PROSTHETIC LEG WITH WEIGHT RESPONSIVE KNEE LOCK

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ABSTRACT
A knee structure for a prosthetic limb, which allows the shin portion to pivot with respect to the thigh portion about an axle and has a brake band around the axle with novel means for causing the brake band to tighten around the axle, when the wearer places weight on the limb, to allow the knee to lock at any angular position. The brake automatically releases when the weight is lifted off the limb.

7 Claims, 7 Drawing Figures
PROSTHETIC LEG WITH WEIGHT RESPONSIVE KNEE LOCK

FIELD OF THE INVENTION

The present invention relates to a prosthetic limb and, more particularly, to the knee structure thereof with a means for braking.

BACKGROUND OF THE INVENTION

Prosthetic or artificial limbs have been designed many ways and each way is calculated to simulate more closely the motion of a natural limb. However, at times this appears to be an impossibility because of the many functions our Great Creator compacted within a relatively small package. Therefore, man can only hope to approach the function of the natural limb. Up to now, a prosthetic leg had a knee structure which locked when the leg was straight so that the knee would not give way from under the wearer. If the wearer desired to lock the knee when the leg was bent, he had to use his hands to apply a lock to the knee assembly in the bend position.

OBJECTS OF THE INVENTION

An object of this invention is to provide a novel pivotal structure for a prosthetic limb which can be locked in any angular position.

Another object of this invention is to provide a knee structure for a prosthetic leg having a means for locking the knee whenever weight is supported by the prosthetic leg.

Another object of this invention is to provide a novel knee structure that is simple, durable, economical and more closely simulates, in function, a natural knee.

These and other objects and features of the invention will become apparent after studying the following description and the accompanying drawings which describe and illustrate the preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a small scale pictorial view of the novel prosthetic leg.

FIG. 2 is a side elevation in section taken on the center line of the knee structure of the novel leg shown in FIG. 1.

FIG. 3 is also a side elevation in section taken on one side of the center line showing the knee structure with the knee slightly bent.

FIG. 4 is a plan section taken substantially on line 4—4 in the direction of the arrows shown in FIG. 2.

FIG. 5 is a section taken on line 5—5 in the direction of the arrows shown in FIG. 2 showing only the brake portion.

FIG. 6 is a pictorial view of the brake band employed in the knee.

FIG. 7 is a pictorial view of the brake drum.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a prosthetic leg incorporating this invention and there is shown a thigh portion 11 and a shin portion 12 which pivot relative to each other about an axle or shaft 13. The shaft 13 is disposed in the shin portion through bores, such as bore 14 (FIG. 4), formed within one of the respective two bosses 15. The shin portion 12 has a well 16 (FIG. 2) extending down through the top thereof an bosses 15 are disposed on opposite sides of the well 16. The shaft 13 is suitably keyed to the bosses 15 and, in turn, the shin portion.

The thigh portion 11 is attached to the shaft 13 through two cranks or links (21) placed on opposite sides of the thigh portion 11, as shown in FIG. 4. Each link 21 has bores 22 and 23 formed at the respective ends. Through bores 23 on both links 21 is disposed a rod 24 and is suitably keyed to the links 21. Through bores 22 of both levers 21 passes the shaft 13, and between the wall of the bore 22 and shaft 13 are disposed bronze bushings 26 which are suitably fixed to the respective levers 21. Since the shaft 13 is preferably made of stainless steel, the bronze-stainless steel mating surfaces form a bearing. To change the drag on this bearing, each bushing 26 has axially parallel slots 27, and a brass band 28 with tightening screw and bolt 29 surround each bushing 26 over the portion extending inward from the links 21. Thus, by tightening the screws and bolts 29, the bushings 26 clamp down harder on the shaft 13, increasing the drag. This feature is standard in the art to provide a "knee swing" to the feel of the wearer. Rod 24 is also preferably stainless steel and it passes through two aligned bores 31 in the thigh portion 11, with suitable plastic bushings 32 therebetween to provide a bearing. Between the bores 31 and in the thigh portion a cavity 35 (FIG. 2) is formed at the lower end to provide two opposing members 35a, which cavity is preferably accessible from the rear wherein is provided an opening 36. Bores 31 are in members 35a. In addition, the thigh portion has two aligned holes 37 (FIG. 4) also situated on opposite sides of the cavity 35, through which holes 37 pass the shaft 13 and bronze bushings 26. These holes 37 are much larger than the item therein disposed for reasons that will become apparent hereinafter. Aligned bores 41 are also formed in the thigh portion to accommodate a dowel 24 to which is engaged a check lever 43, the lower end of which engages a suitable member (not shown), as is standard in the art to check or prevent the forward swing of the shin portion 12.

Within the cavity 35 is disposed the novel means for locking the knee in any angular position. The means, in the preferred embodiment, comprises a brake band 51 surrounding a brake drum 52 on the shaft 13, as shown in FIG. 2. The brake band 51 and drum 52 are preferably made of nylon. The drum 52 is cylindrical in shape, as shown in FIG. 7, and is locked to the shaft 13 by a set screw 53 (FIG. 2). The brake band 51 is generally U-shaped, as shown in FIG. 6, wherein one side 51a of the band is much larger than the other 51b and the one side 51a has a bore 54 through which passes the rod 24. The band 51 is locked to the rod by a set screw 53a. The brake band 51 is tightened whenever a brake lever 55 is pushed down. This function is possible because the brake lever 55 engages a screw 56 under its head, which screw is disposed substantially vertically, and loosely passes through a hole 57 in the larger side 51a and engages suitable nut 58 imbedded in a hole 59 in the other side 51b of the band 51. The brake lever 55 pivots about a fulcrum 61 on the brake band 51. The rearwardly disposed end or end of the lever 55 disposed over dowel 42 bears against an upper wall 35a of the cavity 35, as shown in FIGS. 2 and 3.
Two compression springs 62 (FIG. 5) acting between opposite sides 51a and 51b of the brake band 51 ensure that the band and drum are free when the lever 55 is not depressed.

The brake is applied whenever the wearer places weight on the prosthetic leg to transfer force from one portion to the other. When weight is being supported the weight is transmitted by the thigh portion to the shin portion 12 through bushings 32 around rod 24 and through the lever 55, since it is in contact with the upper wall 35a of the cavity 35. This bearing force on bushings 32 causes both links 21 to tend to rotate about the shaft 13, since the forward ends of the ends 21 are being pressed down. The thigh portion moves downward slightly causing the brake lever 55 to pivot about the fulcrum 61, lifting the front end of the lever 55 and the screw 56. This motion to the brake lever 55 can be applied by the wearer when the knee is in any angular position, as shown in FIG. 3, to allow the wearer to lock the knee when, for example, in the half knee-bend position. When the wearer lifts his leg, as when walking, the knee is free to bend or swing, since the thigh portion 11 lifts up off lever 55.

Although one embodiment of the invention has been shown and described, the invention is not limited thereto but includes all embodiments within the scope of the claims.

I claim:

1. A prosthetic leg comprising:
   a thigh portion having a cavity formed at the lower end thereof with opposing walls
   a shin portion having a well at the upper end within which well the lower end of the thigh portion is free to pivot a shaft fixed to said shin portion at the upper end thereof and across said wall,
   a rod passing through said opposing wall of said thigh portion and
   a pair of links engaging said rod and said shaft at their respective ends,
   a brake band disposed within said cavity, around said shaft and affixed to said rod, and
   a lever member disposed within said cavity engaging said brake band and said thigh portion so that the brake band tightens around said shaft when the thigh portion bears down upon said lever member.

2. The leg of claim 1 wherein:
   said rod is disposed on one side of said shaft and parallel thereto,
   said brake band is U-shaped and has the upper side thereof fixed to said rod,
   a bolt passes through both sides of the band and is free with respect to the upper side and fixed to the underside,
   said lever member engages the upper end of said bolt,
   a fulcrum is on the upper side of said brake band on which said lever member pivots,
   said lever member bearing against the upper wall of said cavity at a point thereof disposed on the side of said shaft opposite said rod.

3. A prosthetic leg comprising:
   a thigh portion having a pair of opposing members depending from the lower end thereof,
   a shin portion having a well at the upper end for receiving said members,
   said pair of members having at least one pair of aligned holes,
   a rod disposed snugly within said pair of aligned holes,
   a shaft disposed at the upper end of said shin portion and across said well,
   a link connecting said rod to said shaft and being journaled on said shaft,
   a brake band disposed between said pair of members and around said shaft and having one end thereof engaging said rod,
   a bolt fixed to the other end of said band, which slides through an opening in said one end of said brake band,
   a fulcrum,
   a lever engaging said bolt and said thigh portion so that when weight is being supported by said leg said link rotates downward about such shaft, causing said thigh portions to drop slightly, pivoting said lever about said fulcrum to cause said bolt to slide with respect to said opening in said one end, causing the brake band to tighten around the shaft.

4. The leg of claim 3 wherein:
   another link is provided connecting said rod to said shaft with said brake band disposed between the levers, said other link is journaled on said shaft, said rod is substantially disposed in front of said shaft when the leg is in the straight portion, said lever is disposed so that one end extends rearward to engage said thigh portion so that weight is transmitted through the spaces areas to said shin portion.

5. The leg of claim 3 wherein:
   said one end of said brake band is disposed over the other end and has a bore through which said rod passes,
   said lever engages said bolt by the forward end of the lever,
   said fulcrum if formed on said brake band on the upper side thereof.

6. A pivotal mechanism for a prosthetic limb comprising:
   a first portion with a cavity formed at one end thereof,
   a second portion with a well formed at one end to allow said one end of said first portion to pivot freely therein,
   a shaft fixed to said second portion across said well,
   a rod passing through and in journaled relationship with the opposing walls of said cavity,
   means for allowing said rod to rotate about and parallel to said shaft,
   a brake band disposed around said shaft and within said cavity and having one end engaging said rod and the other end having contact with said first portion so that said brake band tightens around said shaft when said first portion bears toward said second portion.

7. The mechanism of claim 6 wherein:
   said one end of said brake band has a hole formed therethrough,
   a link is disposed through said hole and is connected to said other end,
   a fulcrum is formed on said one end
a lever is connected at one end to said pin and disposed to pivot about said fulcrom and has its other end in contact with said first portion.

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