May 12, 1931. J. A. COLLINS 1,804,915

ARTIFICIAL LIMB

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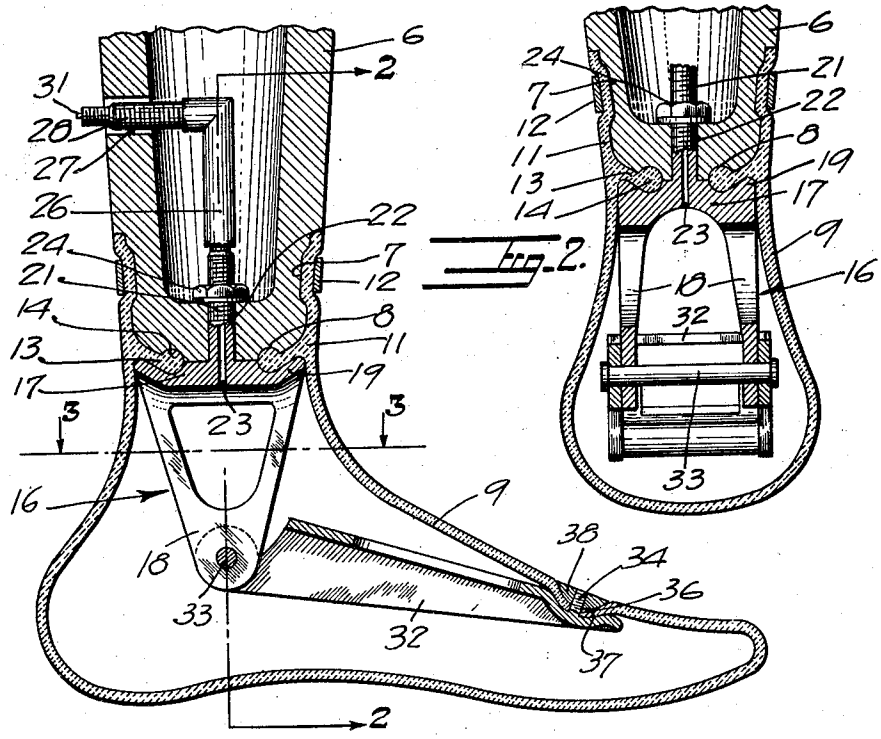


Fig. 1.

Fig. 2.

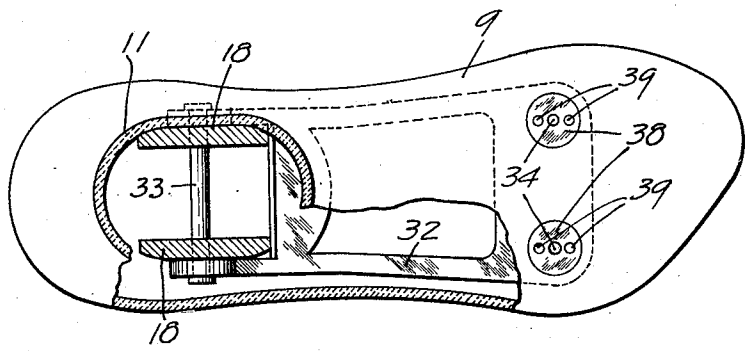


Fig. 3.

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ARTIFICIAL LIMB

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The invention forming the subject matter of this application relates to artificial limbs, and particularly to artificial feet which are inflated so as to offer resiliency and silent operation.

The primary object of the invention is the provision of an inflated, artificial foot, which is so secured to the lower extremity of an artificial leg or stump as to pivot thereon, simulating the natural up and downward turning of the natural ankle.

Another object of the invention is the provision of an inflated, artificial foot, which is readily attachable to an artificial calf or stump, and in which the means securing the same to the stump are adapted to connect the interior of the foot to an inner valve for inflating and deflating the foot at will.

Other objects of the invention are to provide an artificial foot of the character described that will be superior in point of simplicity, inexpensiveness of construction, positiveness of operation, and facility and convenience in use and general efficiency.

In this specification and the annexed drawings the invention is illustrated in the form considered to be the best, but it is to be understood that the invention is not limited to such form because it may be embodied in other forms; and it is also to be understood that in and by the claims following the description, it is desired to cover the invention in whatsoever form it may be embodied.

The invention is clearly illustrated in the accompanying drawings, wherein:

Figure 1 is a vertical, sectional view of the artificial limb.

Figure 2 is a sectional view of the limb, the section being taken on the line 2—2 of Figure 1 and

Figure 3 is a sectional plan view of the artificial limb the section being taken on the line 3—3 of Figure 1.

Referring to the drawings wherein similar reference characters designate similar parts throughout, the various figures described above adequately illustrate my invention, and the following detailed description is commensurate with the above mentioned drawings in enabling an artisan to construct and assemble the same.

In carrying out my invention I make use of a hollow stump 6, the lower end of which is closed. On the said end of the stump 6 is formed a circumferential groove 7, and a substantially elliptical indentation 8. Upon the said end of the stump 6 is disposed an artificial foot 9, preferably made of rubber or other pliant material and being hollow so as to form an inflatable tube. A neck 11 is formed on the ankle portion of the foot 9, the said neck being hollow and being open at the free end thereof.

In order to attach the foot 9 to the stump 6, the neck 11 is stretched and pulled over the end of the stump 6, the material of the foot 9 being pliant it assumes a shape conforming to the contour of the end of the stump 6 at the neck 11 thereof. A band 12 surrounds the outer periphery of the neck 11, opposite the groove 7, whereby the neck 11 is held in said groove 7. On the inner periphery of the neck 11 is formed a collar 13, the opening of which is formed with a bead 14, which bead 14 fits into the indentation 8 of the stump 6. When the neck 11 is positioned in place on the end of the stump 6, then the upper half of the bead 14 is disposed within the indention 8 as shown in Figures 1 and 2.

The firm and final securing of the foot 9 to the stump 6 is accomplished by means of a bracket 16 positioned within the hollow of the foot 9. The bracket 16 comprises a clamping disk 17, and two legs 18 depending from the opposite sides of the disk 17. The upper face of the disk 17 is so shaped as to receive the lower half of the bead 14 and also to form a flange 19 extending toward the corners of the lower extremity of the stump 6, and over the lower face of the collar 13, thus clamping the said collar 13 between the upper face of the disk 17 and the end of the stump 6.

A threaded extension 21 on the upper face of the clamping disk 17 protrudes through an aperture 22 in the end of the stump 6 and extends within the hollow of the stump. The extension 21 has an air passage 23 communicating with the interior of the foot 9. After the extension is inserted into the aperture 22,

then a lock nut 24 is screwed thereon, the stump usually being open on the upper end thereof allows the threading of the nut from said open end by an extension wrench or the like. It is apparent that when the nut 24 is tightened the collar 13 and the bead 14 thereon are firmly clamped by the disk 17 to the end of the stump 6.

After the nut 24 is tightened an elbow 26 is attached to the upper end of the extension 21 and turned so that the horizontal branch thereof is in alignment with a hole 27 in the side of the stump 6; the said branch of the elbow 26 is interiorly threaded to receive a valve stem 28 in which latter is disposed a usual tire valve 31 protruding slightly beyond the outer periphery of the stump 6.

The foot 9 is inflated thru said valve 31 in the usual manner by compressed air, and is firmly held in position by the clamping action of the bracket 16.

The artificial foot is adapted to simulate the upward and downward movement of a natural foot by an arrangement of a lever 32 within the hollow of the foot 9. One end of the lever 32 is pivotally secured to the legs 18 of the bracket 16 by means of a pivot pin 33; the pivoted end of the lever 32 is bifurcated and the legs of the fork end extend outside of the legs 18, thus the upward swing of the lever 32 is limited to a point where it abuts the legs 18. On the free end of the lever 32 are studs 34 extending thru holes 36 in the toe portion of the foot 9. Below the studs 34 the lever 32 is indented to form semispherical concavities thereat denoted by the numeral 37. Semispherical nuts 38 are threaded upon the studs 34 outside the foot 9, so as to impress the material of the foot into said concavity, and firmly hold the same therein.

The semispherical nuts 38 are thus substantially countersunk below the outline of the foot 9. After the foot 9 is assembled on the end of the stump 6 in the aforedescribed manner, it is airtight. The inflation is effected thru the inner valve 31, so that the foot is rendered resilient to a desired degree. After the foot 9 is inflated it assumes the form of a natural foot. In order to facilitate the handling of the nuts 38, the same are provided with holes 39 in the flat outer surface thereof, which holes may be readily engaged by the prongs of a suitable wrench not shown.

It is apparent that escapement of air from the foot 9 is effectively obviated. While walking on the foot 9 the weight is exerted substantially throughout the sole of the foot 9, the resultant of the force thus exerted being located substantially on the line of the bracket 16. The resiliency of the inflated foot 9 prevents any sudden shock or jerk upon the foot 9 and entirely eliminates the attendant noises. The pressure being evenly divided throughout the foot 9 the lever 32 remains stationary. However in the usual course of walking movement the foot is raised forwardly and this results in transfer of weight to the toe portion of the foot 9, the force thus exerted is directed upwardly and causes the turning of the lever 32 around its pivoted end, substantially in the manner of the usual ankle movement. This turning movement is limited by the abutment of the lever 32 against the legs 18 of the bracket 16, transferring a transverse force thereupon and supporting the weight of the body on the toe portion of the foot 9. Then the foot is completely lifted and advanced in the usual manner, at the next step the weight is put again on the heel portion of the foot 9. During the whole movement of the foot the shock created by the placing of the weight thereon is absorbed by the resiliency of its inflated tube structure. Any movement of the foot at the neck 11 thereof relatively to the stump 6 and any leakage thereat is effectively obviated by the aforedescribed positive clamping means.

It will be recognized that a particularly facile device is provided to achieve the noiseless, smooth use of an artificial limb, and one the resiliency of which is determined by the air pressure therein, said air pressure being readily regulated thru the usual tire valve. By the inflatable artificial foot many of the disadvantages of the metal or wooden artificial limbs are entirely eliminated; the device allows the formation of an artificial foot which both in shape and resiliency approximates the comforts of a natural foot and reduces the shock to the stump to a minimum.

Having thus described my invention what I now claim as novel and desire to secure by Letters Patent is:

1. An artificial foot comprising an inflatable foot member, adapted to be secured over the end of a stump, clamping means within the foot member for securing said member to the stump, said clamping means having an air passage therethru, and shut off means in operative relation to the said passage to allow the inflation and the deflation of said member at will.

2. An artificial foot comprising an inflatable foot member on the end of a stump, clamping means disposed within the foot member capable of engagement with the stump so as to secure the foot member thereto and to seal said foot member at the secured end thereof, an element pivotally connected to said clamping means and attached to the toe portion of the foot member for allowing a limited turning movement of the foot member around said clamping means, and means operatively connected to the interior of the foot member for allowing the inflation and the deflation thereof.

3. An artificial foot comprising an inflatable foot member, a neck portion thereon be-

ing secured to a stump, clamping means disposed within the foot member and extending thru said neck portion for attaching the foot member to the stump, and means operatively connected to the interior of said foot member through said neck to allow the inflation and deflation of said foot member and to seal the same.

4. An artificial foot comprising an inflatable foot member, a neck portion thereon being secured to a stump, clamping means disposed within the foot member and extending thru said portion for attaching the foot member to the stump, an element pivotally connected to said clamping means and attached to the toe portion of said member for allowing a limited turning movement of the foot member around said clamping means, and means operatively connected with the interior of said foot member for sealing the same and for allowing the inflation and the deflation of said member.

5. An artificial foot comprising an inflatable foot member, a neck portion thereof being secured upon a stump, a collar formed on said neck portion, clamping means for attaching said collar to the end of the stump, and means operatively connected to the interior of said foot member to allow the inflation and the deflation of said foot member therethru and to seal the same thereat.

6. An artificial foot comprising an inflatable foot member, a neck portion thereon being secured upon a stump, a collar formed on said neck portion, clamping means for attaching said collar to the end of the stump, an element pivotally connected to said clamping means and attached to the toe portion of the foot member for allowing a limited turning movement of the foot member around said clamping means, and means operatively connected to the interior of said foot member to allow the inflation and the deflation of said member therethru and to seal the same thereat.

7. An artificial foot comprising an inflatable foot member, a neck portion thereon being secured to a stump, a collar formed on the inner periphery of said neck, clamping means disposed within the foot member for clamping said collar upon the said stump, said clamping means having a passage therethru, and means connected to said passage for sealing the same and for allowing the inflation and the deflation of said foot therethru.

8. An artificial foot comprising an inflatable foot member, a neck portion thereof being secured upon a stump, a collar formed on the inner periphery of said neck, clamping means disposed within the foot member for clamping said collar upon the end of the stump, an element in said foot member having an end thereof pivotally secured to said clamping means and the other end thereof attached to the toe portion of said foot member so as to allow a limited swinging movement of said foot member around said clamping means, and means operatively connected to said passage to seal the same and to allow the inflation and the deflation of said foot member therethru.

9. An artificial foot comprising an inflatable foot member, a neck portion thereof being secured on a stump, a collar formed on the inner periphery of said neck, clamping means disposed within said foot member for clamping said collar to the stump, said clamping means extending into said stump and having a passage therethru in communication with the interior of said foot member, and means connected to said passage to seal the same and to allow the inflation and the deflation of said foot member therethru.

10. An artificial foot comprising an inflatable foot member, a neck portion thereof being secured on a stump, a collar formed on the inner periphery of said neck, clamping means disposed within said foot member for clamping said collar to the end of said stump, said clamping means extending into said stump and having a passage therethru in communication with the interior of said foot member, an element disposed in said foot member and having an end thereof pivotally secured to said clamping means and the other end thereof attached to the toe portion of said foot member so as to allow a limited swinging movement of said foot member around said clamping means, and means connected to the said passage to seal the same and to allow the inflation and the deflation of said foot member therethru.

11. An artificial foot comprising an inflatable foot member, a neck portion thereof being secured to a stump, a collar formed on the inner periphery of said neck portion, a clamping bracket disposed within said foot member and extending thru said neck into said stump so as to clamp said collar upon the end of the stump, said bracket having a passage therethru communicating with the interior of said foot member, and a valve operatively connected to said passage to seal the same and to allow the inflation and the deflation of the foot member.

12. An artificial foot comprising an inflatable foot member, a neck portion thereof being secured to a stump, a collar formed on the inner periphery of said neck portion, a clamping bracket disposed within said foot member and extending thru said neck into said stump so as to clamp said collar upon the end of the stump, said bracket having a passage therethru communicating with the interior of said foot member, a lever disposed in the foot member having an end thereof pivotally secured to said bracket and the other end thereof attached to the toe portion of said foot member, said lever being

capable of limited pivotal movement on said bracket, and a valve operatively connected to said passage to seal the same and to allow the inflation and the deflation of said foot member therethru.

13. In combination a hollow stump having a side opening thereon, an inflatable artificial foot, a neck of said foot being secured over the end of said stump, a collar formed on the inner periphery of said neck, a bracket disposed within the foot and engaging the inner face of said collar, an extension on said bracket extending thru said collar into the stump, means on said extension to engage the inner end of said stump thereby to secure said clamp to the stump and to clamp said collar thereto, said extension and said bracket having a passage therethru in communication with the interior of said foot, a valve stem attached to said extension having an end thereof in registry with said opening in the stump, and a valve insertable thru said opening into the stem for inflatably sealing said passage.

14. The combination as claimed in claim 13 and a lever disposed in the foot member having an end thereof pivotally secured to said bracket and the other end thereof attached to the toe portion of said foot member, said lever being capable of limited swinging movement on said bracket.

In testimony whereof I have affixed my signature.

JOHN A. COLLINS.