March 4, 1952 F. KLEINEKATHÖFER 2,588,013

ARTIFICIAL LEG

Filed Nov. 30, 1949 2 SHEETS—SHEET 1

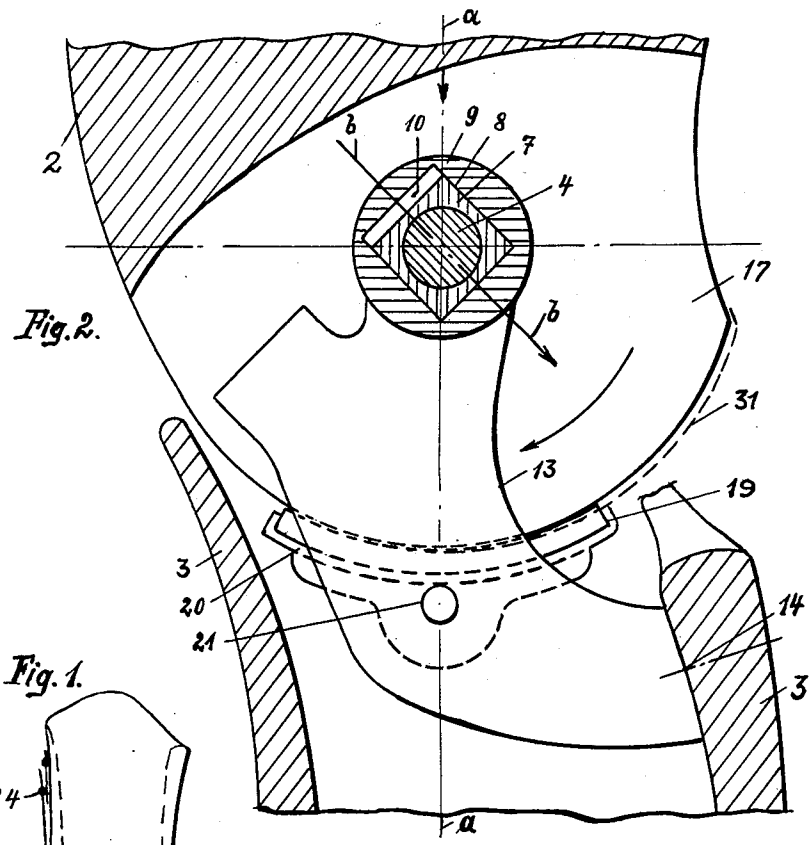
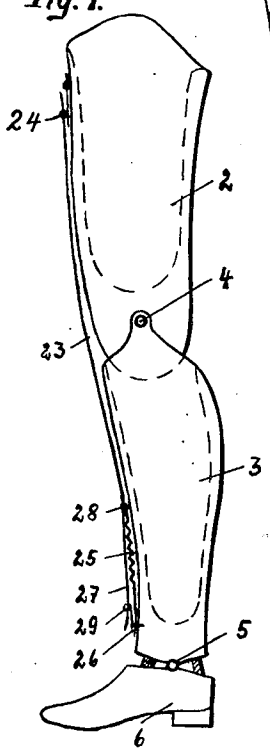


Fig. 2.

Fig. 1.



Inventor

Felix Kleine Kathofer

by Richard Low

Ag't.

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Fig. 3.

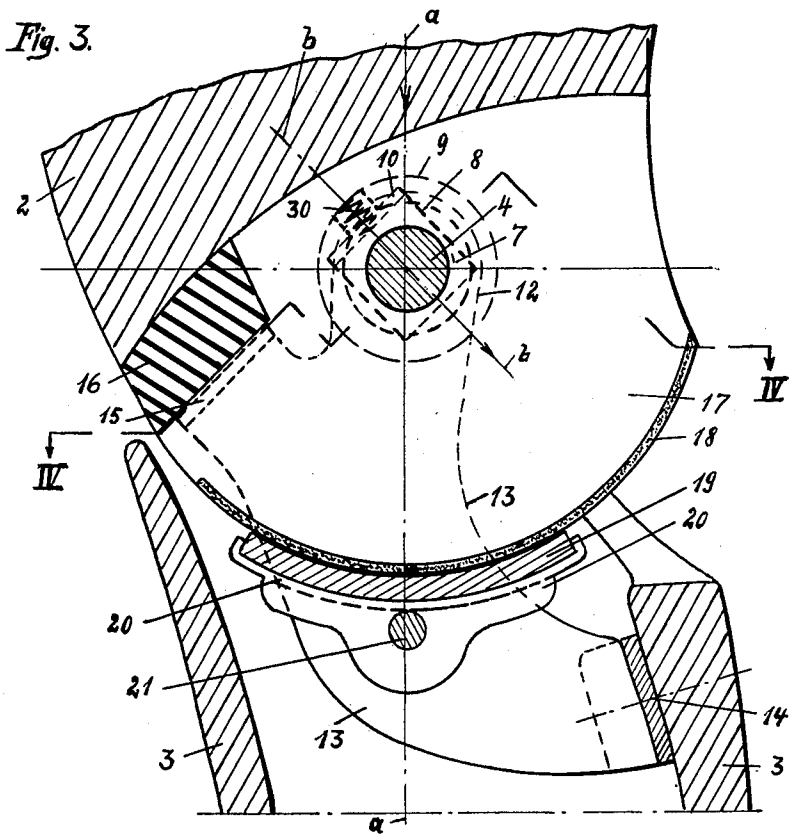
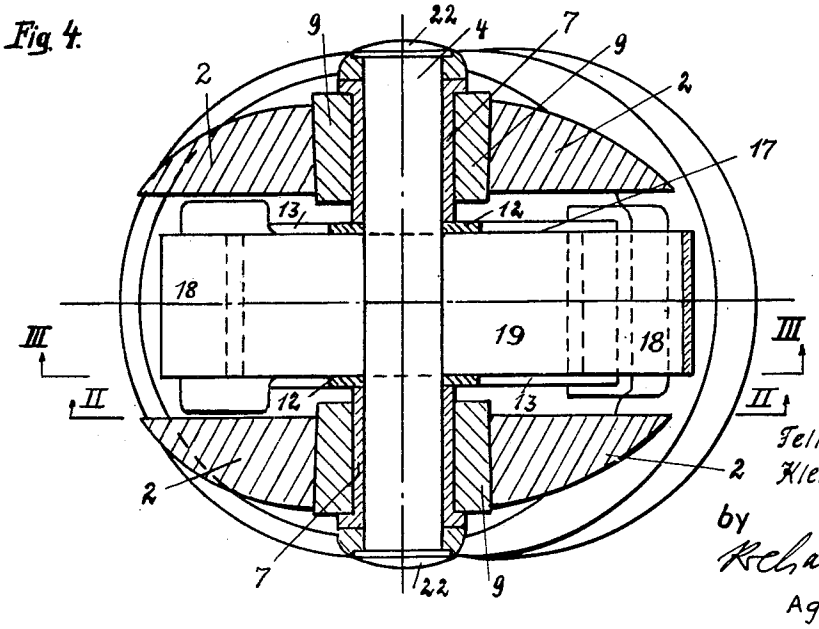


Fig. 4.



Inventor
Felix Kleinekathofer
by Richard Hund
Ag't

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UNITED STATES PATENT OFFICE

2,588,013

ARTIFICIAL LEG

Felix Kleinekathöfer, Bad-Kreuznach, Germany

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9 Claims. (Cl. 3—2)

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The present invention relates to a leg-prosthesis, and is particularly directed to an artificial leg provided with a novel type of one-shaft knee-joint.

It is a fact well known to the art that in the manufacture of artificial legs the use of one-shaft knee-joints has almost become a general practice. The reason being that this type of construction is preferable to two- and more-shaft knee joints, or knee-joints provided with slide-faces instead of shafts, because of its simplicity and superior resistance to wear.

But the known kind of one-shaft knee-joints has the disadvantage that it does not provide for the person using it the necessary assurance and safety in standing and walking, especially when the ground is rough instead of level. Too large a step or some other cause may result in sudden and unforeseen bending and collapse of the knee-joint, and the person using the artificial leg will then have neither the time nor strength to regain control and drop down to the ground.

These known constructions have been found to be particularly unsatisfactory and dangerous if, when walking on root-covered forest roads or when too large a step is taken, the foot is placed on the ground with its heel first, so that the pressure is first exerted against the heel. These deficiencies may be partly overcome through the use of two- and more-shaft knee-joints or of knee-joints provided with slide-faces. But truly satisfactory results can not be attained that way.

The present invention, therefore, has for its object to obviate the aforesaid drawbacks and to devise an artificial leg which provides for its wearer in every respect the required assurance and safety in standing and walking, and which uphill as well as downhill and also on rough roads or ground permits safe and effortless walking.

For this purpose the knee-joint of the artificial leg has been provided with an automatic brake, which begins to function as soon as the leg is moved into contact with the ground and thus placed under pressure either in outstretched or bent condition or at any stage between outstretched and bent position, which, however, becomes inactive when during the walking the pressure is temporarily interrupted through lifting of the leg from the ground, so that the shank can swing forward while the leg is in bent position. It is obvious that unintended bending of the knee is thereby made impossible, as the automatic brake will instantly stop the bending in the knee-joint as soon as a pressure is exerted.

The inventive value of the novel construction

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resides in the feature that the conventional one-shaft knee-joint has been transformed into a brake-controlled knee-joint through simple exchange of the customary stop-frame for a stop-frame provided with a braking mechanism actuated with the aid of a slide-block bearing, whereby said braking mechanism consists of a slide-block bearing, a stop-frame provided with a brake-shoe, and an intermediate portion of the artificial thigh for engagement between two arms of the stop-frame and carrying a brake-lining for cooperation with the brake-shoe of the stop-frame. Apart from this there are no fundamental changes in the structure of the prosthesis.

Additional features and advantages of the invention will be understood from the following detailed description, taken in connection with the accompanying drawings, showing an embodiment of the invention. However, it is to be understood that the invention is not confined to any strict conformity with the drawings, but may be changed or modified, so long as such changes or modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings, in which similar characters of reference indicate corresponding parts in all of the several figures—

Fig. 1 is a side elevation of the artificial leg;

Fig. 2 is a side elevation on an enlarged scale and partly in section of the knee-joint and braking mechanism;

Fig. 3 is a vertical sectional view on line III—III of Fig. 4, showing further details of construction;

Fig. 4 is a cross-section of the knee-joint on line IV—IV of Fig. 3.

Referring now to the drawings in detail, the reference numerals 2 and 3 denote the thigh and shank connected by means of the shaft 4, while the shank 3 and the foot 6 are pivotally connected by the shaft 5.

The pivoted connection between the thigh and shank has been devised as a slide-slot bearing with the result that, when pressure is exerted on the bearing, an eccentrical displacement of the centers of thigh and shank with respect to each other will take place. This eccentrical displacement has been utilized for producing a braking effect in the knee. For this purpose the shaft 4 of the knee-joint has been arranged in two slide-blocks 7, having a cross-section of square formation and being preferably so positioned that two of their pointed edges are pointing in the direction of the longitudinal axis *a—a* (see Fig. 2).

The slide-blocks 7 are arranged in a rectangular slot 8 of the bushings 9, so that, when the slide-blocks are in their normal position, a gap 10 is created. The bushings 9 are stationarily secured in the walls of the thigh 2 and may preferably be at their outer circumference of slightly conical shape.

The shaft 4 is further secured in the bearing openings 12 of the arms 13 of a U-shaped stop-frame, which in its turn is fastened to the back of the shank 3 as illustrated at 14. The walls 15 on the opposite side of the stop-frame are, when the leg is in outstretched position, bearing against two buffer cushions 16 of rubber or the like provided at the thigh. The thigh terminates in a lower end portion of globular shape provided with an intermediate portion 17, which is axially flat and radially of semicircular formation. The intermediate portion is equipped with a brake-lining 18. Positioned beneath the intermediate portion 17 is a brake-shoe 19 mounted on a bearing 20 pivoted to the arms 13 of the stop-frame at 21. The parts are so devised and so disposed with respect to each other that, when no pressure is exerted on the shank, a slight clearance exists between the brake-lining 18 and the intermediate portion 17 and the brake-shoe 19, so that free swinging of the shank is then not interfered with. Instead of employing the bearing means 7, 8, 9 it is also possible to arrange the shaft 4 in an elongated hole for displacement in the latter in the direction *b—b* (see Figs. 2 and 3).

The stop-frame guides between its arms 13 the movements of the intermediate portion 17 of the thigh, so that in spite of the provision of the slide-block bearing or slide-slot bearing the disadvantages of a shaking knee have been avoided. The slide-block bearings 7 are of such length that they are bearing against the bearing collars 12 of the arms 13 of the stop-frame, due to the pressure exerted against the slide-block bearings by the cap-nuts 22 of the shaft 4, so that lateral yielding of the arms 13 and bearing collars 12 is thereby reliably prevented.

For limiting the bending of the knee to the required degree the invention provides a knee-stretching strap 23 (Fig. 1) of leather or other inelastic material, which is longitudinally adjustably secured to the thigh at 24 and fastened to the shank at 26, and which, when the leg is in outstretched position, terminates at its lower end 25 in zigzag-like fashion. The zigzag-like contraction 25 of the strap 23 is caused by a rubber strap 27 which is fastened to the strap 23 at 28 and adjustably secured to the shank at 29. The slide-block bearing 7 may also be of the spring-pressed type as indicated at 30 (see Fig. 3).

The knee-joint provided with automatic braking means as disclosed in the present invention functions as follows: When pressure is exerted on the artificial leg by placing it on the floor or ground in either outstretched or bent condition, the thigh i. e. the intermediate portion 17 of the latter, becomes displaced with respect to the shank in the direction *b—b*, as indicated in Fig. 2 in broken line at 31. The result is a braking effect caused by the friction between the brake-linings 18 and 19 and corresponding in intensity to the intensity of the pressure, the braking effect being dependent upon the pressure due to the wedgelike condition produced by the angular displacement of the intermediate portion 17, as indicated by the line 31. When the pressure increases, the braking effect increases accordingly, but as soon as the pressure ceases, through lifting of the artificial leg from the floor or ground, the knee-joint moves back to its former position and the shank can then swing freely as before.

What I claim as new and desire to secure by Letters Patent of the United States:

1. Artificial leg comprising a thigh, a shank, means for rotatably connecting the shank to the thigh, and braking means to check the motion of the thigh and shank relative to each other, said connecting means including bearings slidingly arranged in slanting slots in the thigh, a shaft supported by said bearings, and a pair of arms secured to and extending from the shank and rotatably engaging said shaft for the support of the thigh, said braking means provided both on said arms and on the thigh and adapted to be automatically moved into a wedge-like braking engagement with each other to prevent undesired bending of the leg when pressure is exerted on the thigh.

2. Artificial leg comprising a thigh, a shank, means for rotatably connecting the shank to the thigh, and braking means to check the motion of the thigh and shank relative to each other, the thigh terminating in a lower globe-shaped end portion consisting of two oppositely disposed outer wall portions and an intermediate portion spaced apart from the outer wall portions, the intermediate portion being laterally flat and radially of semicircular formation, said connecting means including a pair of bearings slidingly arranged in slanting slots in said outer wall portions, a shaft and a U-shaped frame, said frame consisting of a pair of arms secured to the shank and extending into said globe-shaped end portion on both sides of the intermediate portion, each arm being provided at its upper end with an opening, the shaft extending through the intermediate portion, the openings in the arms and said bearings for rotatable connection of the shank to the thigh and for support of the thigh, said braking means provided both on the arms and on the thigh and adapted to be automatically moved into a wedgelike braking engagement with each other to prevent undesired bending of the leg when pressure is exerted on the thigh.

3. An artificial leg as specified by claim 2, including a knee-stretching strap of leather or other inelastic material adjustably secured at one end to the upper end of said thigh and fastened at the other end to the lower end of said shank for limiting the bending of the knee to the required degree; and a rubber strap adjustably secured at one end to the lower end of said shank and fastened at the other end of said knee-stretching strap somewhere in the middle of said shank in such a way that said knee-stretching strap is thereby partly contracted in zig zag-like fashion.

4. The leg according to claim 2, wherein each of said bearings comprises a slide block allowing said globe-shaped end portion to give way downwardly and rearwardly when pressure is exerted on the thigh.

5. The leg according to claim 2, wherein each of said bearings comprises a slide block standing on an edge and allowing said globe-shaped end portion to give way downwardly and rearwardly when pressure is exerted on the thigh.

6. In the leg according to claim 2, the U-shaped frame being provided with a brake-shoe, the semi-circular surface of the intermediate portion

being provided with a brake-lining, and each of the bearings comprising a slide block standing on an edge and allowing the globe-shaped end portion to move downwardly and rearwardly when pressure is exerted on the thigh, thus causing the braking means including said brake-shoe and brake-lining to engage each other frictionally and to produce a wedgelike braking action against bending of the leg.

7. In the leg according to claim 2, the U-shaped frame having pivotally attached thereto a brake-shoe, the semicircular surface of the intermediate portion being provided with a brake-lining, and each of the bearings comprising a slide block standing on an edge and allowing the globe-shaped end portion to move downwardly and rearwardly when pressure is exerted on the thigh, thus causing the braking means including said brake-shoe and brake-lining to engage each other frictionally and to produce a wedgelike braking action against bending of the leg.

8. The leg according to claim 2, wherein each of said bearings forms a slide block of square cross section, and each of said blocks is fitted in a rectangular slot provided in a bushing, the slide blocks being allowed to give way in one direction only when pressure is exerted on the thigh, the bushings being secured in said outer wall portions.

9. In the leg according to claim 2, a cap nut being provided on each end of said shaft, each of said bearings being of such length that it is caused by the pressure of the respective cap nut to bear against one of said arms, the arms thus snugly embracing said intermediate portion and allowing the intermediate portion to move rotatively, but preventing the intermediate portion from tipping sidewise and therefore preventing the thigh from sidewise shaking relative to the shank.

FELIX KLEINEKATHÖEFER

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
37,087	Cotty	Dec. 9, 1862
762,031	Engels	June 7, 1904
2,400,032	Talbot	May 7, 1946
2,450,728	Havens	Oct. 5, 1948

FOREIGN PATENTS

Number	Country	Date
293,433	Great Britain	Aug. 16, 1928
490,884	Germany	Feb. 6, 1930