J. A. Foster,

Artificial Leg,

No. 49,253, Patented Aug. 8, 1865.

Fig. 5

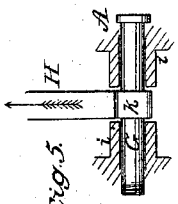

Fig. 6

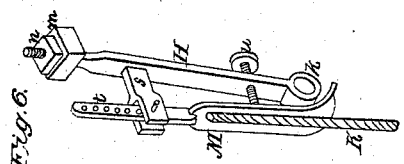

Fig. 7

Fig. 1.

Fig. 2.

Fig. 4.

Fig. 3

Witnesses:
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UNITED STATES PATENT OFFICE.

JAMES A. FOSTER, OF DETROIT, MICHIGAN.

IMPROVEMENT IN ARTIFICIAL LEGS.

Specification forming part of Letters Patent No. **49,253**, dated August 8, 1865.

To all whom it may concern:

Be it known that I, JAMES A. FOSTER, of Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Artificial Legs; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification—

Figure 1 is a central vertical section of my improved leg; Fig. 2, a plan of the foot, showing more particularly the lever connected with the toe-piece and the coupling or bearing forming the ankle-joint; Figs. 3 and 4, longitudinal and cross sections, respectively, of the device forming the ankle-joint; Fig. 5, a longitudinal section of the device forming the knee-joint, and showing the method of tightening the same; Fig. 6, a perspective view of the device for graduating the tension of the spring-cord; Fig. 7, a diagram showing the method of holding the spring-cord in place.

Like letters of reference indicate corresponding parts in all the figures.

My invention has relation more particularly to the arrangement of a single spring for producing the necessary elasticity in the knee, foot, and toe, and in the method of modifying the tension of the cord attached to the same and holding it in place; also in the arrangement of the knee and ankle joints.

As represented in the drawings, A is the thigh, B the inferior leg, and C the foot, of the artificial limb.

The ankle-joint consists of a cylindrical iron, D, of suitable size and length, provided with two sharp-edged bearings, *a a*, the object of which is to keep the foot and ankle in place laterally. With the upper side of the iron D connect two or more bolts, *b b*, passing upward through the wood *c* of the ankle, and having nuts *d d* screwing on top. This arrangement holds the iron closely to the ankle, and the articulation is produced within the foot portion. The interior of the iron is provided with a bearing, *f*, conveniently formed of a screw passing through, and upon this bearing fits and turns loosely within a slot, *e*, of the iron an eye, E, Figs. 3 and 4, having a shoulder, *g*, and a bolt, *h*, below the latter, passing through the wood of the foot, with a nut screwing on its end. By turning the nut the shoulder *g* is clamped down closely upon the wood, as shown in Fig. 1, and thus the ankle and foot are firmly connected by being bolted on both sides. At the same time, as the eye E is fitted on the bearing *f* so as to allow the latter to turn, and as the slot *e* in the iron D permits this turning movement, it is obvious that the necessary articulation of the ankle will be produced without difficulty. A similar device to D, having one or more bearings, *a a*, has before been employed; but in such case the bolts *b b* and eye E, as well as the central bearing, *f*, have not been used.

It is the combination of these parts with D that constitutes the novelty in my device. By this arrangement the parts are firmly secured together without peradventure of detachment or misplacement, while the articulation is more efficient than in the old device. In the latter case the cords and tendons alone serve to keep the foot and leg together, as there is no fastening device at the ankle. In my device the bolts *b b*, being represented some distance apart, guard against lateral misplacement of the ankle, while the eye E allows the necessary turning motion.

The knee-joint consists simply of the ordinary screw-bolt G, Figs. 1 and 5, resting in boxes or bushes *i i*. On the center of the bolt, between the boxes, rests loosely the eye K of a tightening-lever, H, which passes upward through the cross-piece *l* of the thigh-socket, and has on its end a rubber or other equivalent spring, *m*, and a nut, *n*. By turning the nut it is manifest that the lever will be drawn up, thus tightening the bolt G up against the upper surface of the boxes *i i*. By this means I am enabled at any and all times to tighten the joint in such a manner that it will not rattle or make noise, and so that the knee-joint will be firm and steady; and at the same time the spring *m* relieves the joint of all rigidity or unyieldingness. This is of great consequence in walking. For instance, if the foot should catch under any impediment, the upward strain would cause the spring to yield and the shock would be greatly relieved. I am aware of no other similar device for tightening the joint and still allowing a necessary degree of yieldingness.

The toe-piece I is jointed to the foot at *o* in the usual manner; but it differs from all other devices, so far as I am aware, in having a stiff projection, *p*, Figs. 1 and 2, forming a lever, projecting backward a suitable distance in a cavity in the foot. When the toe-piece is in its normal position this lever strikes up against the roof *q* of the foot, which forms a stop, but when the toe is flexed in the act of walking it assumes the position indicated by red lines, Fig. 1. To the extremity of this lever is attached a cord, K, passing upward into the inferior leg, where a spiral spring, L, or equivalent, is interposed, and it then extends still upward into the thigh-socket through adjusting-holes *j j* in the cross-piece *l*, and is secured in any suitable manner. I prefer, however, to divide the cord into two branches, *r r*, above the cross-piece, and to pass these branches outward through holes to the outside of the leg, where they may be drawn taut and tied.

To the tightening-lever H, at a suitable position, is secured a fulcrum-bearing, *s*, Figs. 1 and 6, in which is hung, by means of a set of adjusting-holes, *t t*, an arm, M, over which the cord K passes in extending up. This arm extends downward a little distance below the knee-joint, its lower end being preferably curved or bent to allow the cord to work easily. An adjusting-screw, *u*, or equivalent, passes through the lever in the rear and rests against the back of the arm.

By the arrangement before described it will be perceived that the single spring L answers the universal use of a knee, foot, and toe spring. The spring drawing down will give the necessary reaction to the knee and drawing up will give the same elasticity to both the toe and the foot, first drawing the toe to its natural position and then, by the lever *p* striking the stop *q*, acting in the same manner on the foot; and this is accomplished by a simple ordinary spring and cord, without the attendant devices of levers, arms, &c. The device is so simple that it cannot easily get out of order, or, if so, can be easily repaired.

I am aware that a device has been patented in which a single spring connecting with an adjusting lever or standard is employed to give a universal elasticity to the foot; but such device is for regulating the foot only, and does not accomplish the effect of mine—viz., giving the necessary reaction to the knee, foot, and toe.

By the employment of the arm M, I am enabled to adjust the tension of the cord K to any degree desired.

If it is desired to give a greater degree of tension at any time, it is only necessary to either turn the screw *u* so as to force the arm outward or to move the arm down endwise by means of the adjusting-holes *t t*, as indicated by red lines, Fig. 1; or, should it be desired to adjust to a considerable degree, both means may be employed.

It will be perceived that this device forms a lever over which the cord must work, and the greater the length of the lever the greater will be the tension of the cord.

By means of the adjusting-holes *j j* in the cross-piece *l*, through which the cord K passes, and the adjusting-holes *t t* in the arm M, and the screw *u*, I am enabled to make the knee stiffest in any position desired. Some prefer to have the greatest action of the spring when the leg is straight, and lose its force as the thigh bends back. Others prefer that the action of the spring should be greatest when the leg is flexed, to move the foot and inferior leg forward in the act of walking, and then as the leg becomes straight that the spring should lose its force. By my arrangement I can adjust the spring to these various requirements. For instance, place the cork K through the holes *j*, close to the front of the leg, and adjust the arm M high up and close to the knee-pin, then the spring is most powerful when the leg is straight, and is most powerful in one position only. Then, with the cord in the same position, extend the arm M down to one of the upper holes, *t*, still resting closely to the knee-pin, and the spring will then be most powerful in two positions—viz., when straight and when flexed to its greatest extent. Now, to reverse the action and make the spring most powerful where it is now the weakest, place the cord K through the holes *j j*, near the center of the cross-piece, adjust the arm M down about halfway, then turn the screw *u* out a suitable distance, and the cord K is farthest from the knee pin when the knee is half bent, and consequently the action is greatest. By adjusting so that the cord will rest upon the arm M all the time in its motion the spring will be gradual and equable in its action. I know of no device where this variety of action is produced.

For the purpose of holding the cord K away from the front of the leg, so that the spring will not chafe and wear, I pass around it a small cord, *w*, Figs. 1 and 7, forming a loop, and fasten the opposite end on hooks *x* in the rear.

This device is very convenient, for by its pliability it allows the cord K to work without any friction or difficulty, which would not be the case if said cord passed through an eye or rigid bearing.

The ordinary cords P, and Q, are employed to prevent too great reaction of the foot and leg.

I form in the heel of the foot an inclined stop, *z*, against which the bearing *c* of the ankle strikes when the leg is bent back.

I claim—

1. The lever *p* of the toe-piece I, in combination with the stop *q* of the foot and the spring-cord K, substantially as and for the purpose herein specified.

2. In combination with the cord K, the adjusting-arm M and lever H, so arranged and operating that the tension of said cord may

be modified by merely moving the arm outward or downward, substantially as herein set forth.

3. The combination and arrangement of the lever H, spring *m*, and nut *n* with the bolt G and boxes *i i*, in such a manner as to tighten the knee-joint and to obviate its rigidity, as herein specified.

4. The arrangement of the ankle-joint consisting of the iron D, provided with the central bearing, *f*, the bolts *b b*, and the turning-eye E, constructed as described, the whole being used in combination with the foot C and ankle B, substantially as specified.

5. Holding the cord K in place to prevent friction and wear in its action, by means of the loop *w*, arranged and operating as herein set forth.

6. The inclined stop *z* in the heel of the foot, in combination with the bearing *e* of the ankle, substantially as herein set forth.

In witness whereof I have heteunto signed my name in the presence of two subscribing witnesses.

JAMES A. FOSTER.

Witnesses:

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JAY HYATT.