D. Bly,

Artificial Leg.

No. 38,550. Patented May 19, 1863.

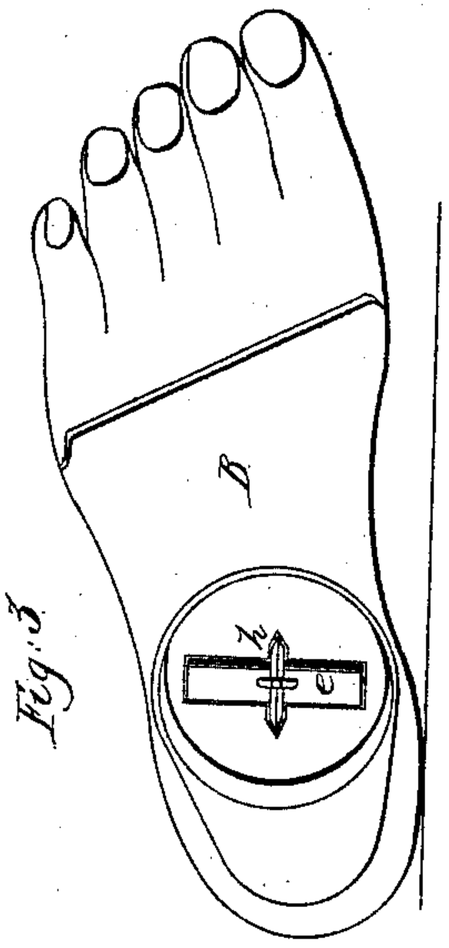
Fig. 3

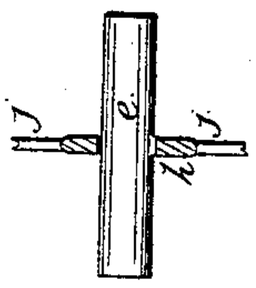
Fig. 5.

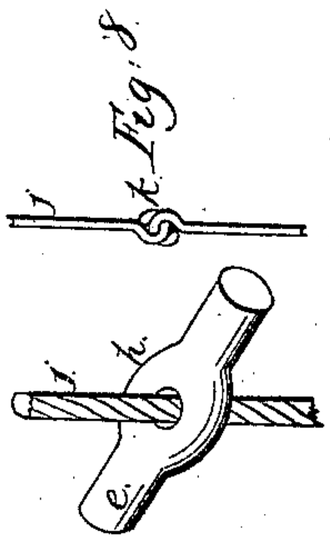
Fig. 6

Fig. 8

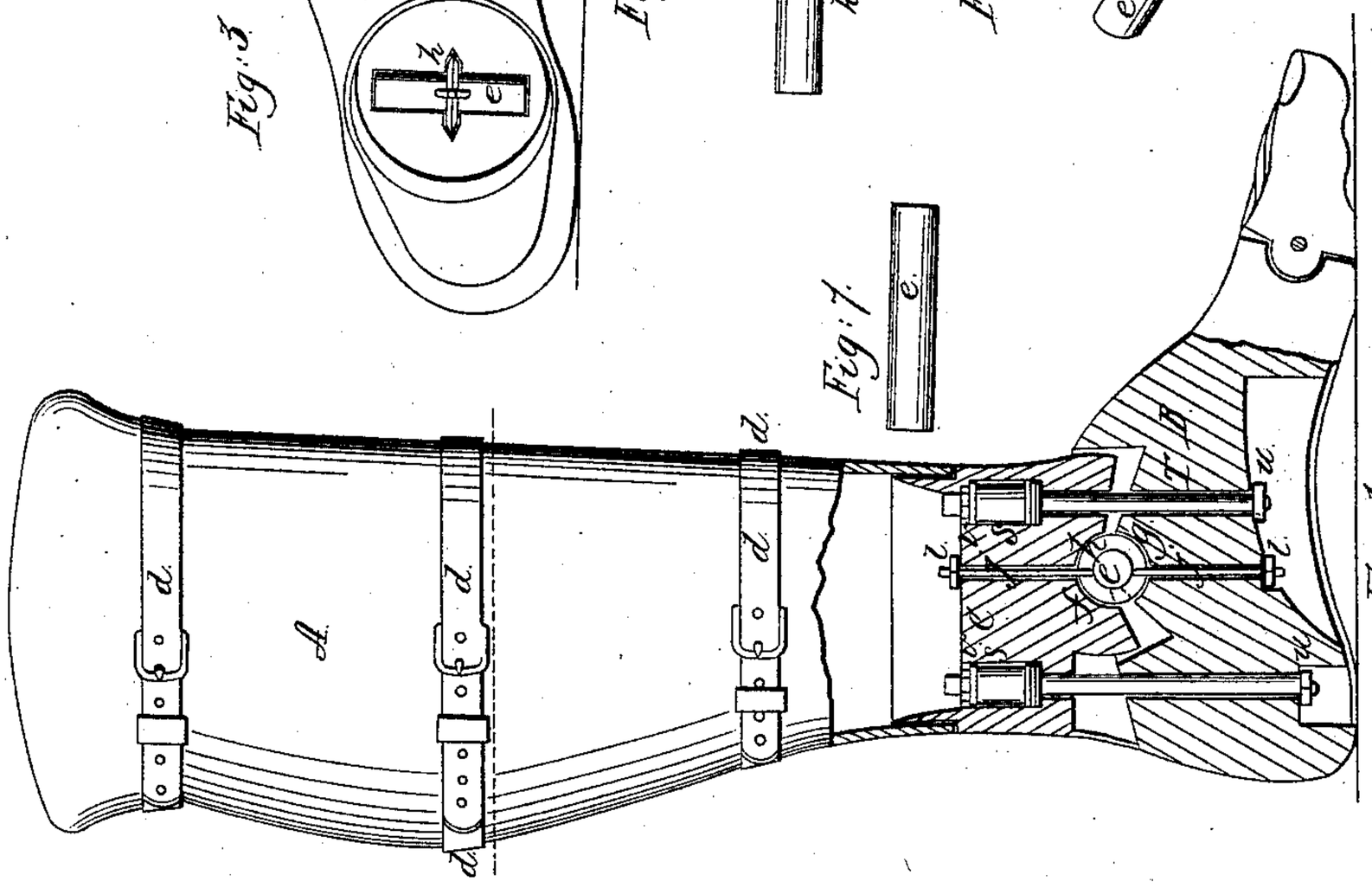
Fig. 1

Fig. 7.

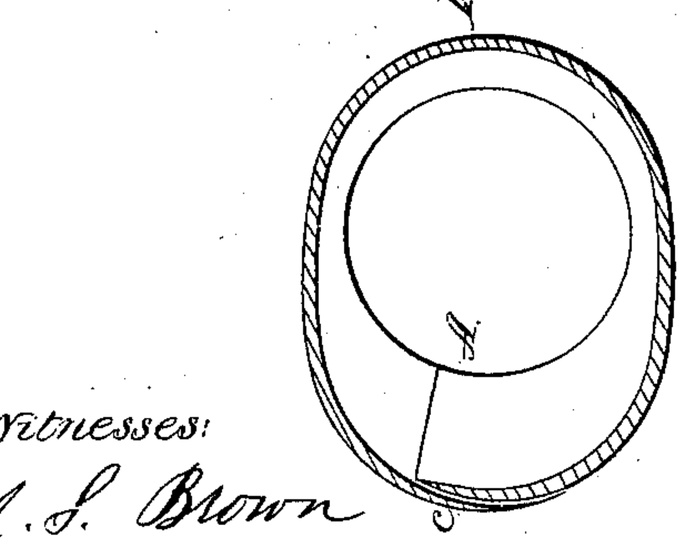
Fig. 2

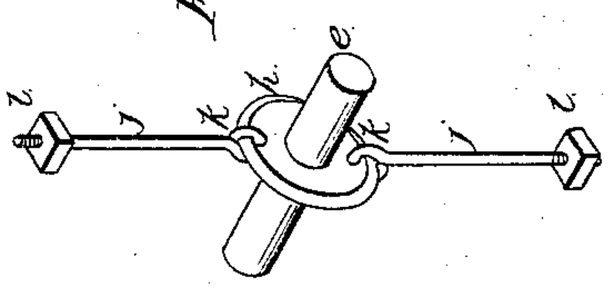
Fig. 4

Witnesses:

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J. C. Day-

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UNITED STATES PATENT OFFICE.

DOUGLAS BLY, OF ROCHESTER, NEW YORK.

IMPROVEMENT IN ARTIFICIAL LEGS.

Specification forming part of Letters Patent No. **38,550,** dated May 19, 1863.

To all whom it may concern:

Be it known that I, DOUGLAS BLY, of the city of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in the Construction of Artificial Legs, of which the following is a full and accurate description, reference being had to the accompanying drawings, making a part of this specification, and the letters of reference marked thereon, same letters referring to like parts in all the figures of said drawings.

Figure 1 is a side elevation of my improved limb, the foot and ankle portion being shown in section; Fig. 2, a transverse horizontal section of the leg in the plane of the red line, Fig. 1; Fig. 3, a plan of the foot portion detached, showing more particularly the relative position of the axis; Fig. 4, a perspective view of the parts forming the ankle-joint detached; Figs. 5 and 6, modifications of Fig. 4; Fig. 7, a view of the plain axis of the ankle; Fig. 8, a modification of the rods *j j*.

The nature of my invention will be understood from the following description and the accompanying drawings. The socket, or that portion of this leg which envelops the stump or mutilated extremity of the wearer, is composed of hard or vulcanized india-rubber, which may or may not extend throughout the limb. Heretofore wood has been used almost exclusively; but much trouble and expense have arisen from the tendency of the wood to split, or form what are called "season-cracks," on account of the varying heat and moisture of the stump. To avoid this, rawhide has been tried, but the offensive odor which arises from the use of it soon caused it to be discarded. Vulcanized india-rubber is free from all these objections, and is far superior, even when the socket is made in the ordinary form. The socket, or that portion of the leg which is fitted to or incloses the stump or mutilated extremity, is made with thin overlapping edges, *c*, Fig. 2, which allows it to enlarge or diminish, so as to fit the stump at all times, whether the patient grows fleshy or lean, and thereby saves the expense of a new leg or the socket portion of it. The changes which take place in the stump are so frequent that very few legs fit the stump six months after their manufacture. This has long been a crying evil, especially to the poor who could not afford the expense of a renewal. In this case the rubber socket is simply tightened down upon the stump by means of the leather straps, and a perfect fit is secured at all times. The rubber socket may be fastened by straps or by lacing, or by movable rivets or other convenient means. This device is applicable to all amputations, whether leg, thigh, arm, or forearm. The socket portion alone may be made of vulcanized rubber and fastened to an intermediate piece, C, of wood or other material, beneath, or the whole may be made of vulcanized india-rubber. The inferior extremity of the leg is grooved to correspond with the axial bolt *e*, upon which it rests. Laterally this groove is beveled a little, so as to allow the leg to rock laterally on the axis *e*, and thereby allow the foot to accommodate itself to lateral grades or positions assumed in labor. The superior portion of the foot also is grooved to receive the axial bolt. This groove *g* is deeper than the corresponding one in the leg, therefore the friction between the bolt and foot is greater than between the bolt and leg. Consequently the bolt remains at rest in the foot, so that flexion and extension of the foot on the leg, and all motion at the ankle, take place between the superior portion of the bolt and the leg. By this arrangement the joint is made "self-cleaning," as every step tends to sweep every particle of foreign matter from the superior surface of the axial bolt. Consequently the joint has great durability. If a little dirt or grit of any kind finds lodgment in a joint, disintegration takes place very rapidly, as is shown in the use of the Palmer leg, where the bolt rotates in the foot, and all the dust and dirt gravitates to the bottom of the joint. This simple device renders the joint self-cleaning, and increases the durability more than double. The axial bolt *e* is simply a plain cylinder. It may be made hollow, to make it light.

This device is exceedingly simple, and not liable to get out of order, is very light, and costs but a trifle, all of which are important considerations in artificial legs. For laboring men, where there is a liability to cramp the ankle a good deal, the axial bolt *e* may be provided with a flange, *h*, Fig. 4, which enters a recess in the foot and leg, respectively, and aids in keeping the parts in their normal position; and in cases where there is a liability

to extreme cramping or wrenching the joint, a couple of rods, *j j*, Fig. 4, may be attached to opposite sides of the flange. Holes may be drilled through the flange, and the ends of the rods passed through, and turned up in the form of hooks *k*, Fig. 4. These rods pass through the foot and ankle-piece, respectively, and fasten by means of nuts *l*, Fig. 4. The nut in the foot is turned up tightly against the foot, but just play enough is left beneath the nut in the leg to allow the leg to rock laterally on the axial bolt, and allow the foot to accommodate itself to different positions assumed in labor, and yet prevent any undue cramping of the ankle; or a movable collar, *h*, turning freely on the bolt *e*, Fig. 5, with projecting arms *j j*, may be substituted in place of the flange and rods; or the axial bolt may be enlarged and perforated in the center, Fig. 6, and a jointed rod, *j j*, Fig. 8, or a strong cord, *j j*, Fig. 6, passed through in lieu of the rods first described. In the anterior and posterior portion of the leg I place an elastic india-rubber spring, *s s*, to perform the functions of the natural muscles, and a flexible non-elastic vulcanized india-rubber tendon, T, to perform the functions of the natural tendons. The springs are placed in recesses in the leg, and the tendons pass through them and fasten by means of a nut, *u*, in the foot, their superior extremities being provided with a nut or enlarged heads, *v*, which rest on the springs. The nut in the foot is screwed up until the rubber springs are slightly compressed. The compression of the india-rubber springs holds the foot snugly to the leg, like the tenacity of the natural muscles. Consequently the joint will never become loose and rattling from use, which is a source of great annoyance when the axial bolt is depended upon to hold the leg and foot together, as in the Palmer leg. The non-elastic vulcanized india-rubber tendons already described are peculiarly adapted to this use for three important reasons: First, because they do not stretch or elongate by use; secondly, because they are not liable to chafe and wear off; thirdly, because they combine extreme lightness with great strength. These advantages are too cogent to require comment. This arrangement of the springs and tendons gives the leg the antagonistic yielding forces, like the natural tendons and muscles, and the consequent motions must ensue. The axial bolt is placed at right angles with the line of motion or progression of the wearer, *e*, Fig. 3, so that in ordinary walking with the toes turned outward the leg flexes on the foot diagonally or in the line of progression, the same as the natural foot. The axis of the joint is at a greater or less angle with the line of the foot as the toes are turned outward more or less.

By this device the rolling of the foot at every step, to compensate for the diagonal flexion of the ankle, and the uncouth gait to which it gives rise, are entirely prevented, also the consequent fatigue.

I claim—

1. Expanding and contracting the artificial limb by means of the vertical or longitudinal overlapping edges *c*, or equivalent, in such a manner as to adapt the same to the size of the mutilated extremity of the natural limb, substantially as herein set forth.

2. The arranging or placing the axis *e* at right angles with line of progression of the wearer when the longitudinal diameter of the foot is at an angle (more or less) with said line.

3. The stationary axis *e*, intermediate with the foot and ankle portion of an artificial leg, in combination with the groove of the ankle, turning in such a manner that the motion and friction come on the superior surface of the axis, so as to clear it of dirt and prevent wear, substantially as herein set forth.

4. In combination with the axis thus arranged, the central flange, *h*, or its equivalent, for retaining the parts C *e* B in their normal relations to each other.

5. In combination with the axial bolt *e* and flange *h*, the connecting-rods *j j*, or their equivalents, as herein described.

6. The flexible non-elastic vulcanized india-rubber tendons, substantially as described.

7. The constant coaptation of the wearing-surface of the joint with an axial bolt by means of yielding springs, in combination with tendons binding the parts together, in the manner set forth.

8. The beveling of the groove *f* in the ankle-piece to facilitate lateral motion of the ankle, as herein described.

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