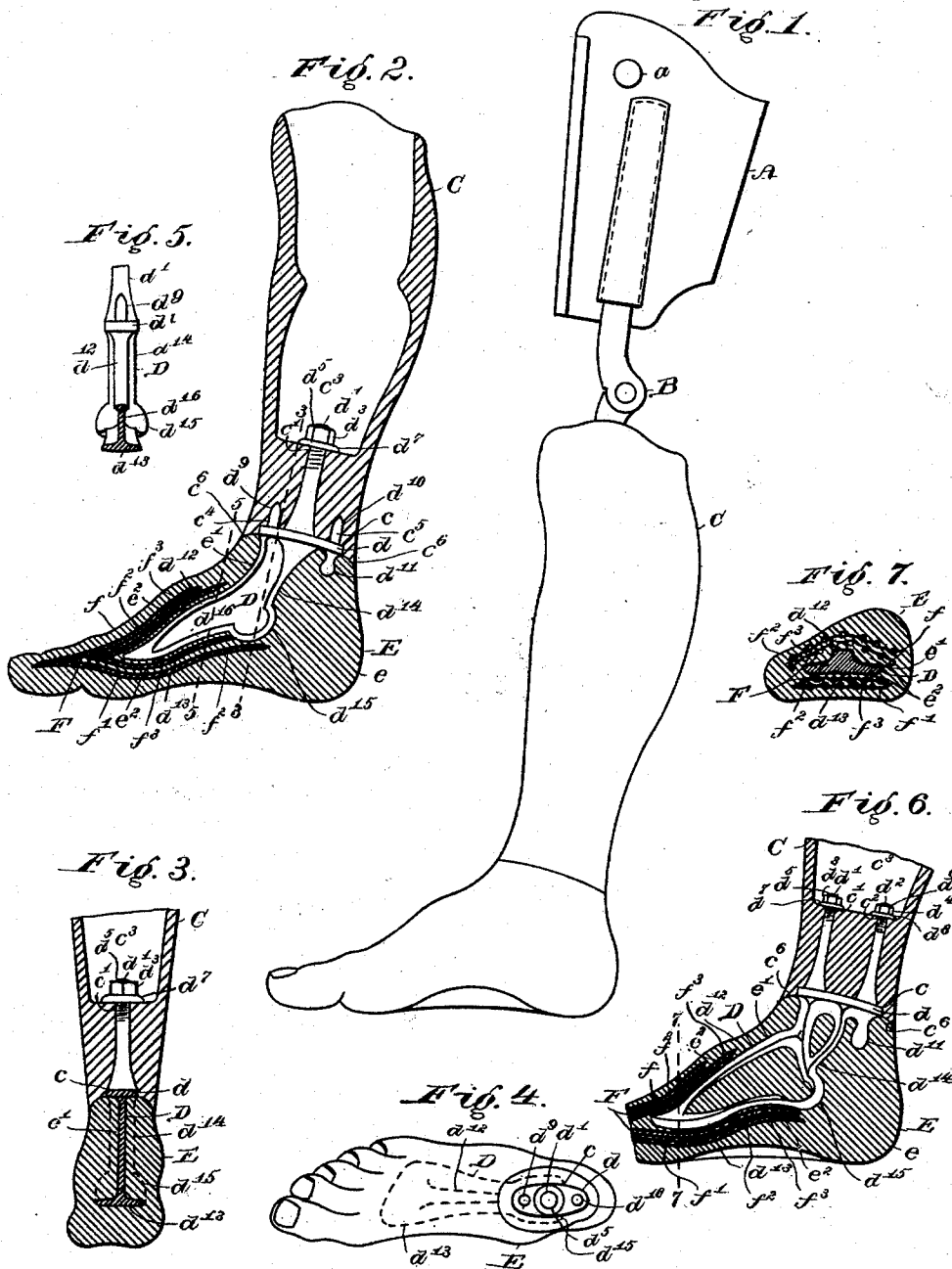


(No Model.)

W. ANDREWS.
ARTIFICIAL LEG.

No. 518,658.

Patented Apr. 24, 1894.



WITNESSES.

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ARTIFICIAL LEG.

SPECIFICATION forming part of Letters Patent No. 518,658, dated April 24, 1894.

Application filed September 30, 1892. Serial No. 447,388. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM ANDREWS, a citizen of the United States, residing at Lowell, in the county of Middlesex and Commonwealth of Massachusetts, have invented a certain new and useful Improvement in Artificial Legs, of which the following is a specification.

My invention relates to artificial legs and comprises means of making the adjacent surfaces of the foot and leg proper continuous with each other at all times; an improved construction of the core; means of securing the core to the leg; means of securing the elastic envelope to the core; means of securing a greater elasticity of the heel portion of the foot and thereby of improving the action of the foot; and an improved construction of the toe-spring.

In the accompanying drawings, Figure 1 is a side elevation of a leg constructed in accordance with my improvement; Fig. 2, a vertical longitudinal section of a leg and foot embodying said improvement; Fig. 3, a section on the line 3 3 in Fig. 2; Fig. 4, a plan of the foot, detached, showing the means by which it is secured to the leg; Fig. 5, a transverse section on the line 5 5 in Fig. 2 of the core, the upper part of the attaching-bolt being broken away; Fig. 6, a vertical longitudinal section of a part of the foot and the adjacent part of the leg, showing a modification of the core; Fig. 7, a transverse section on the line 7 7 in Fig. 6.

The thigh-piece A, provided with buttons a , to engage a strap passed over the shoulder of the wearer, the metallic hinge B, uniting the lacer or thigh-piece A to the shell or socket C and said shell C are of any usual construction and operation, except that the lower end of said shell is adapted to receive the core-bolts, steady-plate and steady-pins and the upper part of the elastic envelope of the core as hereinafter described.

The core D of the foot herein described is rigidly secured to the leg or shell C and the absence of an ankle-joint is compensated for by the elasticity of the heel and toe-portions of the foot. The core D is preferably of aluminum or any of its alloys, combining sufficient strength with small weight, and is provided at the top with an oblong steady-plate

d which enters and fits a corresponding recess c in the lower end of the shell C and with one or more vertical bolts d' d^2 (one being shown in Fig. 2 and two being shown in Fig. 6), said bolts passing up through holes c' c^2 in the lower end of said shell into the cavity c^3 of said shell and being held therein by nuts d^3 d^4 which engage the threaded upper ends d^5 d^6 of said bolts and are turned down upon washers d^7 d^8 surrounding said bolts and resting upon the bottom of said cavity c^3 . The oblong shape of the steady-plate tends to prevent the core D and shell C from turning on each other and this purpose is further served, where but a single core-bolt d' (Fig. 2) is used, by one or more steady-pins d^9 d^{10} , projecting upward from the steady-plate and entering corresponding holes c^4 c^5 in the lower end of the shell.

To the under side of the steady-plate d is secured a downwardly-projecting pin or knob d^{11} which serves to hold the elastic envelope E, hereinafter described, more securely in place and to prevent the same from buckling or bending laterally. The body of the core D below the steady-plate d has a front d^{12} or instep portion which runs from the steady-plate forward and downward, substantially parallel with the instep of the finished foot to the ball of the same, a sole d^{13} which extends from the ball of the foot to a point below and in front of the ankle-joint, and a back d^{14} which extends from a point in the rear of the sole d^{13} to the bottom of the steady-plate, the junction of said sole and back being a curved protuberance d^{15} which serves as a backing or resistance for the heel cushion e hereinafter described. The sole d^{13} of the core is widest at the ball of the foot and is gradually narrowed toward the resistance d^{15} which is broadened out laterally to support the pressure of said heel-cushion.

The front d^{12} , sole d^{13} and back d^{14} of the core may be connected by a thin vertical web d^{16} , as in Figs. 2, 3 and 5, to strengthen the core, or the other parts of the core being made of sufficient strength, said web may be omitted and the open space left by such omission filled with the elastic material which forms the envelope, as shown in Fig. 6.

All the parts of the core, the core-bolts, steady-plate, steady-pins (if such are used)

and the knob d^1 are rigidly secured to each other, preferably by casting all of the same in one piece.

After the core is properly formed, by means of a suitable rubber cement, a thin layer e' of rubber which becomes hard when vulcanized is applied to the entire surface of the core below the steady-plate d , so that said layer e' becoming rigid may remain in place and prevent any slipping on the core of the succeeding layers of rubber, and another thin layer e^2 of rubber which becomes soft and spongy when vulcanized is laid over the core from the instep to the back of the core and the toe-spring F is cemented to the layer e' of sponge-rubber. The toe-spring has two members, the upper f of which extends from about the instep of the finished foot beyond the front end or toe of the core D , the lower member f' extending from the front end of the upper member about to the resistance d and each member consisting of two or more rows of cords $f^2 f^3$, the cords of each row being arranged at intervals from each other and embedded in rubber which becomes hard and springy when vulcanized, and the cords of one row being arranged opposite the intervals between the cords of the other row of the same member and each row being separated from the other row of the same member by a thin layer of soft or sponge-rubber. The hard rubber is by any suitable means caused to completely surround each cord of the toe-spring.

I do not herein claim any combination which includes the toe-spring because I have shown, described and claimed substantially such a spring in combinations similar to those herein shown and described in another application, Serial No. 429,281, filed by me April 15, 1892, and now pending. By the arrangement above described a stronger and more elastic spring can be made by the use of a greater number of smaller cords. After the toe-spring is in place, said toe-spring and the core up to the bottom of the steady-plate are covered with an elastic envelope E , preferably rubber which becomes sponge-rubber when vulcanized and the envelope is made in a suitable mold to take the shape of the natural foot, then vulcanized in the usual manner, the top of the foot, where it joins the leg, being left substantially flat. The top of the foot, when the foot is attached to the leg, is so compressed into a concavity c^6 with which the lower end of the leg or shell is provided that the pressure upon any part of the rubber envelope will not draw any other part of said envelope away from the lower end of said shell and that a compression of any part of the envelope will not cause it to roll over the lower end of said shell. By this means the adjacent surfaces of the leg or shell and of the foot are kept continuous with each other at all times. This construction of the shell, with a concavity c^6 into which the top of the rubber envelope is compressed, is

equally applicable to a foot movably jointed to such shell.

It will be seen that the construction described secures a very large heel-cushion e , the rear portion of the foot, back of the place of the ankle-joint in the natural foot, being nearly all rubber, and prevents any shock when the foot is placed with considerable force upon the ground, as in jumping, and that said heel-cushion e with the elastic toe-spring enables the natural walk to be very closely imitated without the use of an ankle-joint.

The elastic envelope of sponge-rubber adheres sufficiently to a wooden core although liable to separate from a metallic core, but by placing a layer of hard rubber next the metallic core, the envelope may be properly secured, the hard rubber adhering to the metal and the sponge-rubber to the hard rubber. It will be understood that every layer of rubber is cemented to the next inner layer, in the usual manner.

I claim as my invention—

1. The combination of the shell, an elastic envelope, an inelastic core arranged therein and an attaching-bolt, rigidly secured to said core and entering said shell, as and for the purpose specified.

2. The combination of the shell, an elastic envelope, and a metallic core, provided with an attaching-bolt and with steady pins formed in one piece with said core, as and for the purpose specified.

3. The combination of the shell, an elastic envelope and a core, provided with an attaching-bolt and with an oblong steady-plate, arranged to enter and fill a recess with which the lower end of said shell is provided, and a downward projection secured on said steady-plate to enter said envelope, as and for the purpose specified.

4. An artificial foot consisting of an inelastic core and an elastic envelope of the shape of the natural foot, the bottom of said core extending from below the place of the natural ankle-joint to the ball of the foot and said elastic envelope filling the entire space back of the place of said natural ankle-joint, as and for the purpose specified.

5. The combination of the leg or shell, having a concavity in the lower end and a foot attached to said leg and having an elastic upper surface compressed into said concavity, as and for the purpose specified.

6. The combination, in an artificial foot, of the core, a layer of hard rubber next the core and an outer elastic covering, as and for the purpose specified.

In witness whereof I have signed this specification, in the presence of two attesting witnesses, this 26th day of September, A. D. 1892.

WILLIAM ANDREWS.

Witnesses:

ALBERT M. MOORE,
MYRTIE C. BEALS.