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ARTIFICIAL LIMB AND METHOD OF MAKING THE SAME

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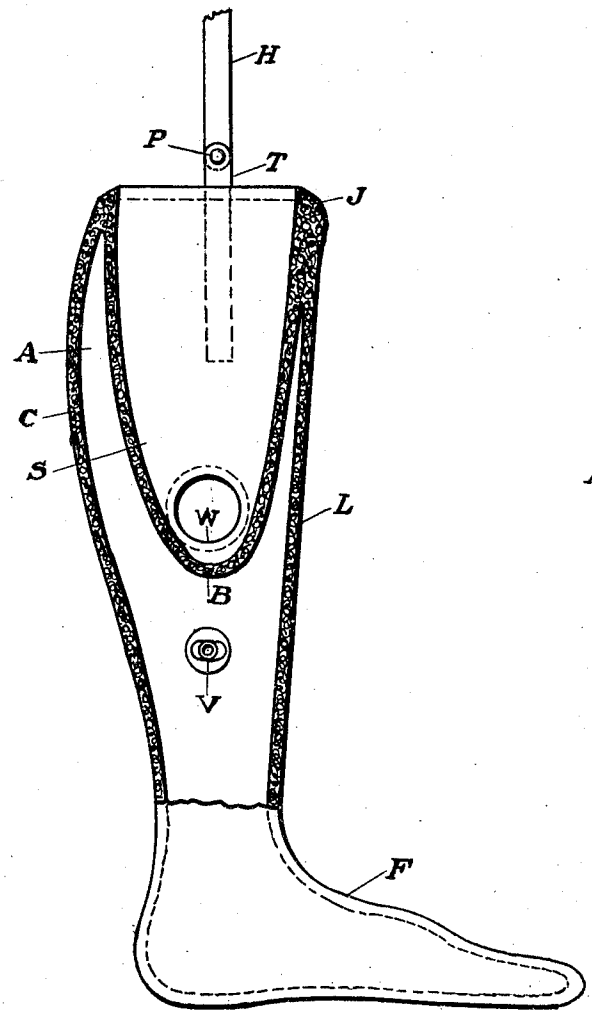


Fig. 1.

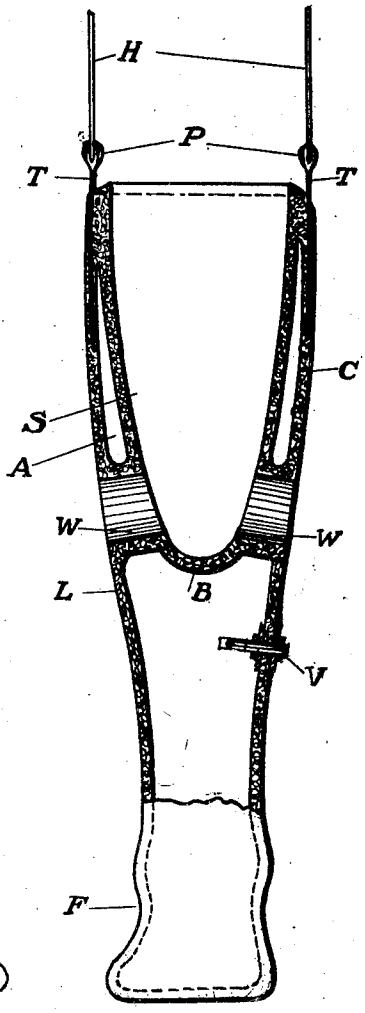


Fig. 2.

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UNITED STATES PATENT OFFICE.

ALBERT ROBERTS, OF WASHINGTON, PENNSYLVANIA.

ARTIFICIAL LIMB AND METHOD OF MAKING THE SAME.

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To all whom it may concern:

Be it known that ALBERT ROBERTS, a citizen of the United States, residing at Washington, in the county of Washington, State of Pennsylvania, has invented certain new and useful Improvements in Artificial Limbs and Methods of Making the Same, of which the following is a specification.

This invention relates to artificial limbs and more especially to inflatable artificial legs especially adapted for attachment to stumps of legs amputated below the knee joint, but it will be understood that certain features of the invention are of general application in artificial legs or arms amputated above as well as below the knee or elbow joints.

Artificial limbs have heretofore generally been made of wood or similar material which splits or is easily broken in use. Such limbs are comparatively heavy and it therefore becomes difficult if not practically impossible to secure the limb so tightly to the body that the weight of the limb will not pull the socket away from the stump a slight amount at every step. This produces friction on the stump when walking, and causes considerable irritation of the stump.

It is, therefore, a primary object of this invention to provide an artificial limb that is both durable and light and of material that will withstand changes in atmospheric conditions without splitting or breaking.

Another object of this invention is to provide an artificial limb that is comparatively inexpensive, readily attachable and detachable, and provided with suitable ventilating means for the stump socket.

The above and other objects and the novel features of the invention will be apparent from the following description taken with the accompanying drawings, in which—

Fig. 1 is a vertical sectional view of an artificial leg embodying my invention.

Fig. 2 is a vertical sectional view of the same taken along a plane perpendicular to the plane of Fig. 1.

Referring to the drawing, L designates the leg generally which is hollow, composed of rubber treated fabric, the rubber being vulcanized into union with the fabric, producing a relatively stiff but inflatable material known as rubberized fabric.

The leg L consists essentially of a hollow foot section F, a hollow calf section C and a hollow stump socket section S, each of such sections being built up of a suitable resilient durable, relatively stiff or rigid inflatable material.

The several sections may be built up separately or the foot and calf sections may be formed simultaneously and the stump socket united thereto, or in any other desirable manner.

As herein disclosed for the purposes of illustration, the hollow foot section and hollow calf section are built up simultaneously on a suitable form, for example, by winding upon a suitable metal or wooden form, a suitable number of plies of rubberized fabric of the necessary resiliency, strength and stiffness, to sustain the weight of the person for whom the limb is designed. After being built up by this winding method, the rubber fabric is vulcanized. The artificial leg may also be made by molding the inflatable material over a form, but the method disclosed is the more desirable one, as far as I am now aware. Thus the foot and calf sections are continuous or integral with one another inasmuch as their walls merge into one another. The danger of breaks, leaks, etc., is thereby eliminated. If desired, the bottom or sole of the foot section may be reinforced in any suitable way, as by being made of a greater number of plies, by having wearing material incorporated therein, by having a facing of wearing metal or other material.

The stump socket S, also built up of plies of vulcanized rubber fabric, extends into the upper end of the calf section C, the socket S and calf section being integrally united and vulcanized together at their upper end, providing a thick stiff annular joint or union J. This joint J gradually increases in width from the rear to the front of the leg as seen in Fig. 1, because the front of the stump requires more support to give steadiness in walking. The walls of the stump socket are spaced from the inside wall of the calf section leaving an annular air space A between the stump socket and calf section, which enables the formation of an air cushion for the stump socket when the calf section is inflated. Suitable means may be provided whereby

the hollow calf and foot sections may be simultaneously inflated, for example, a single valve V of any suitable or preferred construction may be vulcanized in place in the outer side wall of the calf section.

The stump socket is desirably, though not necessarily, provided with ventilating means, and the inner or lower end of the stump socket is desirably, though not necessarily, provided with additional supporting means and the leg with reinforcing means. In the drawing I show a highly satisfactory method of providing such ventilating means and at the same time providing supporting, spacing and centering means for the lower end of the stump socket and reinforcing means for the calf section. Hollow cylindrical webs or bridges W are joined at their inner ends to opposite outer sides of the stump socket at points a slight distance above the extreme lower end or curved bottom B of the stump socket. The webs are inclined downwardly and outwardly and secured at their outer ends, as by vulcanizing, to the walls of the inner and outer sides of the calf section. The hollow webs provide ventilating passages which both open into the lower portion of the stump socket and to the outside atmosphere at the inner and outer sides of the calf section about midway between the top of the calf section and the foot section.

The ventilating openings W may desirably be formed by small tubes or valves vulcanized to the stump socket and to the sides of the legs. These ventilators may be regulated to hold a certain air pressure. For example, for a 250 pound man they may be regulated so as to hold 20 pounds pressure, and a proportionately lower pressure for a lighter man. These ventilators are located at the sides of the leg, instead of the front and back, so as to strengthen rather than weaken the structure and so that, in walking, the forward and backward movement of the leg will not wear or break them. By inclining the ventilators and the webs thereof downwardly, an additional reinforcing effect is obtained for the stump socket and entire structure.

Suitable hinge straps T of metal or other suitable material may be embedded or vulcanized into the thickened upper end of the calf section, at the opposite inner and outer sides thereof, whereby the leg may be suitably connected or pivoted at P to the usual harness or other securing device H carried on the body.

It will be seen that numerous desirable results are obtained by the advantageous construction and arrangement of features disclosed. The herein disclosed artificial leg is designed so that it may be much lighter, more comfortable and easier to manipulate than those heretofore used. By proper selection of rubberized inflatable fabric or material, the leg may be made as resilient and yet as rigid or stiff as desired, as well as durable and inexpensive. The stump socket fits the stump snugly at all times, thus avoiding friction and irritation of the latter, and the pneumatic foot permits the wearer to walk as if on a natural limb, with a springing stride.

While I have shown and described the various advantageous features of the leg in detail, the same principles may be applied to artificial arms, and generally to limbs whether amputated above or below the knee or elbow joint, and therefore, I do not wish to confine myself to the details disclosed as it will be understood that changes may be made in the limb as disclosed, without departing from the spirit of my invention.

I claim:

1. An inflatable hollow artificial limb comprising a hollow foot or hand section, a hollow calf or arm section, a stump socket section fitting into said calf or arm section, said sections being integrally united and consisting of yieldable material, and a single inflating valve for said limb.

2. A hollow artificial leg or the like comprising integrally connected hollow foot and calf sections, and a stump socket integrally connected to and closing one end of said calf section, said integrally connected stump socket and calf section consisting of the same kind of material.

3. A hollow artificial leg or the like comprising integrally connected hollow foot and calf sections of vulcanizable material, and a stump socket of vulcanizable material fitting into and closing one end of said calf section and vulcanized thereto.

4. A hollow inflatable artificial leg or the like comprising integrally connected hollow foot and calf sections of vulcanizable material, a stump socket of vulcanizable material fitting into and closing one end of said calf section and vulcanized thereto, and an inflating valve for said leg.

5. An artificial limb comprising an inflatable section, a stump socket united at its upper end to said section and extending into one end thereof but having its inner end spaced therefrom and a web or bridge joining said inner end of said socket to said section.

6. An artificial limb comprising an inflatable section, a stump socket united to said section and extending into one end thereof but having walls spaced from said section, a reinforcing bridge or web joining said socket to said section, and means which will permit the inflation of said section.

7. An artificial limb of vulcanizable material comprising a calf section or the like and a stump socket section therein and vulcanized thereto, and spaced therefrom by

web reinforcing means vulcanized to said sections.

8. An inflatable artificial limb of vulcanizable material comprising an inflatable calf section or the like, a stump socket section therein and vulcanized thereto, and means spacing the inner end of said stump socket from the inner wall of said calf section.

9. An artificial leg comprising a limb section of vulcanizable material, a stump socket section of vulcanizable material vulcanized to said limb section, said socket section depending into said limb section but spaced from the wall of the latter, and hollow webs vulcanized to said stump section and said limb section and respectively opening into said socket and exteriorly of said limb section so as to constitute ventilating passages for said stump section.

10. An artificial limp comprising a limb section, a stump socket secured to and disposed in the upper end thereof, and a ventilating passage having communication with said socket and extending outwardly laterally through said limb section.

11. An artificial limb comprising a limb section, a stump socket secured to and disposed in the upper end thereof, and ventilating means for said socket comprising passages communicating with said socket adjacent the lower end thereof.

12. An artificial limb comprising a limb section, a stump socket secured to and disposed in the upper end thereof, and a ventilating conduit or passage having walls connecting the stump socket and wall of the limb section and constituting a reinforcing means therefor.

13. An artificial limb comprising a limb section, a stump socket secured to and disposed in the upper end thereof, and ventilating passages extending from adjacent the lower end of said stump socket to the inner and outer sides respectively, of said limb section, such passages comprising walls united to said socket and limb section and serving as reinforcing webs therebetween.

14. An artificial leg comprising a hollow foot section, a hollow calf section and a stump socket section, such section consisting of inflatable rubberized fabric integrally joined together as a unitary body, said stump socket extending into the upper end of said calf section but having the wall thereof spaced from the inside wall of said calf section, ventilating passages leading from said stump socket, at a point slightly above the lower end thereof, downwardly and outwardly to the outer and inner sides, respectively, of said calf section, the walls of such passages being integrally united to said stump socket and said calf section and constituting reinforcing webs between said stump socket and calf section, and a valve in said calf section whereby the latter as well as said foot section and the space between said socket section and calf section may be inflated.

15. The method of making artificial limbs that comprises winding rubberized fabric upon a suitable structure to form a foot and calf section or the like having a continuous wall throughout, inserting an inflating valve in said wall and vulcanizing said wall, and fitting a stump socket within the upper end of said wall and vulcanizing the socket to said wall.

16. The method of making artificial limbs that comprises forming a stump socket, and an integrally connected hollow leg or arm section and hollow foot or hand section, all of vulcanizable material, fitting said stump socket in the upper end of said leg or arm section and spaced therefrom, and vulcanizing together the upper ends of said stump socket and leg or arm sections.

In testimony whereof he hereunto affixes his signature.

ALBERT ROBERTS.