

Sept. 9, 1924.

A. PECORELLA ET AL
ARTIFICIAL LIMB

1,507,683

Original Filed Nov. 24, 1919

4 Sheets-Sheet 1

Fig. 1.

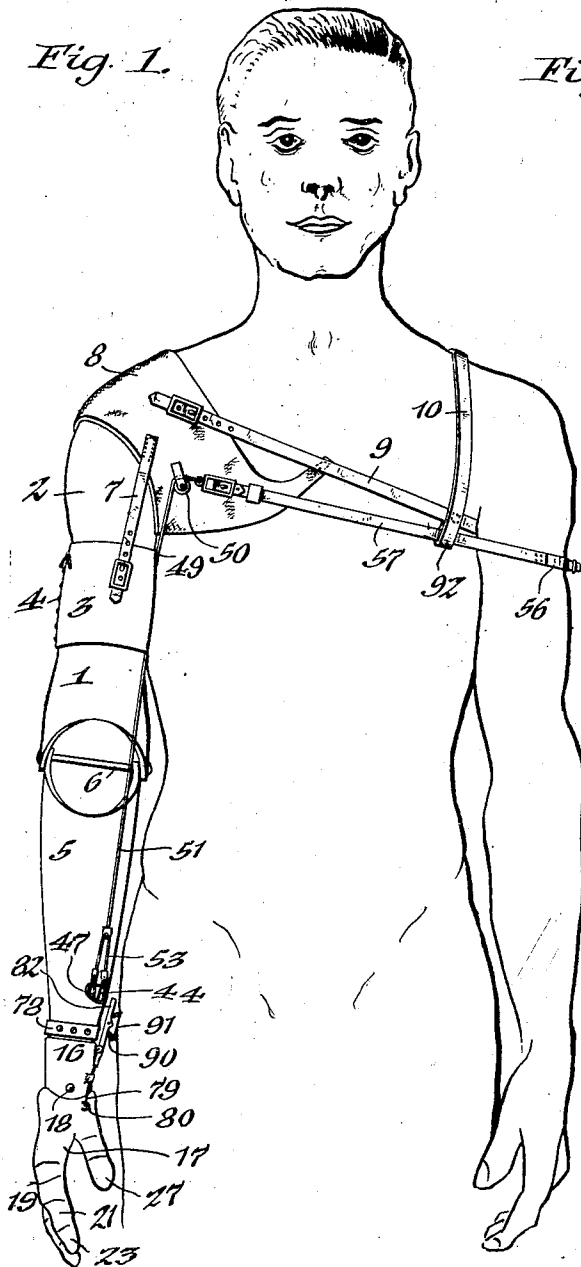
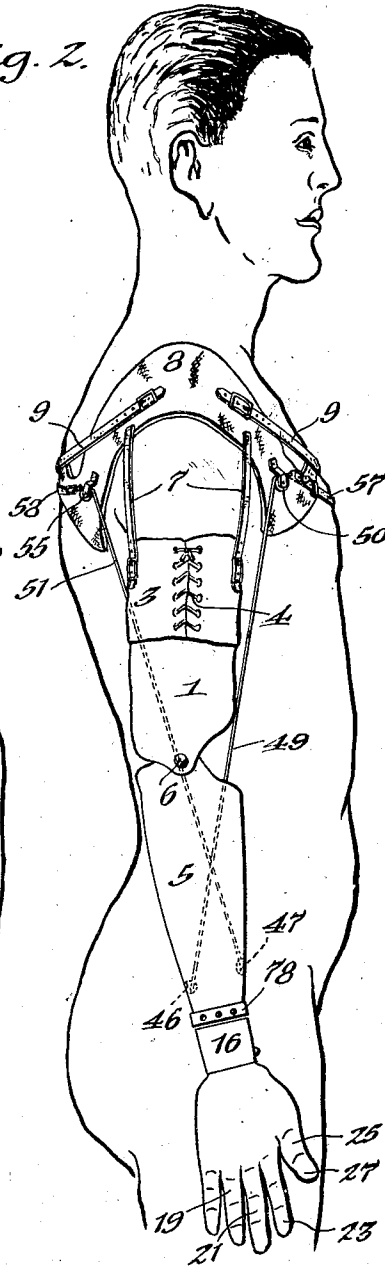


Fig. 2.



Inventors,

A. Pecorella
V. Patricello
T. H. Apple
by *Super & Popp*
Attorneys

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Fig. 3.

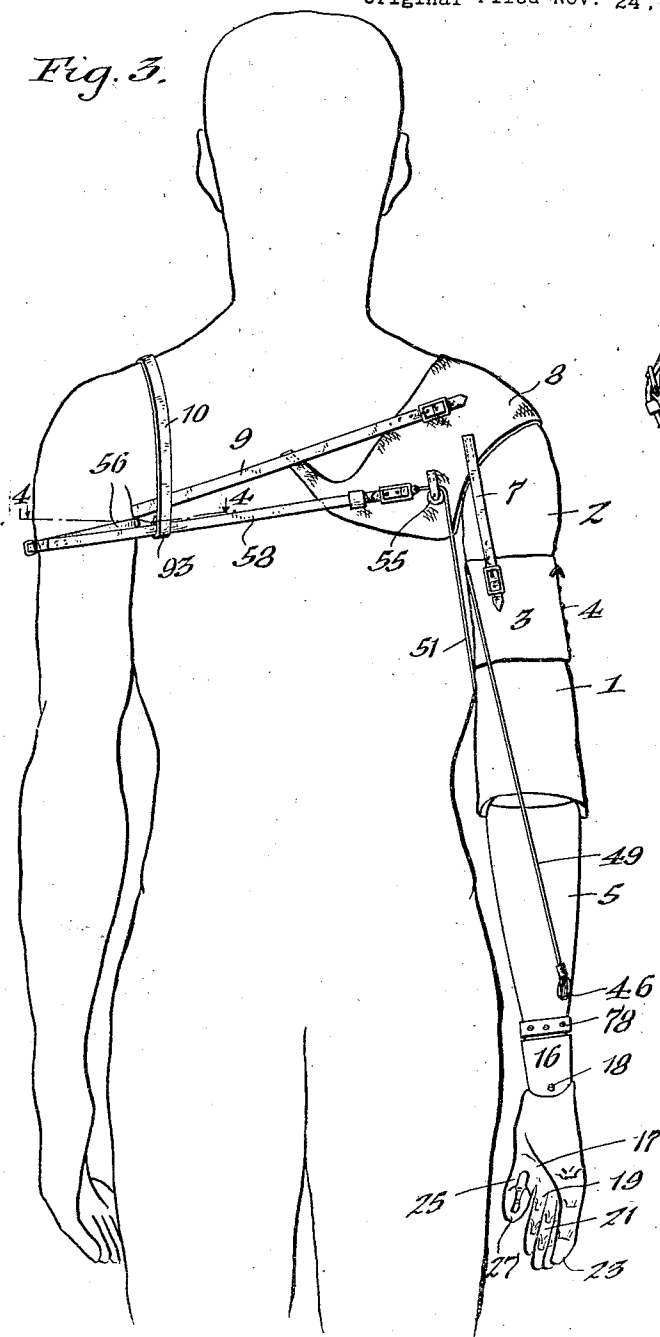


Fig. 4.

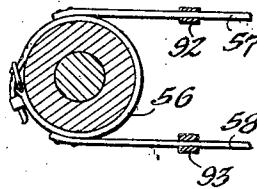
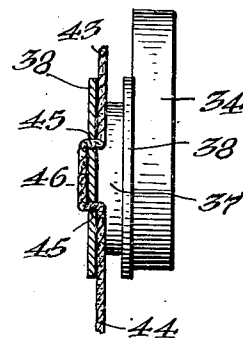


Fig. 5.



Inventors,
A. Pecorella
V. Patricolo
F. H. Apel
by *Ley & Poff*
Attorneys.

Sept. 9, 1924.

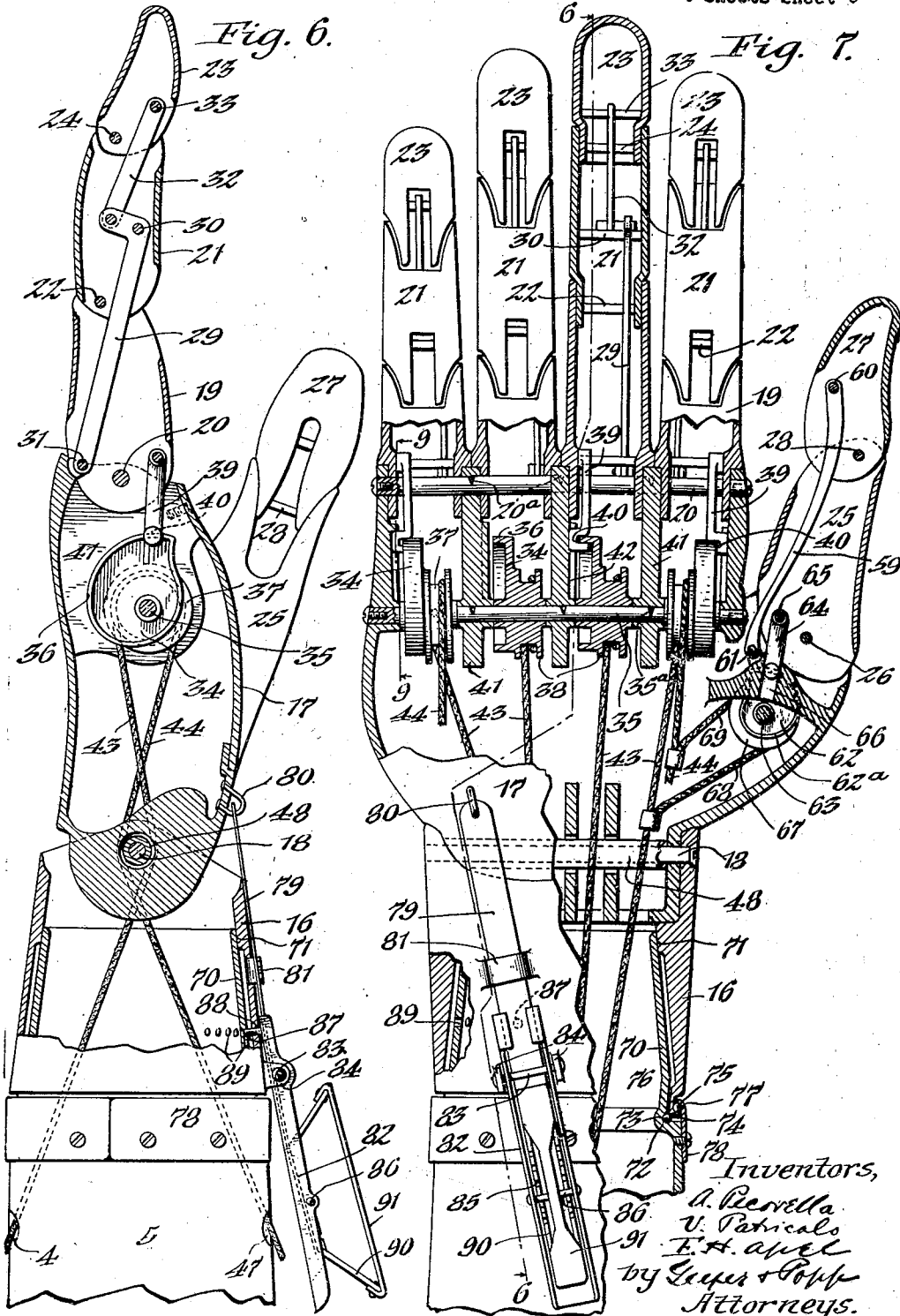
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Fig. 9.

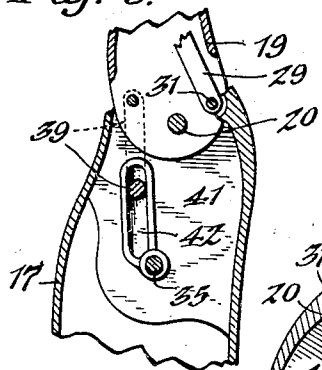


Fig. 8.

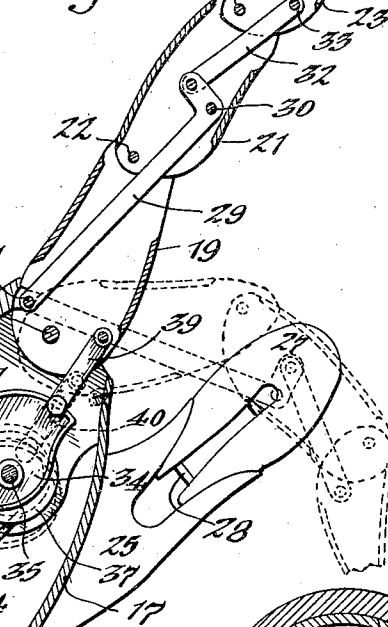


Fig. 10.

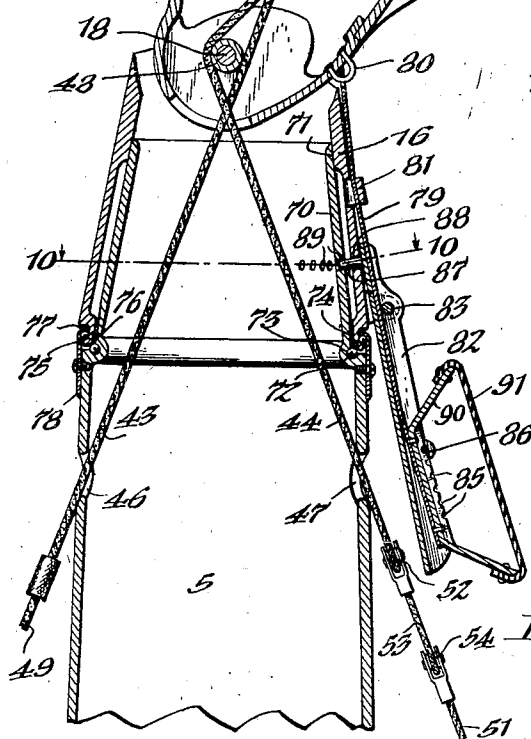
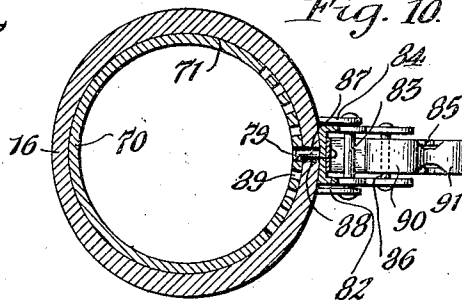


Fig. 11.

Inventors,
A. Pecorella
V. Patricolo
F. H. Apel
by *Super-Poppe*
Attorneys.

UNITED STATES PATENT OFFICE.

ALBERTO PECORELLA AND VINCENT PATRICOLO, OF BUFFALO, AND FREDERICK H. APEL, OF ATHOL SPRINGS, NEW YORK, ASSIGNORS, BY MESNE ASSIGNMENTS, TO LIVINGSTON ARTIFICIAL LIMB COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

ARTIFICIAL LIMB.

Substitute for abandoned application Serial No. 340,330, filed November 24, 1919. This application filed March 18, 1924. Serial No. 700,180.

To all whom it may concern:

Be it known that we, ALBERTO PECORELLA, a citizen of the United States, and resident of Buffalo, in the county of Erie and State of New York, VINCENT PATRICOLO, a subject of the King of Italy, and residing at Buffalo, in the county of Erie and State of New York, and FREDERICK H. APEL, a citizen of the United States, residing at Athol Springs, in the county of Erie and State of New York, have invented new and useful Improvements in Artificial Limbs, of which the following is a specification.

The object of this invention is to provide an artificial hand having improved means for actuating the fingers, so that the same may be moved either in unison or individually and adapt themselves to the article to be grasped, which means are so designed that the fingers are locked against displacement by pressure against the fingers and thus render the fingers rigid in whatever position the same come to rest; to provide improved means for actuating the fingers by motion derived from a relative horizontal movement of the body and a shoulder of the person wearing the artificial limb; to provide improved means for turning the wrist about its longitudinal axis and also turning the palm laterally about a transverse axis relatively to the palm, and to improve the means for pivotally connecting the forearm and wrist.

This application is a substitute for the abandoned application No. 340,330 filed Nov. 24, 1919.

In the accompanying drawings:

Figure 1 is a front elevation of our improved artificial limb applied to the right arm of a person. Figure 2 is a side elevation of the same. Figure 3 is a rear elevation thereof. Figure 4 is a fragmentary horizontal section taken on line 4—4, Fig. 3. Figure 5 is a detached sectional view of one of the finger actuating cams and its drum showing the manner of attaching the operating lines thereto. Figure 6 is a vertical longitudinal section of the artificial limb taken on line 6—6, Fig. 7. Figure 7 is an elevation, partly in section, of the artificial limb viewed from the palm side thereof. Figure 8 is a view similar to Fig. 6, but

showing the palm tilted transversely and the adjusting device for the same and the wrist in section. Figure 9 is a fragmentary vertical longitudinal section taken on line 9—9, Fig. 7. Figure 10 is a horizontal section on line 10—10, Fig. 8. Figure 11 is a fragmentary side elevation of the forearm and wrist, showing the means for equalizing the pull on the sectional fingers and thumb when closing the same.

Similar characters of reference indicate corresponding parts throughout the several views.

As shown in the drawings, our improvements are embodied in an artificial limb having an arm section 1 which is preferably of tubular form and adapted to be secured to the stump of one arm, say the stump 2 of the right arm, as shown in Figs. 1, 2 and 3, in any suitable or approved manner, for instance, by means of a socket or cuff 3, connected with the arm section and secured around the stump by lacing 4, a forearm 5 of the tubular form which is pivotally connected at its rear end by a horizontal pin 6 with the front end of the arm section, so that the arm can be raised and lowered, a wrist 16 which is pivotally connected at its rear end with the front end of the forearm so as to be capable of turning relatively thereto about a longitudinal axis, a palm 17 which is pivotally connected at its rear end with the front end of the wrist by a transverse pin 18 so as to be capable of turning laterally relatively to the palm, a plurality of digits, the fingers of which consist each of a first section 19 pivotally connected with the palm by a pin 20, a second section 21 pivotally connected with the first section by a pin 22, and a third section 23 pivotally connected with the second section by a pin 24, and a thumb comprising a first or inner section 25 pivoted on the palm by a pin 26 and a second or outer section 27 pivoted on the first section by a pin 28. All of these several members are preferably constructed of hollow or tubular form in any suitable and approved manner so that part of the mechanism for operating the same may be located in the interior thereof. The cuff or socket 3 is connected by means of strap hangers 7 with a saddle 8 on the shoulder

of the respective stump and this saddle is held against displacement by means which comprise a horizontal retaining band or strap 9 passing under the pit of the left arm and along the back and chest of the body and connected at its opposite ends to the saddle in front and in rear of the body, and a suspender 10 extending over the left shoulder and connected at its lower ends with the front and rear stretch of the retaining band 9.

Inasmuch as the means for actuating the several fingers for folding or closing and unfolding or opening the same are alike the following description applying to one of them will apply to all of the several fingers.

The first finger section may be turned about the pin 20 either into its open or closed position. 29 represents a first lever of elbow form which is fulcrumed by a pin 30 on the second finger section outwardly beyond the pivotal connection 23 and which has its inner arm pivotally connected by a pin 31 with the outer front edge of the palm, while its inner arm is connected by a link 32 with a pin 33 arranged on the third finger section outwardly beyond the pin 24. This connection between the several finger sections and the palm causes the second and third finger sections to fold and unfold in unison with the first section for grasping and releasing an article or for other purposes.

The several fingers radiate on different lines relatively to the palm so as to simulate the normal position of the fingers on a natural hand and in accomplishing this the innermost pivot 20 of each finger is arranged on a different line from the corresponding pivots of the remaining fingers. In order to simplify the construction and reduce the cost of manufacture, the several pivot pins 20 are made to form sections of a single pivot rod which passes through the several first sections of the fingers and the adjacent parts of the palm and which is provided on its outer side between adjacent pivot sections with notches 20^a, which permit of bending the rod of which the several pivots 20 are made and bringing the same into the proper position for engagement with the openings in the several first finger sections and the palm.

34 represents a plurality of cams which are mounted on a transverse pivot rod 35 carried by the palm so that these cams are capable of turning freely on said rod independently of each other. The pivot rod 35 consists of a plurality of sections each of which is arranged on a line different from the other sections so that each can be arranged properly relatively to the finger which it actuates. To do this in a simple and efficient manner, the rod 35 is provided on its front or outer side with a plurality

of notches 35^a each of which is arranged between two adjacent sections and permits of bending this rod so that the several sections engage properly with the respective openings in the cams and the palm intended to receive the same. Each of these cams is operatively associated with one of the fingers and is provided with a peripheral cam flange 36 projecting laterally from one side thereof while the opposite side of the cam is connected with a drum 37 having peripheral flanges 38 forming a groove on this drum. 39 represents a plurality of links each of which is pivotally connected at its front end with the inner or rear section of one of the fingers at the inner side of the pivotal connection between this finger section and the palm. The inner or rear end of each link 39 is provided with a lateral notch 40 which receives the flange 38 of the respective cam so that upon turning the latter the link and the finger sections associated therewith will be operated for folding and unfolding the finger. The inner end of the link is guided toward and from the axis of its cam during the rotary movement of the latter by providing this link in line with its notch 40 with a guide lug 41 which engages with a guideway or groove 42 formed on the adjacent part of the palm, as shown in Figs. 7 and 9.

Although the fingers may be opened and closed in any suitable manner the motion for accomplishing this is preferably derived from the uninjured shoulder and arm of the person wearing the artificial limb and as shown in the drawings, these means are constructed as follows:

43 represents a plurality of opening branch lines and 44 a plurality of closing branch lines one of each of which forming a pair being connected with the drum of one of the cams and passing circumferentially in opposite directions around this drum so that upon pulling on the line 43, the respective finger will be opened or unfolded while upon pulling on the companion line 44 the finger will be closed or folded. The lines 43, 44 of each pair are preferably made of a single piece of cord and the same may be easily secured to the drum by passing that part of the cord on the drum through a pair of openings 45 in one of its flanges, thereby forming a turn or loop 46 in this cord which effectually prevents disconnection of the opening and closing lines from the respective drum. Each pair of opening and closing lines preferably first cross each other in front of the pivot pin 18 which connects the wrist and palm and then recross each other in rear of this pin and then pass from the interior of the wrist and forearm to the exterior thereof through openings 46, 47 formed respectively on the front and rear sides of the forearm. The

pin 18 is preferably covered with a roller 48 to prevent the lines from wearing unduly while moving in contact therewith. The several opening branch lines are connected
 5 directly with a main or intermediate opening line 49 which preferably passes along the inner side of the arm to the front side of the chest and thence over a guide roller or
 10 wheel 50 mounted on the front side of the saddle. Upon pulling on the main opening line 49 the several branches thereof will turn the cams outwardly and cause the several fingers to simultaneously unfold or
 15 open. The several closing branch lines 44 are preferably indirectly connected with a main or intermediate closing line 51 by an equalizing device which upon pulling the line 51 causes the several fingers to either
 20 close simultaneously when no obstruction is encountered but which permits one or more of the fingers when engaging an article to stop independently of the other fingers and thus enable the fingers to adapt themselves to the shape of the article while at the same
 25 time the fingers are locking in whatever position they come to rest by the action of the cams which prevent the fingers from being moved by any external pressure applied thereto. This equalizing effect is preferably
 30 attained by connecting the rear ends of the branch closing lines 44 in pairs, so that each pair forms a bight which is engaged by an equalizing roller 52. The two rollers 52 engaging the two bights formed by the two
 35 pairs of branch closing lines leading to the four finger operating cams are in turn connected by an equalizing line 53 which is doubled upon itself to form a loop or bight and the latter is engaged by a roller 54 which
 40 is connected with the lower end of the main closing line 51. Upon pulling on the latter the relation of the same and the associated equalizing and branch lines is not disturbed so long as the fingers in their closing move-
 45 ment do not encounter any obstruction, thereby causing the fingers to fold uniformly. If, however, one or more fingers engage the article to be grasped ahead of the other fingers, then the bight of the branch lines
 50 between the finger which stops and the companion finger which continues to close, slides around the respective roller 52 and the bight of the equalizing line will in like manner slide around the roller 54 of the
 55 main pull line. This equalizes the pulling effect upon the several fingers without one interfering with the other at this time and ensures proper engagement of the fingers with the article to be grasped regardless of
 60 any irregularity in its shape. The main closing line 51 passes from the front side of the arm upwardly to the rear side of the back and thence over a guide roller or wheel 55 mounted on the rear part of the saddle. The
 65 main opening and closing lines thus cross

each other on the inner side of the arm and permits of so connecting them with the opposite or uninjured shoulder and arm that the fingers may be opened and closed by a
 70 body motion which will not be conspicuous or embarrassing. The means whereby this is accomplished comprise a bracelet or arm band 56 which is secured around the arm, in this instance the left arm, adjacent to the
 75 left shoulder, and front and rear draw bands or lines 57, 58 which are connected at their left hand ends with the front and rear sides, respectively, of the arm band or bracelet, while their right hand ends are connected
 80 respectively with the upper ends of the main opening and closing lines. It follows from this construction that when the chest is drawn in and the left shoulder and arm are thrown forward, a pulling effect is pro-
 85 duced on the closing lines and a relaxation on the opening lines which causes the fingers to be closed while upon throwing the chest forward and the left shoulder and arm backward a pulling effect will be produced on the opening lines and a relaxation on the
 90 closing lines, whereby the fingers will be opened or unfolded.

The draw bands 57, 58 are held in place adjacent to the arm pit of the wearer by loops 92, 93, arranged on the adjacent parts
 95 of the retaining bands or straps which together with the saddle form the harness for operating the movable parts of the fingers and thumb of the artificial hand.

The mechanism for closing or folding and
 100 opening or unfolding the thumb is constructed as follows:

59 represents a longitudinal shifting bar which is pivotally connected with the thumb
 105 by a pin 60 beyond the pin 28 and outwardly therefrom, while the outer end of this bar is pivoted on the palm by a pin 61 adjacent to the pin 26 and inwardly therefrom. Upon swinging the inner section of the
 110 thumb inwardly, the bar 59 causes the outer section thereof to turn outwardly, and vice versa, thereby causing the thumb sections to adapt themselves to the position of these parts in imitation of the thumb of a natural
 115 hand when the same is relaxed and when the same grasps anything.

62 represents a rotary cam pivoted by a pin 63 on the palm and having a cam flange
 120 62^a which engages with a notch in the inner end of a link 64 similar to the connection between the cams and links which operate the fingers. The outer end of the link 64 is connected by a pivot pin 65 with the inner
 125 thumb section adjacent to the inner side of the pivotal connection between the latter and the palm, as shown in Fig. 7. The inner end of the link 64 is controlled by a guideway 66 on the palm so as to cause the
 130 same to move toward and from the axis of the cam 62. 67 represents a drum connect-

ed with the thumb cam 62 so as to turn therewith. To this thumb drum are secured opening and closing branch lines 68, 69 which pass in opposite directions around this drum and are connected respectively with the opening and closing branch lines 43, 44 of the adjacent finger operating mechanism. Upon pulling on the main closing line 51 the thumb operating cam is turned in the direction for swinging the inner thumb section inwardly and upon pulling on the main opening line 49 this cam is turned in the direction for swinging the inner thumb section outwardly.

The pivotal connection between the wrist and the forearm is preferably constructed as follows:

70 represents a forwardly tapering or conical centering extension of tubular form arranged on the front end of the forearm and forming a part thereof and engaging with a correspondingly shaped internal bearing or socket 71 at the rear end of the wrist. A ball bearing is formed between the inner or rear end of the wrist and the forearm by an inner annular row of balls 72 arranged between an outer ball race 73 arranged on the forearm and an inner ball race 74 formed on the wrist, and an outer row of balls 75 arranged between an outer ball race 76 formed on the wrist and a ball race 77 formed on a sleeve 78 which is secured to the adjacent part of the forearm.

Means are provided for turning the wrist about its longitudinal axis relatively to the forearm and also swinging the palm laterally about a transverse axis relatively to the wrist, which means in their preferred form are constructed as follows:

79 represents an adjusting bar which is connected at its front end by a swivel joint 80 with the palm on the inner side thereof adjacent to its fulcrum and is guided with its front part in a loop 81 on the adjacent part of the wrist. The rear part of the adjusting bar is slidable lengthwise on a guide lever 82 which is channel shaped in cross section to receive the adjusting bar and which is pivoted by a pin 83 on lugs 84 of the wrist so that this lever can rock on said wrist but is compelled to turn bodily with the same relatively to the forearm. By sliding the bar lengthwise on the adjusting lever, the palm can be tilted more or less relatively to the wrist, the normal position of the wrist being shown in Fig. 6, and the tilted position by full lines in Fig. 8. The palm is locked in a more or less tilted position by a plurality of locking or adjusting teeth 85 arranged on the rear end of the adjusting bar and adapted to engage with a locking or adjusting pin 86 arranged transversely on the adjusting lever, as best shown in Fig. 8. On its front arm the adjusting lever is provided with a locking or

adjusting pin 87 which passes through an opening 88 in the wrist and is adapted to engage with one or another of a plurality of locking openings 89 arranged in a circumferential row on the conical extension of the wrist, as shown in Figs. 8 and 10. Upon pressing the rear arm of the adjusting lever inwardly the locking pin 87 on its front arm is disengaged from an opening 89 in the wrist extension, so that now the wrist and the parts mounted thereon may be turned about the axis of the pivotal connection between the wrist and the forearm, and when these parts have reached the desired position the pressure upon the rear arm of the adjusting lever is released, thereby permitting the pin 87 to enter the adjacent opening 89 and hold the parts in this position. The adjustment of the palm relatively to the wrist and the adjustment of the wrist relatively to the forearm is preferably effected by one operation, this being accomplished by providing the rear end of the adjusting bar 79 with a handle or operating member 90 which may either be grasped by the good hand of the wearer or the same may be engaged with a relatively stationary part such as the side of the body, as shown in Fig. 1, for operating the palm and wrist adjusting mechanism. In order to provide a yielding engagement with the handle 90 the outer side of the same is constructed in the form of an elastic strap 91 of rubber or similar material and spans the ends of this handle, whereby a soft and non-slipping contact with the body is produced which will avoid chafing or wearing of the clothes as well as avoid injury to the hand which manipulates the same. The adjusting bar 79 is preferably made of resilient material such as spring steel, whereby the same operates to yieldingly hold the adjusting lever in its interlocked position relatively to the forearm and the adjusting bar is also held in its interlocked position relatively to the adjusting lever.

We claim as our invention:

1. An artificial limb comprising a palm, a finger pivoted on the palm, and means for actuating said finger comprising a rotary cam pivotally mounted on said palm, and a link pivotally connected with said finger and operatively engaged by said cam.

2. An artificial limb comprising a palm, a finger pivoted on the palm, and means for actuating said finger comprising a rotary cam pivotally mounted on said palm, a link pivotally connected with said finger and operatively engaged by said cam, and means on said palm for guiding said link adjacent to its point of engagement with said cam.

3. An artificial limb comprising a palm, a finger pivoted on the palm, and means for actuating said finger comprising a rotary cam mounted on said palm and having a

cam flange, a link pivotally connected at one end with said finger and provided at its other end with a notch which receives the cam flange and a guide lug in line with said notch, and a guide arranged on the palm and receiving said lug and causing that end of the link adjacent to the cam to move radially relatively to the latter.

4. An artificial limb comprising a palm, a finger pivoted on said palm, means for actuating said finger, a rotary drum for operating said finger actuating means, and two operating lines connected with said drum and passing in opposite directions around the same.

5. An artificial limb comprising a palm, a finger pivoted on said palm, and means for actuating said finger comprising a rotary drum, two operating lines connected with said drum and passing in opposite directions around the same, and means mounted on the body of a person for pulling either of said lines.

6. An artificial limb, comprising a palm, a finger pivoted on said palm, means for actuating said finger, a rotary drum for operating said finger actuating means, two operating lines connected with said drum and passing in opposite directions around the same, means mounted on the body of a person for pulling one or the other of said lines and relaxing one or the other of said lines, comprising front and rear draw bands adapted to be arranged on the front and rear sides of the body of a person, intermediate lines connecting said draw bands with said operating lines, guides for said intermediate lines arranged on the front and rear sides of the body of the person adjacent to the shoulder of the arm which has the artificial limb, and means for connecting the opposite ends of said draw bands with the opposite arm of the person for actuating said bands and lines upon moving the body and that arm to which the draw bands are connected either forwardly or backwardly relatively to each other.

7. An artificial limb, comprising a palm, a finger pivoted on said palm, means for actuating said finger, a rotary drum for operating said finger actuating means, two operating lines connected with said drum and passing in opposite directions around the same, and means mounted on the body of a person for pulling either one or the other of said lines and relaxing one or the other of said lines, comprising front and rear draw bands adapted to be arranged on the front and rear sides of the body of a person, intermediate lines connecting said draw bands with said operating lines, guides for said intermediate lines arranged on the front and rear sides of the body of the person adjacent to the shoulder of the arm which has the artificial limb, and a bracelet connected with

the opposite ends of said draw bands and adapted to embrace the opposite arm of the person.

8. An artificial limb, comprising a palm, a finger pivoted on said palm, means for actuating said finger, a rotary drum for operating said finger actuating means, two operating lines connected with said drum and passing in opposite directions around the same, and means mounted on the body of a person for pulling one or the other of said lines and relaxing one or the other of said lines, comprising front and rear draw bands adapted to be arranged on the front and rear sides of the body of a person, intermediate lines connecting said draw bands with said operating lines, guides for said intermediate lines arranged on the front and rear sides of the body of the person adjacent to the shoulder of the arm which has the artificial limb, and means for connecting the opposite ends of said draw bands with the opposite arm of the person for actuating said bands and lines upon moving the body and that arm to which the draw bands are connected either forwardly or backwardly relatively to each other, said intermediate lines being crossed relatively to each other between said guides and said drum.

9. An artificial limb comprising a palm, a plurality of fingers pivoted on said palm, and means for actuating said fingers comprising a main line, a plurality of branch lines each operatively connected with one of said fingers, and an equalizing device interposed between said branch lines and said main line for operating the fingers simultaneously, said equalizing means permitting one or more fingers to come to a standstill while the others continue their closing movement under a pull on the said main line.

10. An artificial limb comprising a palm, a plurality of fingers pivoted on said palm, and means for actuating said fingers comprising a plurality of branch lines each operatively connected with one of said fingers, and the rear ends of said branch lines being connected in pairs to form bights or loops, an equalizing line doubled to form a bight and having guide rollers at its ends which engage with the bights of said branch lines, and a main line having a guide roller engaging with the bight of said equalizing line.

11. An artificial limb comprising a forearm, a wrist, and a rotary connection between said forearm and palm comprising annular ball races formed on the inner and outer sides of the wrist, an annular ball race arranged on the forearm, a sleeve secured to the outer side of the forearm and provided with an inner ball race, and rows of balls interposed between the ball races on said wrist and the ball races on said forearm and sleeve.

12. An artificial limb comprising a forearm, a wrist, a ball bearing arranged between said forearm and wrist, and a conical centering tube arranged on said forearm and engaging with a correspondingly shaped bearing on the interior of said wrist.
13. An artificial limb comprising a forearm, a wrist connected by a longitudinal pivot with said forearm, a palm connected by a transverse pivot with said wrist, means for turning the wrist relatively to said forearm, and means mounted on said first named means for turning said palm relatively to said wrist.
14. An artificial limb comprising a forearm, a wrist connected by a longitudinal pivot with said forearm, a palm connected by a transverse pivot with said wrist, and a longitudinally movable shifting bar guided on said wrist and pivotally connected at its front end with said palm while its rear end is provided with a handle.
15. An artificial limb comprising a forearm, a wrist connected by a longitudinal pivot with said forearm, a palm connected by a transverse pivot with said wrist, a longitudinally movable shifting bar guided on said wrist and pivotally connected at its front end with said palm while its rear end is provided with a handle, a guide for said shifting bar mounted on said wrist and provided with an adjusting pin, and a longitudinal row of adjusting teeth arranged on said shifting bar and adapted to engage with said locking pin.
16. An artificial limb comprising a forearm, a wrist connected by a longitudinal pivot with said forearm, a palm connected by a transverse pivot with said wrist, a longitudinally movable shifting bar guided on said wrist and pivotally connected at its front end with said palm while its rear end is provided with a handle, a guide for said shifting bar mounted on said wrist and provided with an adjusting pin, and a longitudinal row of adjusting teeth arranged on said shifting bar and adapted to engage with said locking pin, said guide being pivoted on said wrist to swing transversely and provided with an adjusting pin, and said forearm being provided with an extension having a circumferential row of openings, one or another of which is adapted to be engaged by the adjusting pin of said guide.
17. An artificial limb comprising a forearm, a wrist connected by a longitudinal pivot with said forearm, a palm connected by a transverse pivot with said wrist, a longitudinally movable shifting bar guided on said wrist and pivotally connected at its front end with said palm while its rear end is provided with a handle, a guide for said shifting bar mounted on said wrist and provided with an adjusting pin, and a longitudinal row of adjusting teeth arranged on said shifting bar and adapted to engage with said locking pin, said shifting bar being constructed of resilient metal and operating to hold the teeth therein in engagement with the pin on said guide.
18. An artificial limb comprising a forearm, a wrist connected by a longitudinal pivot with said forearm, a palm connected by a transverse pivot with said wrist, a longitudinally movable shifting bar guided on said wrist and pivotally connected at its front end with said palm while its rear end is provided with a handle, a guide for said shifting bar mounted on said wrist and provided with an adjusting pin, and a longitudinal row of adjusting teeth arranged on said shifting bar and adapted to engage with said locking pin, said guide being pivoted on said wrist to swing transversely and provided with an adjusting pin, and said forearm being provided with an extension having a circumferential row of openings one or another of which is adapted to be engaged by the adjusting pin of said guide, said shifting bar being constructed of resilient metal and operating to yieldingly hold the teeth thereon in engagement with said pin on said guide and also yieldingly holding said pin of the guide in engagement with the openings of said forearm.
19. An artificial limb comprising a palm, a plurality of fingers radiating on different lines from said palm and each turning about an axis which is out of line from the axes of the other fingers, and a single pin pivotally connecting the several fingers with said palm and consisting of a plurality of sections which are arranged on different lines and each of which pivotally connects one of said fingers with the palm, said pin being provided with notches between adjacent sections which permit of bending each section relatively to another.
20. An artificial limb comprising a palm, a plurality of fingers radiating on different lines from said palm, and each turning about an axis which is out of line from the axes of the other fingers, means for actuating said fingers comprising a plurality of cams each of which is operatively connected with one of said fingers, and a single pin pivotally connecting the plurality of cams with said palm and consisting of a plurality of sections which are arranged on different lines and each of which pivotally connects one of said cams with said palm, said pin being provided with notches between adjacent sections which permit of bending each section relatively to another.

In testimony whereof we affix our signatures.

ALBERTO PECORELLA.
VINCENT PATRICOLO.
FREDERICK H. APEL.