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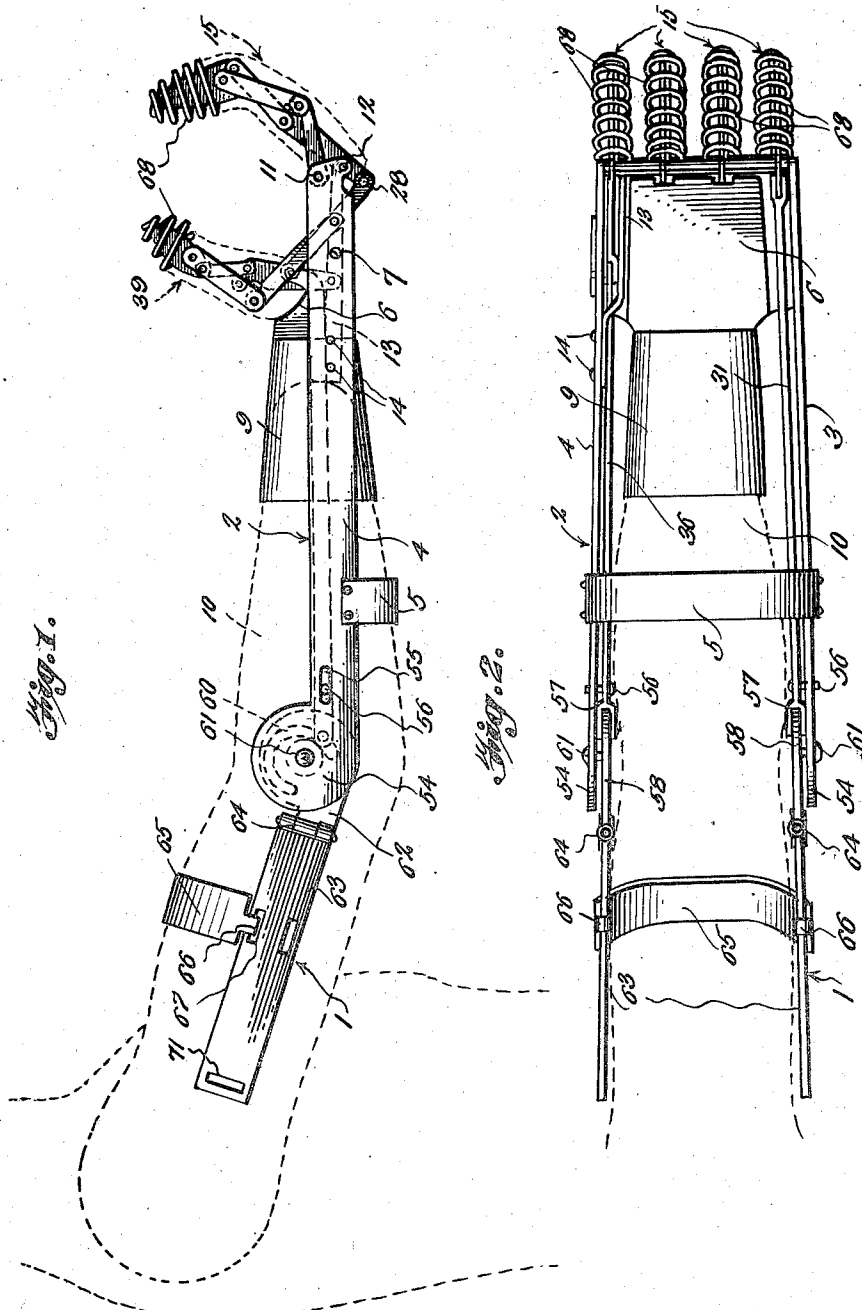
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2,449,728

ARTIFICIAL HAND AND ARM

Filed Jan. 24, 1946

4 Sheets—Sheet 1



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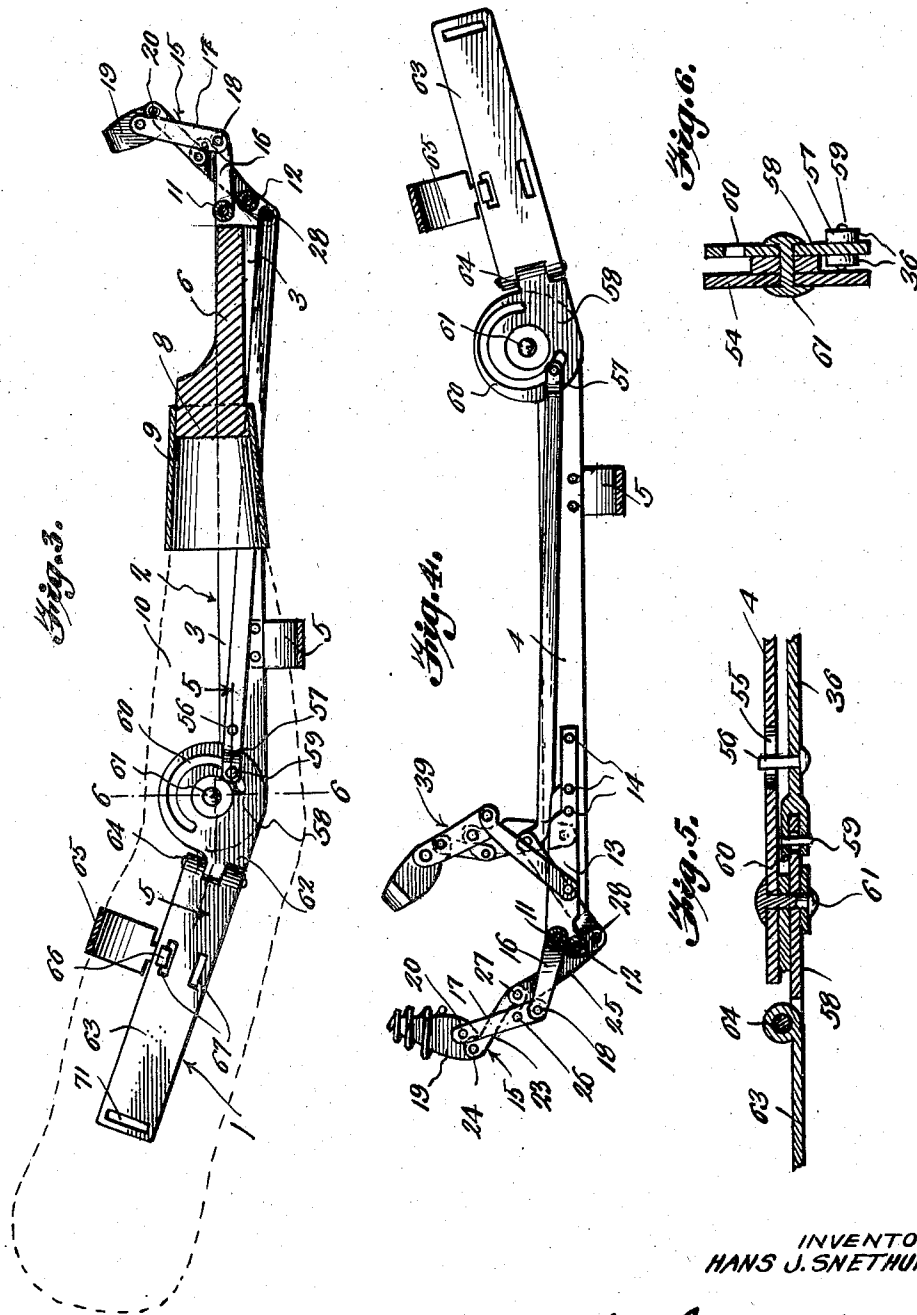
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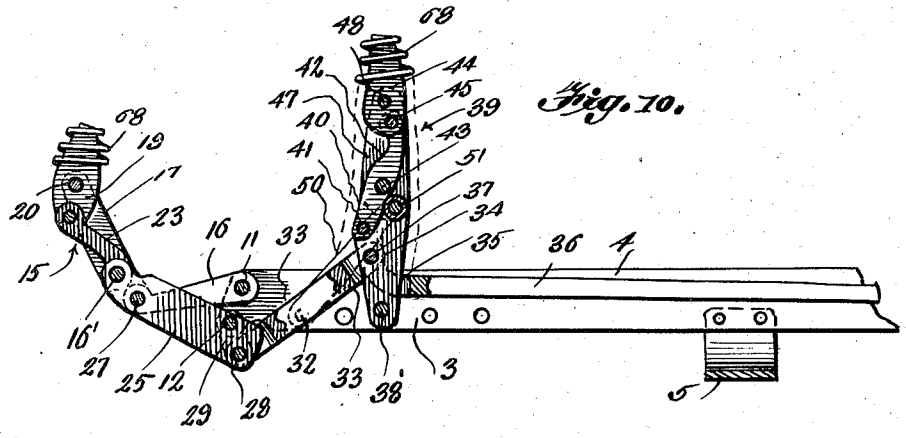
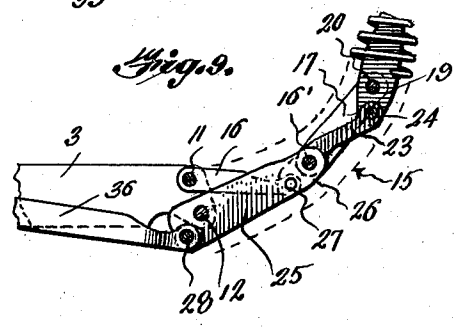
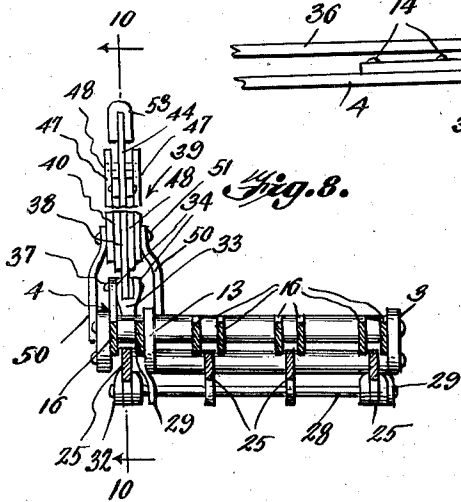
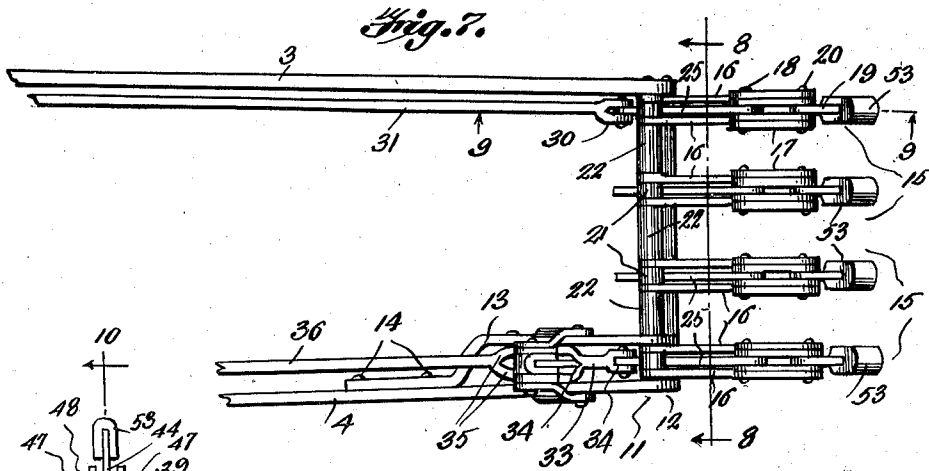
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ARTIFICIAL HAND AND ARM

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4 Sheets-Sheet 3



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Fig. 11.

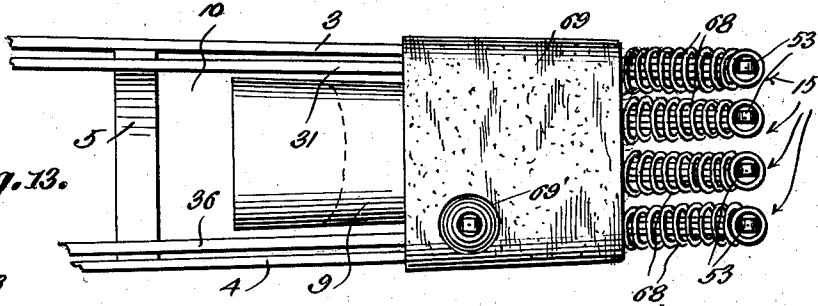


Fig. 13.

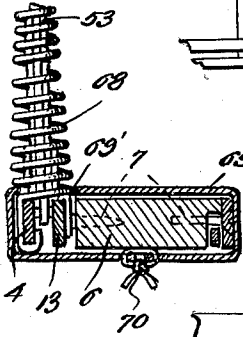


Fig. 12.

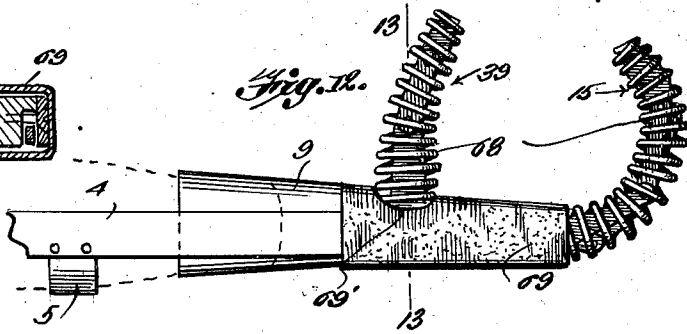
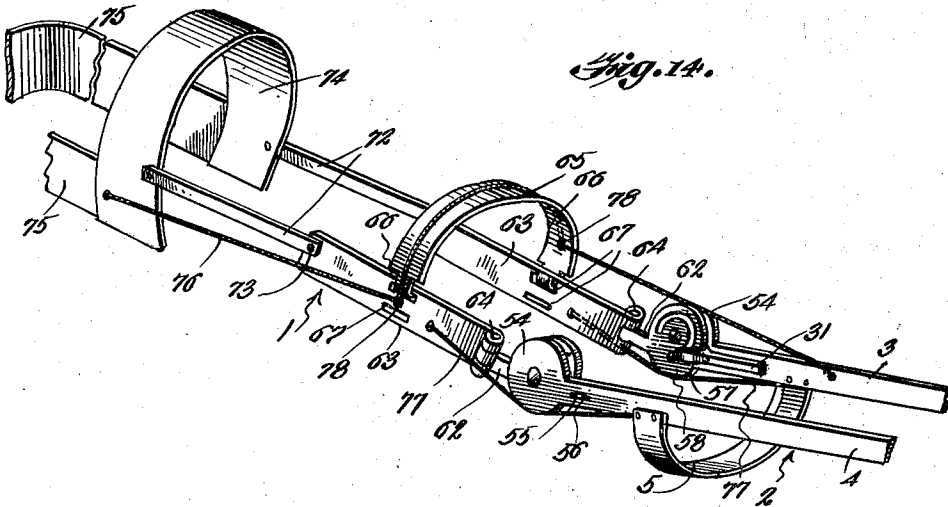


Fig. 14.



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UNITED STATES PATENT OFFICE

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ARTIFICIAL HAND AND ARM

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Application January 24, 1946, Serial No. 643,021

4 Claims. (Cl. 3—12)

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This invention relates to an artificial hand which is to be applied to the stump of an arm from which the hand and a portion of the arm have been removed.

At the present time artificial arms and hands in general use are not satisfactory as the fingers are stiff and an object can not be grasped with the artificial hand.

Therefore it is one object of the invention to provide an artificial hand so constructed that the fingers are formed of links or strips which are pivoted to each other at points corresponding to finger joints and thus allow the fingers to be moved in a natural manner for opening and closing the hand.

Another object of the invention is to provide mechanism for holding the artificial hand in place about the front end of the arm, the mechanism including members so mounted and so connected with the fingers that when the forearm is moved at the elbow the fingers will be moved and the hand opened or closed according to the direction in which the forearm is moved.

Another object of the invention is to provide an artificial hand wherein the pivotally connected links forming the fingers are enclosed in helical springs which form yieldable sleeves for the fingers and impart a more natural appearance to the hand when it is covered by a glove serving as a casing for the hand and in addition allow the thumb and fingers of the artificial hand to obtain a good grip upon an article to be picked up without danger of crushing the article.

Another object of the invention is to provide an artificial hand having side bars adapted to be strapped to an arm where they will be firmly held and companion upper and lower ones of the side bars pivoted to form an elbow joint having finger-actuating bars so connected with lower portions of the upper side bars that they will be shifted longitudinally to move the fingers when the arm is bent at the elbow.

Another object of the invention is to provide an artificial hand which is very efficient in operation, strong and durable, and capable of being easily applied or removed.

The invention is illustrated in the accompanying drawings wherein:

Fig. 1 is a side view of the improved artificial hand showing it applied to the arm of a person indicated by dotted lines.

Fig. 2 is a bottom plan view of the artificial hand.

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Fig. 3 is a sectional view taken longitudinally through the artificial hand.

Fig. 4 is a view partially in section and partially in side elevation showing the palm of the hand and the socket carried thereby removed.

Fig. 5 is a fragmentary sectional view taken along the line 5—5 of Figure 3.

Fig. 6 is a sectional view taken through the elbow joint along line 6—6 of Figure 3.

Fig. 7 is a view of the fingers and their operating mechanism with the helical springs of the fingers removed.

Fig. 8 is a sectional view taken along the line 8—8 of Figure 7.

Fig. 9 is a sectional view taken along the line 9—9 of Figure 7.

Fig. 10 is a sectional view taken longitudinally of the artificial hand showing the fingers in the opened position.

Fig. 11 is a plan view of the artificial hand and showing a leather covering for the palm in place.

Fig. 12 is a side view of Figure 11.

Fig. 13 is a fragmentary sectional view taken along line 13—13 of Figure 12.

Fig. 14 is a perspective view of an artificial hand and arm adapted to be applied to an arm which has been amputated above the elbow.

This improved artificial hand, or hand and arm, has companion sections which may be referred to as upper and lower sections and are designated in general by the numerals 1 and 2. The lower section or front section 2 has side bars 3 and 4 to which are secured ends of a metal strip 5 which is curved longitudinally and forms a cradle which extends transversely of the forward section 2 and is intended to engage under and support the forward portion of a person's arm. A block 6 which simulates the palm and adjacent portions of a person's hand is disposed between forward portions of the bars 3 and 4 where it is secured by screws 7 and this block has a shank 8 carrying a socket 9 to receive the stump or forward end of an arm 10 which has been amputated near the wrist. The socket is tapered towards its front end so that the arm will fit snugly in the socket and have wedging fit therein.

Rods 11 and 12 are mounted between front ends of the side bars 3 and 4 and these rods also pass through the front end of a strip or bar 13 which extends longitudinally of the side bar 4 and is spaced from the inner surface of this bar for the major portion of its length but has its rear end portion secured flat against the side bar by rivets

14. Fingers 15 are carried by the rod 11 and 12 and each has inner links or plates 16, intermediate plates or links 17 pivotally connected with the links 16 by a pin 18, and an outer plate or link 19 pivotally mounted between the outer ends of the intermediate links by a pin 20. The inner links are pivotally mounted upon the rod 11 and spaced from each other by spacers 21 and the fingers are spaced from each other by spacing sleeves 22. Links 23 are pivoted to inner ends of the links 19 rearwardly of the pins 20 by pins 24 and these links 23 are disposed between the intermediate links 17 and have their rear ends pivotally connected with links 25 by pins 26. The links 25 are also pivoted at their front ends to the links 17 by pins 27 and have their rear ends pivotally mounted on a rod 28 which extends parallel to the rod 12 and mounted through links 29 carried by the rod 12. The rod 28 has one end portion mounted through forks 30 at the front end of an actuating rod or bar 31 and its other end portion mounted through forks 32 at the front end of a link 33. The link 33 is disposed between the bar 4 and the strip 13 and extends rearwardly at an upward incline with its rear end formed with forks 34 with which the forks 35 at the front end of an actuating rod or bar 36 are pivotally connected by a pin 37. The link 33 has its rear end pivoted to the lower link 38 of the thumb 39 which extends between the forms of the link 33 and the rod 36 and formed with an opening through which the pin 37 passes. The lower end of link 38 is pivotally mounted by pin 38'. Links 40 have their lower ends pivoted against opposite sides of the link 38 by a pin 41 and the links 40 are located between links 42 which are pivoted to the links 40 by a pin 43. An outer link 44 is pivotally mounted between outer ends of the links 42 by a pin 46 and its inner end the link 44 is pivotally connected with outer ends of side links 47 by a pin 48. The side links 47 are pivoted to the upper end of the link 38 by a pin 49 located rearwardly of the links 42 and the lower ends of the side links are also pivoted to upper ends of links 50 by a pin 51, the links 50 having their lower ends pivoted to the bar 4 and the strip 13 by a pin 52. When the rods or bars 31 and 36 are shifted longitudinally of the bars 3 and 4 the rod 28 is shifted forwardly or rearwardly, according to the direction in which the bars 31 and 36 are moved and during such movement of the rod tilting movement will be imparted to the various links of the fingers and the thumb and the fingers and thumb caused to have opening or closing movements in the same manner the fingers and thumb of a person's hand move in order to open or close the hand. Therefore a person using the artificial hand may grasp articles in a natural manner. Clips 53 carried by the end links of the fingers and thumb provide blunt ends for them.

The side bars 3 and 4 are of such length that they will extend to the elbow of an arm from which the hand has been amputated and at their rear ends the side bars are each formed with an enlargement or disk 54. Forwardly of the disks each bar is formed with a longitudinally extending slot 55 through which engage pins 56 carried by the actuating bars or rods 31 and 36 and serving to direct sliding movement thereof relative to the side bars 3 and 4. The rear ends of the actuating bars 31 and 36 are formed with forks 57 which straddle disks 58 at front ends of the side bars of the upper arm section 1. The forks carry pins 59 which pass through slots 60 formed in the

disks 58 and since the slots are eccentric to the pins 61 which pass through the companion disks 58 and 48 and pivotally mount the disks 58 for turning movement, such turning movement of the disks 58 will cause longitudinal shifting of the rods 31 and 36. Each disk 58 has a rearwardly extending shank 62 and these shanks are hinged to side bars 63 of the upper arm section by hinges 64. The side bars 63 are connected by a bowed strap 65 for engaging across the bicep muscle of a person's arm and since this strap has hooks 66 at its ends for engaging selected ones of the slots 67 in the side bars 63 it may be adjusted to fit comfortably about a person's arm. Referring to fingers 1 and 2 it will be seen that when the artificial hand is applied the joint between the upper and lower sections 1 and 2 is located at the elbow and will be moved whenever a person's arm is extended or swung inwardly or upwardly towards the chest. During such movement of the lower section 2 the actuating rods 31 and 36 will be shifted longitudinally. When the lower arm section is extended forwardly or downwardly to the position shown in Figure 1 the fingers and the thumb will be moved to an opened position and when the forearm portion is swung upwardly the fingers and the thumb will be closed. Therefore an article may be grasped in the hand and lifted or moved from one place to another or a pen or pencil may be grasped and used for writing in the usual manner.

It is desired to permit articles to be grasped without excessive pressure being applied to them. Therefore the fingers and the thumb are encased in jackets 68 having the form of helical springs and formed from strands of resilient wire. The jackets or spring coverings for the fingers are tapered towards their outer ends and each has the outer end of the resilient strand forming it bent to form a hook which passes through the clip 53 of the thumb or finger while the inner end of the resilient strand is bent to form a hook which engages about the rod 28 and anchors the spring or yieldable jacket in place. The convolutions of the helical springs are spaced from the links forming the fingers and the thumb and this allows the springs to yield when subjected to transverse pressure. A covering 69 formed from a sheet of soft leather fits about the block 6 forming the palm of the hand and also about forward portions of the side bars 3 and 4, where it is secured by lacing its ends to each other by a lacing 70 or in any other desired manner, and this cover is formed with an opening 69' through which the thumb passes. The entire hand may then be covered with a glove and it will closely resemble a natural hand. Slots 71 are formed through upper ends of the side bars 63 so that a harness may have portions passed through them and the device held in place and prevented from slipping longitudinally out of its proper position in which the elbow joints of the side bars are at the elbow joint of the person's arm.

In case the person's arm has been cut off at or above the elbow the side bars 63 or the upper arm section 1 are provided with extensions 72 formed from metal strips. These extension strips are secured to the side bars 63 by rivets 73 and have their upper ends riveted to the shoulder band 74 which straddles a person's shoulder and is held in place by a chest strap or band 75. Spring members 76 and 77 yieldably hold the upper and lower sections 1 and 2 in normal angular relation to each other and are formed of elastic strands or elongated coiled springs mounted

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as shown in Figure 14. Referring to this figure it will be seen that the spring member 76 has an intermediate portion extending across the yoke or strap 76 and is then passed through openings 78 and its end portions extended longitudinally of the artificial arm and secured at its ends to the band 74 and the side bar 3. There are two of the spring members 77 which are secured at their ends to the side bars 63 and the side bars 3 and 4 and have their intermediate portions engaged under the elbow joints. When this artificial arm is in use movements are imparted to its forearm portions by movements of a person's shoulder and upper arm.

Having thus described the invention, what is claimed is:

1. An artificial hand and arm comprising upper and lower arm portions having side bars pivoted to each other to form by an elbow joint the side bars of the upper arm portion being formed with slots eccentric to the pivots of the elbow joints, a hand at the front end of the lower arm portion having fingers movable to opened and closed positions, and actuating rods slidable longitudinally of the side bars of the lower arm portion and having front ends connected with the fingers and their rear ends engaged in the slots formed in the side bars of the upper arm portion whereby the actuating rods will be shifted longitudinally along the lower arm portion and cause movement of the fingers to a closed position when the lower arm portion is swung about the elbow joint to a raised position.

2. An artificial hand and arm comprising lower side bars, upper side bars pivoted on the lower side bars and having slots eccentric to their pivotal connections with the lower bars, rods slidable longitudinally of the lower bars having their rear ends provided with pins passing through the slots and moving the rods longitudinally when the lower side bars are tilted about their pivots, a hand mounted between forward portions of the lower side bars, a cross rod mounted between the lower side bars at the front of the hand, fingers pivotally mounted upon the cross rod and formed of pivotally connected links providing joints for the fingers, and a rod engaged with inner ends of the fingers and moving with the side rods to open and close the fingers.

3. An artificial hand and arm comprising lower side bars, upper side bars pivoted to the lower side bars and having slots eccentric to their pivotal connections with the lower bars, rods slidable lon-

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gitudinally of the lower bars having their rear ends provided with pins passing through the slots and moving the rods longitudinally when the lower side bars are tilted about their pivots, a hand mounted between forward portions of the lower side bars, a cross rod mounted between the lower side bars at the front of the hand, fingers pivotally mounted upon the cross rod and formed of pivotally connected links providing finger joints and allowing opening and closing movements of the fingers, brackets pivoted upon the cross rod, and a rod carried by said brackets and engaged by inner ends of the fingers and connected with the side rods for movement therewith to impart opening and closing movement to the fingers when the lower side bars are swung relative to the upper side bars.

4. An artificial hand and arm comprising upper and lower arm portions having side bars pivoted to each other for swinging movement of the lower arm portion, the upper side bars having slots therein eccentric to the pivots connecting the upper and lower side bars, a block at the front end of the lower arm portion having a socket extending rearwardly for receiving the stump of a person's arm from which the hand has been amputated, fingers and a thumb extending from the front and one side of said block and consisting of links pivoted together and providing joints permitting opening and closing movements of the thumb and fingers, actuating rods for said thumb and fingers slidable longitudinally of the side bars of the lower side portion and having pins at their upper ends engaged in the slots whereby the rods will be shifted longitudinally and move the thumb and fingers when the lower arm section is moved, and yieldable jackets for the thumb and the fingers.

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