(No Model.)

U. TANNER.

ARTIFICIAL LEG.

No. 473,097. Patented Apr. 19, 1892.

Fig. 1.

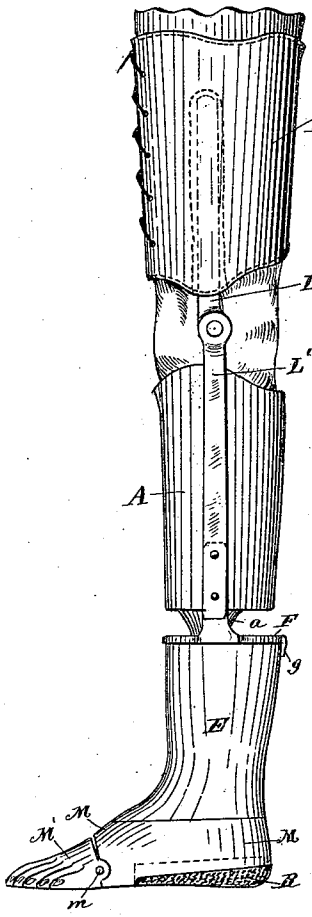


Fig. 2.

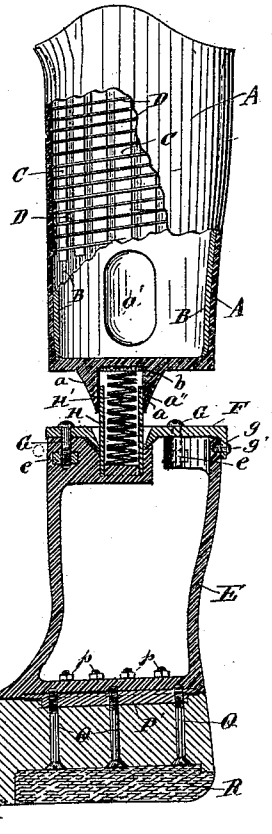


Fig 6

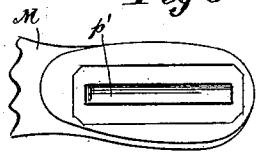


Fig. 7.

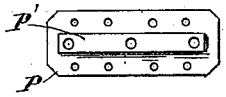


Fig. 5.

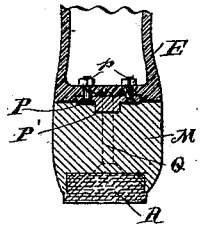


Fig. 4.

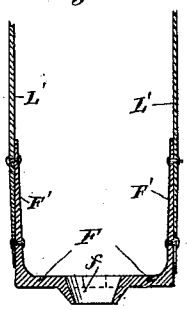
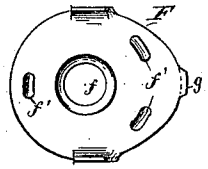


Fig. 3.



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UNITED STATES PATENT OFFICE.

ULYSSES TANNER, OF MINNEAPOLIS, MINNESOTA.

ARTIFICIAL LEG.

SPECIFICATION forming part of Letters Patent No. 473,097, dated April 19, 1892.

Application filed August 17, 1891. Serial No. 402,849. (No model.)

To all whom it may concern:

Be it known that I, ULYSSES TANNER, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Artificial Limbs; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to artificial limbs, and has for its object to effect certain improvements in the structure of the different parts with a view to greater ease and comfort to the wearer and greater strength and durability to the artificial parts. To this end, in order to obtain strength with lightness, I construct such of the sections of the artificial limb as are most liable to excessive strain or sudden shock of vulcanized rubber, having embedded therein flexible pieces or strips of metal, preferably arranged in the form of a trussing, consisting of longitudinal stays or strips and a winding of wire. The stays and the strands of wire are spaced apart from each other, so that the rubber, when vulcanized, will fill up the meshes and embed or embody the trussing therein. When formed in this way, the section of the artificial limb will withstand any strain to which it may be exposed and will not break to pieces under sudden shocks or jars, and will last for a great length of time, even under the roughest usage. The stump-section has in addition to the exterior wall or shell of hard rubber and the metallic trussing above described an inner wall of soft rubber, constituting an elastic lining or bearing-seat for the stump, rendering the same easy and comfortable to the wearer. In the vulcanizing process as applied to the stump-section the inner and outer walls or bodies of rubber become fused in the parts or at the points through the meshes of the trussing, thus securing the trussing in position as a metallic filling between the two bodies of rubber and rendering the entire structure practically integral or one body. The stump-socket plate is adjustable on the ankle-section for permitting the foot or other connected section of the artificial limb to be set at any desired angle with reference to the stump. It is also provided with vertically-extended parts or prongs for connection with the said straps or joint-irons, enabling the said parts to be secured together in their proper positions without requiring the straps to be made to exact sizes from preliminary measurements.

The foot and ankle sections of the artificial leg are separable, but are rigidly connected together or formed without an ankle-joint. The rigid connection is effected by means of a metallic connecting-plate secured to the ankle-section fitting a seat in the foot-section and screw-threaded bolts or set-screws working through the foot-section and engaging screw-threaded holes in the said connecting-plate. By this form of connection the ankle and foot sections when in use are practically integral or one, all lateral motion or any movement whatever of the one part with reference to the other being impossible. The toe-section of the foot is pivotally connected or jointed to the body of the foot and held in its normal position by a strong elastic band or strip in a well-known standard way. The rigid connection between the ankle and the foot sections in co-operation with the pivoted toe-section of the foot constitutes an important improvement, the co-operation of the said parts being materially different than where an ankle-joint is employed The stiff ankle gives a different action, the weight being thrown at once on the ball of the foot, while in the former constructions employing the ankle-joint the movement was first at the ankle before it was thrown on the toe or ball of the foot. With the ankle-joint construction the movement and strain was so great that it would quickly wear out the shoe or the boot and also produce so much lost motion in the parts that the foot-section would get out of position or shape, imperiling the safety of the wearer. With the rigid connection between the ankle and foot sections the parts will always retain their proper relative positions and the wear or tear on the boot or shoe will be scarcely greater than in the case of a natural foot. The foot-section is cushioned at the heel by a body of felt or other elastic material. The ankle-section has fixed in the top of the same a hollow spring holder or tube, which telescopes within a tube

seat or socket projecting from the stump-section and formed of the same material, and within the tube is placed a coiled spring for yieldingly sustaining the weight. In order to avoid any jar or shock when the tube-seat and tube telescope to their limit, the tube-seat is provided at its upper end with a cushion of felt, rubber, or other yielding elastic material. To further avoid noise and to take up lost motion from the play of the parts, the tube-seat may be provided with a bushing of soft rubber.

My improvements are illustrated in the accompanying drawings, wherein, like letters referring to like parts throughout—

Figure 1 is a side elevation of an artificial leg embodying my invention shown in its working position. Fig. 2 is a view, partly in section and partly in elevation, of the artificial leg detached from the stump. Figs. 3 and 4 are details, in plan and vertical section, showing the stump-socket plate. Fig. 5 is a section on the line X X′ of Fig. 2. Fig. 6 is a plan of a part of the foot-section, and Fig. 7 is a bottom plan view of the connecting-plate detached.

A B C D represent the stump-section of the artificial leg, of which parts A is the exterior wall or shell composed of hard rubber; B, the inner wall or lining composed of soft rubber, and C D the metallic trussing composed of the stays C and the wire D, the said trussing being secured, as before stated, between the two bodies of rubber, by the union of the rubber through the meshes of the trussing under the vulcanizing process. The metallic strips constituting the stays are preferably made of aluminum on account of its lightness; but any other flexible metal might be employed.

a is the tube-socket, formed integral with the lower end of the outer wall of the stump-section, and *b* the cushion of felt or other elastic substance, fixed to the upper end of the same. The stump-section is cut away or formed with openings, as shown at *a′*, to afford ventilation.

E is the ankle-section, which is formed of vulcanized rubber, either with or without metallic trussing, as shown in the stump-section. In the drawings, the ankle-section is represented as formed of a single wall of hard rubber, without the metallic trussing. Owing to the shape and size of the ankle-section, the walls may be of greater thickness than in the case of the stump-section, and the metallic trussing is not necessary. It may of course be used, and, if so, the ankle-section would have the metallic strips and the winding of wire embedded in the wall of the rubber, as is shown in the stump-section.

F F′ is the stump-socket plate, of which F is the body or flat portion fitting the top of the ankle-section and F′ are the vertically-extended parts or prongs for connection with the side straps. The body of the socket-plate has the central hole *f* for passing the spring-holder or socket-tube, and is provided with the slots *f′* for permitting the plate to be adjusted about the socket.

G are the set-screws or screw-threaded bolts, working through the slots *f′* in the socket-plate and engaging with nuts *e*, embedded in the ankle-sections for securing the socket-plate in whatever position it may be set. For further security the socket-plate may have a downturned lip or flange *g*, through which and into the ankle-section may be placed a set-screw *g′*.

H is the spring-holder or socket-tube embedded in the top of the ankle-section passing through the central hole of the socket-plate and having its projecting end working inside the tube-socket *a* on the stump-section.

H′ is the coiled spring seated within the tube H.

K is the thigh leather and lacing, and L and L′ are respectively the upper and lower sets of side straps or joint-irons pivotally connected together and secured one set to the thigh-leather and the other to the prongs of the socket-plate. The prongs and lower set of strap-irons overlap and may be riveted together at any point. Hence the strap-irons need not be made to an exact predetermined length, the necessary adjustment to an exact fit is readily effected, and much time and expense is saved. This is of great importance in the business. The socket-plate and the strap-irons can be made and kept in stock, and the proper fitting be made at once without the delay and expense which would otherwise be necessary. This construction is important for another reason—viz., that it enables the use of different metals for the strap-irons and the stump-socket with its prongs. This is absolutely necessary, in order to make the parts so that they will stand the work and be sufficiently light on the wearer. The strap-irons must be of hard metal or they will give out at their bearings, and should be of metal having considerable elasticity or spring. On the other hand, the socket-plate and its prongs must be of soft metal, such as malleable-iron, otherwise the prongs would break at their junction with the body of the plate. Experience has proven that side straps made of steel or other hard metal, as they must be, will, when directly connected to the socket-plate, in a short time break at the point of junction with the socket-plate. With my construction the parts will last indefinitely.

M M′ are respectively the body and the toe portion of the foot-section pivotally connected together or jointed, as shown at *m*.

N is the elastic strip united to the body of the foot and the toe-section to hold the latter in its normal position.

P P′ is the metallic connecting-plate for rigidly uniting the ankle and foot sections. This plate is fixed to the ankle-section by bolts and nuts, as shown at *p*, the bolts working through holes in the expanded or flanged part P of the plate. The raised portion P′ of the

plate fits a countersunk seat p' in the top of the foot-section, and when the two sections have been placed in position they are secured together by the set-screws or screw-threaded bolts Q, working through the foot-section and engaging with screw-threaded holes in the raised part of the connecting-plate. This connection unites the ankle and foot sections firmly together, making them practically as rigid as if they were one continuous body.

The toe-joint is slightly in advance of the ball of the foot. The fact that the heel and ankle sections are rigidly connected together and that the toe-joint is located forward of the middle of the foot, as just stated, gives an action which renders this artificial leg more serviceable. It gives a better base of support and a foot movement which is almost as easy as that of the natural foot.

R is the heel-piece, of felt or other elastic material, fitting a corresponding seat in the foot-section and secured therein by glue or in any other suitable way.

The tube-socket a may have a soft-rubber bushing, as shown at a'', to prevent noise from the play of the telescoping parts. In virtue of the fact that the socket-plate is adjustable about the socket or around the axis of the ankle-section, the foot may be set at any desired angle to the stump-section, so as to take the position of the natural foot. With many persons, as is well known, the "toes turn in," and with others the "toes turn out." With my construction I can set the artificial foot to do the same.

The construction, operation, and advantages of my invention have now been fully set forth.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. An artificial limb having the walls of one or more of its sections constructed of vulcanized hard rubber and with flexible pieces of metal embedded in the rubber, substantially as described.

2. In an artificial limb, a stump-socket constructed with an exterior wall or shell of hard rubber and an inner wall or lining of soft rubber vulcanized together, substantially as described.

3. In an artificial limb, a stump-socket having an exterior wall or shell of hard rubber, an inner wall or lining of soft rubber, and flexible pieces of metal located between the inner and outer walls and embedded by the vulcanizing of the two bodies of rubber.

4. In an artificial limb, a stump-socket constructed with an outer wall or shell of hard rubber, an inner wall or lining of soft rubber, and a flexible metallic trussing located between the said inner and outer walls, consisting of longitudinal metallic strips or stays and a winding of wire, the said strips and strands of wire being spaced apart to permit the two bodies of rubber to fuse together between said openings, when vulcanized, embedding the trussing therein, substantially as described.

5. In an artificial leg, the combination, with the stump-socket and the ankle-section, of the stump-socket plate adjustable on the ankle-section, and securing devices for fixing the plate in any position in which it may be set.

6. In an artificial leg, the combination, with the separable foot and ankle sections, of the metallic connecting-plate for rigidly uniting the two sections, substantially as described.

7. The combination, with the foot-section provided with the plate-seat, of the ankle-section, the connecting-plate secured to the ankle-section and fitting the seat in the foot-section, and screw-threaded bolts working through the foot-section and engaging screw-threaded holes in said plate.

8. In an artificial leg, the combination, with the stump and ankle sections, of the stump-socket plate provided with the vertical prongs and the sets of side straps or joint-irons, the lower members of which overlap the said prongs and may be secured thereto in any desired position, the said prongs and side straps being connected below the the knee-joint, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ULYSSES TANNER.

Witnesses:
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A. H. OPSAHL.