

March 27, 1962

N. J. BROWN
PROSTHETIC HANDS

3,026,534

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2 Sheets-Sheet 1

FIG_1

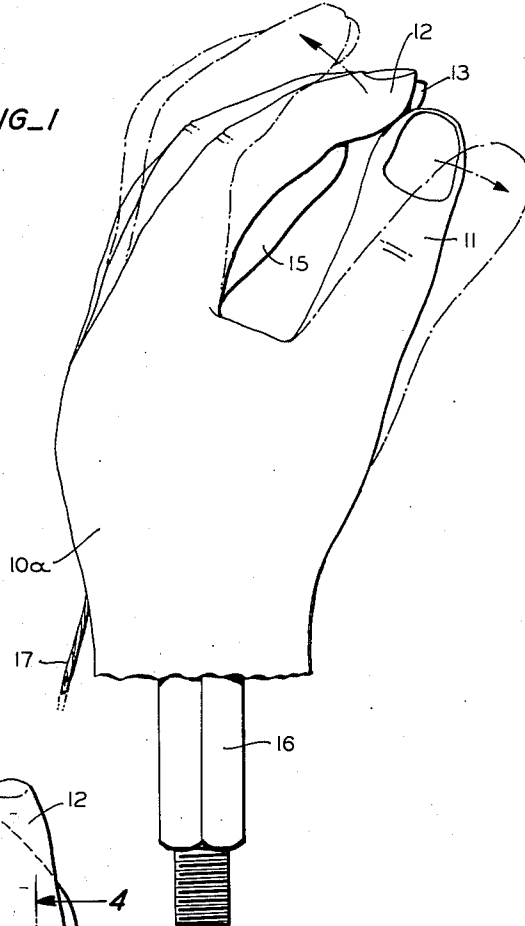
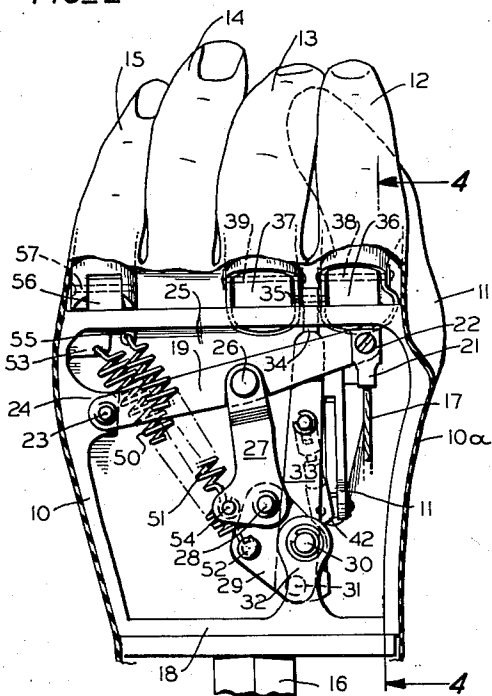


FIG_2



INVENTOR.
NOEL J. BROWN

BY

Allen and Brommy
ATTORNEYS

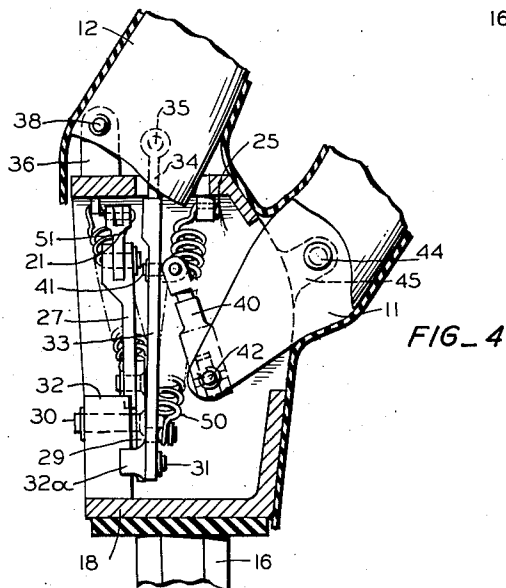
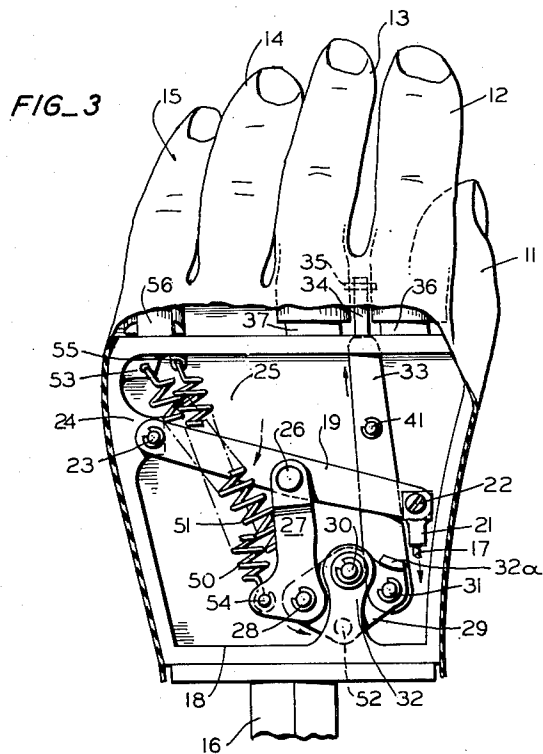
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INVENTOR.
NOEL J. BROWN

BY

Allen and Chromy
ATTORNEYS

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PROSTHETIC HANDS

Noel J. Brown, 748 Coleman Ave., San Jose, Calif.

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5 Claims. (Cl. 3—12.7)

This invention relates to prosthetic hands in general, more particularly this invention relates to prosthetic hands of an improved and light construction.

An object of this invention is to provide an improved prosthetic hand with which a firm grip may be obtained on an object that the wearer of the prosthetic hand desires to handle.

Another object of this invention is to provide an improved prosthetic hand of durable and light construction in which the thumb and index finger may be locked about an object when it is desired to handle such object.

Still another object of this invention is to provide an improved prosthetic hand that is equipped with a little finger attached thereto by a friction joint so that the little finger may be used for moving light objects.

A further object of this invention is to provide an improved prosthetic hand in which selected fingers and the thumb are pivotally attached to the frame thereof and there is provided a simple mechanism for linking the thumb and pivoted fingers together to an actuating lever whereby the thumb and pivoted fingers may be opened by manipulating an actuating cable so that an article may be received between the thumb and the pivoted fingers and gripped therebetween.

A further object of this invention is to provide an improved prosthetic hand with the thumb and selected fingers thereof pivoted to the frame of the hand in which the pivoted thumb and pivoted fingers are connected by means of a linkage to a crank-type lever which is provided with a stop and which is spring-biased to bring it past the dead center of the pivot of the crank when said stop engages the frame whereby the pivoted thumb and pivoted fingers are closed and locked in this closed position when the stop engages the frame.

Other and further objects of this invention will be apparent to those skilled in the art to which it relates from the following specification and claims.

In accordance with this invention, there is provided an improved prosthetic hand of durable construction and light weight in which the thumb and selected pivoted fingers may be firmly locked when the hand is used to grip an object such as the handle of a suitcase which the wearer of the prosthetic hand desires to move from place to place. Furthermore, this gripping of the object to be carried is accomplished without continued actuation of the pivoted thumb and pivoted fingers of the prosthetic hand by the wearer thereof since mechanism is provided in the frame of the prosthetic hand for locking these fingers and thumb in their article gripping position.

The above and other features of this invention will be set forth in detail in the following specification and illustrated in the drawing in which briefly:

FIGURE 1 is a view of the outside of a prosthetic hand embodying this invention and in this view the thumb and forefinger are shown in closed position in solid lines and in open position in broken lines;

FIGURE 2 is a view of this prosthetic hand with part of the cover broken away to show the positions of the levers inside of the hand when the thumb and the pivoted fingers adjacent thereto are closed.

FIGURE 3 is a view similar to FIGURE 2 showing the positions of the levers when the pivoted fingers and the thumb are open; and

FIGURE 4 is a detail view showing the levers linking the pivoted fingers and the thumb.

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Referring to the drawings in detail, there is shown in FIGURES 2 and 3, a frame member 10 of the artificial hand made in simulation of the metacarpus of a human hand, having a thumb 11 and fingers 12, 13, 14 and 15 and provided with a flexible covering 10a made of rubber or the like finished to appear like a human hand. The frame 10 has a chamber 25 formed therein and this frame is made of metal, such as aluminum or magnesium or alloys thereof to provide a light and strong construction. A shank 16 is attached in rigid fashion to the back wall 18 of the frame and this shank is provided for attachment of the artificial hand to a member retained upon the arm or shoulder of the human being. A suitable metal disk and a rubber gasket (not shown) are provided around the shank 16.

The cable 17 for actuating the lever 19 is attached to the clevis 21 which is in turn pivotally attached by the pivot pin 22 to one end of the lever 19. The other end of this lever is pivotally attached to the projection 24 on the inner wall of the frame 10, by means of the pivot pin 23. The projection 24 is formed integral with the frame work 10 below the base of the little finger 15. The lever 19 is attached substantially at its middle to the upper end of the lever 27 by the pivot pin 26 and the other end of the lever 27 is pivotally attached by the pivot pin 28 to the crank 29 which is pivotally attached by pivot pin to the projection 32, that is formed integral with the end wall 18 of the frame. One end of the actuating lever 33 that is employed for actuating the pivoted fingers 12 and 13 is pivotally attached by the pivot pin 31 to the crank 29 and the other end of this lever 33 is attached to the rod 34 which extends up between the fingers 12 and 13. This rod 34 is provided with a pin 35 which extends laterally therefrom and this pin is positioned in holes formed in the frames of the fingers 12 and 13. The frames of these fingers 12 and 13 are attached to members 36 and 37 respectively which are fixedly attached to the end wall 25 of the frame 10. Pins 38 and 39 are provided on the members 36 and 37 respectively for pivotally supporting the fingers 12 and 13 respectively thereon; whereby said fingers may be tilted on said pivots by actuating the lever 33.

The thumb actuating leverage includes the lever 40, one end of which is pivotally attached by the pivot pin and swivel 41 to the actuating lever 33. The other end of the lever 40 is attached by another pivot pin and swivel 42 to the inner end of the thumb member 11 which extends into the frame 10 as shown in FIGURE 4. The lever 40 must be connected to the lever 33 and to the thumb member 11 by means of swivel joints 41 and 42 respectively which are themselves pivotally attached to the lever 33 and thumb member 11. This is necessary because when the cable 17 is actuated to control the fingers the lever 33 is swung with respect to the inner end of the thumb member to which it is connected by the lever 40. Consequently the pivot pin 41 must be able to rotate with respect to the lever 33 and the pivot pin 42 must be able to rotate with respect to the thumb member 11. Also the ends of the lever 40 must be able to rotate with respect to these pivot pins and this is accomplished in the swivel joints thereof. Of course this same result could be obtained by the use of ball and socket joints if desired.

The thumb member 11 is pivotally supported by the pivot pin 44 between a pair of projections, such as the projection 45, formed integral with the frame 10. The other end of the thumb member is formed in the configuration of a thumb and is provided with a flexible covering 10a made of leather, fabric, plastic or the like.

When the thumb 11 and fingers 12 and 13 are in their closed position, as shown in FIGURE 2, the pin 31 which pivotally attaches the lever 33 to the crank 29 is past dead

center with respect to the pin 30 supporting the crank 29 on the projection 32 and the stop 32a is positioned against the projection 32. Thus the lever 33 and crank 29 are prevented from moving further in the clockwise direction, with respect to the pivot pin 30 by the stop 32a which engages the projection 32, with the leverage in this position. Since the pivot pin 31 is past dead center of the pivot 30 with the levers in this position the thumb and fingers 12 and 13 are effectively locked in their closed position, so that in this position the fingers may be closed around the handle of a suitcase or similar object and the hand may be used for lifting such object.

A pair of springs 50 and 51 is provided for the purpose of urging the finger operating leverage into its finger closed position. One end of the spring 50 is connected by means of the pivot pin 52 to the crank 29 and the other end of this spring is connected to the projection 53 formed integral with the frame 10 and projecting inward in said frame adjacent to the lower end of the little finger 15. The spring 50 passes the lever 19 on one side thereof and the spring 51 passes it on the other side thereof. One end of the spring 51 is attached by means of the pivot pin 54 to the lever 27 and the other end thereof is attached to the member 55 also below the lower end of the little finger but displaced from the projection 53. The spring 51 may be dispensed with if a spring 50 of sufficient strength is provided.

The little finger 15 which is preferably rigid like fingers 12 and 13, is also pivotally attached to the projection 56 formed integral with the end plate 25 of the frame and a pin 57 is provided for this purpose. The joint between the little finger and the projection 56 is preferably relatively tight so that this little finger may maintain a more or less set position whereby it may be employed for pushing small objects without readily shifting its position. Thus if the wearer of the hand desires to employ the hand for shifting the position of a book or similar object on a table, he may do so by engaging such object with the little finger 15 and push such object on the table.

If desired, a pair of washers may be positioned between the thumb member and the supporting projections 45 thereof and these washers may be made of plastic material such as nylon to provide smooth operation of the thumb member pivot. Also a suitable sheath may be placed over the cable 17 where the cable passes through the hand covering 10a so that the cable 17 does not produce unnecessary wear on the covering.

In operation of this device, the cable 17 which is attached to suitable means whereby the wearer may actuate this cable by shoulder or other movement and thus move the lever 19 on its pivot pin 23 so that the lever 27 produces rotation of the crank 29 around its pivot 30 from the closed finger position thereof shown in FIGURE 2 to the opened finger position shown in FIGURE 3. Thus the lever 33 is moved upward and causes the fingers 12 and 13 to rotate slightly about the pivots 38 and 39 respectively thereof thereby swinging the outer ends of these fingers away from the thumb to the positions shown in broken lines in FIGURE 1. At the same time the lever 40 which is attached by a suitable pin and swivel connection 41 to the lever 33 is shifted upward slightly thereby rotating the thumb member on its pivot 44 also through a slight angle away from fingers 12 and 13. When pulling force is relieved from the cable 17 the springs 50 and 51 return the leverage to the finger closed position thereof shown in FIGURE 2 in which position the stop 32a is against the projection 32. In this position pivot 31 of lever 33 is past dead center with respect to the pivot pin 30 of the crank 29 so that exerting pressure on the fingers 12 and 13 and the thumb 11 tending to open the grip thereof is ineffective even though this pressure might be sufficient to overcome the tension of the springs 50 and 51 since as noted above the pivot 31 of the lever 33 is past dead center of the pivot 30 of the crank 29.

While I have described a preferred embodiment of this

invention in detail, it is of course, obvious that modifications therein may be made without departing from the spirit and scope thereof and therefore I do not desire to limit this invention to the exact details described and illustrated except insofar as those details are defined by the claims.

What I claim is:

1. A prosthetic hand comprising a hollow frame forming the body of the prosthetic hand, a plurality of fingers including a thumb, means pivotally attaching a finger opposite said thumb to the forward end of said frame, means pivotally attaching said thumb to a side of said frame, said thumb having an extension extending into said frame past the pivot thereof, and a mechanism normally holding said thumb and said pivotally mounted finger closed, said mechanism comprising a crank pivotally attached to the inside of said frame, a lever having one end pivotally connected to said crank, means pivotally connecting the other end of said lever to said pivotally mounted finger opposite said thumb and a linkage pivotally connecting the inner end portion of said thumb extension to point of said lever intermediate the ends thereof, resilient means rotating said crank in one direction to close said thumb and said pivotally mounted finger and stop means for said crank for stopping the rotation of said crank by said resilient means when said thumb and said pivotally mounted finger opposite said thumb are closed, said stop means being positioned such that it stops rotation of said crank when the pivot of said lever on said crank is past dead center with respect to the pivot of said crank whereby said thumb and said pivotally mounted finger opposite said thumb are locked in closed position when said stop means arrests rotation of said crank, and means for rotating said crank in the opposite direction to open said thumb and said pivotally mounted finger.

2. A prosthetic hand comprising a hollow frame forming the body of the prosthetic hand, a plurality of fingers including a thumb, means pivotally attaching a finger opposite said thumb to the forward end of said frame, means pivotally attaching said thumb to a side of said frame, said thumb having an extension extending into said frame past the pivot thereof, and a mechanism normally holding said thumb and said pivotally mounted finger closed, said mechanism comprising a crank pivotally attached to the inside of said frame, a lever having one end pivotally connected to said crank, means pivotally connecting the other end of said lever to said pivotally mounted finger opposite said thumb and a linkage pivotally connecting the inner end portion of said thumb extension to a point of said lever intermediate the ends thereof, resilient means rotating said crank in one direction to close said thumb and said pivotally mounted finger and stop means for said crank for stopping the rotation of said crank by said resilient means when said thumb and said pivotally mounted finger opposite said thumb are closed, said stop means being positioned such that it stops rotation of said crank when the pivot of said lever on said crank is past dead center with respect to the pivot of said crank whereby said thumb and said pivotally mounted finger opposite said thumb are locked in closed position when said stop means arrests rotation of said crank, and means for rotating said crank in the opposite direction to open said thumb and said pivotally mounted finger, said last mentioned means having a cable attached thereto for actuation thereof.

3. A prosthetic hand comprising a hollow frame forming the body of the prosthetic hand, a plurality of fingers including a thumb, means pivotally attaching a finger opposite said thumb to the forward end of said frame, means pivotally attaching said thumb to a side of said frame, said thumb having an extension extending into said frame past the pivot, and a mechanism normally holding said thumb and said pivotally mounted finger closed, said mechanism comprising a crank pivotally attached to the

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inside of said frame, a lever having one end pivotally connected to said crank, means pivotally connecting the other end of said lever to said pivotally mounted finger opposite said thumb and a linkage pivotally connecting the inner end portion of said thumb extension to a point of said lever intermediate the ends thereof, resilient means rotating said crank in one direction to close said thumb and said pivotally mounted finger and stop means for said crank for stopping the rotation of said crank by said resilient means when said thumb and said pivotally mounted finger opposite said thumb are closed, said stop means being positioned such that it stops rotation of said crank when the pivot of said lever on said crank is past dead center with respect to the pivot of said crank whereby said thumb and said pivotally mounted finger opposite said thumb are locked in closed position when said stop means arrests rotation of said crank, and another linkage attached to said crank for rotating said crank in the opposite direction to open said thumb and said pivotally mounted finger, said last mentioned linkage having a cable attached thereto such that exerting a pulling force on said cable produces the rotation in said opposite direction to open said thumb and said pivotally mounted finger.

4. A prosthetic hand comprising a hollow frame forming the body of the prosthetic hand, a plurality of fingers including a thumb, means pivotally attaching a finger opposite said thumb to the forward end of said frame, means pivotally attaching said thumb to a side of said frame, said thumb having an extension extending into said frame past the pivot thereof, and a mechanism normally holding said thumb and said pivotally mounted finger closed, said mechanism comprising a crank pivotally attached to the inside of said frame, a lever having one end pivotally connected to said crank, means pivot-

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ally connecting the other end of said lever to said pivotally mounted finger opposite said thumb and a linkage pivotally connecting the inner end portion of said thumb extension to a point of said lever intermediate the ends thereof, resilient means rotating said crank in one direction to close said thumb and said pivotally mounted finger and stop means for said crank for stopping the rotation of said crank by said resilient means when said thumb and said pivotally mounted finger opposite said thumb are closed, said stop means being positioned such that it stops rotation of said crank when the pivot of said lever on said crank is past dead center with respect to the pivot of said crank whereby said thumb and said pivotally mounted finger opposite said thumb are locked in closed position when said stop means arrests rotation of said crank, and another lever having one end pivotally attached to said frame, means for connecting an intermediate point of said other lever to said crank for rotating said crank in the opposite direction to open said thumb and said pivotally mounted finger and a cable attached to the other end of said other lever whereby exerting a pulling force on said cable causes rotation of said crank in said opposite direction.

5. A prosthetic hand as set forth in claim 1 further characterized in that said plurality of fingers includes a little finger attached to said frame with a friction joint so that said little finger may be used by the wearer of the prosthetic hand to arrange objects on a surface.

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