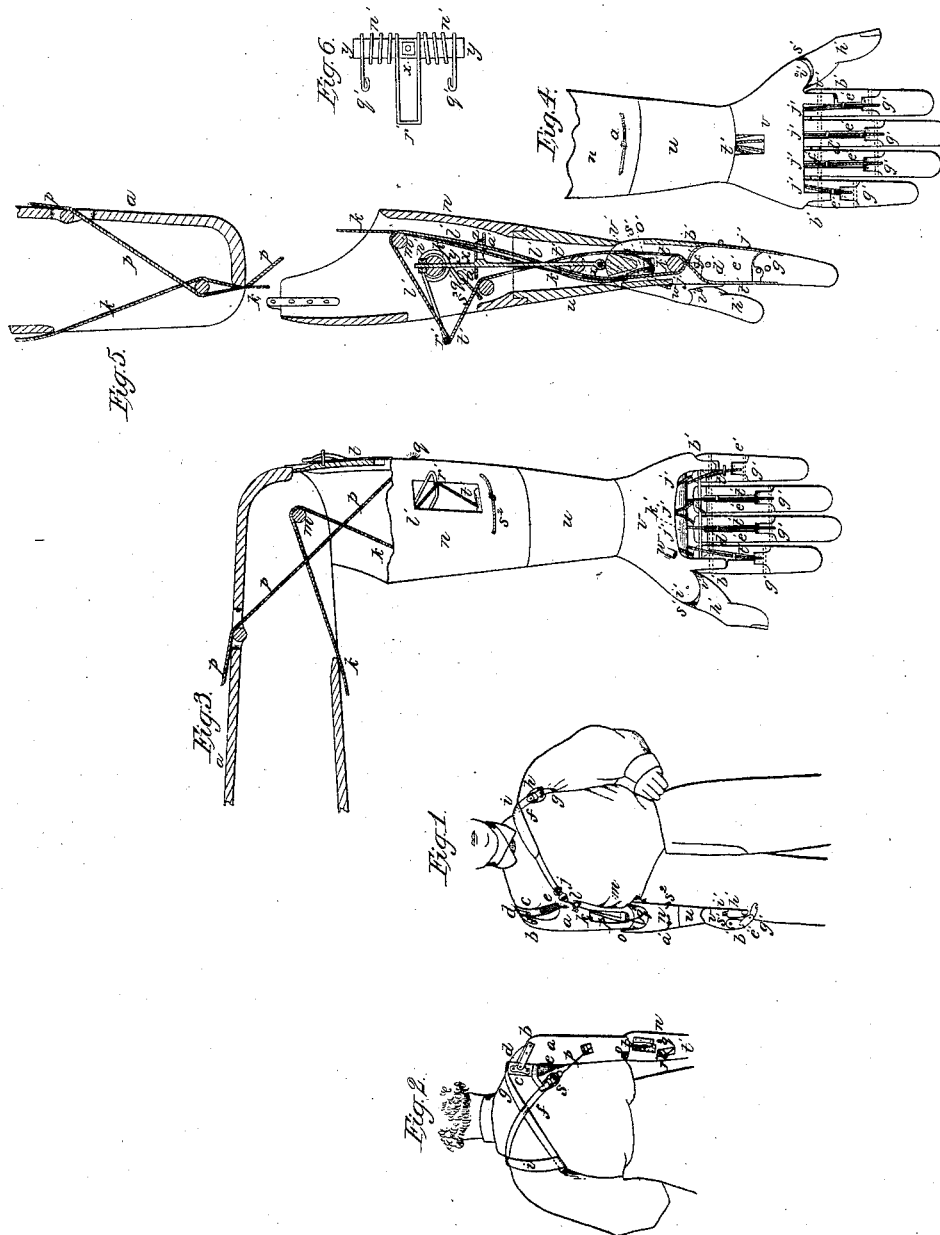


T. Uren,
Artificial Arm and Hand,
Patented Jan. 31, 1865.

N^o 46,159.



Witnesses:
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IMPROVEMENT IN ARTIFICIAL ARMS AND HANDS.

Specification forming part of Letters Patent No. 46,159, dated January 31, 1865.

To all whom it may concern:

Be it known that I, THOMAS UREN, of the city, county, and State of New York, have invented certain new and useful Improvements in Artificial Arms and Hands; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a front elevation of the upper part of a person with an artificial arm and hand applied, and Fig. 2 a back elevation, both figures representing the mode of attaching the artificial arm; Fig. 3, a section of the upper arm, combined with an elevation of the forearm and palm of the hand, and representing the forearm as held by the bolt *t* at right angles to the upper arm; Fig. 4, a view of the back of the hand and a portion of the forearm; Fig. 5, a vertical section of the arm and hand, the forearm and hand taken in a plane at right angles to the plane of the palm of the hand, and with the fingers distended and the upper arm detached and partly turned, that the plane of the section may represent the mechanism; and Fig. 6, a plan of the spring.

The same letters indicate like parts in all the figures.

The first part of my said invention relates to a simple means of connecting an artificial forearm to an artificial upper arm, so that by a single cord and its connections the person wearing it can, by the motions of the stump of an upper amputation, impart the desired motions to the forearm; and the last part of my said invention relates to an improved means for operating the fingers and thumb of an artificial hand.

In the accompanying drawings, *a* represents the upper arm, or that portion of it which extends from the elbow to the shoulder. It is made hollow, of wood, papier-maché, leather, or other suitable material. The upper end is suitably formed to receive the stump of the amputated arm, and to extend up in front and back of the shoulder, as at *b b*, to which parts a broad strap, *c*, or shoulder-plate, made of leather or other suitable material, is connected by two metallic joints, which I prefer to make as represented at *d d*. To both ends of this strap or shoulder-plate is secured a strap or webbing, *e*, which extends under the armpit. To the back of the shoulder-plate *c*, and just

below the back joint *d*, is secured one end of a strap, *f*, which extends across the back and over the other shoulder; and one end of another strap, *g*, is attached to the shoulder-plate *c* between the two joints *d d*, extends across the back to and under the other armpit, and up in front, where it is connected by a buckle, *h*, to the first-named strap, *f*, the two being attached where they cross at the back, and being also connected by a strap, *i*, which passes over the shoulder. This strap *i* extends beyond the strap *f* in front, and is connected by a buckle, *j*, with a cord, *k*, which I prefer to make of catgut, which passes under a guide-roller, *l*, attached to the upper arm, *a*, and thence it passes through an aperture to the inside of the arm *a* and around a guide-roller, *m*, to the inside of the forearm, where it is attached to the finger-expansion cords, as will be hereinafter described. The fore or lower arm, *n*, is also made hollow and of wood or other suitable material, and it is hinged to form the elbow-joint by hinge-pieces *o o*. A cord, *p*, is attached to the inside of the forearm at *q*, a short distance below the elbow-joint and at the rear part thereof, and this cord passes over the guide-roller *m* in the lower part of the upper arm, and thence passes out through a hole in the rear part, and not far from the upper end, and there passes around a guide-pulley, and is then secured by a buckle, *s*, to a short strap projecting from the strap *f* at the back; and by reason of the connections of this cord it results that when the stump of the natural arm is moved forward, as in the act of lifting the natural arm, a pull is made on the cord *p*, which lifts the forearm *n* toward the face, as by the action of the contracting muscles of a natural arm, and when the stump of the natural arm is moved back the tension on this cord is relieved, and the forearm descends by gravity.

It is desirable for many purposes to hold the forearm in a position at or nearly at right angles with the upper arm. To do this by the action of the stump of the natural arm would be very fatiguing, particularly in the case of a short amputation. To effect this purpose without fatigue, I have combined with the two parts of the arm hinged a sliding-bolt, *t*, or stop, which is adapted to slide in a recess in the back part of the forearm *n*, and near the elbow-joint. This bolt has a short handle,

which projects through a slot to the outer surface, so that it can be reached conveniently to be operated. One edge of the said slot is notched, and the opposite edge is provided with a strip of vulcanized india-rubber, or equivalent spring, which presses against the handle of the bolt, and by its tension tends to force it into the notches formed in the opposite edge of the slot. When the bolt is pushed until its handle is forced into the notch nearest the elbow-joint, the end of the bolt abuts against the lower end of the upper arm, *a*, and the forearm *n* is thereby held in a position forming an acute angle with the upper arm, and if the said handle be placed in the middle notch the forearm will be held in a position at right angles with the upper arm, and when placed in the notch farthest from the elbow-joint the end of the bolt clears the upper arm and leaves the forearm free to be moved. In this way the forearm can be readily fixed in any desired position, or left free to be operated by the motions of the stump of the natural arm, and as there is a spring-pressure which tends constantly to force the handle into the notches, to operate the bolt it is only necessary to draw the handle out of any one notch, and by it push the bolt lengthwise to the desired position.

It is best to make the wrist part *u* separate from the forearm and hand, and fitted to the lower end of the forearm by a flute-joint, so that it can turn thereon, and fitted to the upper part of the hand *v* by forming the outer end of the said wrist-piece of a semi-cylindrical shape fitted to a socket of corresponding shape in the upper end of the hand; and a rod, *w*, inserted and secured in the hand, is hinged to another rod, *x*, so that the axis of this joint shall be about the junction of the hand with the wrist-piece, and this latter rod, *x*, extends through the wrist-piece into and through a hole in a cross-bar, *y*, placed in the lower part of the forearm, and this rod has a short arm, *z*, projecting from it with two cords, *a'*, which extend in opposite directions through holes in and to the outer surface of the forearm, where they are tied, so that by drawing on these cords and tying them the hand can be turned and set in any desired position.

The hand is preferably made in one piece as far as the main knuckle-joints *b'*, and the forefinger and the little finger are connected with the hand by rule-joints, and a fulcrum-pin, *d'*, passes through, on which the rear ends of all the fingers *e' e' e' e'* are mounted so as to turn to a limited extent, the rear ends of the fingers being so formed as to strike against a rod, *f'*, parallel with the fulcrum-pin *d'* and above it, which serves as a stop to limit the range of motion of the fingers either when opened or closed.

The fingers are each formed with a second knuckle-joint, *g'*, which is preferably made in the form of rule-joint, as represented. The thumb *h'* is connected with the hand by a rule or other equivalent joint, *i'*. If desired, it may

be made with a second joint, like the fingers, but this is not deemed to be essential.

Four cords, *j' j' j' j'*, preferably made of cat-gut, and which I term the "finger-expansion cords," are attached, one to each finger, between the second knuckle-joints and the tips, pass over the outer surfaces, which are best made with guide-grooves for the purpose, and under guide-staples near the main knuckles. The four cords pass under a guide-roller, *k'*, in the hand, and beyond that they are all connected to one cord, *l'*, and thence continue as a single cord through to the inside of the forearm to and around a guide-roller, *m'*, mounted in the forearm, and then it is attached to the upper side of a spring, *n'*, to be presently described; and the said expansion-cords are also united to the cord *l'* before described, so that the fingers can be opened either by the tension of the spring or by the same back movement of the stump of the arm which is required for throwing out or straightening the forearm. A fifth cord, *s'*, which is attached to the thumb, back of its fulcrum-pin, and which I term the "thumb-expansion cord," passes inside of the hand, under a roller, *o'*, and is then attached to the finger-cords, where they are united, and to be operated in like manner. The four fingers and the thumb are closed by the tension of the spring *n'* within the forearm. This spring is preferably made of coiled wire and held in place by the cross-bar *y*, which extends through it and across the inside of the forearm; and this spring is so coiled as to have two arms, *q'*, and one, *r'*, and the arm *r'* is formed by bending the wire at the middle of its length and then coiling up each end in the form of two helices, and then extending the two ends and leaving them to project sufficiently to form the other two arms, *q'*, to the extremities of which cords *s² s²* are attached, which pass through holes to the outside of the forearm, where they are connected so that they can be readily tightened or loosened to increase or decrease the tension of the spring to regulate the grasp of the fingers and thumb.

Four cords, *t'*, termed the "finger-contracting-cords," (one for each finger,) are attached to the under side of the fingers, pass to the inside of the hand, over the guide-roller *k'*, to the front side of the arm *r'* of the spring *n'*, to which they are all attached; and a fifth cord, *v'*, termed the "thumb-contracting cord," is attached to the inner part of the thumb, and passes around the roller *o'*, and thence as the finger-contracting cords, and like them attached to the arm *r'* of the spring *n'*.

By the means above described the fingers and thumb are closed or contracted by a spring, the tension of which always tends to close them, and by a force which can be readily regulated, and they are opened or expanded by pulling on the finger and thumb expanding cords, which is effected by the same outward movement of the stump of the amputated arm which is used for throwing out the forearm.

From the foregoing it will be seen that the fingers and thumb are thus suspended to the spring, which is interposed between the expansion and contraction cords, and which are connected with it on opposite sides, so that by tightening the cords which are connected to the arms q' , of the spring the tension of the said spring will contract the fingers and thumb and thus keep the hand closed; but by throwing out the arm the expansion-cords are pulled by their connection with the straps over the breast, which overcomes the tension of the spring n' , and the fingers and thumb are thereby expanded to open the hand.

The outer end of the arm n' of the spring n' , with which the expansion and contraction cords are connected on opposite sides of it, projects to a sufficient distance outside of the forearm, so that bearing the outer end of it on a table or any other surface and drawing the arm back will cause the fingers and thumb to be operated and the hand to be opened at the will of the person wearing it.

When this is to be applied to an amputation below the elbow, but which is not too near the wrist, the spring n' and its connections should be placed lower down toward the wrist to leave the requisite room for the reception of the stump of the natural forearm, to which the upper end of the forearm will be properly adapted; and although I have herein described the adjustability of the several cords as being effected by simply tying, I wish it to be distinctly understood that I do not

limit myself to the use of such means of adjustment and attachment, having simply adopted such mode as being cheap, simple, and convenient; but it will be obvious that other and equivalent modes of attachment and adjustment may be substituted without changing the principle or mode of operation which constitutes my invention.

I claim—

1. Combining the forearm, which is hinged at the elbow to the upper artificial arm, with a cord attached to the back of the forearm and below the elbow joint, and which passes over a guide-roller mounted in the forearm and near the lower part thereof, and thence through the back of the upper arm, and attached to the strapping at or near the back, substantially as described, thus enabling me to produce an artificial arm for an upper amputation which, by a single connection will enable the person wearing it to move the arm at will, as described.

2. The spring arm or lever which projects to the outside of the forearm, so as to be operated by bearing against any resisting object, substantially as described, in combination with the jointed fingers and the expansion and contraction cords, substantially as and for the purpose specified.

THOMAS UREN.

Witnesses:

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