April 5, 1949. I. TOUSON 2,466,134

KNEE JOINT FOR ARTIFICIAL LEGS

Filed May 8, 1945

Fig. 1.

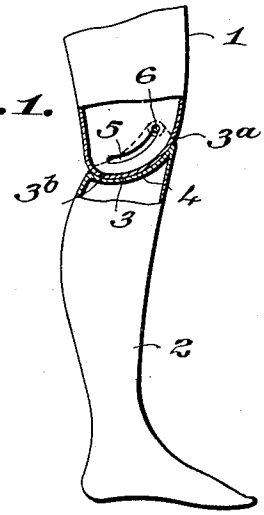


Fig. 2.

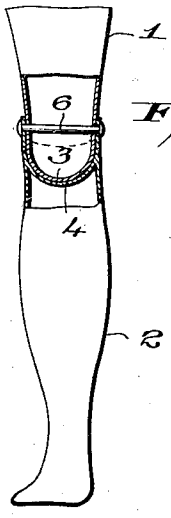


Fig. 3.

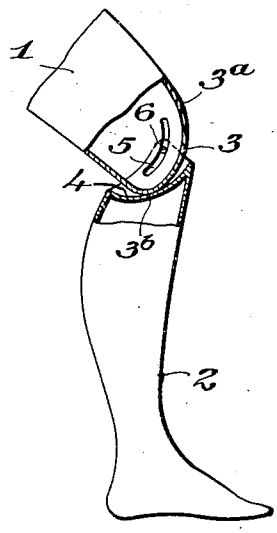


Fig. 5.

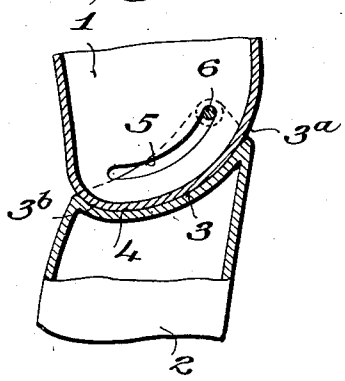
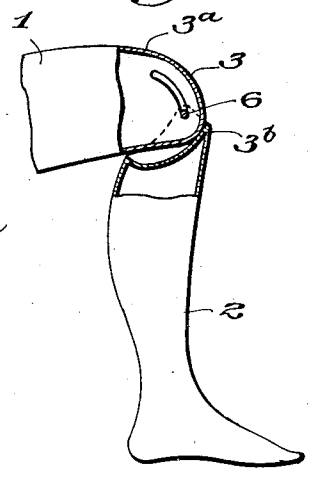


Fig. 4.



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2,466,134

KNEE JOINT FOR ARTIFICIAL LEGS

Isaac Touson, Buenos Aires, Argentina

Application May 8, 1945, Serial No. 592,567

1 Claim. (Cl. 3—2)

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This invention relates to knee joints providing means for effecting easily walking movements and even mounting and descending staircases, sitting down and other inherent acts, within the range of the natural member. Within arthrological science this joint has been studied scientifically so as to enable the amputee to place, at his desire, with only the movement of the stump or the body, the two parts of the leg from a straight position to the different angular positions, during which movements the joint in any one of these positions has always a fulcrum or stable point of support which impedes bending by the weight of the body, thereby avoiding falls or loss of equilibrium. The joint enables therefore the leg to be folded or doubled to a determined angle at will and receive in such circumstances the gravitational weight of the amputated person without danger that it continues to fold or double. For the return to its straight position it only needs to be raised by a simple movement of the stump or by inclination of the body at the moment in which the other leg effects the support of the body. When these acts are thus carried out rhythmically, the required movements of the artificial member can be executed after the fashion of the natural leg in accordance with prothetic rules.

The characteristic of the invention resides essentially therein that the joint is formed by the mating of two surfaces, one at each extremity of the two united parts, that one which corresponds to the thigh section being similar to that of a parabolic segment, and the section which corresponds to the calf of the leg of equal shape as that of the thigh, but with an entering curve so as to constitute an efficient joint. Both parts of the artificial leg are united by an axle which is fixed to one of them, whereas at the other one it passes through an arcuate groove within which it swivels and moves. An artificial joint made thus enables, as will be shown later on, that the thigh section may have a function of a lever whose fulcrum or point of support is at the axle, the strength at the thigh itself and the resistance to movement being tangent with the two surfaces of the joint, so that, considering the leg in a given angular position, it cannot close farther than the angle at which it may have been placed. In this fashion the corresponding support may be continued to be exercised without danger that the amputee loses stability.

So that the invention may be understood and carried into practice, it has been shown by way of example in various illustrative figures, wherein:

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Figure 1 is a side elevation, partly in section showing the artificial limb in vertical position, and including the knee joint of the present invention.

Figure 2 is a front elevation partly in section of the construction shown in Fig. 1.

Figure 3 is a side elevation similar to Fig. 1 with the sections of the limb in slightly angular position.

Figure 4 is a further side elevation similar to Fig. 3 showing the parts at the limit of their angular movement.

Figure 5 is a detail vertical cross sectional view of the knee joint on a larger scale.

In the different figures of the drawing the same numbers indicate equal or corresponding parts.

The construction illustrated in the accompanying drawing consists of the two principal parts of the leg, the upper one or the thigh portion or section **1** and the lower one or peroneotibial portion or section **2**. The thigh portion possesses an extremity which differs from a spheroid, as it is similar to a paraboloid, the exterior surface **3** of which starts at the level of the kneepan or rotula which we shall call the anterior pole **3a** and it ends at a lower level, at the hind part or popliteal region which we shall call the posterior pole **3b** which is of a minor radius. The second or shin section, viz. the peroneotibial part **2**, has a concave head forming a groove, adjusting itself to the shape of that of thigh section **1**, the surface of which is indicated by the numeral **4**.

The inner or lower portion of the thigh section **1** has disposed therein a slot **5** which, as said portion is hollow, is at each side thereof; said slot **5** follows an arcuate shape in a direction which ascends from rear to in front, as may be seen specially in Figure 5, following preferably a parabolic line. Through this slot **5** there passes axle **6** which is fixed by convenient means to the spaced triangular portions at both sides of the upper end of the shin section **2**. The position of the axle **6** must coincide, when the leg is in a straight position (Figs. 1, 2 and 5), with the anterior end of slot **5**, viz. where it begins.

Between the two parts of the artificial member there may be placed one or more springs, counter weights, linings, packings and other means which are known in this art without novelty resulting therefrom.

The operation is as follows:

In the straight position of the leg, as that of Fig. 1, it will be noticed that the support is normal, there exists an ample contact between the two surfaces **3** and **4** of the groove.

For the act of walking or mounting stair steps the amputee will try to raise the artificial leg, sustaining himself with the other leg. Thus the thigh section will take an angular position as illustrated in Fig. 3, being enabled under such circumstances to support now the body. In this position it will be noticed that due to the shape of surfaces 3 and 4, pole 3^b of the first or thigh section will rest upon a spot of the second or shin section, and that between said spot and the axle 6, there exists a lever arm which tends to prevent the thigh section 1 bending farther than said position upon the calf of the leg 2, as said thigh section 1 cannot turn freely round said axle 6. Obviously when taking the position in question, the head of thigh section 1, besides turning upon axle 6, moved forward along the guides formed by grooves 5.

In the case of Fig. 4 which may correspond to a sitting position of the amputee person, the angular play of the two parts of the artificial member will be limited by the support of thigh section 1 at the posterior edge 4^b of surface 4 which corresponds to the peroneotibial part 2, a support which therefore is at the region of the knee bend or popliteus of the leg, thigh section 1 having moved until axle 6 remains at the other end of grooves 5, forming the secondary support.

In accordance with arthrologic science, natural movements may be readily simulated developing as the amputee acquires practice without danger of possible loss of equilibrium, because, when body weight is imposed upon the orthopedic leg, regardless of its angular position, there always will be produced the double support to which reference has been made as regards the position of Fig. 3.

For the cases of osteectomy or separation of both legs upon the knee, it will be useful to provide artificial legs with a knee joint made in accordance with this invention, as the amputee will readily acquire skill in walking with a rhythmical inclination of the body and of one and the other of the stumps.

It will, of course, be understood that variations may be resorted to within the scope of the appended claim.

I claim:

A knee joint for artificial limbs comprising a shin section having at its upper end a pair of spaced triangular portions bounding a groove, said groove having a longitudinally and transversely concave bottom, the longitudinal curvature being parabolic, a pin seated in both of said triangular portions near their apices and bridging the space therebtween, a hollow thigh section having a lower end fitting into said groove of said shin section when both portions are aligned, the opposed walls of said thigh section having registering parabolic slots receiving said pin, said slots always establishing communication between the interior of said thigh section and the exterior thereof, whereby in any angular relation of said thigh section to said shin portion the imposition of the body weight upon the knee joint causes a frictional coaction between the lower end of said thigh section and a bottom portion of said groove on one hand and between said pin and corresponding walls of said slots to prevent decrease of the angle between said thigh section and shin portion.

ISAAC TOUSON.

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