(No Model.)

H. P. JUDSON.

ARTIFICIAL LIMB.

No. 497,026. Patented May 9, 1893.

Fig. 3.

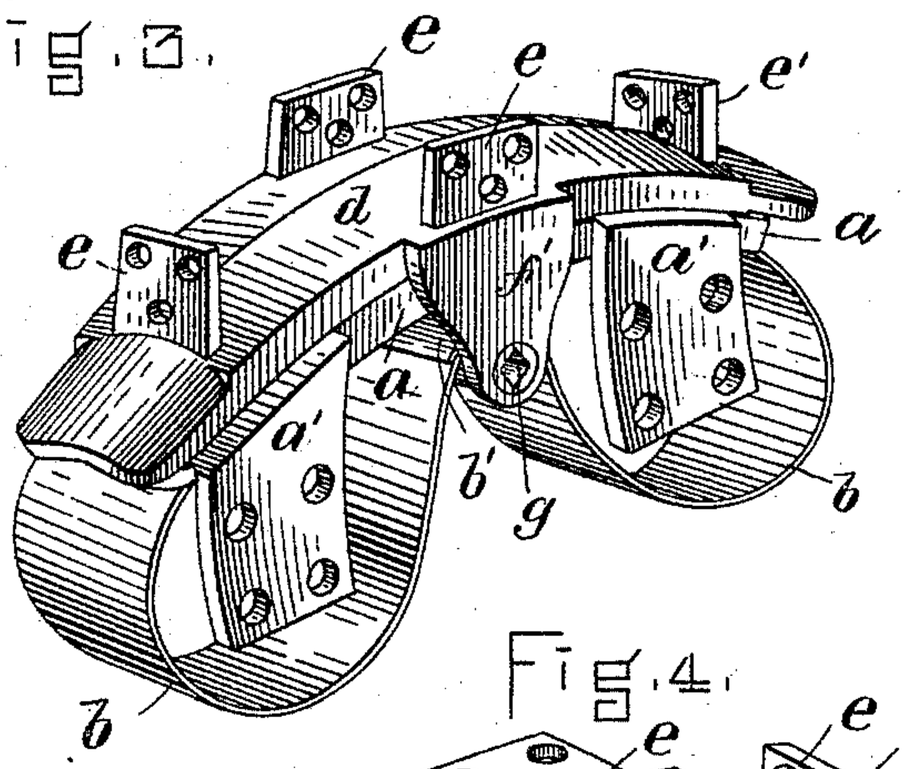


Fig. 4.

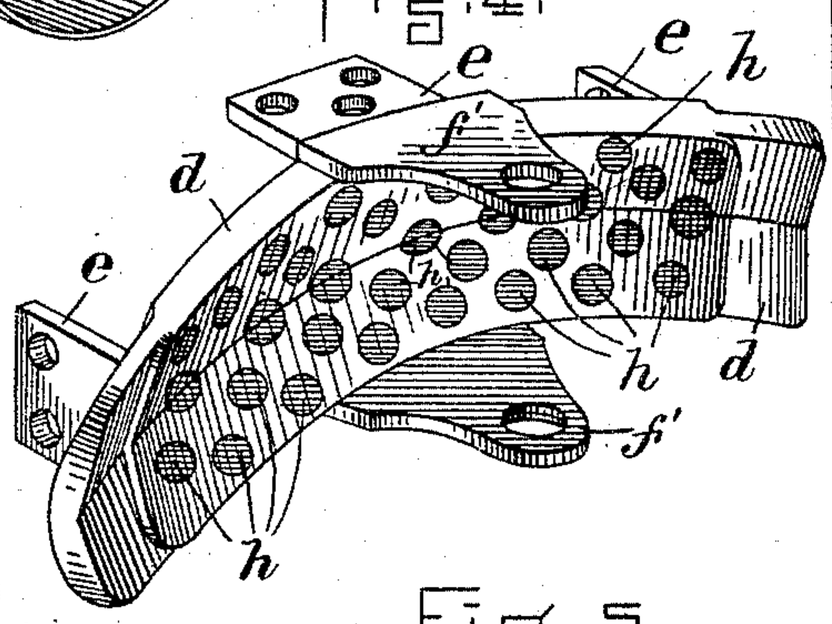


Fig. 1.

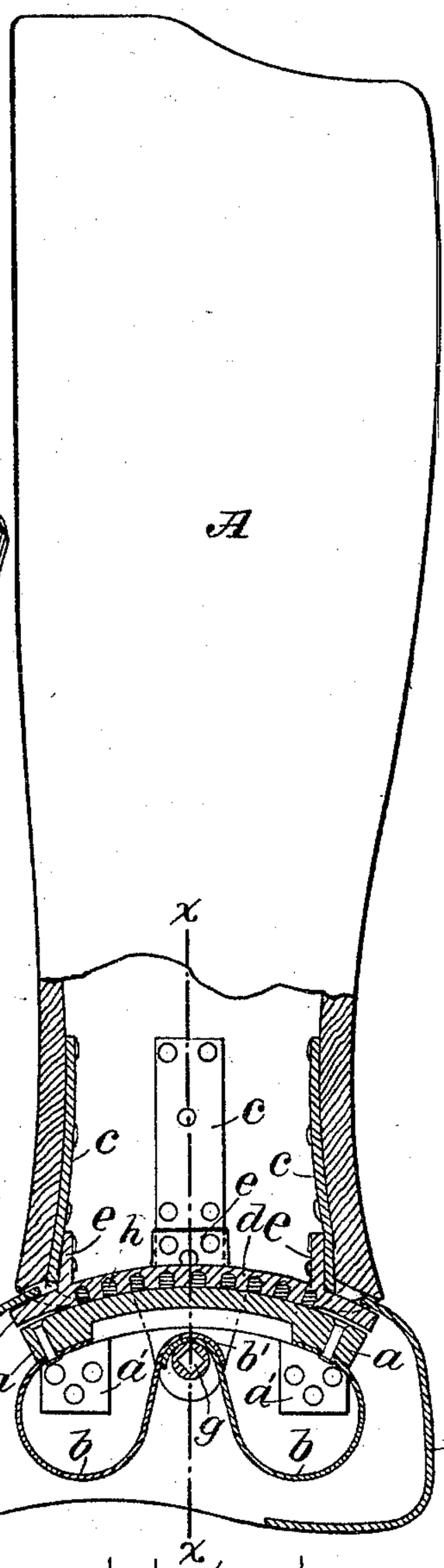


Fig. 2.

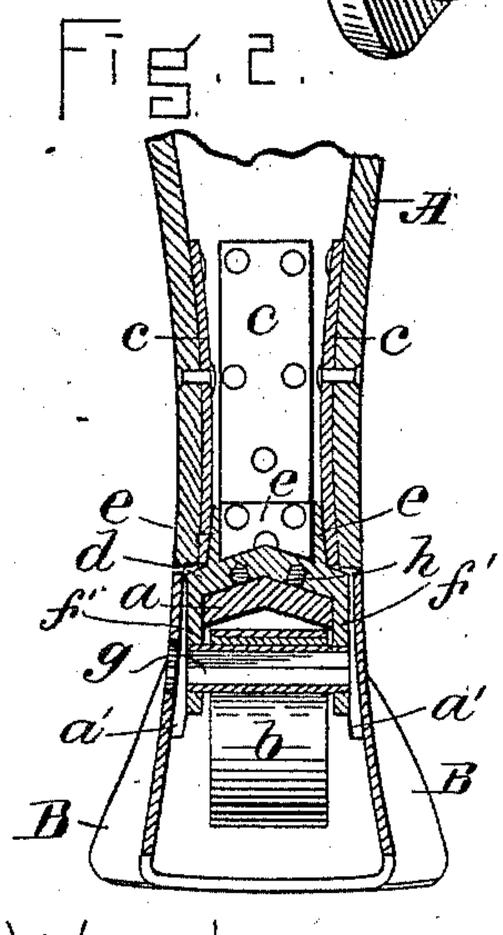
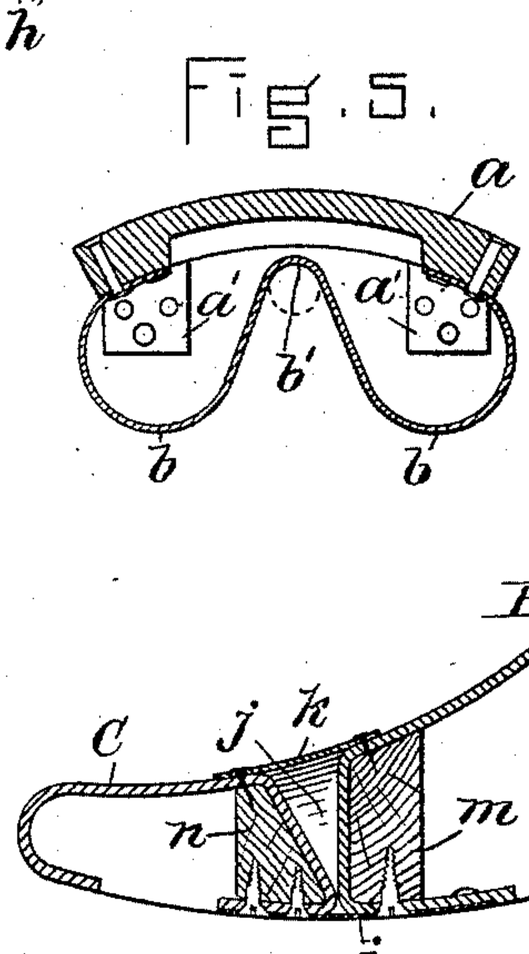


Fig. 5.



Witnesses.

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UNITED STATES PATENT OFFICE.

HENRY P. JUDSON, OF CAMBRIDGE, MASSACHUSETTS.

ARTIFICIAL LIMB.

SPECIFICATION forming part of Letters Patent No. 497,026, dated May 9, 1893.

Application filed September 17, 1892. Serial No. 446,174. (No model.)

To all whom it may concern:

Be it known that I, HENRY P. JUDSON, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Artificial Limbs, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to artificial feet and has for its main object the production of an ankle joint that shall be easy of operation, effective, reliable and durable and it consists in certain novel features of construction, arrangement and combination of parts which will be readily understood by reference to the description of the accompanying drawings and to the claims hereinafter contained and in which my invention is clearly pointed out.

Figure 1 of the drawings is a sectional elevation of an artificial foot embodying my invention. Fig. 2 is a vertical section on line *x x* on Fig. 1. Fig. 3 is a perspective view of the two parts of the ankle joint detached from the foot and the leg socket. Fig. 4 is a perspective view of the upper portion of the ankle joint looking at its under or bearing face and showing the means of lubrication. Fig. 5 is a vertical section through the lower section of the ankle joint and the springs and showing the springs made from a single piece of metal instead of two pieces as shown in Fig. 1.

In the drawings A is the leg socket which may be made of wood or any other suitable material and of any suitable form.

B is the main body of the foot preferably cast hollow of aluminum though it may be made of wood if desired by reducing the chamber within to the minimum of size to receive the metal parts which make up the ankle joint.

The foot B has an opening at its upper side nearly equal in size to the ankle end of the leg socket A and has secured therein the supporting plate *a* curved in the direction of the length of the foot to an arc of a circle of about three inches' radius more or less and firmly riveted to the foot by rivets which pass through the ears *a' a'* formed thereon and through the side walls of the foot B as shown in Fig. 1.

The plate *a* has its upper surface composed of two inclined surfaces meeting each other at an obtuse angle as shown in Fig. 2, and is made somewhat longer than the opening in the top of the foot and is so located within said foot that a portion of the upper part of the foot projects over each end of said plate, but somewhat above the same as shown in Fig. 1.

To the under side of the plate *a*, at each end, is riveted one end of a curved plate spring *b b* which may be made in two pieces as shown in Figs. 1 and 3, or in one piece as shown in Fig. 5.

The leg socket A has firmly secured to its ankle end by means of the straps *c c* the plate *d* the under surface of which is made to fit the curved and beveled upper surfaces of the plate *a* for the greater part of its length and provided with the ears *e e* to which the straps *c c* are riveted, and with the ears *f, f'*, to receive the bolt *g* preferably made tubular, said plate *d* being of such a length that its ends will be inclosed by the shell of the foot in whatever position it may assume when being moved in the act of walking. The tubular bolt passes freely through the ear *f* and is screwed into the ear *f'* with the bend or bends *b'* of the springs *b* above the same as shown in Figs. 1, 2, and 3, the opening through said bolt when made tubular being made rectangular for a portion, at least, of its length at the end thereof that is not threaded, for the purpose of receiving a wrench to screw it in or out when desired.

The under surface of the plate *d* has formed therein a series of chambers which are filled with the compound called metalline to form a wearing surface that will require no other lubrication, as shown at *h h* in Figs. 1, 2 and 4.

In order to keep the weight of the foot within suitable limits and produce a practicable and durable ankle joint I make the plates *a* and *d* of aluminum, and of proper dimensions for strength, while the springs *b b* are made preferably of the best spring brass, and the bolt *g* of brass or composition.

C is the toe section of the foot made preferably hollow and of aluminum though in some cases wood may be used, said toe section being attached to the main body of the foot by the plate of spring metal *i* which is screwed or riveted to the two parts B C of the foot as shown in Fig. 1, so as to permit the

foot to bend slightly, an angular space *j* being left between the adjacent ends of the foot body and the toe section, which space is covered by a strip of leather or other suitable material *k*, secured to the foot body and toe section by tacks, screws, or rivets, as shown in Fig. 1, or by cementing if preferred.

The upper edges of the side walls of the foot body are curved concentric to the axis of the curves of the contact surfaces of the plates *a* and *d*, but with a somewhat greater radius and the ankle end of the leg socket is curved parallel thereto and is made of a width, from front to rear, somewhat greater than the length of the opening in the top of the foot body as shown in Fig. 1, and as the portions of the foot body immediately in the front and rear of said opening are curved concentric to the curves of the contact surfaces of the plates *a* and *d* the ankle end of the socket A may move about the axis of said curve toward the front or rear the necessary distance required to permit a free action of the ankle joint without coming in contact with said foot body.

By the use of aluminum for the plates *a* and *d* and the foot body and toe section I am enabled to make a strong and durable foot and ankle joint without making it too heavy for practical use, and by the use of the metalline inserted in pockets in one of the contact surfaces of the plates *a* or *d* the wearing surfaces will be amply lubricated without the use of oil or other lubricant.

In the forward end of the foot body and the rear end of the toe section are inserted the pieces of wood *m* and *n* respectively which are secured to the metal shells by screws and serve to receive and hold the tacks or screws which secure the leather strip *k* in position which tacks or screws pass through holes drilled in the metal shells as shown in Fig. 1.

The operation of my invention is as follows: The leg socket being properly secured in any well known manner to the stump of the limb upon which it is to be worn the foot will, when the wearer is standing erect, normally remain in the position shown in Fig. 1 substantially at right angles to the leg socket. If the wearer attempts to walk when he places the artificial foot forward to take a step and the heel of his boot is placed upon the ground and the weight of his body is thrown upon that foot the plate *d* carrying with it the ankle end of the leg socket will move slightly toward the rear upon the curved surface of the plate *a* said movement being about the axis of the curve of the contact surfaces of the plates *a* and *d*, and at the same time the bolt *g* will be moved in the same direction but a slightly less distance thereby increasing the tension upon the springs, *b b*. When the other foot is moved forward so that the body of the wearer is moved over the artificial foot the tension of the two portions of the spring *b* acting upon the bolt *g* will cause the foot to again assume its normal position, and as the body is moved still farther foward the plate *d* will be moved along the plate *a* toward the front beyond its normal or central position and the bolt *g* will be moved in the same direction a somewhat less distance but sufficient to increase the tension of the springs *b b* so that when the artificial foot is lifted to take another step, the tension of said springs will cause said foot to immediately assume its normal position as shown in Fig. 1.

It should be understood that the function of both parts of the spring or springs *b b* is to hold the bolt *g* and the plate *d* in their normal or central position relative to the plate *a*, or to return said parts to said normal or central position when, in the act of walking, they have been moved either forward or backward from said position.

It will be observed that when this invention is in operation in the act of walking the plate *d* slides along or about the curved upper surface of the plate *a* in a path concentric to a center common to the curve of both of said plates, as distinguished from a rolling contact of two curved surfaces the convex peripheries of which are presented to or in contact with each other.

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

1. In an artificial limb the combination with a foot body and a leg socket of an ankle joint composed of two bearing or contact plates secured one to the foot body and one to the ankle end of the leg socket, and having their contact surfaces curved longitudinally or in the direction of the length of the foot to an arc of a circle the axis of which is below said bearing plates, a pair of ears formed upon the upper plate and projecting below the lower plate, a bolt mounted in said ears in a position eccentric to the curve of the contact surfaces of said plates, and a double spring or springs firmly secured to each end of the foot bearing plate, and acting upon said bolt to press said bearing plates together and normally to maintain said upper plate in a central position on the lower plate substantially as described.

2. The combination of the leg socket A; the foot body B the plates *a* and *d* and curved to arcs of circles concentric to a common center and beveled as set forth, and connected one to the foot body and the other to the leg socket; the ears *f' f'* formed on the plate *d* the bolt *g* mounted in said ears; and the spring or springs *b b* secured to each end of the plate *a;* and bearing upon the upper side of the bolt *g*.

3. The combination in an artificial limb of the leg socket; the foot body B; the bearing plates *a* and *d* curved to arcs of circles concentric to a common center and beveled as set forth and secured one to the foot body and the other to the leg socket; the ears *f' f'* formed on the plate *d*, the bolt *g* mounted in said ears; the springs *b b* secured to the ends of the plate *a*, and the metalline plugs *h h* set

in one of said bearing plates as a means of automatic lubrication.

4. In an artificial limb a foot body and toe section both cast hollow and connected together by a spring plate firmly secured to each part in any suitable manner.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 14th day of September, A. D. 1892.

HENRY P. JUDSON.

Witnesses:
N. C. LOMBARD,
F. E. JUDSON.