June 7, 1932. J. W. BAEHR 1,861,678

ARTIFICIAL HAND

Filed Sept. 26, 1929 2 Sheets-Sheet 1

Fig. 1

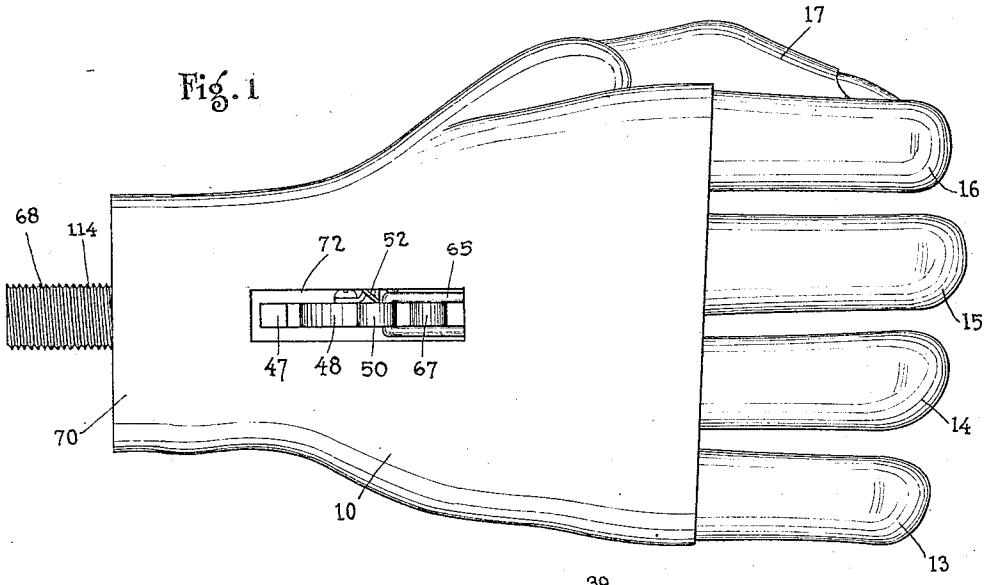


Fig. 2

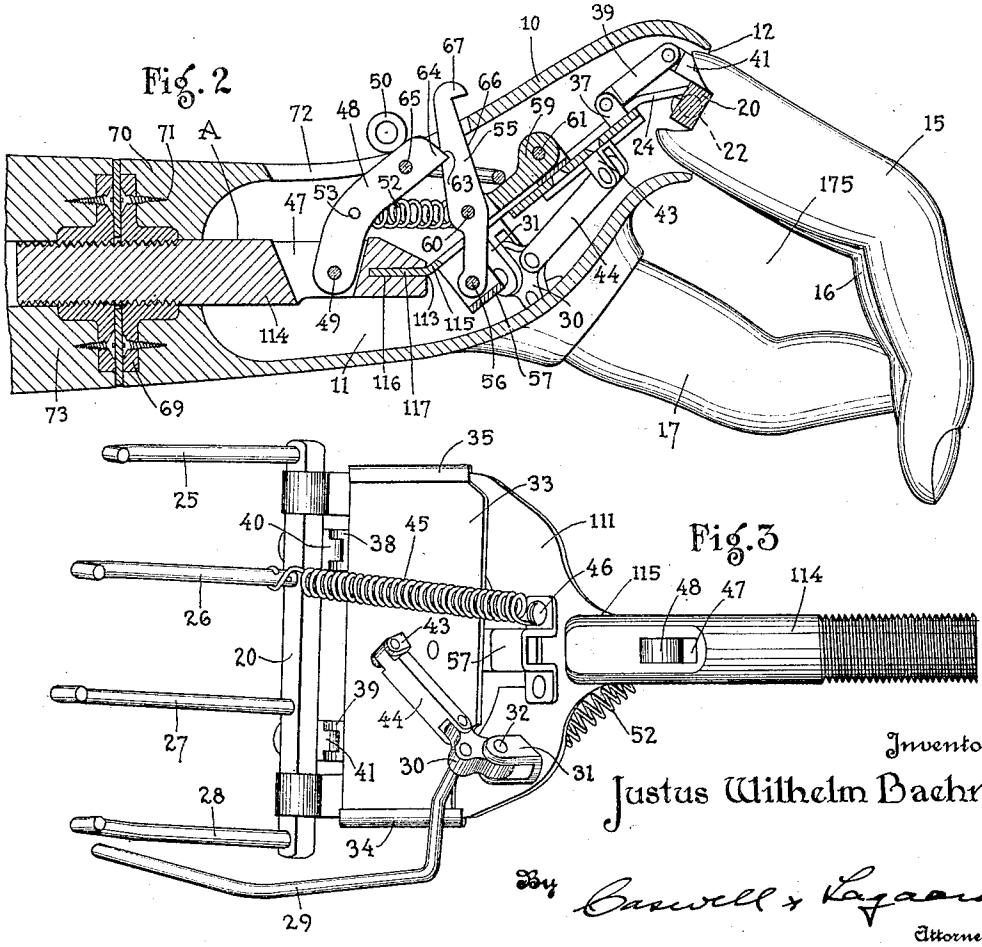


Fig. 3

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ARTIFICIAL HAND

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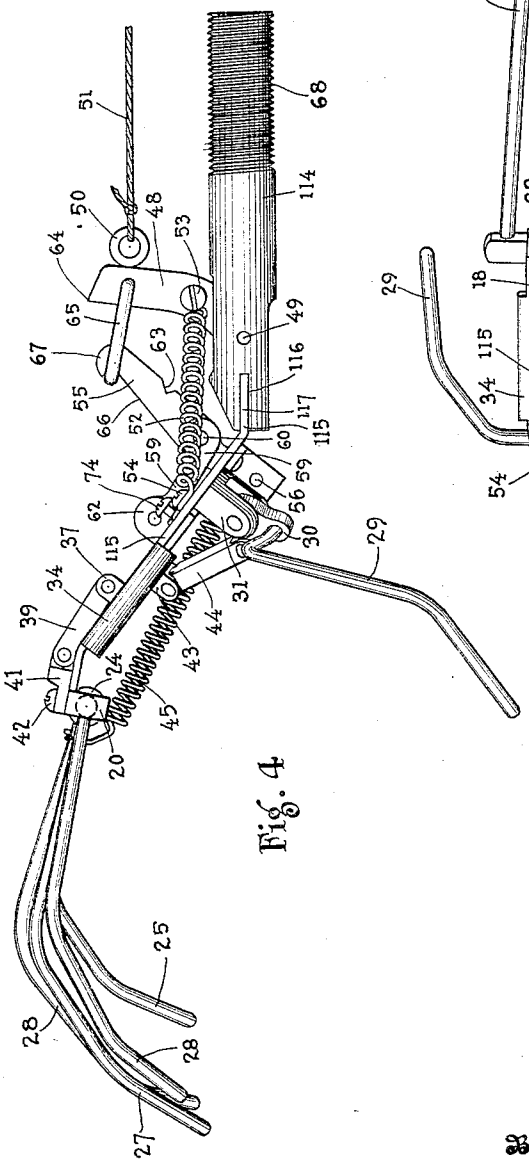


Fig. 4

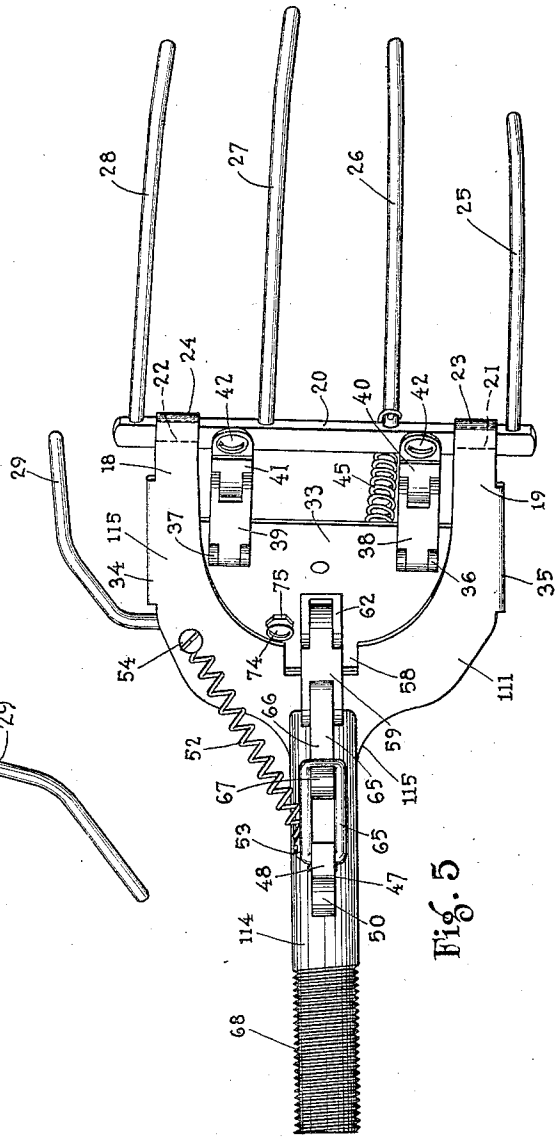


Fig. 5

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UNITED STATES PATENT OFFICE

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ARTIFICIAL HAND

Application filed September 26, 1929. Serial No. 395,373.

My invention relates to artificial hands and has for its object to provide an artificial hand which will closely simulate in appearance the human hand, and which may have all of the principal movements and functions of the human hand.

An object of the invention resides in constructing the hand with a framework including a shank and a plate-like body member issuing outwardly therefrom in inclined relation thereto on which the fingers and actuating mechanism are mounted.

Another object of the invention resides in pivotally mounting a bar at the end of said body member, and in securing rods thereto bent to simulate the fingers of the hand, and in further pivoting to said body member to one side thereof and adjacent the shank, another rod bent to simulate the thumb of the hand.

A still further object of the invention resides in forming guides along the outer edges of said body member and in slidably mounting along said guides a plate-like actuating member for operating said thumb and fingers.

An object of the invention resides in forming said bar with two spaced lugs and in pivoting thereto links correspondingly pivoted to said plate for swinging said bar to move said fingers upon reciprocation of said plate, said links further serving to assist in guiding said actuating member for movement along said guides and to prevent the binding of said member during such movement.

Another object of the invention resides in providing a similar link pivoted to said thumb and pivoted to said actuating member intermediate the pivots of the links for said finger bar thereto, said link extending obliquely across said actuating member.

An object of the invention resides in pivoting to said frame a lever engaging said actuating member for moving the same to articulate said thumb and fingers and in further pivoting to said frame an arm having a draw cord attached thereto, and having means for engaging said lever to lock the same from movement.

Another object of the invention resides in forming said lever with a substantially radial portion and in providing said arm with a link normally free from said lever and adapted to engage said radial portion upon the unlocking of said lever by movement of said arm through said draw cord, and to move along said radial portion to vary the leverage applied to said lever in operating said actuating member.

Other objects of the invention reside in the details of construction thereof, and in the novel combination and arrangement of parts hereinafter illustrated or described.

In the drawings:

Fig. 1 is a plan view of a completed artificial hand illustrating an embodiment of my invention.

Fig. 2 is a central longitudinal sectional view of the hand shown in Fig. 1 attached to an arm stump socket.

Fig. 3 is an inverted view of the skeleton of the hand showing the fingers in closed position.

Fig. 4 is a side elevational view of the skeleton of the hand illustrating the thumb and fingers in fully open position.

Fig. 5 is a plan view of the skeleton of the hand shown in Fig. 4.

The hand proper of my invention comprises an outer shell 10 simulating the metacarpus of the human hand which is constructed hollow, as indicated at 11 to form a chamber for the reception of the operating mechanism of the device. The forward portion of the shell 10 is constructed open as indicated at 12, to receive the various fingers 13, 14, 15, 16 and the thumb 17, which extend into the chamber 11, and which are articulated in a manner to be presently described. The shell 10 may be constructed of wood or any other suitable material, while the fingers of the device may be constructed of suitable padding covered with any desirable material, or may be formed from a solid substance similar to the metacarpus of the hand.

The entire mechanism of the hand, which I have designated at A comprises a frame 111 which includes a shank 114 and a plate-like body member 115 rigidly secured thereto. The extreme end of the shank 114 is formed with a slot 116 to receive a tongue 117 on the

end of the body member 115, which may be constructed of sheet metal and which may be securely held in place within said slot by soldering, riveting or otherwise. The body member 115 extends angularly outwardly from the shank 114 and is forked to provide two spaced branches 18 and 19. The entire mechanism including the fingers and thumb are carried by this frame structure in a manner to be presently described in detail.

Extending directly across the extreme end of the branches 18 and 19 of the body portion 115 is a rectangular bar 20 which is turned down intermediate its ends, as designated at 21 and 22 to form spindles for the journalling of the said bar. The extreme ends 23 and 24 of the branches 18 and 19 of body 115 are looped about the spindles 21 and 22 to provide the bearings therefor, whereby the bar 20 may be journalled for rotation relative to the frame 111. Issuing outwardly from the bar 20 are four rods 25, 26, 27 and 28 which are bent to simulate the shape of the fingers 13, 14, 15 and 16 of the hand and which serve as a skeleton on which the said fingers are constructed. As previously stated, these fingers and thumb 17 as well, may be constructed of some suitable padding to surround the various rods 25, 26, 27 and 28 and covered with a suitable covering, such as a glove or other similar device. If desired, each of these fingers may be constructed of molded composition, molded about the said rods or in any other suitable manner, the particular method of forming the said fingers not constituting any feature of the present invention.

The thumb 17 of the hand includes a rod 29 similar to the rods 25 to 28, which rod is rigidly secured to a mounting 30, best shown in Fig. 3. This mounting is pivoted to a forked lug 31 through a rivet 32. The lug 31 is rigidly secured to the frame 111 toward one side thereof and at the end of said frame nearest the shank 114. It will be noted that the said lug is so disposed that the mounting 30 and thumb 17 swing angularly with respect to the direction of movement of the fingers 13 to 16 so that the same move in a manner quite closely simulating the natural movements of the thumb and fingers of the human hand.

For the purpose of operating the various fingers and thumb of the hand, an actuating member is employed, indicated in its entirety at 33. This member is preferably constructed of sheet metal in the form of a plate which extends substantially across the entire body member 115. At the outer edges of this body member are formed guides 34 and 35 which are constructed by bending over portions of the said body member which are spaced therefrom to form facing grooves. The actuating member 33 is slidably mounted in these guides for movement in the plane of the body member 115 toward and from the shank 114. The actuating member 33 has secured to it in close proximity to the branches 18 and 19 of the body member 115, two spaced forked lugs 36 and 37 which have pivoted to them two links 38 and 39. These links are in turn pivoted to two lugs 40 and 41 issuing outwardly from the bar 20 and secured thereto through machine screws 42. The two lugs 40 and 41 serve as lever arms for swinging the bar 20 and moving the fingers 13 to 16 when the actuating member 33 is reciprocated along the guides 34 and 35 which serve merely to confine the movement of the member 33 to the plane of the body portion 115 while the two links 38 and 39 serve to direct the reciprocating movement of the said member and to prevent binding of the actuating member 33 laterally with respect to the guides 34 and 35.

For operating the thumb 17, a forked lug 43 is provided, which is attached to the actuating member 33 intermediate the two lugs 36 and 37. This lug has pivoted to it a link 44 which is in turn pivoted to the mounting 30 to which the thumb rod 29 is attached. Upon reciprocation of the member 33, the link 44 is moved to swing the mounting 30 and operate the thumb. If desired, both the lugs 43 and 31 may be swivelly attached to the member 33 to compensate for the oblique direction of pull upon the said mounting, or sufficient play may be allowed in the various joints of the linkage to procure the desired results.

For the purpose of varying the position of the fingers 13 to 16 and the thumb 17 when the hand is in closed position, I employ an adjustable stop which consists of a screw 74. The actuating member 33 is threaded to receive this screw which may be held in adjusted position relative thereto, by means of a lock nut 75. The screw 74 is so positioned as to engage the link 44 operating the thumb 17 and functions to limit the closing movement of said thumb with respect to the fingers of the hand. By properly adjusting this screw, the space left between the thumb and the fingers of the hand, which I have indicated at 175 in Fig. 2, may be varied to meet with the desired requirements.

The thumb and fingers of the device are normally held in closed position by means of a tension coil spring 45. This coil spring is hooked upon the finger 26 and extends across the inner portion of the hand where the same is hooked at its other end to a screw 46 attached to the body member 115 of the frame 113. The hand is normally brought into closing position through the action of this spring and is opened against the said spring by mechanism to be now described in detail.

In the portion of the shank 114 of frame 113 adjacent the body member 115 is constructed a narrow slot 47 in which is mounted an arm 48. This arm is pivoted to said

shank by means of a pintle 49 which extends completely through said arm and shank. The arm 48 extends outwardly beyond the frame 113 as best shown in Fig. 2 and terminates in an eye 50 to which a suitable draw cord, such as shown in Fig. 4 at 51, may be attached. Arm 48 is normally forced forwardly by means of a tension coil spring 52 which is secured at one end to said arm through a screw 53 and at its other end to the body member 115 of the frame 113 through a screw 54. Upon tensioning the draw cord 51, said arm may be swung from its normal position shown in Fig. 2 in which the hand is closed and to its extreme opposite position as shown in Fig. 4, in which the hand is open. Operating in conjunction with the arm 48 I employ a lever 55 which is pivoted at one end through a pintle 56 to a bracket 57 attached to the inner surface of the body member 115 of frame 113, as best shown in Figs. 2 and 3. The lever 55 extends through the open portion of the body member 115 between the branches 18 and 19 and through a notch 58 cut in said body member and communicating therewith. Lever 55 is pivoted to a link 59 by means of a pintle 60, which link is pivoted through a pintle 61 to a forked lug 62 secured to the actuating member 33. Upon reciprocation of the lever 55, the actuating member 33 may be reciprocated along the guides 34 and 35 to move the fingers and thumb into opening and closing position against the action of the spring 45.

For the purpose of locking the fingers in closing position, the lever 55 is constructed with a notch 63 which is adapted to receive a dog 64 formed on the end of the arm 48. The notch 63 is also disposed so that when the fingers and thumb of the hand are in closed position, the dog 64 drops into said notch and prevents movement of the said lever in opening direction, thereby locking the fingers as desired. In order to unlock the lever 55, it is merely necessary to apply tension to the cord 51 which swings the dog 64 out of engagement with the said notch and frees the said lever, permitting the same to be moved in a rearward direction so as to move the actuating member 33 and articulate the fingers. For this purpose, I employ a chain link 65 which is pivoted to the arm 48 in proximity to the eye 50 and which surrounds the outstanding portion of the lever 55. This link is adapted to ride along a portion 66 of the said lever and to finally engage a hook 67 upon the extreme end of the said lever. During the movement of the arm 48 rearwardly, the link 65 is gradually brought into operating position so as to gradually open the fingers, giving the same a more life-like movement. When the link finally engages the hook 67, the fingers are rapidly opened and brought into their extreme open position, as shown in Fig. 4.

In order to mount the operating mechanism within the shell 10, the shank 114 is formed with threads 68 at the extreme end thereof on which may be screwed a flange 69. This flange is attached to the stump end 70 of the shell 10 through screws 71 in a manner to hold the entire mechanism properly mounted within the said shell. To give access to the arm 48 and lever 55, the shell 10 is formed with an opening 72 through which these parts extend so that the draw cord 51 may be attached to the arm 48 in a manner to permit of swinging the same to operate the device. The threads 68 on the shank 15 extend considerably beyond the flange 69 and serve to attach the hand to the usual arm stump socket, such as indicated at 73 in Fig. 2.

My invention operates as follows: When the hand is properly attached to the arm stump of the wearer and the draw cord 51 secured to a suitable shoulder harness, tension applied upon the said cord causes the arm 48 to swing rearwardly and away from the lever 55. This disengages the dog 64 from the notch 63 and unlocks the said lever. Further movement of the arm 48 causes the link 65 to engage the portion 66 of lever 55 and to gradually swing the lever 55 outwardly in a manner to open the fingers, as shown in Fig. 4, the hook 67 preventing the disengagement of link 65 from said lever. When in open position, the thumb and fingers can be made to grasp various implements and to pick up various articles and to otherwise perform numerous functions of the human hand. When the hand is used for holding articles such as the handle of a suitcase, or other similar devices, where it is desired to fully close the fingers, the dog 64 through the action of spring 52 drops into the notch 63 and locks the lever 55 from movement. This prevents the accidental dropping of the suitcase carried, or the opening of the fingers while the article held therein is so positioned. In this manner the locking and unlocking of the fingers is automatically performed by the single operation of manipulating the fingers, thereby relieving the user of considerable inconvenience.

My invention is highly advantageous in that an extremely simple and inexpensive device is provided for the desired purpose. The device may be constructed largely of sheet metal and other stock material, and the same can be fabricated at a reasonable cost. The fingers and thumb are directly pivoted to a structure independent of the supporting mechanism so that considerable strain can be placed on the same without injuring or weakening the operating mechanism. The locking occurs directly at the operating lever so that a minimum amount of lost motion is present and so that the fingers are more securely locked than would be other-

wise possible. The unlocking operation of the fingers is automatically accomplished by a single movement of the draw cord so that the operation of the device is automatic and fool proof. The device can be constructed to closely simulate the shape and form of the human hand and the particular operating mechanism movement of the fingers to closely simulate the movements of the human hand.

Changes in the specific form of my invention, as herein disclosed, may be made within the scope of what is claimed without departing from the spirit of my invention.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. An artificial hand comprising a frame, fingers articulated thereon, an actuating member for moving said fingers, a lever pivoted to said frame and engaging said actuating member for moving the same, an arm pivoted to said frame and having a draw cord attached thereto, means on said arm for locking said member from movement, and means on said arm for engaging said lever to move the same to operate said actuating member.

2. An artificial hand comprising a frame, fingers articulated thereon, an actuating member for moving said fingers, a lever pivoted to said frame and engaging said actuating member for moving the same, an arm pivoted to said frame and having a draw cord attached thereto, means on said arm engaging said lever for locking the same from movement, said arm being adapted to move upon tensioning said draw cord to unlock said lever, and means on said arm normally free from said lever and adapted to engage said lever upon the unlocking thereof for swinging said lever to move said actuating member.

3. An artificial hand comprising a frame, fingers articulated thereon, an actuating member for moving said fingers, a lever pivoted to said frame and engaging said actuating member for moving the same, an arm pivoted to said frame and having a draw cord attached thereto, means on said arm engaging said lever for locking the same from movement, said arm being adapted to move upon tensioning said draw cord to unlock said lever, and a link pivoted to said arm and normally free from said lever adapted to engage said lever upon the unlocking thereof to swing said lever in a manner to move said actuating member.

4. An artificial hand comprising a frame, fingers articulated thereon, an actuating member for moving said fingers, a lever pivoted to said frame and engaging said actuating member for moving the same, said lever having a substantially radial portion, an arm pivoted to said frame and having a draw cord attached thereto, and a member pivoted to said arm and adapted to engage the radial portion of said lever, said member being adapted to slide radially outwardly along said radial portion upon the tensioning of said draw cord to swing said lever with varying degrees of leverage.

5. An artificial hand comprising a frame, fingers articulated thereon, an actuating member for moving said fingers, a lever pivoted to said frame and engaging said actuating member for moving the same, an arm pivoted to said frame and having a draw cord attached thereto, and a member connected to said arm and engaging said lever for swinging said lever to move said actuating member, said second named member having a sliding connection with said lever.

6. An artificial hand comprising a frame, a thumb and fingers articulated thereon, an actuating member, guides for slidably mounting said member upon said frame, means connected to said member for articulating said fingers, a thumb pivoted to said frame toward one side of said member, a link pivoted to said member and to said thumb for operating said thumb, and a stop formed on said member and engaging said link for limiting the movement of said thumb relative to said fingers.

In testimony whereof I have affixed my signature to this specification.

JUSTUS WILHELM BAEHR.