J. T. APGAR.

ARTIFICIAL LEG.

APPLICATION FILED MAR. 5, 1908.

909,859. Patented Jan. 19, 1909.

3 SHEETS—SHEET 1.

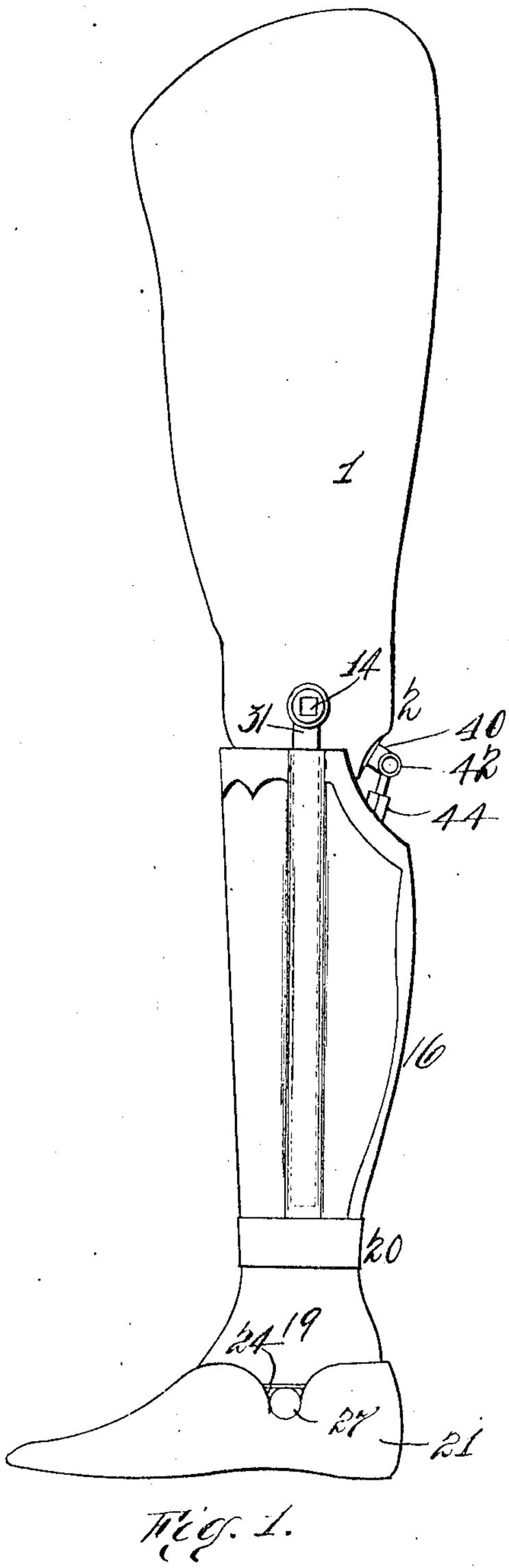

Fig. 1.

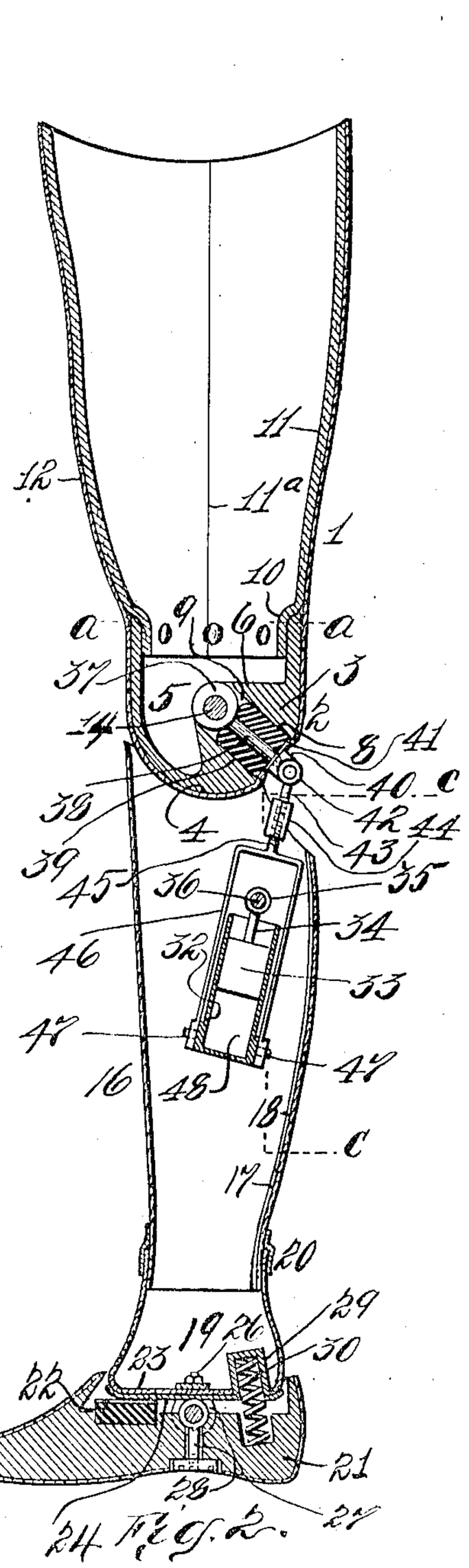

Fig. 2.

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3 SHEETS—SHEET 2.

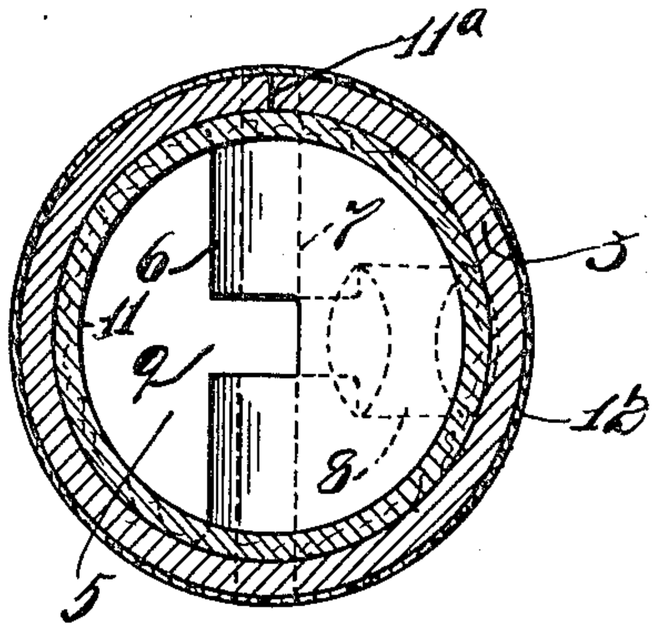


Fig. 3.

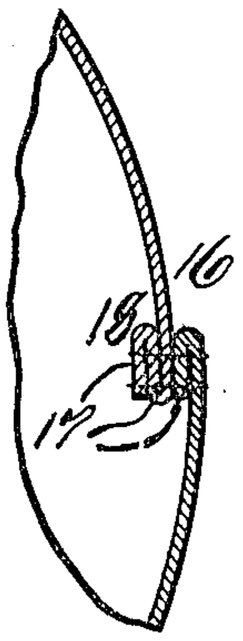


Fig. 8.

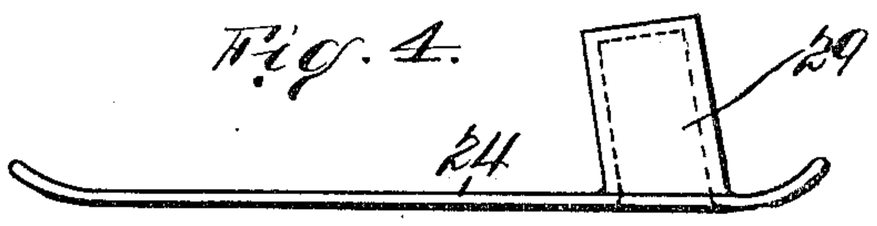


Fig. 4.

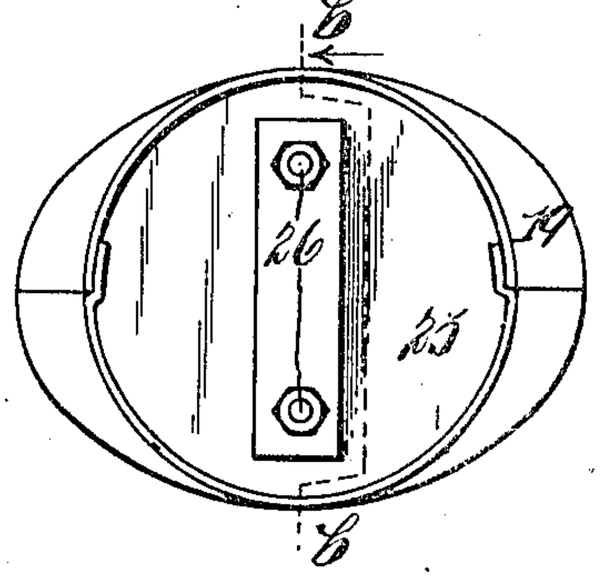


Fig. 6.

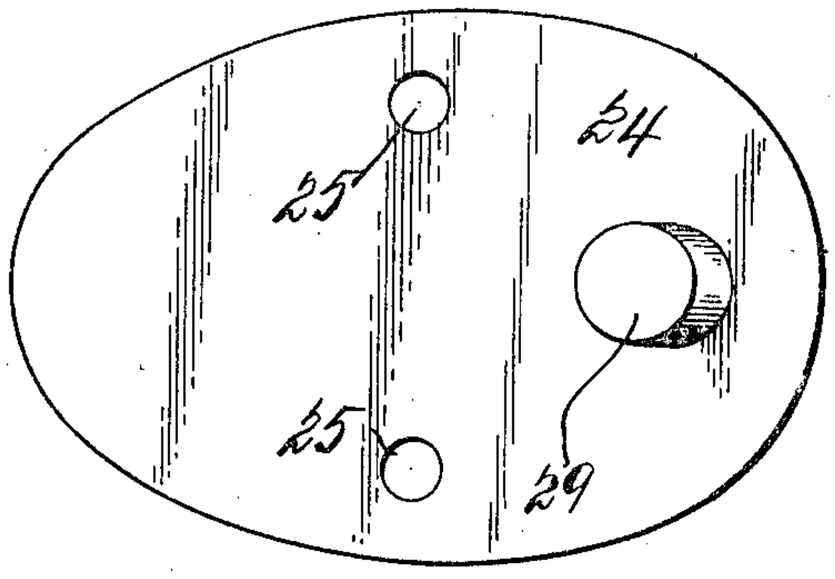
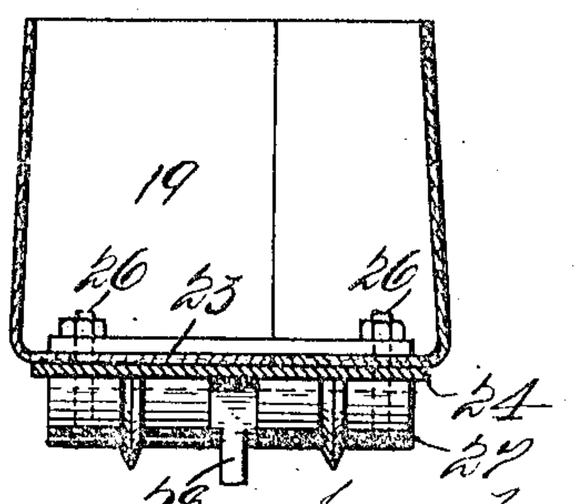


Fig. 5.

Fig. 7.



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3 SHEETS—SHEET 3.

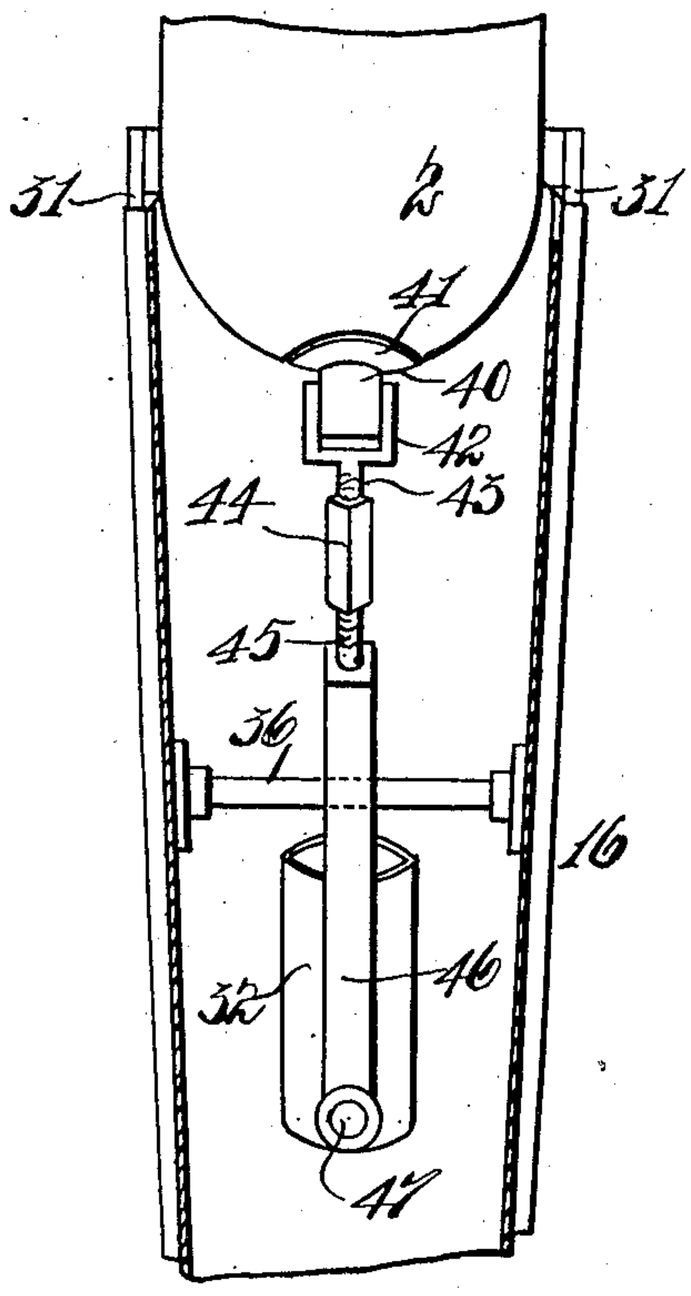

Fig. 9.

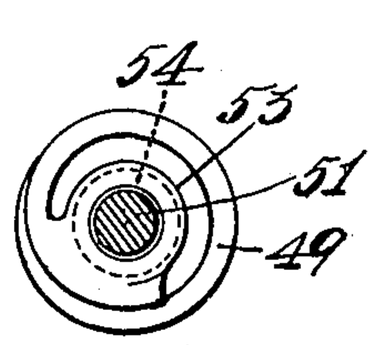

Fig. 11.

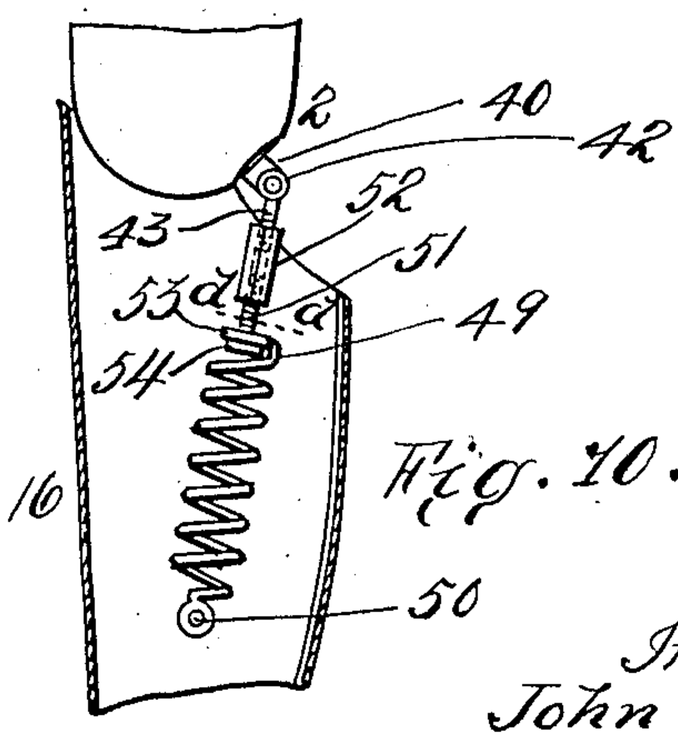

Fig. 10.

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UNITED STATES PATENT OFFICE.

JOHN T. APGAR, OF NEW YORK, N. Y.

ARTIFICIAL LEG.

No. 909,859. Specification of Letters Patent. Patented Jan. 19, 1909.

Application filed March 5, 1908. Serial No. 419,345.

To all whom it may concern:

Be it known that I, JOHN T. APGAR, a citizen of the United States, residing at New York city, borough of Manhattan, county and State of New York, have invented certain new and useful Improvements in Artificial Legs, of which the following is a clear, full, and exact description.

This invention relates to an improved construction in the manufacture of artificial legs.

One of the chief advantages that an artificial leg can present is lightness combined with strength, and every ounce taken from the weight of an artificial leg adds to its value.

To produce a leg, having the above named attributes, I have designed an upper or socket member, of a leg, and a lower leg member which can be formed out of comparatively thin material, such as leather, rawhide, or the like, and held together to form the proper shape without the aid of rivets or metallic welt-strips, at the seams thereof. To further aid in the construction of a light artificial leg, I have designed an ankle portion made from rawhide and having a separably connected metallic wear plate on the bottom thereof.

Other advantages will hereinafter appear, such for instance as a pneumatic cushioning device in lieu of knee-cords, and a wood reinforced knee-portion of special construction.

To these and other ends, which will hereinafter appear, my invention comprises the novel features of improvement and arrangement and combination of parts which I will now proceed to describe and finally claim, reference being had to the accompanying drawings, forming part hereof, wherein—

Figure 1 illustrates a side view of my improved artificial leg; Fig. 2 is a vertical central section thereof, certain parts being shown in elevation; Fig. 3 is an enlarged detail top plan view of the knee portion of my invention, the section being taken on a line *a*—*a* in Fig. 2; Fig. 4 is an enlarged detail side elevation of the wear plate of the ankle portion of my improved device; Fig. 5 is a top plan view thereof; Fig. 6 is an enlarged detail top plan view of the ankle portion of my device; Fig. 7 is a cross section thereof, taken on a line *b*—*b* in Fig. 6; Fig. 8 is an enlarged fragmentary detail view, showing the manner of forming the seam of the lower leg member; Fig. 9 is an enlarged vertical sectional detail view of the leg member, looking from the rear in Fig. 2, the section being taken on a line *c*—*c* in Fig. 2, only a portion of the upper socket member being shown; Fig. 10 is a sectional view, on a reduced scale, and shows another form of cushioning device for the upper socket member; and Fig. 11 is an enlarged top plan sectional view of the spring taken on a line *d*—*d* in Fig. 10.

Referring now to the drawings, particularly to Fig. 2, it will be seen, by those skilled in the art, that my improved upper or socket section 1 is quite different, in construction, from those ordinarily used. It will be seen, in Fig. 2, that the surface of the knee-portion 2 is a continuity of the surface above the said knee-portion; in other words, the whole outer surface of the upper section 1 is a continuous surface. While this feature may or may not be necessary it is the result of my improved construction. The section 1 is built up as follows: I take a wooden block and form it as indicated by 3 (Fig. 2), that is to say I round it, as at 4, and gouge it out as at 5, leaving a bridge piece 6 through which I bore an opening 7. At about an angle of 45° I bore an opening 8, which communicates with a slot 9, the said slot 9 intercepting the opening 8, as shown in Fig. 3. I then take a sheet of leather, for instance, and secure it to the flange 10 of the knee-block 3, by riveting or otherwise, the said sheet having first been molded to the proper shape as indicated by 11, over a plaster cast, the said cast having been made to conform to the shape of the stump of the amputated leg. The socket 11 is butt-jointed, as at 11^a, and may be cemented at said joint, I then take a sheet of raw-hide 12, soften it by soaking in water, and apply it to the outer surface of the socket 11. The covering 12 is cemented, or sewed to the entire outer surface of the socket 11 and wood knee-block 3. After the rawhide covering 12 has dried, it securely binds the socket 11 and knee block 3 firmly together. The joints of the said covering 12 may abut. In the above described manner I am able to make a light durable upper or socket section of an artificial leg. The surface of the covering 12 can be varnished or otherwise ornamented. The knee-block 3 not only serves to reinforce the rawhide and leather at the knee-portion of the upper socket 1, but it

also acts as an anchorage for the pivot-pin 14, for the lower leg section 16. The said pivot pin 14 passes through the opening 7 in the knee-block 3.

In order to make an exceedingly light lower leg member, but yet one that will be strong enough to stand the strain put upon it, I form the said lower leg member out of rawhide. As shown in Figs. 1 and 2 the lower leg member 16 is made from a sheet of rawhide formed by molding or otherwise, to the proper shape. Before shaping the sheet of rawhide I bend the ends, which eventually form the securing seam, to form a plurality of folds 17 (see Fig. 8). After having formed the said folds 17 I shape the rawhide, bringing the folds 17 together to form a seam 18 (Fig. 8). I then preferably stitch the said seam 18. Owing to the folds 17 the seam 18 not only acts as a securing element but also acts as a strengthening strip due to the thickness of the lower leg member at the said seam 18. In the above described manner I obviate the necessity of a metal strengthening strip at the seam of the lower leg member, such a metal strip being usually employed.

To still further carry out one of the objects of my invention, I provide a hollow ankle portion 19, which is preferably formed out of rawhide. The ankle portion 19 is molded or otherwise formed to the proper shape, but differs from other ankle portions in that the bottom thereof is closed. By forming the ankle portion in this manner, and attaching it to the lower leg member 16, as indicated by 20, Figs. 1 and 2, by stitching or otherwise, a very strong structure is provided, also a very light structure. To adapt my improved ankle portion 19 for connection to the foot 21, which is provided with a cushion 22, also to still further strengthen the bottom 23 of the ankle portion 19, I secure to the said bottom 23 a wear-plate 24 which is provided with openings 25, which aline with openings in the bottom 23 of the ankle portion 19. By means of the bolts 26 and nuts thereon, which are carried by the journal-piece 27, the wear-plate 24, journal-piece 27 and the ankle portion 19 are securely held together. The journal piece 27 carries the usual bolt 28 which secures the foot 21 and ankle-piece 19 together, as shown in Fig. 2. The wear-plate 24 is provided with a socket 29, the said socket passing through the bottom 23 of the ankle portion 19, as shown in Fig. 2. The foot 21 carries a resilient element 30 adapted to cushion the backward movement of the lower leg member 16. The wear-plate 24, at its forward end, rests upon the cushion 22.

One of the objects of my improved artificial leg is to eliminate the knee-cords which are employed to check the forward movement of the upper socket member 1 during the action of walking. As a matter of fact, the knee-cords take a considerable part of the weight of the body, when walking, and communicate movement to the lower leg member 16, whereby the said lower leg is caused to swing on the foot 21. One of the objections to the knee-cords is that they stretch and cause the leg members to move too freely, and another objection is that they break, thereby rendering the leg useless. When in the best condition, the knee-cords check the forward movement of the upper socket member 1 too suddenly and jar the wearer. I eliminate these objections in the following manner: It may be here stated that I pivotally secure the upper socket member 1 and lower leg member 16 together by means of the bolt 14 which connects with the side bars 31, one only being seen in Fig. 1. As this connection is usual, no further reference thereto will be made.

The means which I employ, in lieu of knee-cords, comprises a cylinder 32 in which a piston 33 is adapted to work. The piston 33 is provided with a piston rod 34 having an eye 35 at the outer end thereof. A rod 36, which is supported by the wall of the lower leg 16, passes through the eye 35. The piston 34 is loosely mounted on the bar 36 whereby the said piston 33 is free to swing, and accommodate itself to the movement of the upper socket section 1. As has been stated, the cylinder 32 passes over the piston 33, the said cylinder being actuated up or down in the following manner: The pivot pin or bolt 14, the function of which has been described, passes through the eye 37 of a bolt 38. In the socket 8 of the knee-block 3 and surrounding the bolt 38, I place a rubber bumper 39. The bumper 39 aids to break the shock of checking the forward movement of the upper socket member 1. The outer end of the bolt 38 carries an eye 40, which is screwed onto the end of the bolt 38 and against the bumper 39, a washer 41 being interposed. To the eye 40 I pivotally secure a fork 42, (see Fig. 9) the said fork being provided with a spindle 43 which in this instance is threaded right handed. One end of a turnbuckle 44 engages the threads of the spindle 43. The opposite end of the turnbuckle 44 engages the left hand threads of a spindle 45 carried by a yoke 46. The lower end of the yoke 46 is pivotally connected to the cylinder 32 as at 47. The construction of the piston 33 may be one of the many well-known forms adapted to form an air tight contact with the wall of the cylinder 32. In a sitting posture, the upper section 1 will assume a position substantially at a right angle to the lower leg member 1. When the upper section 1 is moving backwardly, to the sitting position, the cylinder 32 will be forced downwardly, and as the

said cylinder is open at the top thereof there will be no cushioning effect to resist the backward movement of the upper section 1.

To change from a sitting position to a standing position, the upper socket portion 1 will move upwardly, thereby pulling the cylinder 32 upwardly. As the cylinder 32 travels upwardly from the sitting to the standing position, there will be a compression of the air in the cylinder 32, but the compression will not be enough to annoy the wearer of the leg. When the upper member 1 reaches a vertical position, as shown in Fig. 2, the compression of the air in the cylinder 32 will commence to be evident. As the wearer of an artificial leg takes a step forward with the right leg, supposing the artificial leg to be the left, the upper section 1 will move forward as will also the lower leg member 16. The forward movement of the lower leg section is dependent upon the movement of the upper section, and the movement of the upper section is transmitted to the lower leg member through the air cushion in the chamber 48. A peculiar condition existing in an artificial leg, is that the lower leg member tends to move backwardly after having been moved slightly forward by the commencement of the forward movement of the upper socket member. The pivotal connection at the knee-portion of the leg is responsible for this action. If this opposite movement of the upper socket member and lower leg member can be accomplished with ease and yet to a somewhat limited extent the wearer of the leg derives very much benefit therefrom. The fact that the lower leg member cannot go backwardly, in the usual artificial leg, at the proper time, due to the non-resilient knee-cords, tends to tire the wearer. The pneumatic cushion employed in my improved artificial leg permits of the aforesaid opposite movement, for the reason that when the lower leg member tends to move backwardly and the upper socket is moving forwardly the cylinder 32 will move upwardly, thereby increasing the tension of the air cushion. The increasing of the tension of the air cushion will be gradual, and not abrupt.

In Fig. 10 I have shown a spring 49, which at its lower end is attached to a rod 50 carried by the wall of the lower leg member 16. The action of the spring will be the same as the air cushion hereinbefore described. The spindle 51 carried by the turnbuckle 52 has a sliding connection with the eye 53 of the spring 49 in order that the spring will offer no resistance to the upper socket section, when said upper socket moves backward to the sitting position. The spindle 51 carries a button 54 which impinges the end of the spring as soon as the upper section assumes a vertical position.

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

1. In an artificial leg, a hollow rawhide ankle portion, a wear plate carried by said ankle portion at the lower end thereof, and a journal piece carried by said wear plate.

2. An artificial leg-member, composed of rawhide, molded to form a hollow structure, said structure having a securing seam, said seam composing a plurality of folds of raw hide, adadpted to form a strengthening strip.

3. In an artificial leg, a lower leg member comprising a rawhide structure having a securing seam, a rawhide strengthening strip therefor, a hollow rawhide ankle portion having a closed bottom, and a journal piece carried by the closed bottom of said ankle portion.

4. An artificial leg member, comprising a rawhide structure, the said rawhide structure having a seam reinforced by rawhide.

Signed at New Yok, N. Y., this 4 day of March 1908.

JOHN T. APGAR.

Witnesses:
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