J. T. JENSEN.
ARTIFICIAL ARM AND HAND.
APPLICATION FILED JULY 2, 1917.

1,303,905.

Patented May 20, 1919.
2 SHEETS—SHEET 1.

Fig. 1.

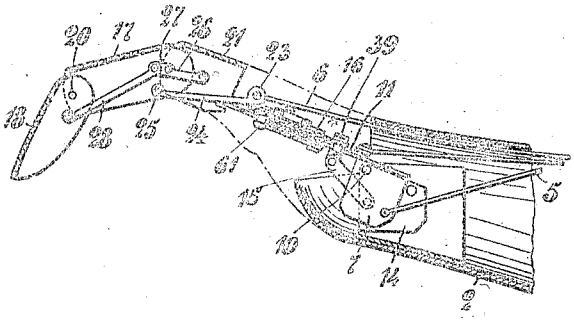


Fig. 2.

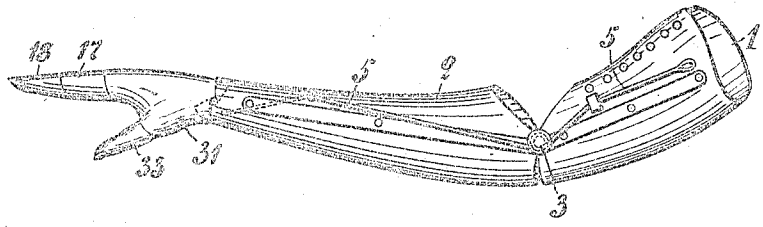
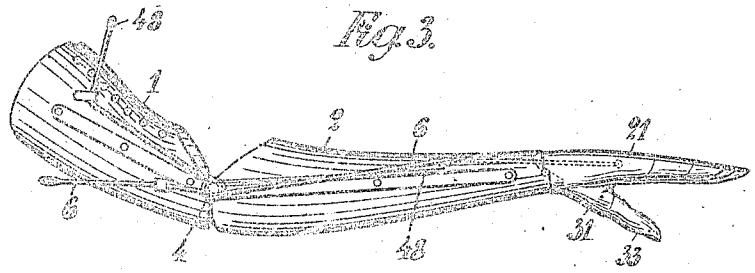


Fig. 3.



Inventor
Jørgen Thomas Jensen
by
Attorney

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Fig. 4.

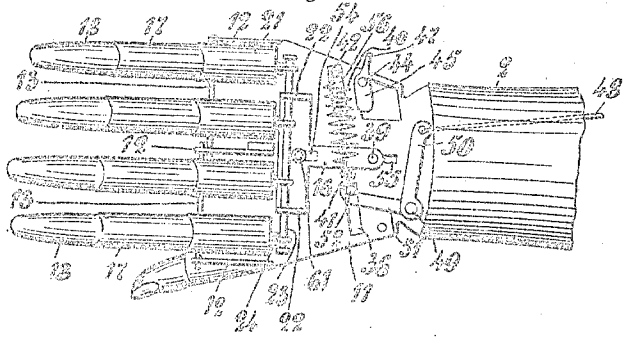


Fig. 5.

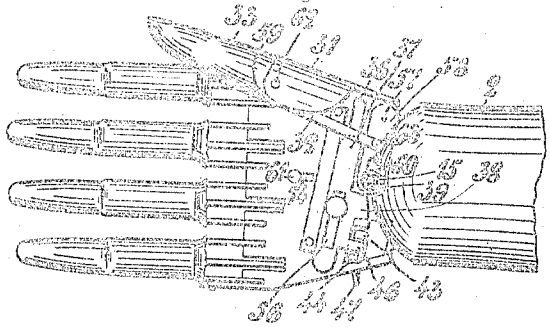
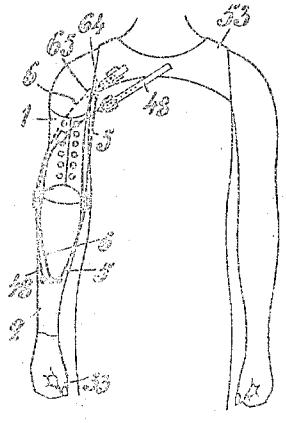


Fig. 6.



Inventor

Jørgen Thomas Jensen

By Bringle & Co.

Attorney.

UNITED STATES PATENT OFFICE.

JØRGEN THOMAS JENSEN, OF COPENHAGEN, DENMARK.

ARTIFICIAL ARM AND HAND.

1,303,905. Specification of Letters Patent. Patented May 20, 1919.

Application filed July 2, 1917. Serial No. 178,346.

To all whom it may concern:

Be it known that I, JØRGEN THOMAS JENSEN, a subject of the Kingdom of Denmark, and a resident of Copenhagen, Denmark, No. 50 Olfert Fischersgade, bandage-maker, have invented new and useful Improvements in Artificial Arms and Hands, of which the following is a specification.

This invention relates to improvements in artificial hands.

It is known in artificial hands to provide means under the control of tension members attached to the shoulder or upper arm of the patient for positioning the fingers or finger joints of the hand. It is an object of the present invention to improve this control of the finger joints and the thumb by the provision of relatively movable plates located in the forearm and in the wrist portion of the artificial hand and subject to the control of tension members in such manner that movement of one of these plates also will influence the other plate and thereby alter the positions of the thumb joints and finger joints relatively to each other.

Other objects relating to the improvements in the general construction of devices of this kind will be more fully understood by reference to the following specification and accompanying drawings, wherein—

Figure 1 is a central vertical section through a finger and the mechanism of the artificial hand, certain parts being, however, omitted;

Fig. 2 is a side elevation of the artificial hand and the upper and fore arm members connecting the artificial hand with the arm or arm stump of the invalid;

Fig. 3 is a side elevation similar to Fig. 2, viewed from the other side;

Fig. 4 is a top plan view of the artificial hand;

Fig. 5 is a bottom plan view of the same, and

Fig. 6 illustrates the attachment of the tension elements to the body of the wearer.

While in the accompanying drawings and in the following specification reference is made to the embodiment of the invention contemplating the use for an invalid who is able to bend the elbow joint, it should be pointed out here that the invention also is applicable to the use by invalids who have left only a stump of the upper arm, and wherein a bending of the elbow may also be effected by tension elements attached to the shoulder or in some other suitable way.

The upper arm portion 1 and the sleeve 2 for the fore arm are interconnected by pivots 3 and 4, located in proximity of the natural elbow, whereby these two arm members may be held in their relative position by bending of the elbow joint. The invalid carries, in addition to these arm sleeves 1 and 2, a yoke 53 (Fig. 6), which rests on his shoulders and to which tension elements 5 and 6 are secured at one end. As may be seen from Fig. 6, the tension element 5 in form of a strap is secured to the front portion of the yoke, while the tension element 6 is fastened to the rear portion, and both of these tension elements are trained over little pulleys on the hinge pivots 3 and 4, and are then threaded into the interior of the fore arm sleeve 2 through suitable openings. The fore arm sleeve 2 contains, in its front portion, as shown in Fig. 1, a stationary plate 14, to which another plate 7 is pivotally secured. The pivot 10 extends through a point near one corner of the plate 7, and the strap 5 is attached to it near the diagonally opposite corner.

The plate 7 serves as support for a transverse plate 11, located approximately in the palm of the hand and provided near its forward portion at its lateral edges and near the center (Fig. 4) with upwardly directed flanges 12. These flanges serve as bearing members for pivots 13 for first finger joints 21.

A slide or plate 16 of T-shape, Fig. 4, rests on the upper surface of the palm plate 11, and is guided in said plate by bolts 39 and 61, which project through suitable slots 55 and 54 respectively in the plate 11 (Figs. 1 and 4). The bolt 39 is pivotally secured to a connecting arm 15 (Fig. 1), one end of which is pivotally attached to the stationary plate 14 in the fore arm member 2.

Each of the four fingers consists of three joints 21, 17, and 18, (Figs. 1 and 4). The middle joint 17 and the tip or forward joint 18 are both movably connected to the first joint 21, and are also pivotally interconnected by pins 20, which pass through the rear portion of the tip joint 18 and the forward portion of the middle joint 17.

The transverse head of the slide 16 has upwardly projecting flanges 22, which serve as supports for a shaft 23, projecting be-

yond said brackets. A link 24 extends through each of the first joints 21 of the fingers, and is movably connected with a pivot 25 in the joint 17, while the other end of the link is movably secured to the transverse shaft 23.

A movable connection between the joints 17 and 21 is provided in the form of a link 26, pivoted about the shaft 13, and having one end secured to the joint 21, while the other end, indicated at 27, is pivotally secured to an arm 28, the front portion of which is movably mounted in the front joint 18 of the finger.

The thumb of the artificial hand is shown as consisting of the two joints 31 and 33, the fore joint 33 being pivoted on a pin 62, which extends through the rigid member 31 into the plate 11. The joint 33 of the thumb also is connected by means of the link 32 with a bifurcated lever 58, slidable in the lower surface of the wrist plate 11. The link 32 is secured to the joint 33 by the pivot 59, and is attached to the lever 58, which is pivoted on the pin 57 by means of the pin 63. The bifurcated portion 60 of the lever 58 straddles the shank of the screw 39, and it is obvious, therefore, that upon displacement of the slide 16 with respect to the plate 11 the joint 33 of the thumb also will be moved.

The operation of the movable members of the hand may be described at the present without reference to the device for locking these movable members in adjusted position. The strap 5, being attached at 64 (Fig. 6) to the front portion of the yoke 53, a slight forward movement of the arm necessarily will release the tension under which the strap 5 may be. This movement will, however, tension the strap 6, which is attached to the rear portion of the yoke at 65 (Fig. 6).

The pull of the tension member 6 will cause the shaft 23 and the slide 16 connected therewith to move rearwardly on the plate 11. As the bolt 39 of the slide 16 is connected by the link 15 with the stationary plate 14, it is obvious that the angle of this link 15 with respect to the stationary plate 14 will be changed, and this link 15 therefore will swing the plate 11 and hence also the plate 7 about the pertaining pivot 10. The parts may then assume the position shown in Fig. 1.

The movement of the slide 16 in direction toward the plate 7 naturally will also move the arms 24 rearwardly, thus causing the middle joints 17 of the fingers to assume the bent position in which they are shown (Fig. 1). In this movement the middle joints 17 will swing about the shafts 13, with which they are connected by the arms 26. As these arms 26 are connected by the links 28 with the first joints 18, the latter will be swung about their pivots 20, thus producing a natural bending of all of the joints similar to the movement which the joints of the fingers have in a hand.

The movement of the bolt 39 in direction toward the plate 7 also swings the lever 58 on the lower surface of the plate 11 rearwardly, and thereby causes a rearward movement of the link 32, so that the front end of this link will swing the thumb joint 33 about its pivot 62. The movement of the strap 6 therefore leads to the bending of the four fingers and to the inward movement of the thumb, so that all of the members of the hand assume a position in which they are ready to grasp an article.

The invention also contemplates the provision of means for yieldingly urging the fingers and thumb to grasping position. This device includes a transverse slide 37, mounted on the lower surface of the plate 11, and guided in the slots 36 and 56 thereof. A spring 40 is secured at one end to a lug 41 on the top surface of plate 11, and at its other end to a lug 42, which projects from the slide 37 through the slot 56 in the plate 11. A lever 45, mounted on the top surface of the plate 11 and oscillatable about the pivot 44, has a lug 43, which projects through a suitable opening in the plate 11, into the notch between the lateral projections 38 and 46 of the slide 37. If the lever 45 is moved to the position shown in Figs. 4 and 5, the slide 37 cannot leave the position in which it is shown in Fig. 5, and the spring 40 is maintained under tension. The lever 45 has an outwardly projecting tail piece 47, which facilitates the manual adjustment of said lever to release or locking position.

A movement of the slide 37 to normal position, as indicated in Fig. 4, may also be effected by a tension element or strap 48, which is secured to the lever 50, oscillatable about the pivot 49 of the plate 11. Another arm 51 rigidly connected with the rotatable arm 50 has a portion in engagement with the button or knob 52 on the slide 37, Fig. 4.

The release of the slide 37 may be effected by turning the small lever 45 about its pivot 44, and the return of the slide to locked position may be effected by the tension element 48, acting through the arms 50 and 51 upon the button 52.

If the slide is locked against movement, as shown in Figs. 4 and 5, the fingers and thumb of the hand can be moved by the strap 6, as indicated above, without causing any movement of the slide 37 or without being influenced by the same. When, however, the slide 37 is released, owing to the turning movement of the locking lever 45, this slide will be pulled automatically in direction toward the thumb root portion 31 by the spring 40. If, then, the strap 6 is placed under tension, the curved edge of the slide 37 adjacent the shoulder 38

will engage the end 60 of the lever 58, and will force this lever rearwardly to urge thereby the front joint 33 of the thumb and the fingers to grasping position. These members of the hand then are permanently in condition to retain the article which is grasped by the same, until the strap 48 is pulled, which under coaction of the arms 50, 51 forces the slide 37 into the position in which it is shown in Fig. 5. The lever 45 then may lock the slide 37 in this position. As long as the lever 45 is held out of this locking position, the curved edge of the slide 37 engaging the lever 58 and each tension movement of the strap causes the fingers to "close over" the article, so that, immaterial of the size of the article, the artificial hand will retain the article.

If the hand has been moved to grasping position, and if the tension member 5 is actuated, it is obvious that the return of the plate 7 to the original position (not shown in the drawing) with the simultaneous release of the tension on the member 6, will have the effect of stretching the hand into that position in which it is shown in Figs. 2, 3, and 4.

I claim:

1. In an artificial hand, the combination of a fore arm sleeve; a plate pivotally mounted thereon; another plate slidably mounted on said first named plate; fingers consisting of several joints, and tension elements connected with both of said plates, the first named plate being secured to one joint of each finger and the second named plate being secured to another finger joint of each finger.

2. In an artificial arm, the combination, with a fore arm sleeve, of a plate rigid in said sleeve, another plate pivotally mounted in said arm sleeve; finger joints pivotally mounted on said second plate; a third plate slidably mounted on said second named plate; other finger joints movably connected with said third plate; and a tension element for moving said third named plate on said second named plate and for moving said second named plate in said fore arm sleeve with respect to said first plate.

3. In an artificial arm, the combination, with a fore arm sleeve, of a plate pivotally mounted in said arm sleeve; finger joints secured to said plate; a plate slidably mounted on said first named plate, finger joints secured to said second plate, a thumb root; a thumb joint; means connecting said thumb joint with said slidable plate, and a tension element secured to said slidable plate adapted to produce relative movement between said finger joints and said thumb joints when said slidable plate is moved with respect to the pivotal plate.

4. In an artificial arm, the combination, with the fore arm sleeve, of a plate pivotally mounted in said sleeve; finger joints secured to said plate, another plate slidably mounted on said first named plate; finger joints connected with said second plate; a thumb joint pivotally mounted on said first plate; means for sliding said second plate with respect to the first named plate and for causing movements of said finger joints, and means connecting the thumb joint with slidable plate for moving said thumb joint.

5. In an artificial arm, the combination of a fore arm sleeve; a plate pivotally supported therein; finger joints movably secured to said plate; a slide on the top surface of said plate; a shaft supported by said slide; additional finger joints; connections extending from said shaft to said additional finger joints; guiding means for said slide on said pivotal plate; connections between said guiding means and the support for the pivotal plate; and a tension element secured to said slide.

6. In an artificial arm, the combination with a fore arm sleeve, of a pivotal plate supported near one end in said arm sleeve; finger joints, a shaft mounted on said plate near the other end thereof and loosely supporting said finger joints; links extending from said shaft; additional finger joints movably secured to said links; a slide guided on said plate; a tension member secured to said slide and adapted to cause displacement of said plate upon its support when tension is applied; links extending from said slide to said second finger joints; third finger joints; and links extending from said middle finger joints to said third finger joints, whereby upon sliding displacement of the slide on the pivotal plate all of said finger joints alter their angular position with respect to each other.

7. In an artificial arm, the combination, with a fore arm sleeve, of a plate pivoted in said arm sleeve; finger joints pivoted to said plate; a slide guided in said plate; finger joints movably secured to said slide; a tension member adapted to displace said slide with respect to said plate and said plate with respect to its support and said finger joints relatively to each other; a finger bending device; means for normally holding said device in a position in which it does not influence the movement of the other members of the artificial arm, and means for permanently influencing said slide through said finger bending device when said device is released.

8. In an artificial arm, the combination, with a fore arm sleeve, of a plate pivotally mounted therein; finger joints pivotally secured to said plate; a slide guided on said plate; other finger joints movably secured to said slide; a tension element secured to said slide and adapted to displace said slide with

respect to said plate and said plate with respect to each other; another tension element; means under the control of said other tension element for yieldingly pressing said slide in a predetermined direction, and locking means for said last named device.

9. In an artificial arm, the combination, with a fore arm sleeve, of a plate; finger joints pivoted thereto, a slide on one surface of said plate; finger joints movably connected with said slide; a lever controlled by said slide and mounted on the other surface of the plate; another slide on the other surface, said other slide being provided with a portion adapted to act on the said lever and to displace said first named slide in a predetermined direction.

10. In an artificial arm, the combination of a plate, a slide mounted on one side thereof; finger joints controlled by said slide; a thumb actuating lever mounted on the other surface of said plate; means for controlling said thumb actuating lever through said first named slide, a second slide mounted on the other surface of said plate having a curved edge in engagement with said lever, and a spring mounted on the first mentioned surface of said plate for forcing said second slide in a predetermined direction to bring the curved edge into engagement with said lever.

11. In an artificial arm, the combination of a plate; finger joints; a slide controlling said finger joints mounted on the top surface of said plate; a thumb lever mounted on the bottom surface of the same, connections between said slide and lever for actuating the thumb and finger joints upon displacement of said slide; a tension element for displacing said slide; a second slide on the bottom surface of said plate having a notch in one edge thereof, a lever adapted to enter said notch and to lock said second slide in predetermined position, and a tension element connected with said second slide for causing displacement of said slide when released from its lock.

12. In an artificial arm, the combination of a plate; finger joints, thumb joints; tension elements; means interposed between said tension elements and joints for actuating the same, said actuating means being movable on said plate; a slide on said plate adapted to move said actuating means into a position in which the fingers and thumb grasp an article, independently operable means for locking said slide in inoperative position; a spring for yieldingly moving said slide to operative position, and a tension element attached to said slide for overcoming the action of said spring.

13. In an artificial arm, the combination, with the fore arm sleeve, of a plate pivotally mounted in said sleeve; finger joints secured to said plate; another plate slidably mounted on said first named plate and guided to move in a predetermined direction thereon; finger joints connected with said second plate; a thumb joint pivotally mounted on said first plate; means for sliding said second plate with respect to the first plate in direction toward and away from said finger joints, and means connecting the thumb joint with said slidable plate for moving said thumb joint in a direction substantially at right angles to the finger joint.

14. In an artificial arm, the combination of a fore arm sleeve; a plate pivotally supported therein; finger joints movably secured to said plate; a slide on the top of said plate; means for guiding said slide in a direction toward and away from said finger joints; a tension element connected with said slide; another slide mounted on said plate; a spring permanently acting on said other slide; said second slide being guided in a direction substantially transversely to the first named slide, and means interposed between the two slides for influencing the first named slide through the movement of said second named slide.

Signed by me at Copenhagen, Denmark, this 25th day of May, 1917.

JØRGEN THOMAS JENSEN.

Witnesses:

MARTENS,

CHAS. HUDE.