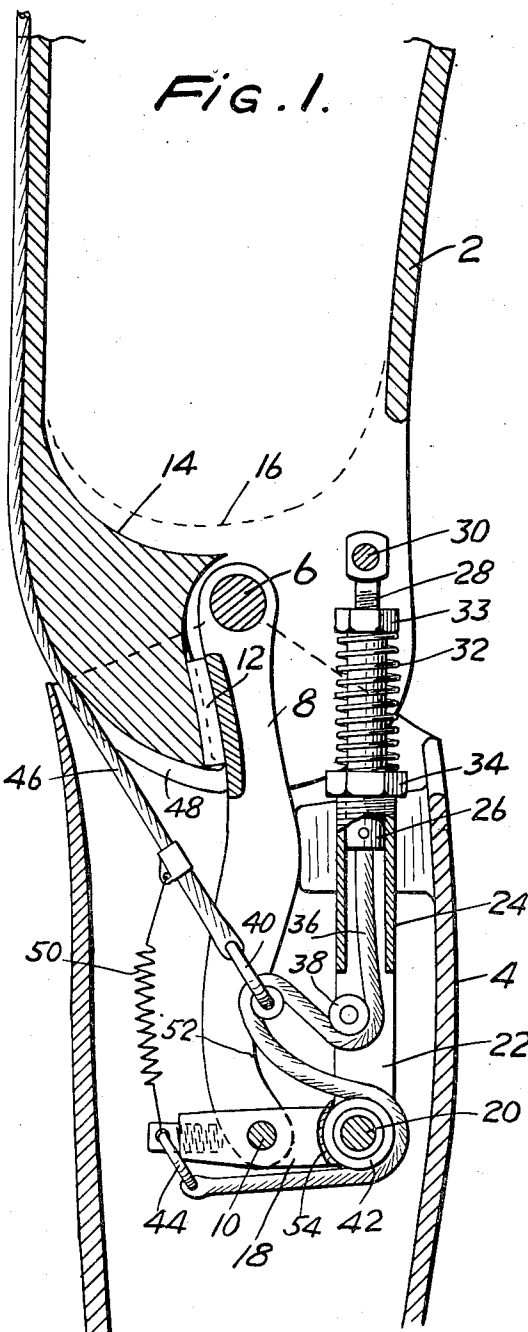
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ARTIFICIAL LIMB

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ARTIFICIAL LIMB

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11 Claims. (Cl. 3—2)

This invention relates to artificial limbs and particularly to an improved limb in which the shin section may be secured against angular movement relative to the thigh section.

5 In an artificial limb it is required that free movement of the shin section about its pivotal connection with the thigh section take place in order to permit sitting and walking. It is desirable, however, that during walking there should be some provision made to swing the shin section forwardly during the taking of steps so as to simulate ordinary walking conditions and also to move the foot sufficiently forwardly to take the weight of the body. In general, the arrangement for throwing the shin forwardly is resilient and does not resist to any great degree the attainment by the shin section of a position substantially at right angles to the thigh section when the wearer is seated.

10 One of the primary objections to artificial limbs of the type heretofore provided has been that if the shin section of the artificial limb is retarded in its forward movement a buckling of the limb will take place at the knee joint with the result that the wearer will fall. Contact of the foot of the artificial limb with any such object as a stone or curb, or the like, will produce this result. Obviously in such cases the wearer does not have time to take any precautions against falling and consequently devices heretofore designed to prevent buckling of the limb have been made to be rendered active by a subconscious movement, primarily the drawing rearwardly of the shoulders when the wearer is about to fall, which action is spontaneous and natural. In the arrangements heretofore provided to lock the two sections of the limb together, when locking takes place, freeing of the sections for a subsequent step is difficult and requires an unnatural operation. Furthermore, the devices do not permit of the desirable action of throwing the shin section forwardly in taking a step.

15 It is the broad object of the present invention to provide an artificial limb in which the parts may be locked together to prevent buckling while at the same time there is no interference either with the normal swing of the shin portion in walking or with the relative position of the two sections when the wearer assumes a sitting position.

20 Heretofore it has been customary to locate the controlling elements for the shin within the lower portion of the thigh section or socket. This, in fact, has been more or less assumed necessary inasmuch as while the thigh section occupies a

fairly fixed relationship to the upper portion of the body, the shin section has very substantial movements relative thereto. As a result of this prior construction so much of the socket is taken up by the controlling elements that if amputation has taken place directly above the knee the socket must be unnaturally elongated with the result that when the wearer occupies a sitting position the knee of the artificial leg projects visibly forwardly of the knee of the other leg.

25 In accordance with the present invention, the controlling mechanism, while necessarily connected to the thigh section, is primarily contained within the shin section. The controlling cord or strap secured to suspenders over the wearer's shoulders extends down the front of the thigh section and is guided about the knee portion thereof into the shin section. The mechanism is such that this arrangement can be provided without any interference with the functions of the controlling means irrespective of the position of the shin section.

30 One of the primary requirements for any controlling mechanism is, of course, lightness coupled with compactness. The arrangement of the present invention satisfies all requirements of this character being very light in weight and concentrated at the extreme upper portion of the shin member so that its effective movement of inertia is minimum.

35 Another object of the invention is the provision of a controlling mechanism which is readily accessible so that, if necessary, it may be removed for cleaning or replacement of parts.

40 The controlling mechanism forming the subject matter of the invention is not only of a type which is entirely satisfactory in cases where only one artificial limb is worn but is also satisfactory in cases where two artificial limbs are worn in which case, as will be obvious, the provisions against buckling are particularly important. The objects of the invention enumerated above together with other objects relating particularly to details of construction will be apparent from the following description read in conjunction with the accompanying drawing in which:

45 Fig. 1 is a vertical sectional view through the knee-joint of the improved artificial limb, the section being taken at right angles to the pivotal axis;

50 Fig. 2 is a diagrammatic view illustrating the positions of the parts when the wearer assumes a sitting position;

55 Fig. 3 is a similar diagrammatic view illustrating the positions of the parts when the shin

and thigh sections are locked together to prevent buckling; and

Fig. 4 is a sectional view showing details of construction.

5 The thigh section of the artificial limb which may take the usual conventional form is indicated at 2 being pivoted to the shin section 4 about a pivot 6 in the form of a pin or shaft which extends through both sections. Mounted on this pin is a member 8 which is secured to the shin section by a transverse pin 10 removably carried by the shin section preferably by having its ends inserted within openings in screws 11 threaded into the side walls of the shin section. The member 8 is of course fixed with respect to the shin in all of its positions and serves primarily as a reinforcement and a back-stop by engagement with a pad 12 carried by the knee portion of the thigh section. The socket opening in the thigh section is defined in part by the curved surface 14 above which may be located a cushion indicated at 16 upon which the padded stump of the wearer may rest. As will be obvious from Fig. 1, the device is adaptable to cases where amputation has occurred immediately above the knee inasmuch as the available opening in the socket extends substantially to the knee portion thereof. This may be contrasted with the usual arrangements in which controlling mechanism is located within the thigh section and requires a controlling strap extending outwardly through openings in the thigh section spaced substantially upwardly of the knee portion thereof.

Pivoted on the pin 10 is a link 18 having fixed in its rear end a pin 20 providing a pivot between the link 18 and the lower portion 22 of a second link. This second link is a composite one and is collapsible inasmuch as it consists of one part 22 providing a cylinder 24 in which there slides the second part consisting of a plunger 26 adjustably threaded upon a pin 28 pivoted on a transverse pin 30 carried by the thigh section. A spring 32 reacts between adjustable nuts 33 and 34 carried by the pin 28 and cylinder 24 respectively. The spring 32 is of compression type and tends normally to expand the collapsible link.

A cord 36 is secured at its upper end to the lower portion of the plunger 26 from which it extends downwardly passing about a pulley 38 carried by the part 22 of the collapsible link thence through a ring 40 and about a pulley 42 mounted on the pin 20 and finally to a ring 44 carried by the forwardly extending arm of the link 18 to which it is secured. The ring 40 which preferably carries a small pulley to receive the cord 36 is secured to the lower end of a strap or cord 46 which is guided within a slot 48 in the knee portion of the thigh section and thence passes upwardly to the front of the usual suspenders carried on the shoulders of the wearer, the rear portions of which are secured to the rear of the top of the thigh section. A tension spring 50 which is normally loose when the parts are in the position illustrated in Fig. 1 is connected between the cord or strap 46 and the forwardly extending arm of the link 18.

The member 8 is provided with a depression indicated at 52 with which may contact a cushion or plurality of cushions 54 mounted concentrically upon the pin 20. This, as will be obvious hereafter, limits the movements of the links.

When the wearer is walking in the normal fashion and the shoulders are held in normal position, the parts will occupy substantially the positions illustrated in Fig. 1. At this time the link 18 re-

tains substantially the position illustrated relative to the shin irrespective of the position of the shin relative to the thigh section. Flexure may take place in the ordinary walking movements by more or less compression of the spring 32 as will obviously be the result when the shin section pivots about 6 relatively to the thigh section and the link 18 remains substantially fixed. The slack in the cord 36 occasioned by this movement makes up for the fact that the strap 46 is substantially fixed about the knee portion of the thigh section. The compression of the spring 32 when flexing of the knee joint takes place tends to throw the shin section forwardly during the forward step of the artificial limb. Accordingly the spring 32 acts to help walking.

When the wearer moves to a sitting position the body is not usually held as erect as during walking. As a result, slack is given to the strap 46 and the spring 32 is free to expand due to the fact that the link 18 will pivot clockwise as viewed in Figs. 1 and 2. As a result, even though some expansion of the spring takes place, the shin section is quite free to occupy a position at a right angle to the thigh section as illustrated in Fig. 2. When the wearer wishes to rise the shoulders are generally raised somewhat so that the link 18 is pulled counterclockwise tensioning the spring 32 and thus aiding the rising action as weight is brought upon the artificial limb. The mere act of rising, accordingly, brings the parts into normal position for walking.

The most important function of the improved arrangement is illustrated in Fig. 3. If the wearer trips and is about to fall there is a tendency to throw the shoulders backwardly to gain equilibrium. This causes a pull upon the strap 46 pulling the cord 36 with the result that the spring 32 is fully compressed and the pivot 20 is brought into substantial alignment with the pins 10 and 30 so that the links will be approximately in dead center position. This position is determined by the contact of the pad 54 with the portion 52 of the member 8. Preferably, this position of the parts is just slightly short of the dead center position so that, as will be obvious, a restoration of the parts to normal position is readily effected. When the parts occupy the position illustrated in Fig. 3, it is not the force exerted by the shoulders of the wearer which prevents buckling but rather the fact that the two links in their substantially dead center positions act effectively as a single rod rigidly separating pivots 10 and 30. While the illustration in Fig. 3 shows the shin and thigh sections substantially in alignment the adjustment of nuts 33 and 34 is preferably such that at this time some further slight compression of the spring 32 may take place. However, the spring 32 will be fully compressed when only a slight angular displacement of the shin relative to the thigh occurs. It will be obvious that substantially the same results are produced with merely a slightly less approach to dead center position if the takeup on the strap 46 occurs when there is even a substantial relative angularity between the shin and thigh sections.

During the action just illustrated the spring 50 is elongated. This spring is arranged to break the toggle to restore the parts to their normal positions when the tension upon the strap 46 is released. The spring, it will be noted, not only pulls the strap 46 downwardly but also tends to swing the link 18 clockwise.

From the above arrangement it will be seen that there is provided a device in which with

little effort and, in fact, subconsciously on the part of the wearer, the shin and thigh sections are locked together to prevent buckling. It will also be seen that restoration of the parts to normal walking position, either from the sitting or locked position, takes place substantially automatically. In cases where very rigid locking is required, as where two artificial legs are worn, it may be desirable to connect the strap 46 directly with the pin 20 or a pin substantially at the position of the pulley 38. In this case, the plunger is left free but the full effort exerted by the shoulders of the wearer is utilized to bring the two links into dead center position. Greater safety and prompter reaction to stumbling is thus effected.

It will be obvious that various changes may be made in the specific embodiment of the invention without departing from the spirit thereof as defined in the following claims.

What I claim and desire to protect by Letters Patent is:

1. An artificial limb including pivotally connected shin and thigh sections, a linkage including a pair of members pivoted to each other and also to the shin and thigh sections respectively, said linkage yielding by relative movements of the members about their pivotal junction under normal conditions thereby permitting pivoting of the shin section relatively to the thigh section, and means for preventing relative movements of the members about their pivotal junction to lock the shin section relatively to the thigh section, said last means acting by bringing said members approximately into a dead center condition.

2. An artificial limb including pivotally connected shin and thigh sections, a linkage including a pair of members pivoted to each other and also to the shin and thigh sections respectively, said linkage yielding by relative movements of the members about their pivotal junction under normal conditions thereby permitting pivoting of the shin section relatively to the thigh section, and means for preventing relative movements of the members about their pivotal junction to lock the shin section relatively to the thigh section, said last means acting by bringing said members approximately into a dead center condition, one of said members being collapsible between its pivots.

3. An artificial limb including pivotally connected shin and thigh sections, a linkage including a pair of links pivoted to each other and also to the shin and thigh sections respectively, said linkage yielding by relative movements of the links about their pivotal junction under normal conditions thereby permitting pivoting of the shin section relatively to the thigh section, and means for preventing relative movements of the links about their pivotal junction to lock the shin section relatively to the thigh section, said last means acting by bringing said links approximately into a dead center condition, one of said links being collapsible, and comprising two relatively slidable parts and a spring urging them into extended condition.

4. An artificial limb including pivotally connected shin and thigh sections, a linkage including a pair of links pivoted to each other and also to the shin and thigh sections respectively, one of said links being resiliently collapsible, said link being normally collapsed during pivotal movements of the shin section about the

thigh section, and means controlled by the wearer for collapsing said link irrespective of such pivotal movements.

5. An artificial limb including pivotally connected shin and thigh sections, a linkage including a pair of links pivoted to each other and also to the shin and thigh sections respectively, one of said links being resiliently collapsible, said link being normally collapsed during pivotal movements of the shin section about the thigh section, and means controlled by the wearer for collapsing said link irrespective of such pivotal movements, said last means also serving to rotate the other link about its pivot.

6. An artificial limb including pivotally connected shin and thigh sections, a linkage including a pair of links pivoted to each other and also to the shin and thigh sections respectively, one of said links consisting of two relatively slidable parts and a spring urging them into extended condition, and means controlled by the wearer for compressing the spring and bringing the links approximately into a dead center condition.

7. An artificial limb including pivotally connected shin and thigh sections, a linkage including a pair of links pivoted to each other and also to the shin and thigh sections respectively, one of said links consisting of two relatively slidable parts and a spring urging them into extended condition, means controlled by the wearer for compressing the spring and bringing the links approximately into a dead center condition, and means aiding the restoration of the links to normal condition from said approximate dead center condition.

8. An artificial limb including pivotally connected shin and thigh sections, a linkage including a pair of links pivoted to each other and also to the shin and thigh sections respectively, one of said links consisting of two relatively slidable parts and a spring urging them into extended condition, and means controlled by the wearer for compressing the spring and bringing the links approximately into a dead center condition, said means including a flexible member operable by the shoulders of the wearer.

9. An artificial limb including pivotally connected shin and thigh sections, a linkage including a pair of links pivoted to each other and also to the shin and thigh sections respectively, one of said links consisting of two relatively slidable parts and a spring urging them into extended condition, and means controlled by the wearer for compressing the spring and bringing the links approximately into a dead center condition, said means including a flexible member operable by the shoulders of the wearer, and a second flexible member extending about the pivot between the two links and connected to one part of the two-part link.

10. An artificial limb including pivotally connected shin and thigh sections, a linkage including a pair of links pivoted to each other and also to the shin and thigh sections respectively, one of said links consisting of two relatively slidable parts and a spring urging them into extended condition, and means controlled by the wearer for compressing the spring and bringing the links approximately into a dead center condition, said means including a flexible member operable by the shoulders of the wearer, and a second flexible member extending about the pivot between the two links and connected to one part of the two-part link, and connected to the first flexible

member between the pivot and part just mentioned.

5 11. An artificial limb including pivotally connected shin and thigh sections, a linkage including a pair of members pivoted to each other and also to the shin and thigh sections respectively, said linkage yielding by relative movements of the members about their pivotal junction under normal conditions thereby permitting pivoting

of the shin section relatively to the thigh section, and means for preventing relative movements of the members about their pivotal junction to lock the shin section relatively to the thigh section, said last means acting by bringing said members approximately into a dead center condition, and adapted to be controlled by movements of the wearer.

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