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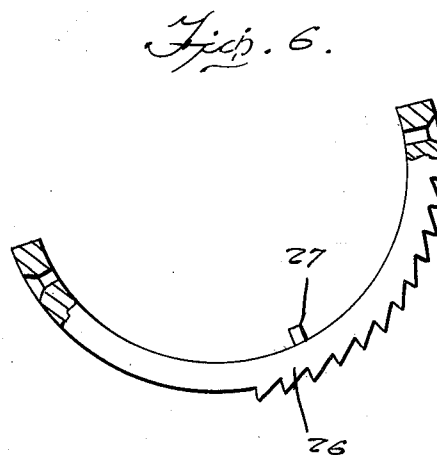
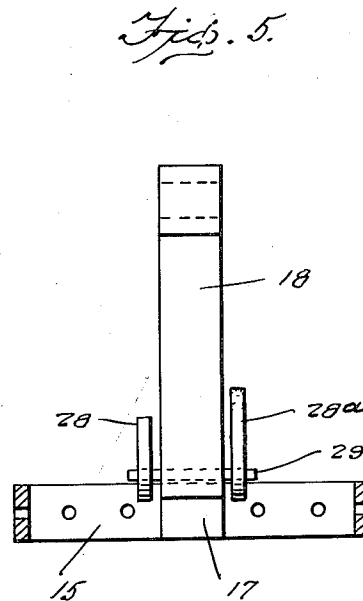
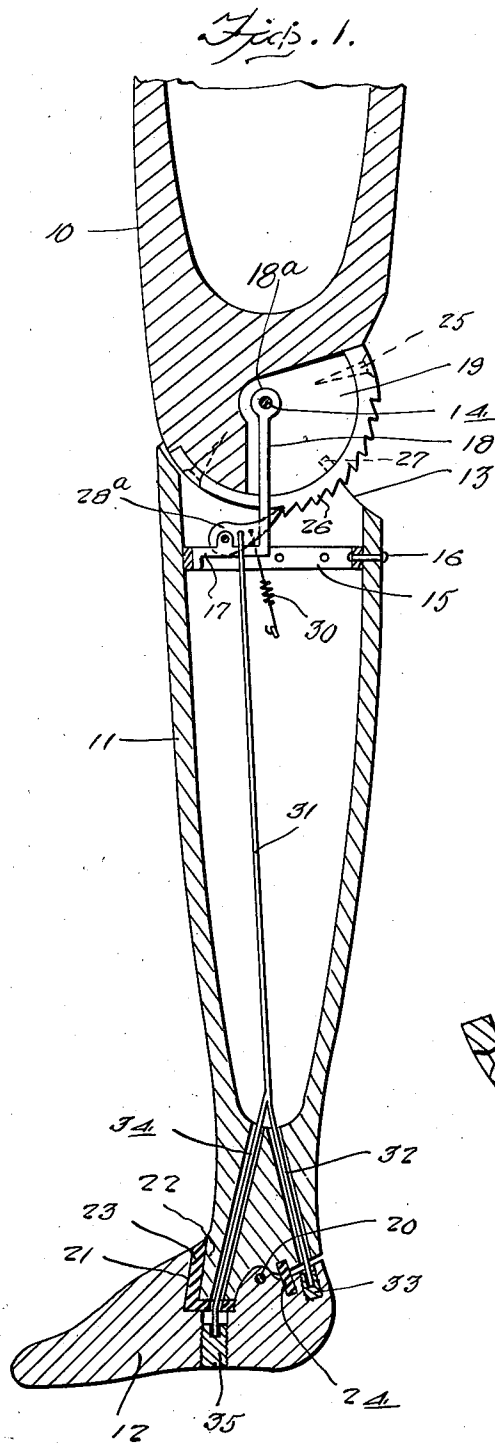
H. W. SPROULS

2,071,711

AUTOMATIC KNEE LOCKING DEVICE

Filed July 17, 1935

2 Sheets-Sheet 1



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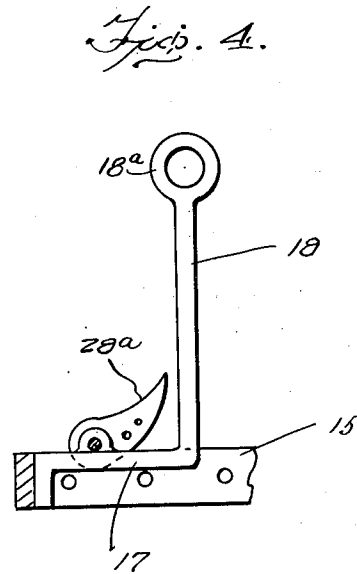
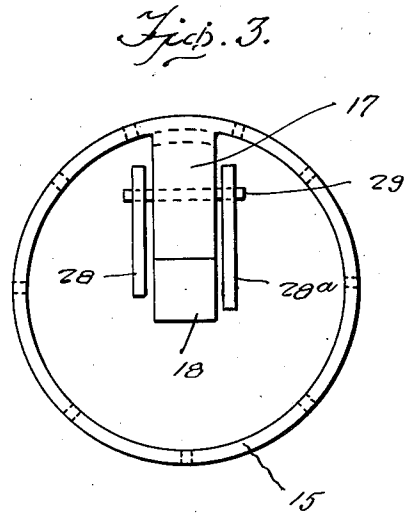
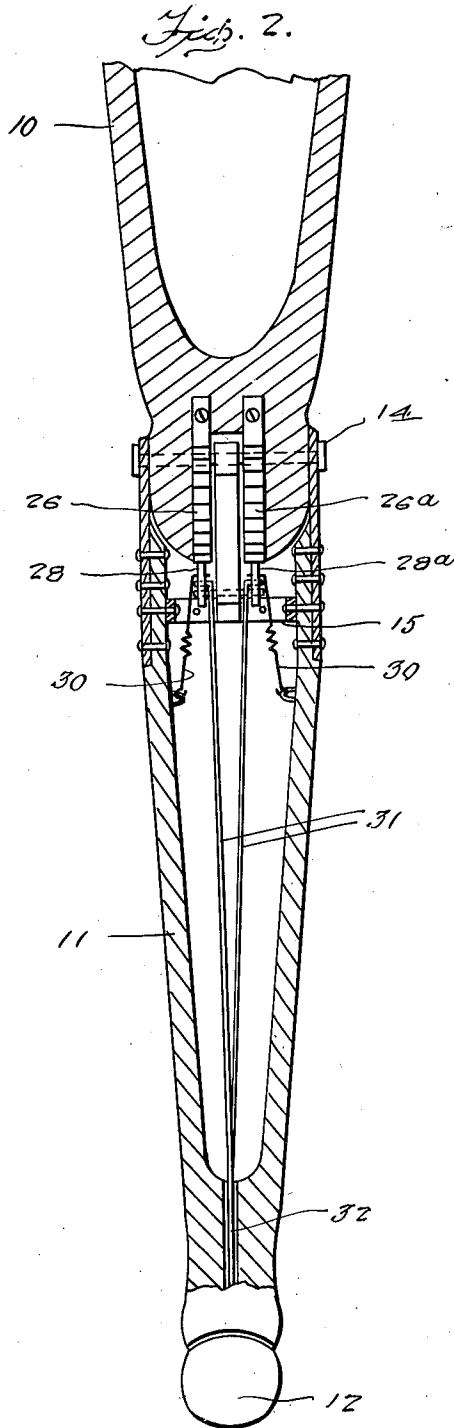
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UNITED STATES PATENT OFFICE

2,071,711

AUTOMATIC KNEE-LOCKING DEVICE

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Application July 17, 1935, Serial No. 31,923

1 Claim. (Cl. 3—2)

This invention relates broadly to artificial limbs and is primarily concerned with a device for use with an artificial leg to automatically lock the knee of the leg in a manner to prevent the same from buckling forward, causing the wearer to fall.

The invention together with its objects and advantages will be best understood from a study of the following description taken in connection with the accompanying drawings wherein:

Figure 1 is a sectional view through the leg with the knee locking device released.

Figure 2 is a sectional view taken substantially at right angles to Figure 1.

Figure 3 is a plan view of a ring and associated parts.

Figure 4 is a fragmentary detail sectional view through the structure shown in Figure 3.

Figure 5 is a sectional view taken substantially at right angles to Figure 4.

Figure 6 is a perspective view of an arcuate rack bar, certain parts being broken away and shown in section.

Referring to the drawings by reference numerals it will be seen that the limb comprises a socket 10 for the reception of a stump, a leg portion 11 and a foot portion 12. At the knee thereof the leg 11 is suitably cut away as at 13 to receive the knee portion of the stump 10, and at the knee the stump 10 and leg 11 are pivotally connected together through the medium of a pivot pin 14 which normally permits a free swinging movement of the limb at the knee.

Within the upper portion of the leg 11 is a ring 15 secured in position through the medium of rivets 16. Extending inwardly from the ring 15 is a bracket plate 17 that merges into an upstanding bumper bar 18. The bumper bar 18 extends upwardly into a notch 19 provided in the socket 10 at the knee, and at its upper end the bar is provided with a suitable eye 18a to accommodate the pivot pin 14. As thought to be clear from a study of Figure 1 the bumper bar 18 will limit swinging movement of the members 10 and 11 relative to one another.

At the ankle the leg 11 and foot 12 are pivotally connected together as at 20. At the instep the foot 12 is formed to provide a socket 21 and the leg 11 is formed to provide an extension 22 that is adapted to engage the socket 21. Arranged in the socket 21 between the confronting faces of the walls of the socket and the extension 22 is what may be termed a cushion member 23, the same being formed of rubber or other suitable material. Also, at the ankle joint the leg

11 and the heel of the foot 12 are suitably grooved to accommodate the ends of a second cushion pad 24 of rubber or other suitable material. Due to the inherent resiliency thereof, the cushion pad 24 has a tendency to normally separate the leg 11 and foot 12 at the heel as suggested in Figure 1.

At the open side of the notch 19 the opposed walls thereof are provided with semi-circular grooves in which are fitted and secured by screws or other fastening elements 25 arcuate rack bars 26, 26a. As also shown in Figure 1 the walls of the notches intermediate the ends of the respective rack bar accommodating grooves are provided with sockets for receiving centering pins 27 provided on the concave edges of the respective rack bars.

Cooperable with the rack bars 26, 26a, are long and short dogs 28, 28a, secured to the ends of a pivot pin 29 extending through a suitable lug provided therefor on the bracket 17. The dogs 28, 28a are normally urged downwardly out of the path of the rack bars 26, 26a, through the medium of suitably anchored spring 30.

Connected at one end with the dogs 28, 28a, are push rods 31 which at their lower ends merge into wish bones, the branches 32 and 34 of the respective wish bones extending through suitable openings provided in the angle portion of the leg 11. At their free ends, the branches 32 of the respective wish bones are equipped with plugs 33 threaded into suitable sockets provided therefor in the heel part of the foot 12. The branches 34 of the wish bones extend through openings also suitably provided in the heel portion of the leg 11 and are provided at their free ends with plugs 35 which are threaded into sockets provided therefor immediately forwardly of the heel of the foot as shown in Figure 1. The plugs 33, 35 serve for adjusting the rods 31 for regulating the arc through which the dogs 28, 28a are to move into and out of engagement with the rack bar 26, 26a.

It will be noted from a consideration of Figure 1 that the teeth of the rack bars 26, 26a are so arranged as to permit some bend at the knee as in natural walking before a contact of the dogs 28, 28a with the teeth of the rack bars 26 will be made.

From the above it will be apparent that in actual practice when, as in walking, pressure is placed on the foot 12 at the toe thereof the rubber cushion 23 will be compressed with the result that the rods 31 will move in the direction of the knee of the limb thus swinging the dogs

28, 28a in a counter clockwise direction against the actions of springs 30 for positioning the dogs in the path of the teeth of the rack bars 26, 26a. As the knee bends, as is natural in the act of walking, the dogs 28, 28a being in this last named position, said dogs will engage in a manner hereinafter fully described with the teeth of the rack bars 26, 26a holding the knee from buckling forward until pressure is taken off the foot 12 at the toe thereof.

Similarly when pressure is applied to the heel there will be a relative swinging movement between the foot 12 and the leg 11 causing the cushion 24 to contract and the rods 31 to be pushed upwardly to swing the dogs 28, 28a in a counter clockwise direction for again engaging the rack bars 26, 26a to lock the knee joint and thereby prevent forward buckling of the artificial limb at the knee.

In connection with the above it is to be noted, and as before stated, that one of the dogs, 28a, as shown, is longer than the dog 28. In this connection it is to be further understood that the improved knee lock provides for the locking of the limb in a straight line at any angle up to 45 degrees, and further that the notches in the rack bars 26, 26a are so spaced that when the weight is put on the heel the longer of the dogs 28a comes into contact with the first notch on its rack bar 26a, if the leg is in a straight line. If the leg is bent or buckled ahead, the said dog 28a will contact with the next or one of the next notches. If there is any weight on the heel of the foot the condition indicated will obtain. If there is no weight on the heel of the foot the leg will rock forward until it passes center when the pressure is put on the ball or toe, causing the push rod 31 to raise the said dog 28 into contact with the rack bar 26 locking the leg in a manner to prevent buckling thereof at the knee and thereby safeguard the wearer from falling.

Under normal conditions the longer dog 28 comes into contact with its rack bar 26a as the wearer steps forwardly and as he advances, the said comparatively long dog is dropped back and as wearer comes on over forward onto the toe,

the short dog 28 rises into contact with its rack bar 26 about an inch ahead of the first tooth on its rack bar. This slight play between the said dog and the rack bar allows the leg to bend at the knee or break as is natural in walking.

From the above it will be apparent that with a limb of this character, natural knee action may be obtainable without danger of the limb buckling forward at the knee. Buckling forward of the limb at the knee often results in causing the wearer to fall and for this reason artificial limbs have become very objectionable.

This application is a continuation in part of my prior application Ser. No. 727,356, filed May 24, 1934.

Having thus described the invention, what is claimed as new is:

In an artificial limb of the character described, a stump socket, a leg, a pivot joint between the socket and the leg at the knee and disposed above the leg, a foot, a joint between the leg and the foot at the ankle, and means controlled by the relative movement of the leg and foot at the ankle for locking the knee joint to prevent buckling of the limb at said joint upon shifting of the weight to the toe or heel portion of the foot, and for automatically releasing the knee joint upon release of the weight, said locking means including arcuate rack bars secured to the pivoted end of the stump socket, dogs pivotally mounted within the leg and engageable with the rack bars upon relative movement of the leg and stump in the bending of the limb at the knee for locking the joint at the knee against buckling forwardly, one of said dogs being longer than the other, and means for moving the dogs into and out of engagement with the rack bar incidental to the action taking place at the ankle joint of the limb incidental to walking, said last named means including a pusher extending through the leg and connected at one end with said dogs, and having a free end provided with divergent branches extending through openings in the leg at the ankle at opposite sides thereof.

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