Nov. 1, 1949 W. I. JINKINS 2,486,746

ARTIFICIAL LIMB

Filed March 22, 1946 2 Sheets-Sheet 1

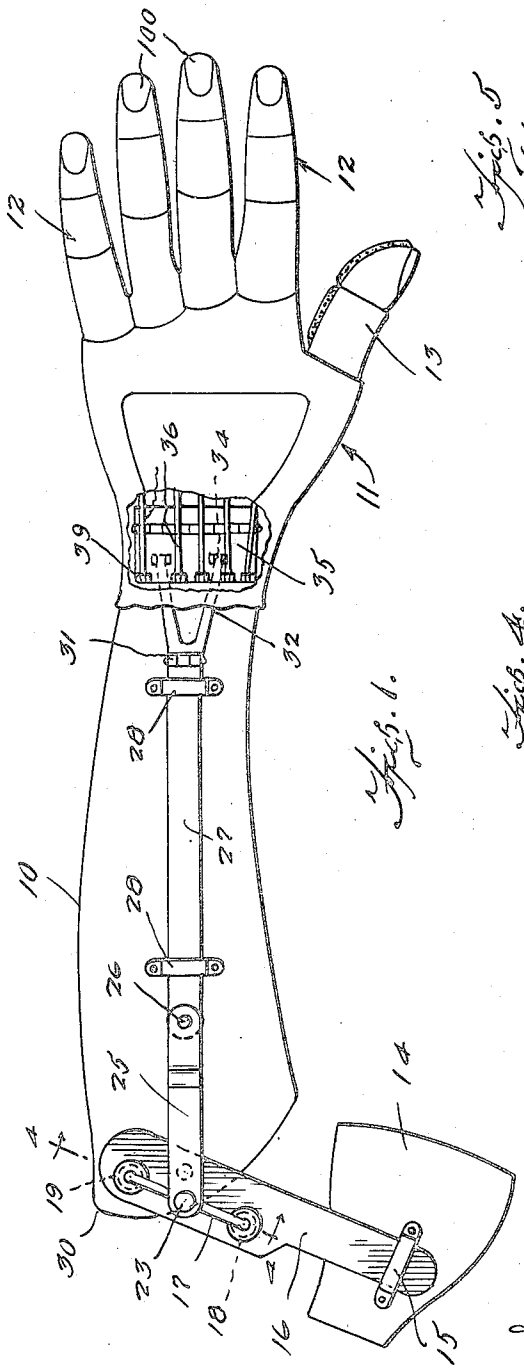

Fig. 1.

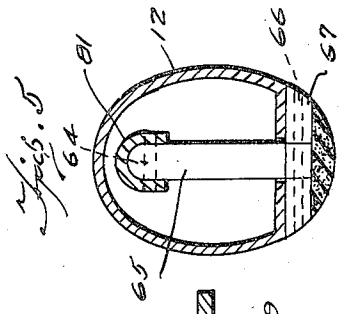

Fig. 5.

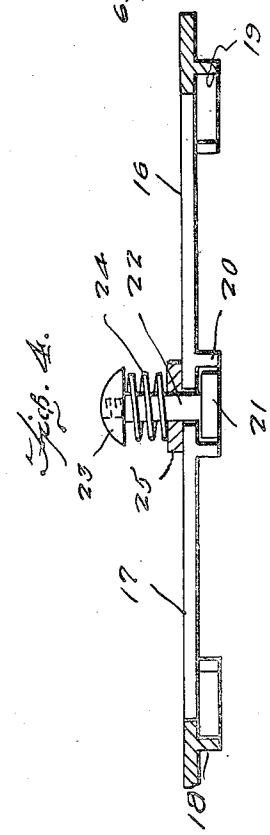

Fig. 4.

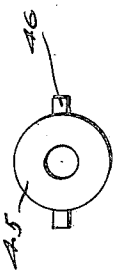

Fig. 8.

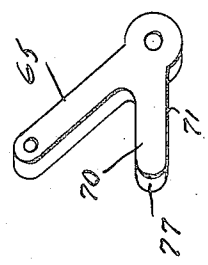

Fig. 7.

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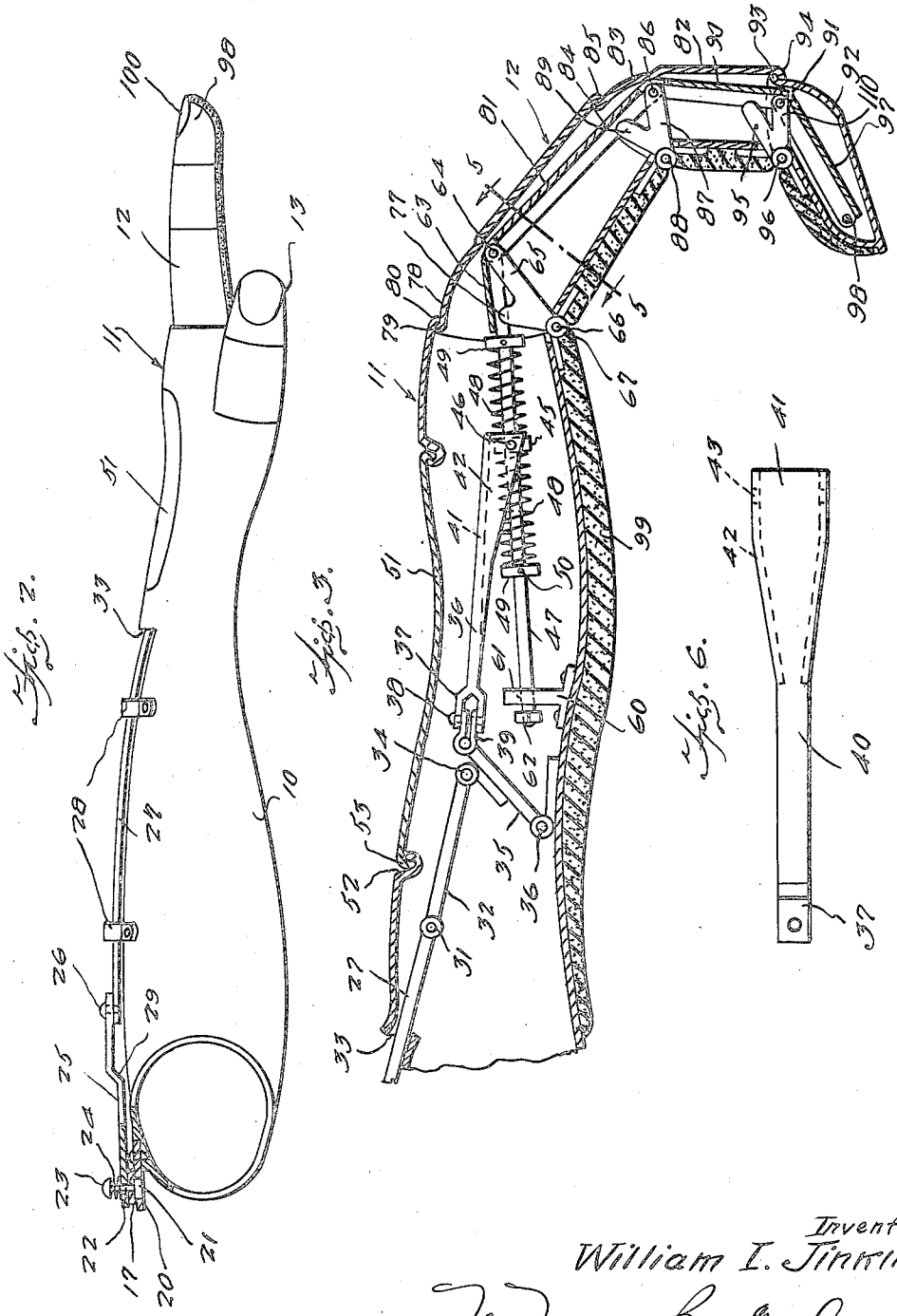

Fig. 2.

Fig. 3.

Fig. 6.

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UNITED STATES PATENT OFFICE

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ARTIFICIAL LIMB

William I. Jinkins, Catlin, Ill.

Application March 22, 1946, Serial No. 656,380

8 Claims. (Cl. 3—12)

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This invention relates to an artificial limb, and more particularly to an artificial hand and arm.

A primary object of this invention is the provision of an improved artificial hand and forearm provided with means whereby the fingers and thumb may be readily flexed to permit the grasping of an object.

An additional object of the invention is the provision of such a device which will be natural and lifelike in appearance and operation.

Still another object of the invention is the provision of means associated with the device whereby the fingers may be moved by straightening and bending the arm.

A still further object of the invention is the provision of such a device whereby the fingers may be curled, when the parts are in one position of adjustment upon straightening the arm and uncurled by bending the arm, and when the parts are in a further position of adjustment, curled by bending the arm and straightened by straightening the arm.

Still another object of the invention is the provision of means in association with such a device whereby the operation of the fingers may be discontinued at the will of the operator by a simple adjustment of the mechanical parts of the limb.

A still further object is the provision of a device of this character which is sturdy and durable in construction, reliable and efficient in operation, lifelike in appearance, and relatively simple to utilize and inexpensive to manufacture.

Other objects will in part be obvious and in part be pointed out as the description of the invention proceeds, and shown in the accompanying drawings, wherein there is disclosed a preferred embodiment of this inventive concept.

In the drawings:

Figure 1 is a top plan view of one form of device embodying features of the instant invention.

Figure 2 is a side elevational view of the device disclosed in Figure 1.

Figure 3 is an enlarged longitudinal sectional view taken through the hand portion of the device.

Figure 4 is an enlarged sectional view taken substantially along the line 4—4 of Figure 1.

Figure 5 is an enlarged sectional view taken substantially along the line 5—5 of Figure 3, as viewed in the direction indicated by the arrows.

Figure 6 is an enlarged top plan view of a constructional detail, certain concealed portions thereof being indicated in dotted lines.

Figure 7 is an enlarged perspective view of a further constructional detail.

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Figure 8 is a plan view of still another constructional detail.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to the drawings, and particularly to Figure 1, the device of the instant invention includes a hollow forearm stub section 10, a hand section generally indicated at 11, and the customary number of finger sections generally indicated at 12. A thumb member 13 is also provided, substantially identical in operation to that of the fingers 12, as will be more fully described hereinafter. The device also includes an arm band 14 adapted to be positioned about the upper arm.

The arm band 14 is provided with a lever guide 15, in which is movable an extremity of a lever 16. The lever 16 is provided on the under side thereof with an elongated slot 17 provided at each extremity with cup-shaped detents 18 and 19, respectively, and a central cup-shaped detent 20, the cup-shaped detents comprising connector stations and adapted to be engaged selectively by a latch button 21 positioned on the lower extremity of a shaft 22 provided with a head 23, the head being spring-biased upwardly, as by a spring 24, to force the button 21 into the cup with which it is associated. The shaft section 22 is pivotally secured to one end of a connector lever member 25, which is pivotally connected at its other end, as by a pivot 26, to the adjacent end of an additional lever section 27 mounted in guides 28 which extends downwardly over the forearm section 10. The connector 25 is offset, as at 29, to permit the lever section 27 to lie flush against the upper surface of the forearm section 10.

From the foregoing it will now be seen that with the connector 25 positioned, as shown in Figure 1 with button 21 seated in the intermediate cup 20, when the artificial limb is adjusted to the arm of a wearer, movement of the upper arm section and straightening and bending of the stub of the forearm at the elbow will have substantially no effect on the lever 27. Conversely, however, it will be readily apparent that if the pin 22 and button 21 are moved in the slot 17 to engage the cup 18, that when the arm is straightened, the connector 25, and correspondingly the lever 27, will be retracted with respect to the hand portion 11, that is, drawn toward the elbow. Similarly, a bending of the arm will effect an opposite movement. It will further be seen that when the button 21 is positioned in the

cup 19, an exact reverse of this operation will be effected in that straightening the arm will extend the lever 27 towards the hand section 11, and bending the arm will retract the same toward the elbow. The purpose of this movement, and the function thereof, will be more fully described hereinafter.

It may here be pointed out that the forearm section is preferably lined with sponge rubber or similar material, and that the elbow 30 is provided with a similarly lined interiorly positioned housing to protect the elbow and prevent disalignment of the forearm stub, as well as prevent the artificial hand from drifting with respect to the arm.

Referring back to the lever 27, it will be seen, as best shown in Figure 1, that the forward extremity of the lever 27 has pivoted thereto, as by a pivot pin 31, a bifurcated member 32. The member 32 extends inwardly through a slotted aperture 33 in the upper portion of the hand section and each free end of the bifurcations thereof is pivotally connected, as by a pivot 34, to a hinge member 35, hinged, as by a pivot 36, to the lower extremity of the hand portion 11.

As best shown in Figure 1, the hinge 35 extends the full width of the hand portion, and has secured thereto five members 36, one for each finger 12 and thumb 13, which members are comprised, as best shown in Figures 3 and 6, of a bifurcated rear extremity 37, secured, as by a pin 38, to an extension 39 of hinge 35, a forwardly extending portion 40, and an expanded forward extremity 41 including oppositely disposed depending flanges 42 provided adjacent their forward extremities with aligned apertures 43.

Each of the members 41 engages a collar 45 (Figures 3 and 8) provided with diametrically opposite pins 46 engageable in the apertures 43. Each collar 46 is slidably mounted on a rod 47 and is abutted on opposite sides by coil springs 48. The springs 48 are held in position on the rod by fixed collars 49 secured in position, as by set screws 50. The tension of the springs 48 serves to bias the slidable collar 45 to a mid point or centrally disposed position on the rod 47. The upper portion of the hand section 10 is provided with a removable cover 51 seatable in grooves 52 in the upper surface thereof and engaged therein by depending flanges 53, removal of the cover 51 permitting access to the springs 48 for the purpose of adjustment through set screws 50 and collars 49.

As best shown in Figure 3, a transversely extending upstanding flange 60 is provided with apertures 61 through which the rear extremities of each rod 47 pass, the rods being held in position, as by nuts 62, on the rear extremities thereof. The forward end of each rod 47 terminates in channel-shaped members 63, the forward extremities of which are pivotally secured, as by pivots 64, to the upper ends of link members 65 (Figure 7), the lower extremities of which are hingedly fixed, as by pins 66, to a hinge joint 67 representing the first knuckle of each finger. Each of the members 65 includes a rearwardly and upwardly extending arm 70, the lower face edges 71 of which when the fingers are extended, abuts with the lower inner surface 76 of each finger section, to preclude the extension of the fingers past straight line positions. The upper extremity 77 of each portion 70 abuts with the inner portion of channel-shaped member 63 to preclude bending of the fingers beyond a certain point. An extension to the finger section 78 is slidable within the hand section when the fingers are straightened and coacting flanges 79 and 80 on each finger section and the hand section, respectively, preclude the passage of the portion 78 beyond normal curvature. Secured to each pivot 64 is a channel-shaped section 81 which extends from the knuckle section adjacent the hand to the second knuckle section 82 which corresponds in general configuration to the first knuckle section and includes a retractable portion 83 provided with a flange 84 coacting with a flange 85 at the extremity of the first section in a manner similar to that described in connection with the flanges 79 and 80. The outer extremity of the channel-shaped member 81 is pivoted, as on a pivot 86, to a second link member 87, pivoted, as at 88, to form a hinge for this section of the finger and provided with an arm 89 which functions in a manner similar to the arm 65 previously discussed. From the pivot 86 a channel section 90 extends to a pivot 91 in the fingertip which is provided with a retractable section 92 having a flange 93 coacting with a flange 94 at the extremity of the section 82. A third link member 110 is pivotally connected at its upper end, as at 91, to the forward end of channel section 90 and at its lower end is pivotally connected, as on a pivot 96, to a further hinge section in the lower portion of the finger constituting the extreme outer joint. An upwardly directed arm 95 extends from the lower end of link 110 and functions in the same manner as the arms 77 and 89 previously described. A channel-shaped section 97 leads from the pivot 91 to a pin 98 extending across the fingertips.

The lower portion of the hand and finger section may be provided with a pad of sponge rubber 99, or the like, and artificial fingernails 100 may be provided at the extremities of each digit if desired.

From the foregoing the operation of the device should be readily understandable. When the lever 27 is moved forwardly toward the fingers, the members 36 are extended, which, in turn, through the channel-shaped sections 63, 81, 90 and 97 and their pivotal engagement with the members 65, 87 and 110 effects a curling or clasping movement of the fingers. Obviously, reverse movement of the lever 27 causes straightening of the fingers. As has previously been pointed out, the extension and retraction of the lever 27 may be occasioned by either bending or straightening the arm in accordance with the position of the lever 25 in respect to the lever member 16.

If desired, of course, a glove may be positioned over the artificial hand and the device will seem in appearance to be natural and lifelike.

From the foregoing it will now be seen that there is herein provided an improved artificial hand which accomplishes all the objects of this invention, and others, including many advantages of great practical utility and commercial importance.

As many embodiments may be made of this inventive concept, and as many modifications may be made in the embodiment hereinbefore shown and described, it is to be understood that all matter herein is to be interpreted merely as illustrative and not in a limiting sense.

I claim:

1. In an artificial limb including an upper arm band, a forearm section, a hand and at least one finger comprising at least two sections, one of said sections including a finger tip, separate pivot means hingedly connecting said finger to said hand and said finger sections together, a sepa-

rate lever pivoted on each pivot means, links connecting said levers together and to said finger tip, rigid means longitudinally disposed relative to said forearm section and longitudinally reciprocable relative thereto, one end of said rigid means being operatively connected to said links whereby reciprocation thereof in one direction is operative to open said finger and in the other direction to close said fingers, a rigid connector pivotally connected to the other end of said means, means pivotally connecting said arm band to said forearm section, said last-named means including at least two longitudinally spaced connector stations, and means for selectively connecting said connector to each of said stations whereby when connected to one station to reciprocate said rigid means in one direction when the elbow of the wearer is bent and in the other direction when the elbow is straightened, and when connected to the other station to reverse the directions of reciprocation of said rigid means when the elbow is bent and straightened.

2. In an artificial limb including an upper arm band, a forearm section, a hand and at least one finger comprising a plurality of hingedly connected sections, said band and forearm section being adapted to be secured to an arm on opposite sides of an elbow joint, rigid means reciprocable longitudinally of said forearm section and operatively connected at one end to said hand and finger to open the latter when reciprocated in one direction and to close the finger when reciprocated in the other direction, a rigid connector pivotally connected to the other end of said rigid means, means slidably and pivotally connecting said arm band to said forearm section, said last-named means extending across the axis of said elbow joint and including at least two longitudinally spaced connector stations, one of said stations being on the forearm side of said elbow joint, the other of said stations being on the upper arm side of said elbow joint, and means for selectively connecting said connector to each of said stations whereby when connected to one station to reciprocate said rigid means in one direction when the elbow of the wearer is bent and in the other direction when the elbow is straightened, and when connected to the other station to reverse the directions of reciprocation of said rigid means when the elbow is bent and straightened.

3. In an artificial limb including an upper arm band, a forearm section, a hand and at least one finger comprising a plurality of hingedly connection sections, said band and forearm section being adapted to be secured to an arm on opposite sides of an elbow joint, means slidably and pivotally connecting said forearm section to said band and extending across the axis of said elbow joint, a selectively shiftable connector connecting said means to said finger, said connector being shiftable on said means to and from a position on the forearm side of said elbow joint and a position on the upper arm side of said elbow joint, said connector being operative in one position of said connector to open and close said finger as the wearer's elbow is bent and straightened, respectively, and operative when said connector is shifted to the other position to close and open said finger as the wearer's elbow is bent and straightened, respectively.

4. In an artificial limb including an upper arm band, a forearm section, a hand and at least one finger comprising a plurality of hingedly connected sections, said band and forearm section being adapted to be secured to an arm on opposite sides of an elbow joint, means slidably and pivotally connecting said forearm section to said band and extending across the axis of said elbow joint, a selectively shiftable connector connecting said means to said finger, said connector being shiftable on said means to and from a position on the forearm side of said elbow joint and a position on the upper arm side of said elbow joint, said connector being operative in one position of said connector to open and close said finger as the wearer's elbow is bent and straightened, respectively, and operative when said connector is shifted to the other position to close and open said finger as the wearer's elbow is bent and straightened, respectively, and said connector being shiftable to a third position located on a prolongation of the axis of said elbow joint whereby the elbow may be bent and straightened without opening and closing said finger.

5. In an artificial limb including an upper arm band, a forearm section, a hand and at least one finger comprising a plurality of hingedly connected sections, said band and forearm section being adapted to be secured to an arm on opposite sides of an elbow joint, means slidably and pivotally connecting said forearm section to said band and extending across the axis of said elbow joint, a selectively shiftable connector connecting said means to said finger, said connector being shiftable on said means to and from a position on the forearm side of said elbow joint and a position on the upper arm side of said elbow joint, said connector being operative in one position of said connector to open and close said finger as the wearer's elbow is bent and straightened, respectively, and operative when said connector is shifted to the other position to close and open said finger as the wearer's elbow is bent and straightened, respectively, and said connector being shiftable to a third position whereby the elbow may be bent and straightened without opening and closing said finger, said third position being located on a prolongation of the axis of said elbow joint, a slot formed in said means connecting said arm band and forearm section, said slot connecting said positions, said means being formed to provide spaced detents locating said positions, and a spring-loaded latch carried by said connector and selectively engageable with said detents to lock said connector to said means in a selected position.

6. In an artificial limb, including a hand section and at least one hollow finger, pivot means adjacent the palm side of said hand hingedly connecting said finger to said hand, said finger comprising at least two longitudinally aligned sections, a second pivot means adjacent the palm side of said finger and hingedly connecting said sections together, a pair of levers each having an inner end pivoted on one of said pivot means and having its other end extending radially outwardly thereof within the confines of a finger section, a link pivotally connecting the outer ends of said levers, and means pivotally connected to the outer end of the lever of said first pivot and adapted to actuate said levers to open and close said finger, a rigid extension of each of said levers, said extensions comprising stops to limit opening and closing of said fingers.

7. In an artificial limb, including a hand section and at least one hollow finger, pivot means adjacent the palm side of said hand hingedly

connecting said finger to said hand, said finger comprising at least two longitudinally aligned sections, a second pivot means adjacent the palm side of said finger and hingedly connecting said sections together, a pair of levers each having an inner end pivoted on one of said pivot means and having its other end extending radially outwardly thereof within the confines of a finger section, a link pivotally connecting the outer ends of said levers, means pivotally connected to the outer end of the lever of said first pivot and adapted to actuate said levers to open and close said finger, a guide channel in said finger and slidably receiving the free ends of said levers, a rigid arm integral with each of said levers and extending diagonally outward from the inner ends thereof, said arms comprising stops to limit the opening and closing of said fingers.

8. In an artificial limb, including a hand section and at least one hollow finger, pivot means adjacent the palm side of said hand hingedly connecting said finger to said hand, said finger comprising at least two longitudinally aligned sections, a second pivot means adjacent the palm side of said finger and hingedly connecting said sections together, a pair of levers each having an inner end pivoted on one of said pivot means

and having its other end extending radially outwardly thereof within the confines of a finger section, a link pivotally connecting the outer ends of said levers, a reciprocable rod pivotally connected at one end to the outer end of the lever of said first pivot, a pair of coil springs concentric to said rod and in end-to-end relation, a slidable collar on said rod intermediate said springs, and actuating means pivotally connected to said collar and operative to reciprocate the same and said rod.

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