D. D. Parmelee,

Artificial Leg.

No. 37,637. Patented Feb. 10, 1863.

Fig. 1.

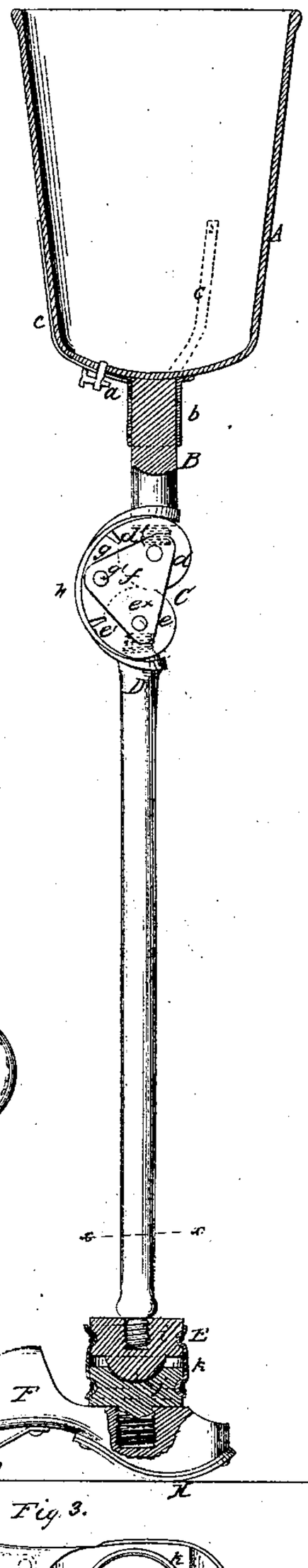


Fig. 2.

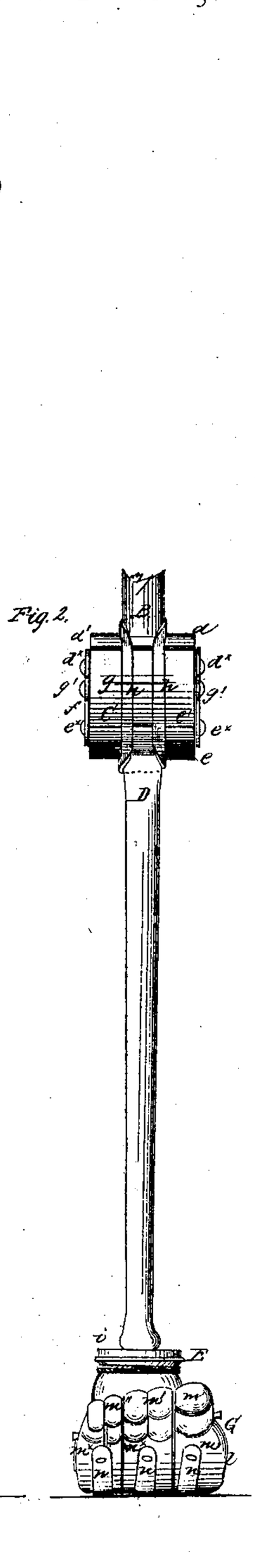


Fig. 4.

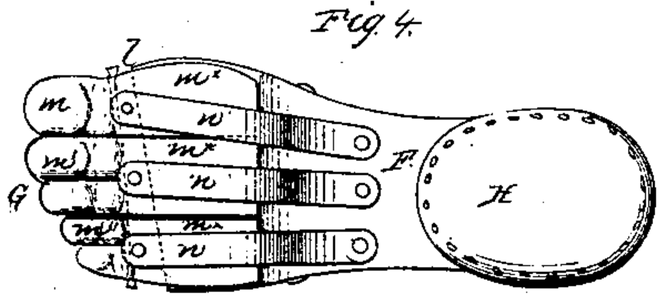
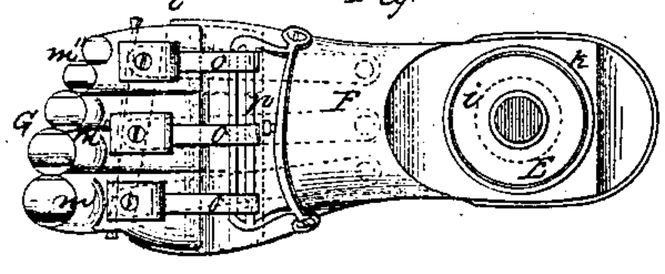


Fig. 3.



Witnesses

Timothy Shine

W. S. Partridge

Inventor.

Daboes D Parmelee

UNITED STATES PATENT OFFICE.

DUBOIS D. PARMELEE, OF NEW YORK, N. Y.

IMPROVEMENT IN ARTIFICIAL LEGS.

Specification forming part of Letters Patent No. **37,637**, dated February 10, 1863.

To all whom it may concern:

Be it known that I, DUBOIS D. PARMELEE, of the city, county, and State of New York, have invented certain new and useful Improvements in Artificial Limbs; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 represents a sectional side elevation of a leg constructed according to my invention. Fig. 2 is a front view of the same. Fig. 3 is a horizontal section of the same, taken in the plane indicated by the line *x x*, Fig. 1. Fig. 4 is an inverted plan of the same.

Similar letters of reference in the three views indicate corresponding parts.

The first part of this invention relates to the bucket or socket of artificial legs or arms intended to receive the stump; and it consists in the fastening of such bucket to the stump by means of atmospheric pressure in such a manner that the straps usually employed for this purpose can be dispensed with, and at the same time a perfect fit of the bucket is attained.

The invention consists, further, in the peculiar construction of the knee-joint, which is formed of two cylindrical rollers—one being secured to the upper end of the large bone of the leg (tibia) and the other to the lower end of the thigh bone, (femur,) and each provided with a projecting lip or stop—in combination with an elastic band or spring, and with a double concave sector fitting between the two cylindrical rollers and held in place by metallic clasps, which also form the bearings for the axes of said rollers, in such a manner that in walking the cylinders roll over each other, instead of rubbing, as is the case with other joints, and consequently the friction is considerably diminished, and at the same time, by the elastic band, the forward movement of the foot while walking is facilitated and uniform elastic pressure on the knee-pan is effected.

It consists, further, in dividing the toe-piece of the foot in two or more distinct parts, each being provided with a separate joint and adjustable spring in such a manner that the toes can adapt themselves to the inequalities of the ground.

It consists, finally, in the arrangement of curved tails or shanks projecting from the toes on the under side or sole of the foot, in combination with suitable leather straps and springs and adjusting-clasp, in such a manner that the rigidity in the play of the toes can be regulated at pleasure, and that the toes are kept in the proper position to prevent interference when bringing the foot forward, and when the foot is brought down on the ground it presents a comparatively large and a yielding base, and enables the person wearing the leg to maintain his or her balance with little labor.

To enable those skilled in the art to make and use my invention, I will proceed to describe it with reference to the drawings.

A represents the bucket or socket to receive the stump of the amputated limb. The process by which this bucket is formed is somewhat similar to that by which dentists form plates of hard rubber to conform perfectly to the roof of the mouth to be held there by atmospheric pressure. A form or mold of the stump is prepared in wax or plaster-of-paris, (if of plaster-of-paris the inside of the mold should be oiled,) or gutta-percha may be employed. Into this mold plaster-of-paris or fusible metal is cast, and thereby a perfect fac-simile or form of the natural stump is obtained. Around this form a sheet of india-rubber or gutta-percha compound prepared for hard vulcanization is tightly wound and made to smoothly conform to said form. The whole is then firmly bound with wetted cloths or embedded in plaster-of-paris, and thus prepared it is placed in the heater and vulcanized. After the vulcanization is completed the bucket is taken out and polished and mounted, as will be presently described.

Instead of this mode of obtaining the bucket, the following process may be found practicable: A hollow cone of vulcanite is formed, the inner circumference of which is the measurement of the stump to be fitted. A form or fac simile of the stump is next taken, as above described. The hollow cone is heated to 212° Fahrenheit, or more, if necessary, and forced over the form of the stump and allowed to cool upon it. The form is next broken out. If of plaster, or if of fusible metal, the whole is embedded in plaster-of-paris, and then the metal melted out by immersion in oil or other liquid capable of sustaining the required temperature. The bucket A is provided with a small faucet, *a*, inserted in its under side, and,

when properly made by either of the above or any other suitable process, so perfectly does it fit the stump that on opening the faucet and forcing the stump into said bucket, and closing the faucet again, the pressure of the atmosphere will hold the bucket in its place till air is readmitted through the faucet. To obviate any inconvenience from insensible perspiration a dry sponge, cotton, wool, or small bag of fused chloride of calcium may be placed at the bottom of the bucket. This bucket is fastened to that part representing the thigh-bone or femur B, when used for a leg above knee, or the stump of the arm or leg below knee by a metal ferrule, *b*. From this ferrule three or more metal bands, *c*, project, which are riveted to the bucket. By this arrangement it is perfectly easy to adjust the length of the limb with mathematical accuracy simply by shifting the ferrule *b* up or down on the artificial thigh-bone B until the bucket has attained the required position.

C is the knee-joint, which is formed of two cylinders, *d e*, one being fastened to the lower end of the artificial thigh-bone B, and the other to the upper end of the artificial large bone of the leg or tibia D. Each of these cylinders is provided with a lip or off-set, *d' e'*, and they rotate on axles *d* e**, which have their bearings in metallic clasps *f*. A double concave sector, *g*, is placed between the cylinders *d e*, being retained in its place by pivots *g'*, passing through the clasps *f*. The concave sides of this sector, which fit the surfaces of the cylinders *d e*, form the artificial knee-pan and its edges by coming in contact with the lips or off-set *d' e'*, confine the motion of the joint within the desired limits. An india-rubber band, *h*, which is stretched over the convex surface of the knee-pan and around the supports B D has a tendency to straighten the knee-joint, and thereby assists the movement of the foot forward while walking, and at the same time a uniform elasticity is obtained by said band over the artificial knee-pan. The cylinder *d* rolls on the surface of the lower one, *e*, and the friction created by the working parts of the joint is reduced to the smallest possible degree. The heel or ankle-joint E is formed of two pieces, *i j*, one of which is provided with a semi-spherical socket and the other with a corresponding prominence, as clearly shown in Fig. 1 of the drawings. This prominence fits perfectly the socket, and each of the two pieces *i j* is provided with flanges projecting beyond the socket and prominence, whereby the movement or play of said parts in either direction is confined between limits, such as may be desired by the constructor. The upper part, *i*, of the heel-joint is fastened to the lower end of the artificial tibia, and the lower part, *j*, of said joint is screwed or otherwise firmly secured to the foot-piece F, and the two parts *i j* are fastened together by an india-rubber tube, *k*, of proper thickness and strength to attain the effect desired, which is stretched over the same and secured to each part by tying with cord or in any other desirable manner. The foot-piece F corresponds to the bones of the instep and heel-bone of the natural foot. Its front end, *l*, is rounded off and forms the fulcrum for the piece G. This piece is divided into three (more or less) distinct parts, *m m' m''*, one of which corresponds to the large toe, and each of the others to two of the other toes, as clearly shown in Figs. 3 and 4 of the drawings. These toe-pieces are held in place by bands *n*, of leather or other inelastic but flexible material, fastened by means of screws or any other desirable means to the under side of the same and of the foot-piece, and by elastic bands *o*, of india-rubber or any other suitable material, fastened by any convenient mode to the upper surface and that of the foot-piece, as clearly shown in Figs. 1, 3, and 4. The inner ends of the elastic bands *o* pass through a metal clasp, *p*, so as to admit tightening or loosening, according to the requisite rigidity desired in the play of the toes. By the action of these elastic bands or springs the points of the toes are thrown up so as to prevent interference when bringing the foot forward, and their position is regulated by the length of the leather bands *n*, which bear against the stems or tails *m**, extending from the toe-pieces *m m' m''* below the point of the foot-piece F, as shown in Fig. 1 of the drawings. If the weight of the body is upon the front of the foot, by the action of the tails *m** the toe-pieces are turned down and a large base is attained, thereby enabling the person wearing the leg to maintain his or her balance with little labor. By the division of the toes they are enabled to adapt themselves to an unequal surface. The heel H is covered by an elastic pad, to prevent any jarring in the act of walking. The case for this leg or arm may be made of cork, papier-maché, or any other suitable material, but that form I would recommend would consist of a leather tube cut into the shape of the limb, sewed up, and small hoops of steel springs placed and fastened on the interior at about three inches apart to give form to the case, and at the same time preserve its flexibility. Such a case might be fastened by hooks to the bucket at the top, and when used for a leg be made to connect at the bottom with the leather boot, inclosing the foot.

The principal advantages of my artificial limb are that it can be fastened to the stump without the use of straps around the waist or shoulder, and it requires no tedious fitting. With limbs of the ordinary construction the patient is required to sit and wait for repeated trials, while the artisan scrapes away the wood to fit the socket, and this operation is hardly ever attended with perfect success until after several trials of the leg. Furthermore, my knee-joint works with the least possible friction. It is simple, cheap, durable, and not liable to get out of order, and the toe-piece of an ordinary leg presents not quite

one-half the area for basal support that is attained by the peculiar arrangement of the toe-piece in my leg.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. Fastening the bucket A of an artificial limb to the stump by means of atmospheric pressure, substantially in the manner specified.

2. The knee-joint C constructed of two cylinders, *d e*, clasps *f*, double concave-sector *g*, and elastic band *h*, all arranged and operating substantially in the manner and for the purpose herein shown and described.

3. Dividing the toe-piece G in two or more distinct parts, substantially as and for the purpose set forth.

4. The arrangement of the stems or tails *m**, projecting from the under side of the toe-pieces *m m′ m″*, in combination with the bands *n*, of leather or other suitable material, and with the elastic bands *o*, adjustable by a metal clasp *p*, or its equivalent, all constructed and operating substantially in the manner and for the purpose described.

DUBOIS D. PARMELEE.

Witnesses:

TIMOTHY SHINE,

M. S. PARTRIDGE.