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W. M. DRENNON

2,556,524

ARTIFICIAL HAND

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FIG. 1.

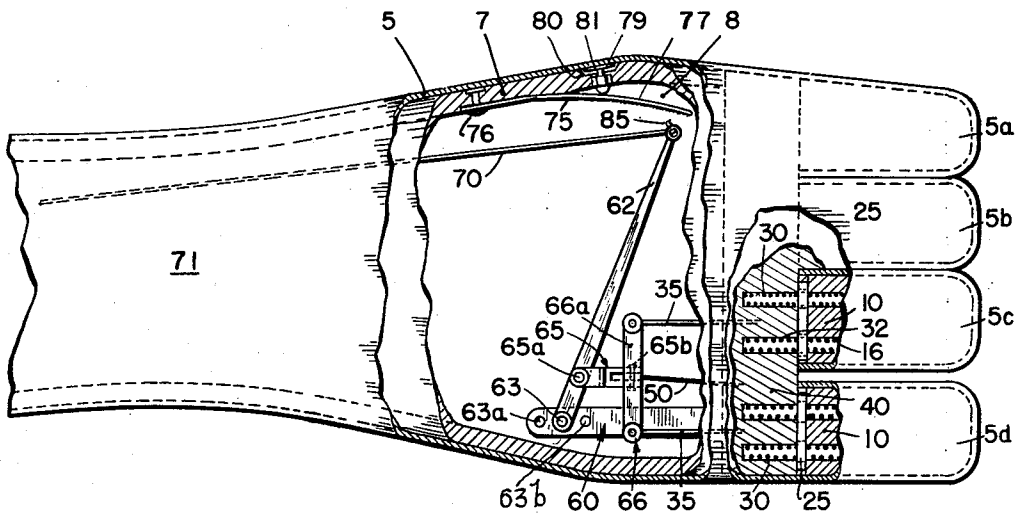


FIG. 2.

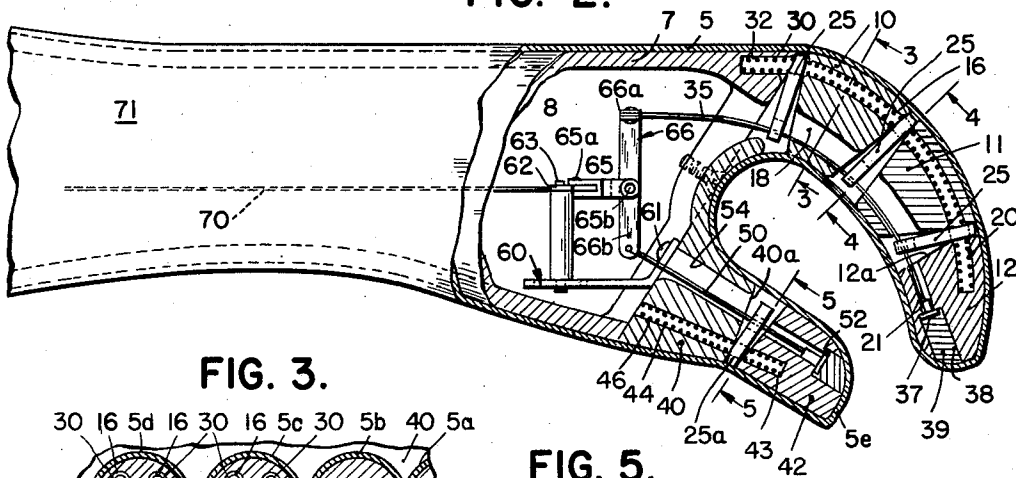


FIG. 3.

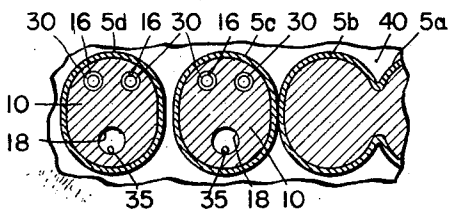


FIG. 5.

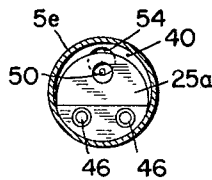


FIG. 4.

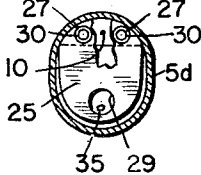
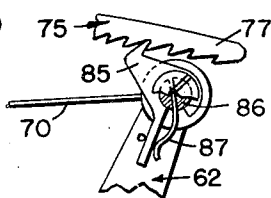


FIG. 6.



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ARTIFICIAL HAND

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6 Claims. (Cl. 3—12)

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This invention relates to improvements in artificial hands.

It is among the objects of my invention to provide an artificial hand which simulates the human hand as nearly as possible both in appearance and in operation.

It is another object to provide, in an artificial hand, a novel and efficient segmental finger construction which renders the fingers easily operated, quite flexible and capable of grasping an object with substantial strength.

A further object is to provide an artificial hand construction in which the segments comprising the fingers are readily operable to grasp an object but are resiliently held against rotative movement relative to each other.

Another object is to provide an artificial hand construction wherein the efficiency and durability of the hand are materially enhanced by use of novel spacer and guide elements between the segments comprising the fingers.

A further object is to provide an efficient means of automatically operating the fingers to cause them to grasp an object.

Another object is to provide artificial hand construction wherein the fingers may be releasably locked in object grasping position.

Other objects will appear hereinafter.

Generally described, my invention includes providing a substantially rigid hollow body portion for the hand, to which relatively movable finger segments are flexibly attached by means of springs extending through the segments, the springs providing hinges for the segments. Between the contiguous segments of each pair I preferably provide a spacer and guide element through which the springs and operating member extend. Actuating wires lead from the end-most segments through the other segments and spacers to the body and are there connected to a lever mechanism, from which a wire or chain leads up the sleeve of the user to be anchored at the shoulder. Thus, by moving the hand as a unit relative to the fist anchorage, the latter wire is placed under tension which causes the fingers to constrict about an object in the palm of the artificial hand. A flexible sheathing or glove, such as leather, rubber, or any suitable plastic material, covers the entire hand.

For instance, without intending to limit my invention in its broader aspects to such specific structure or embodiment, I illustrate in the accompanying drawings and will now describe a particular embodiment which I at present prefer. In the drawings:

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Fig. 1 is a top plan view of an artificial hand embodying one example of my invention, parts being broken away and some parts being sectioned for illustrative purposes;

Fig. 2 is a side elevation with some parts being broken away and some sectioned for illustrative purposes;

Figs. 3, 4 and 5 are sectional views taken on lines 3—3, 4—4 and 5—5, respectively, of Fig. 2; and

Fig. 6 is an enlarged fragmentary elevation of the locking mechanism.

Referring now to the drawings, I show a glove or sheathing 5 which I prefer to make of a flexible leather, although other materials may be used for the purpose, such as rubber or a suitable plastic. The glove is hand shaped, providing four finger portions 5a, 5b, 5c and 5d, and a thumb portion 5e.

The glove fits upon and encloses the finger segments to be described, as well as a rigid body 7 having an inner cavity 8 to house the operating mechanism to be hereinafter described.

Within each of the finger portions 5c, 5d, I mount a plurality of segments 10, 11, 12. As best shown in Figs. 2 and 3, the segments 10 and 11 are tapered towards the palm of the hand while the inner end surface of the tip segment 12 is correspondingly beveled at 12a. Each of the segments 10, 11 has a pair of transversely spaced parallel, longitudinal holes 16, and a relatively large lower hole 18, which holes extend through the respective segments. The tip segment 12 has two holes or sockets 20 registering with holes 16, and a socket 21 registering with hole 18.

A spacer and guide member 25 is interposed between contiguous segments. Each of the members 25 has a pair of holes 27 (Fig. 4) registering with holes 16, and a lower hole 29 registering with hole 18.

The other two finger portions 5a, 5b preferably do not contain segments such as before described, but each of those finger portions is filled by a relatively rigid integral part of the body extending into them, so that those fingers are stationary and have the shape of the other fingers when the latter are in the open position shown in Fig. 2. Of course, it is within the purview of my invention to make the fingers 5a and 5b of the construction of fingers 5c and 5d.

To urge the segments of fingers 5c, 5d into the object grasping position shown in Fig. 2, I provide in each of those fingers a pair of coil springs 30, the inner end of each of those springs being anchored in a socket 32 in the body and the

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outer end being anchored in the socket 20 in the tip segment, the respective springs extending through openings 16 in the intervening segments and through the holes 29 in the members 25. The spring is prestressed to draw the segments towards the body 7 and thus urge them into the object grasping position of Fig. 2.

A wire 35 is anchored at its outer end in socket 21 in the tip segment 12 and extends through openings 16, 29. To mount the anchor element 37 I provide a socket 36 in the tip segment and then, after effecting the anchor, fill the socket as by a plug 39.

Referring now to the thumb, its inner core portion 40 is rigid with the body 7, having a beveled outer end surface 40a. The tip segment 42 has a pair of parallel sockets or openings 43 which register with openings 44 in portion 40. A pair of coil springs 46 are anchored at their respective ends in the body and in the tip segment 42 and extend through openings 44 as well as through the openings 27 in the spacer and guide member 25a, which is like the previously described members 25. An operating wire 50 is anchored at its outer end in a socket 52 in the tip segment 42, extends through the opening 29 in the member 25a, and through an opening 54 in the portion 40.

The operating linkage will now be described. A bracket 59 is fixed to the body by means of a screw 61 and has a lever 62 pivoted thereto at 63. As shown in Fig. 1, the bracket 59 has additional pivot holes 63a, 63b to permit adjustment by selectively placing the pivot pin in either of the holes.

A bifurcated link 65, pivoted at 65a on the lever 62, has its opposite end 65b bifurcated to accommodate a T-shaped equalizer link 66. The cross portion 66a of the link 66 is provided at its ends with openings to receive the ends of the wires 35, the portion 66b of the link 66, having a similar opening to receive the end of the wire 50. With this arrangement, a pulling force on the wire 70 will actuate the links 65 and 66 to effect a uniform tension on each of the wires 35 and 50.

From the free end of the lever 62 a wire 70 leads through the wrist portion 71 and preferably is passed up the sleeve of the wearer and anchored in any suitable manner at the shoulder.

From the foregoing it will be apparent that by moving the hand as a unit, with the opposite end of the wire 70 fixed, the lever 62 is swung to the left, causing the linkage to pull on the wires 35 and wire 50, to draw the fingers and thumb towards each other, so that an article held in the palm of the hand may be firmly grasped.

As best seen in Figs. 1 and 6, I provide means for releasably locking the fingers and thumb in object grasping position, the parts being shown in unlocked position in Fig. 1 and in locked position in Fig. 6. A resilient bar 75 is fixed at its left-hand end to the body as by screw 76, and its outer end is formed as a rack 77. Normally the resiliency of the bars maintains the rack portion in the position of Fig. 1, out of engagement with the pawl to be described, but by manually pressing downwardly on the plunger 79, which reciprocates through a hole 80 in the body, the rack portion is forced into the position of Fig. 6. The head 81 of the plunger is countersunk and may underlie the sheathing 5, which is flexible, so that the user, by pressing downwardly on that area of the sheathing, may operate the plunger.

As best shown in Fig. 6, the free end of the lever 62 has a pawl 85 mounted thereon by a

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pivot 86, the pawl being urged clockwise by a spring 87. Thus, when the rack is in the position of Fig. 6, the pawl will engage the teeth of the rack and will be retained in such engagement by the stress placed on the lever through the finger and thumb operating wires. To release the pawl, the user merely moves the hand as a unit to place further momentary tension on the wire 70, at which time the rack portion 77 will automatically spring back into the position of Fig. 1.

I claim:

1. In an artificial hand, a hollow body, a thumb and a finger projecting forwardly from the body, said finger being comprised of aligned relatively movable segments, each of which is wedge-shaped in longitudinal section and has a plurality of parallel longitudinal openings through its relatively wider top portion and a longitudinal hole through its narrower bottom portion, the openings in each segment being in register with the respective openings in the other segments and the hole in each segment being in register with the holes in the other segments, an elongated flexible tie member extending through each group of aligned openings, each said flexible tie member being anchored at one end to the outer endmost segment and anchored at its other end to the body, a flexible pull member extending through said registering holes, said pull member being anchored at its outer end to said outer endmost segments, and operating means in the body secured to the inner end of the pull member.

2. In an artificial hand, a hollow body, a thumb and a finger projecting forwardly from the body, said finger being comprised of aligned relatively movable segments, each of which is wedge-shaped in longitudinal section and has a plurality of parallel longitudinal openings through its relatively wider top portion and a longitudinal hole through its narrower bottom portion, the openings in each segment being in register with the respective openings in the other segments and the hole in each segment being in register with the holes in the other segments, a coil spring extending through each group of aligned openings, each said coil spring being anchored at one end to the outer endmost segment and anchored at its other end to the body, a flexible pull member extending through said registering holes, said pull member being anchored at its outer end to said outer endmost segment, and operating means in the body secured to the inner end of the pull member.

3. In an artificial hand, a hollow body, a thumb and a finger projecting forwardly from the body, said finger being comprised of aligned relatively movable segments, each of which is wedge-shaped in longitudinal section and has a longitudinal opening through its relatively wider top portion and a longitudinal hole through its relatively narrower bottom portion, said opening and said hole in each segment being in register with the opening and hole in each of the other segments, a flat spacer block interposed between each pair of contiguous segments, each block having an opening and a hole registering with said opening and hole in each of the contiguous segments, an elongated flexible tie member extending through said registering openings, said tie member being anchored at its outer end to the outer endmost segment and anchored at its inner end to the body, a flexible pull member anchored to the outer endmost segment and extending through said registering holes into the body, and tension exerting means in the body

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connected to the inner end of the pull member.

4. In an artificial hand, a hollow body, a thumb and a finger projecting forwardly from the body, said finger being comprised of aligned relatively movable segments, each of which is wedge-shaped in longitudinal section and has a longitudinal opening through its relatively under top portion and a longitudinal hole through its relatively narrower bottom portion, said opening and said hole in each segment being in register with the opening and hole in each of the other segments, a spacer block interposed between each pair of contiguous segments, each block having parallel end surfaces and having an opening and a hole registering with said opening and hole in each of the contiguous segments, an elongated flexible tie member extending through said registering openings, said tie member being anchored at its outer end to the outer endmost segment and anchored at its inner end to the body, a flexible pull member anchored to the outer endmost segment and extending through said registering holes into the body, and tension exerting means in the body connected to the inner end of the pull member.

5. In an artificial hand, a hollow body, a thumb and a finger projecting forwardly from the body, said finger being comprised of aligned relatively movable segments, each of which is wedge-shaped in longitudinal section and has a plurality of parallel longitudinal openings through its relatively wider top portion and a longitudinal hole through its narrower bottom portion, the openings in each segment being in register with the respective openings in the other segments and the hole in each segment being in register with the holes in the other segments, an elongated flexible tie member extending through each group of aligned openings, each said flexible tie member being anchored at one

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end to the outer endmost segment and anchored at its other end to the body, a flexible pull member extending through said registering holes, said pull member being anchored at its outer end to said outer endmost segments, operating means in the body secured to the inner end of the pull member, and a flexible glove enclosing said body, thumb and fingers.

6. In an artificial hand, a hollow body, a thumb and fingers projecting forwardly from the body, the thumb and fingers each being composed of separate, relatively movable substantially aligned segments whose contiguous ends are beveled toward the palm to provide a wedge-shaped recess between each pair of contiguous segments, a spacer member having parallel end surfaces interposed between each pair of contiguous segments, a pair of resilient tie members extending through and drawing the wider portions of each group of substantially aligned segments with the spacer members interposed therebetween toward the body, flexible pull means anchored to the respective outer endmost of the segments and extending through the narrower portions of each group of substantially aligned segments and through the spacer members interposed therebetween into the body and tension exerting means in the body connected to the pull means.

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