Sept. 16, 1947. R. E. HUCK 2,427,457

ARTIFICIAL LIMB

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Fig. 1.

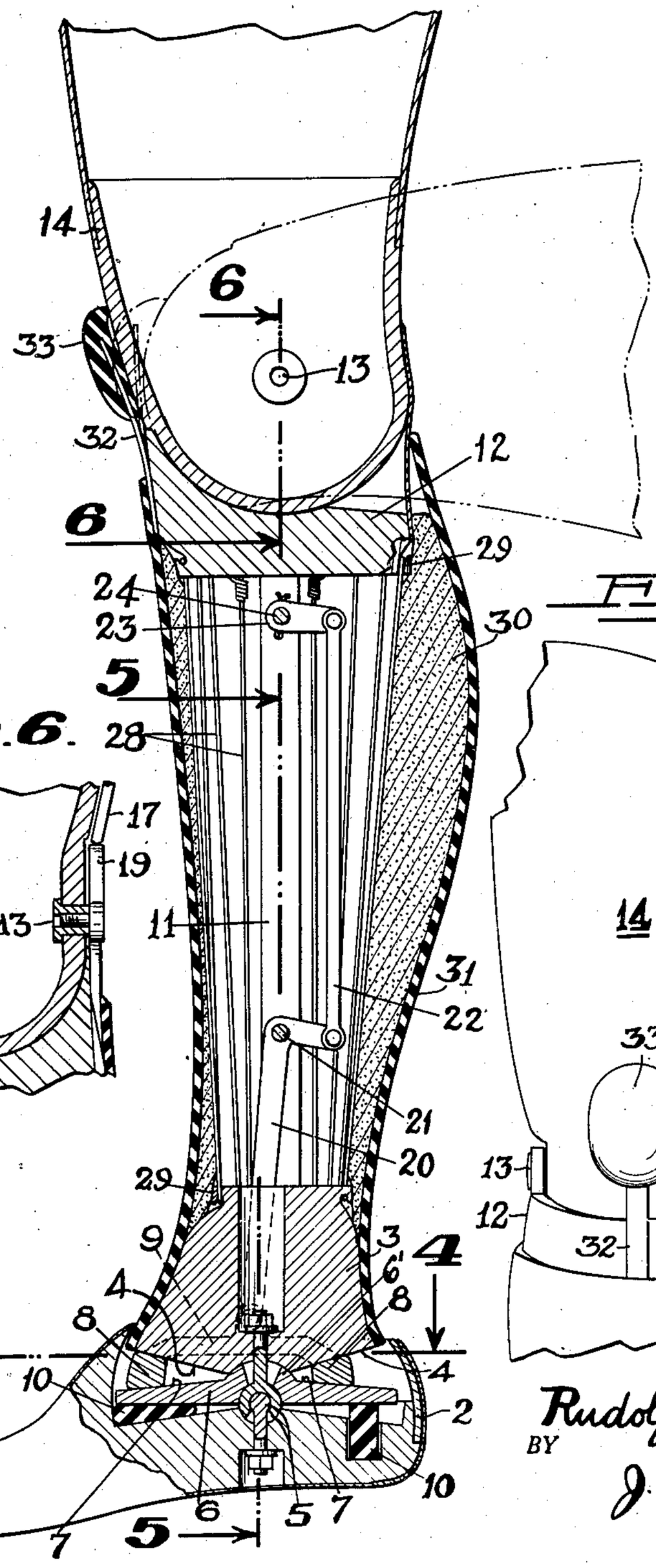

Fig. 6.

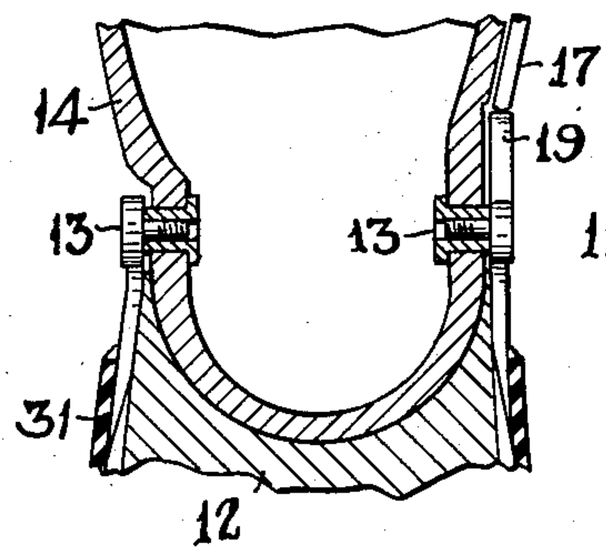

Fig. 2.

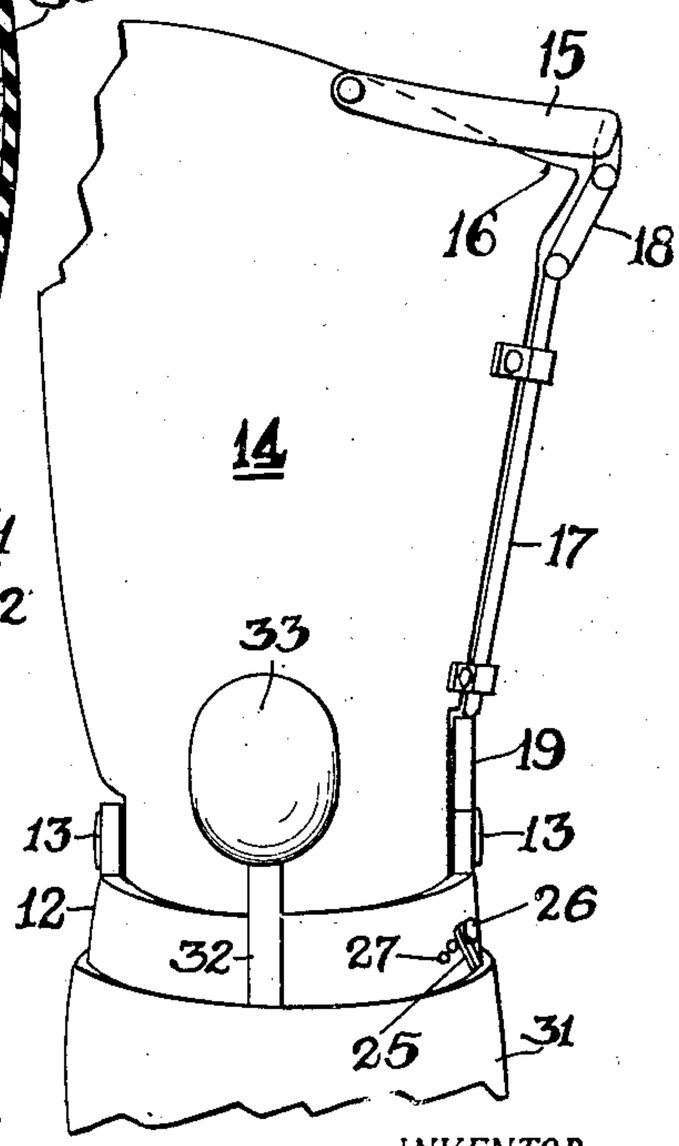

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Fig. 4.

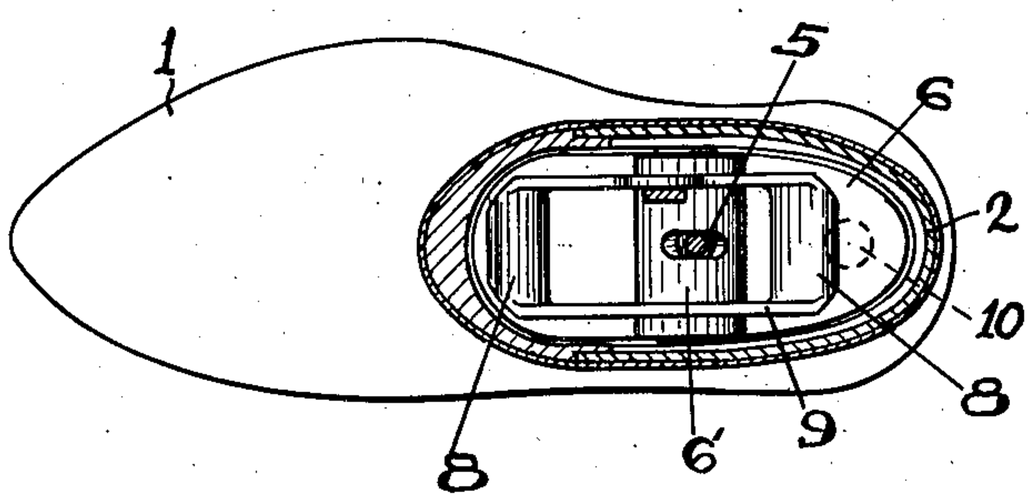


Fig. 5.

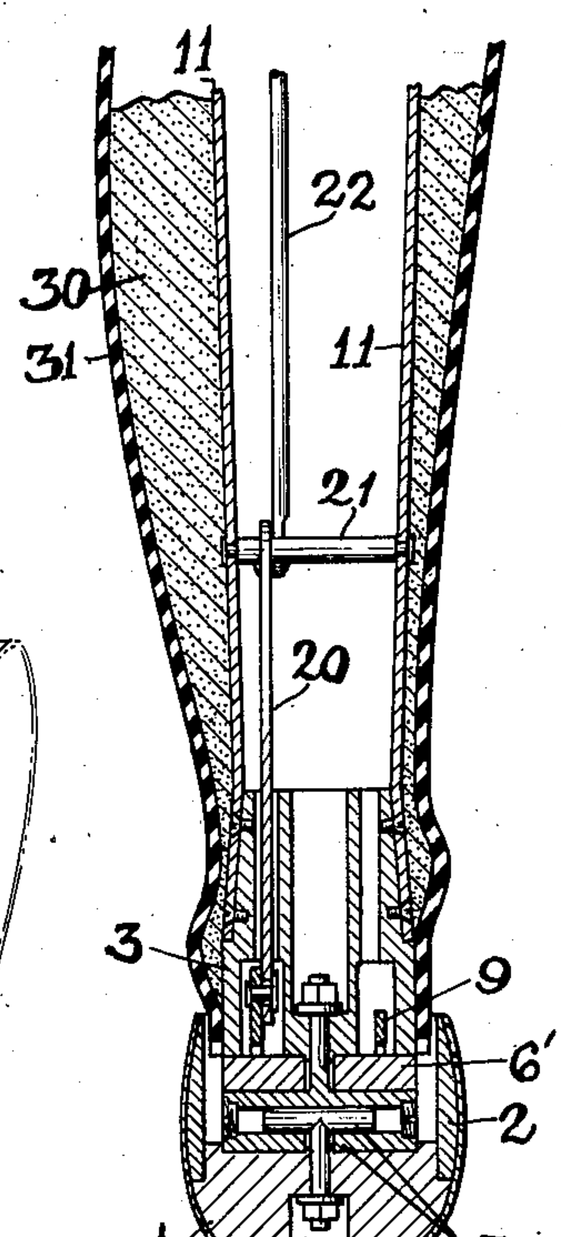
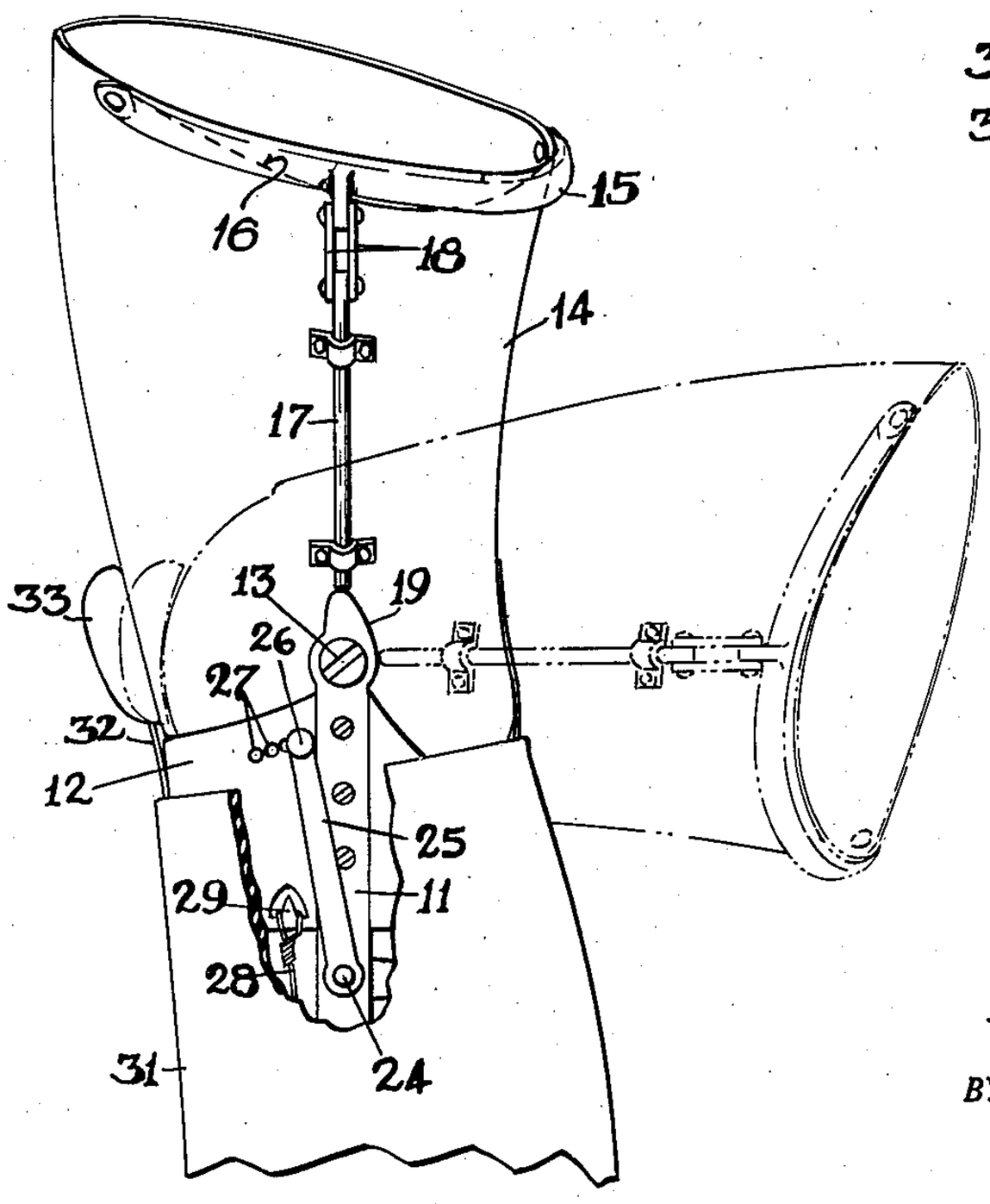


Fig. 3.



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Patented Sept. 16, 1947 2,427,457

UNITED STATES PATENT OFFICE

2,427,457

ARTIFICIAL LIMB

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Application October 16, 1944, Serial No. 558,905

5 Claims. (Cl. 3—2)

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This invention relates to improvements in artificial limbs.

An object of my invention is to provide an artificial leg embodying an improved construction having novel means for adjusting the position of the foot, whereby shoes with heels of varying heights may be comfortably worn.

Another object of my invention is to provide an artificial leg having resilient calf and shin portions which give the leg a natural appearance, eliminate noise ordinarily resulting from contact with solid objects, and reduce damage to silk stockings frequently caused by the breaking or severing of threads when the leg strikes a solid object.

A further object of my invention is to provide an artificial leg having an adjustable kneecap portion which may be selectively positioned to the right or to the left of a vertical center line, whereby the leg may be made to more closely simulate either a left or a right natural leg.

A still further object of my invention is to provide adjustable supporting means at the upper edge of the thigh portion which permits a convenient flexing of the thigh portion with respect to the calf portion without any appreciable forward movement of the knee portion of the leg.

Other and further objects of my invention will be pointed out hereinafter, or will be indicated in the appended claims, or will be obvious to one skilled in the art upon an understanding of the present disclosure. For the purposes of this application I have elected to show herein certain forms and details of an artificial limb which is representative of my invention; it is to be understood, however, that the embodiment of my invention herein shown and described is for the purpose of illustration only, and that therefore it is not to be regarded as exhaustive of the variations of the invention.

In the accompanying drawings:

Fig. 1 is a vertical sectional view of an artificial leg embodying the preferred principles of my invention;

Fig. 2 is a front elevation of the upper part of the leg, showing the means employed for automatically lowering a supporting member at the upper edge of the thigh portion when the leg is flexed;

Fig. 3 is a side view of the upper part of the leg, showing a part thereof broken away and in section;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 1;

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Fig. 5 is a sectional view taken on the line 5—5 of Fig. 1; and

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 1.

Referring to the drawings, the numeral 1 designates a foot portion or member having a recess at its upper side which is enclosed at its rear and opposite sides by a substantially U-shaped member 2. Extending above the recess in the foot member 1 is an ankle portion or member 3 having its lower end formed with a centrally disposed transverse groove and oppositely inclined surfaces 4. Pivotally connecting the ankle member 3 and the foot member 1 is an arrangement comprising means 5 which permits the relative movement of the foot and ankle members about a horizontal transverse pivot. Interposed between the foot and ankle members is an elongated block 6 which is provided with a substantially semi-cylindrical raised central part 6' which fits into the transverse groove in the lower end of the ankle member, and with two oppositely inclined upper surfaces 7 which are positioned directly beneath the oppositely inclined lower surfaces 4 of the said ankle member. The surfaces 5 and 7 are so disposed with respect to one another that two wedge-shaped openings are provided at the front and rear of the pivotal means 5. Adjustably positioned in the wedge-shaped openings and interposed between the inclined surfaces of the ankle member 3 and the block 6 are integrally connected wedge-shaped members 8 of unequal vertical thicknesses and which are formed at the opposite ends of an adjustable carrying frame 9. The frame 9 and wedge-shaped members 8 are capable of being adjusted forwardly and rearwardly. The front wedge-shaped member 8 is of greater thickness than the raer wedge-shaped member. The opposite ends of the block 6 rest on resilient compression members 10 which are supported by the foot member 1. When the frame is adjusted rearwardly to change the position of the wedge-shaped members and cause a rearward tilting of the block 6, the foot member 1 is adjusted about the pivotal means 5 to cause a relative lowering of the toe and a raising of the heel, thereby permitting a shoe with a higher heel to be comfortably worn. An opposite adjustment of the wedge-shaped members 8 will raise the toe and lower the heel, thereby enabling one to comfortably wear a shoe with a lower heel. Suitable means is provided for releasably holding the foot adjusting means in a fixed position, as will be later described.

Secured to opposite sides of the ankle member

3, as by screws, are rigid upright bars 11 which are secured at their upper end to a knee socket 12. Pivotally mounted, as at 13, on the upper ends of the upright bars 11 is a hollow thigh member 14 having an open upper end adapted to receive the stump of a person's leg and a rounded lower end which is movably positioned in the knee socket 12.

Pivotally connected to the thigh member 14 is a substantially semi-circular support 15 which is normally positioned with its central part extending slightly above the inner edge of the thigh member where the latter is cut down, as at 16, to receive the fleshy upper part of the wearer's leg. Slidably mounted on the inner side of the thigh member 14 is a rod 17 which is connected at its upper end by pivotal links 18 to the semi-circular support 15. The lower end of the rod 17 engages with a cam 19 provided on the upper end of the inner upright bar 11. When the artificial leg is used in walking or in supporting a person in a standing position, the semi-circular member 15 is supported at its higher position wherein it extends above the cut down edge 16 of the thigh member 14. It is held in such a position by the lower end of the rod 17 resting on the upper end of the cam 19. As the thigh member 14 is moved rearwardly and downwardly (see Fig. 3) to permit a person to assume a sitting or kneeling position, the lower end of the rod 17 rides downwardly upon the sharply inclined edge of the cam 19, thereby shortening the radial distance between the semi-circular support 15 and the pivot 13 about which the thigh member rotates. Such a movement enables the central part of the support 15 to move about its pivots toward the pivot 13, thus allowing the fleshy part of the person's leg which previously firmly engaged with the semi-circular support to become positioned against the cut down edge 16 of the said thigh member. The result thus achieved is that instead of the knee joint being projected forwardly when a person kneels or sits down, as is customary with the artificial legs now commonly used, the knee joint of the present invention remains in about the same position when a kneeling or sitting posture is assumed. The tissues at or above that upper part of the leg with which the semi-circular support 15 normally engages are allowed to readjust their positions when a sitting or kneeling posture is assumed, this being accomplished without their pressing forwardly against the upper inner edge of the thigh member 14 with a force which would actuate the knee joint in a forward direction. Thus, the automatic shifting or pivotal movement of the semi-circular supporting member 15, when a sitting or kneeling posture is assumed, permits the calf portion and also the knee joint to remain in substantial alignment with the person's natural leg rather than be projected forwardly to an unnatural position.

The means employed for adjusting the positions of the wedge-shaped members 8 and their carrying frame 9 comprises a bell crank 20 pivotally secured to the frame and pivoted on a cross pin 21 secured between the upright bars 11, a connecting rod 22 pivotally connecting the bell crank with a connecting link 23 rigidly secured to a pin 24 which is pivotally mounted near the upper end of the upright member, and a hand adjustable lever 25 rigidly secured to the pin 24. The upper end of the lever 25 is provided with an outwardly disposed knob 26 and with an inwardly protruding projection (not shown) which is arranged to engage with any one of a number of

spaced openings 27 provided in the knee member 12. The hand adjustment of the lever 25 backwardly or forwardly will cause the forward or rearward shifting of the frame 9 and the wedge-shaped members 8, thereby raising or lowering the heel of the foot member 1. The engagement of the inwardly protruding projection of the lever 25 with one of the holes 27 will cause the adjusting means connected to the frame 9 to be held in a stationary position, thereby causing the foot member to be held in its adjusted position.

An open substantially circular resilient framework 28 is provided between the ankle member 3 and the knee member 12 by stringing a wire from one of said members to another and hooking the same over notches or projections 29 arranged in spaced relation around the outer edges of both of said members. The open wire framework 28 provides a support for a tubular resilient calf and shin member 30 which is made from sponge rubber or other suitable material formed in the shape of lower portion of a person's leg. A flexible protective covering 31 of suitable thickness is secured to the member 30, the same extending over parts of the ankle member 3 and the knee member 12. The resilient calf and shin member 30 simulates the yieldable fleshy part of a person's calf, thereby avoiding any appreciable noise when struck by hard objects, and also avoiding the breaking of the threads of silk stockings when encountering such objects. The open wire framework 28 on which the tubular calf and shin member is mounted is yieldable to the extent that it may be temporarily deformed when the lower part of the leg strikes against a solid object. Such a framework contributes to the yieldability of the resilient calf and shin member by providing a resilient core for the said member.

Adjustably secured to the knee member 12 by means of a resilient strip 32 which is normally held in an upright position, as by the inward pressure thereon by the flexible covering 30, is a kneecap member 33. The kneecap member is preferably made of resilient material and is shaped to resemble a person's kneecap when concealed by wearing apparel. The kneecap member 33 is adapted to be shifted to the right or left of a vertical plane extending from front to rear through the leg's axis, thereby giving the leg the appearance of being either a left or a right leg.

What I claim is:

1. An artificial leg comprising a thigh member, a calf member pivotally suspended from the thigh member, an ankle member secured to the lower end of the calf member, a foot member pivotally suspended from the lower end of the ankle member, and adjustable means interposed between the ankle member and the foot member for changing the relative positions of the toe and heel ends of the foot member, whereby the heel end may be raised or lowered to permit the convenient wearing of shoes with high or low heels.

2. An artificial leg comprising a thigh member, a calf member pivotally suspended beneath the thigh member, an ankle member secured to the lower end of the calf member, a foot member pivotally suspended beneath the ankle member, adjustable means interposed between the ankle and the foot members for changing the normal relative positions of the toe and heel ends of the foot member, whereby the heel end may be raised or lowered to permit the convenient wearing of shoes with high or low heels, and securing means connected to the adjustable means for holding the latter in a predetermined adjusted position.

3. In an artificial leg, a thigh member, a calf member pivotally suspended from the thigh member, an ankle member secured to the lower end of the calf member having its lower end formed with a transverse groove and oppositely inclined surfaces extending forwardly and rearwardly from the groove, a foot member pivotally suspended from the ankle member but spaced therefrom, a block arranged for pivotal movement about a transverse axis and positioned between the ankle and foot members and having a transverse protuberance movably positioned in the groove of the ankle member and having oppositely inclined upper surfaces arranged opposite the inclined surfaces of the ankle member, cushion means interposed between the block and the foot member, and adjustable means interposed between the inclined surfaces of the ankle member and the block for adjusting the relative positions of the forward and rear ends of the block and also the toe and heel ends of the foot member, whereby the normal position of the heel end of the foot member may be raised or lowered to permit the convenient wearing of shoes with high or low heels.

4. In an artificial leg, an ankle portion having its lower end formed with a transverse groove and oppositely inclined surfaces extending forwardly and rearwardly from the groove, a foot member pivotally suspended from the ankle portion but spaced therefrom and arranged for pivotal movement about a transverse axis, a block arranged for pivotal movement about the transverse axis and positioned between the ankle portion and the foot member and having a transverse protuberance movably positioned in the groove of the ankle portion, cushion means interposed between and engaging with the opposite ends of the block and the foot member, adjustable means interposed between the block and the inclined surfaces of the ankle portion for adjusting the relative positions of the forward and rear ends of the

block and also the toe and heel ends of the foot member, whereby the normal position of the heel end of the foot member may be raised or lowered to permit the convenient wearing of shoes with high or low heels.

5. In an artificial leg, an ankle portion having its lower end formed with a transverse groove, a foot member pivotally suspended from the ankle portion but spaced therefrom and arranged for pivotal movement about a transverse axis, a block arranged for pivotal movement about the transverse axis and positioned between the ankle portion and the foot member and having a transverse portuberance positioned in the groove of the ankle portion, and adjustable means interposed between the block and the ankle member for adjusting the relative positions of the front and rear ends of the block and also the toe and heel ends of the foot member, whereby the normal position of the heel end of the foot member may be raised or lowered to permit the convenient wearing of shoes with high or low heels.

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