

Oct. 10, 1933.

E. L. LAHERTY

1,929,926

ARTIFICIAL HAND

Original Filed July 9, 1928

2 Sheets-Sheet 1

Fig. 1

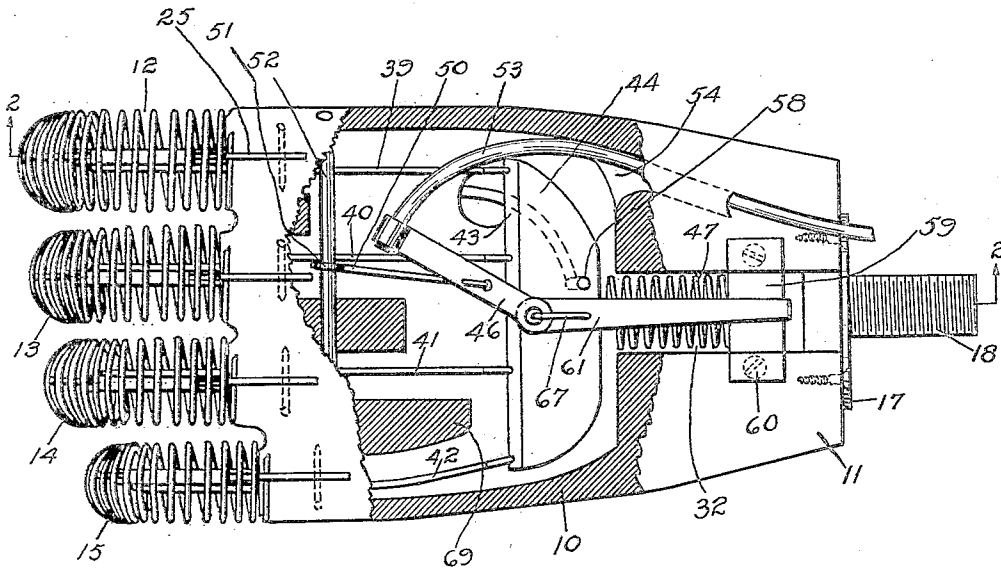
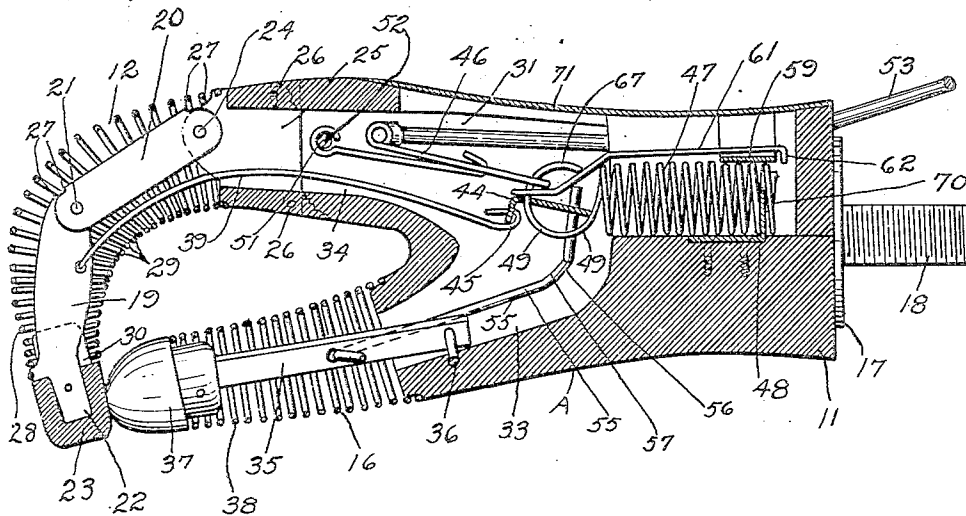


Fig. 2



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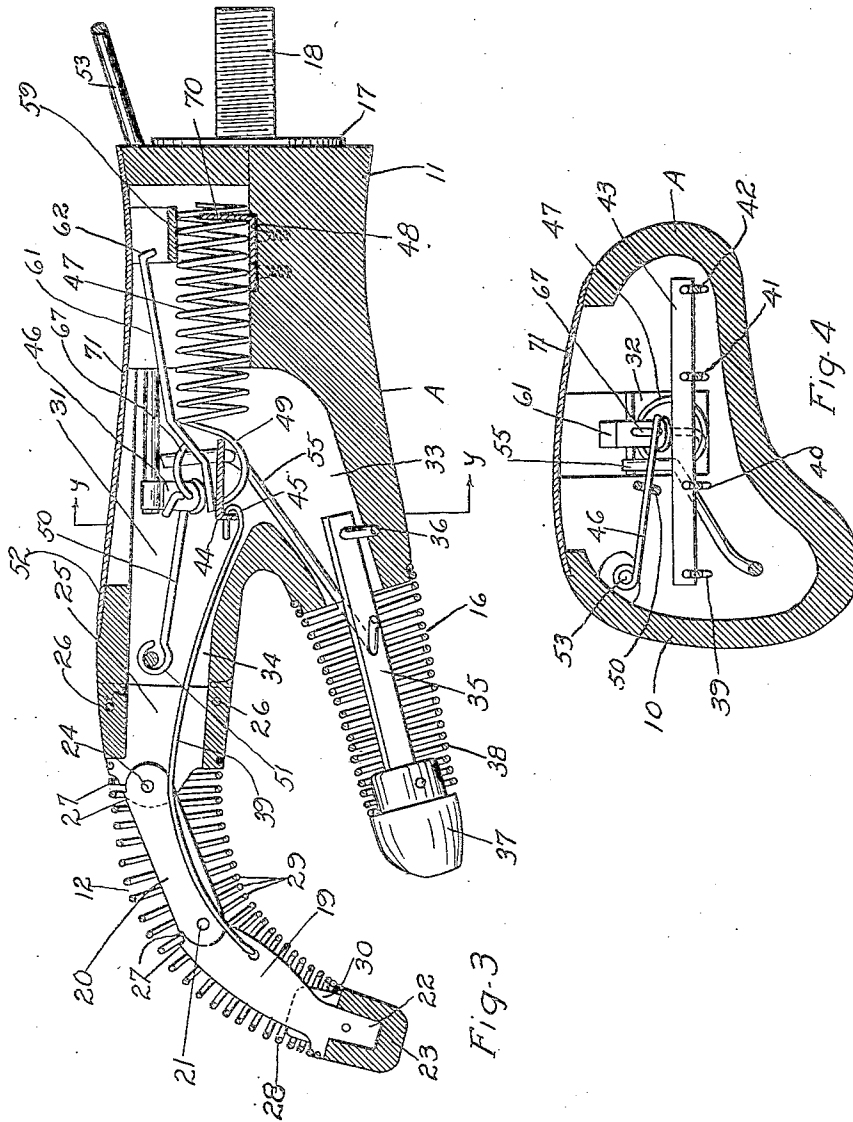
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UNITED STATES PATENT OFFICE

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ARTIFICIAL HAND

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Renewed March 23, 1933

11 Claims. (Cl. 3—12)

My invention relates to artificial hands and has for its object to produce an artificial hand simulating in appearance, function and utility, a natural hand.

5 An object of the invention resides in constructing the thumb and fingers with pivoted members simulating the phalanges and in enveloping the same with coil springs adapted to conform to the position of said phalanges and
10 move laterally so as to simulate actual movements of real fingers.

Another object of the invention consists in constructing the hand with a body, being formed with a cavity at the portion thereof corresponding to the metacarpus and having a longitudinal
15 slot in the wrist and in disposing within said cavity an equalizer having a plurality of links pivoted thereto and connected to the foremost phalanx of each of said fingers and thumb,
20 whereby said fingers and thumb may be jointly moved from open open to closed position.

A still further object of the invention resides in attaching one end of a tension coil spring within the groove in the wrist in said body and
25 in forming the other end of said coil spring with a loop adapted to be threaded through said equalizer bar near the center thereof, said spring serving to normally hold said thumb and fingers in closed position.

30 Another feature of the invention resides in attaching a pintle in said body and to pivoting thereto a fulcrum bar, and in further pivoting a lever to said fulcrum bar and to the loop of said spring whereby said equalizer may be moved
35 to release said fingers upon movement of said lever.

A still further feature of the invention resides in connecting a cord to said lever extending through said body whereby said fingers may
40 be moved from the exterior by movement of said cord.

A feature of the invention resides in connecting the link from the thumb to the equalizer at a point near the connection of said spring to
45 said equalizer so as to give the thumb a positive movement and to further provide a sliding connection between said thumb link and equalizer, whereby the thumb has a less maximum movement than the fingers.

50 Another object of the invention resides in providing a latch bar within said slot and in further providing an arm with a hook adapted to engage said latch bar and mounted on said
55 loop and held in engagement with said latch bar through contact with the end of said loop

and in further pivoting said lever to said loop in such a manner as to release the pressure on said arm prior to the movement of said equalizer so that said arm may become disengaged prior
60 to the movement of said fingers.

With the foregoing and other objects in view, which will appear in the following description, the invention resides in the novel combination and arrangement of parts and in the details of construction hereinafter described and claimed. 65

In the drawings:

Fig. 1 is a plan view of a hand in closed position illustrating an embodiment of my invention with portions thereof cut away to show
70 the interior construction.

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a view similar to Fig. 2 illustrating the hand in open position.

Fig. 4 is a sectional view taken on line y—y 75 of Fig. 3.

My invention is constructed to simulate in appearance and function the natural hand and includes a body A provided with a portion 10
80 simulating the metacarpus of the hand, a wrist portion 11, fingers 12, 13, 14 and 15 and a thumb 16 articulated to the body portion A. At the wrist 11 is attached a flange 17 formed with a threaded stud 18 by means of which the hand may be attached to an ordinary stump socket
85 not shown in the drawings. The interior of the portion 10 of the body A is hollowed out to form a cavity 31 while the wrist portion 11 is formed with a longitudinal groove 32 communicating with said cavity. Openings 33 and 34
90 extend completely through the hand at the thumb and fingers thereof and communicate with the cavity 31. A mechanism for operating the fingers of the hand is disposed within these openings and cavity as will become presently
95 apparent.

The various fingers of the hand are similarly constructed and only the forefinger 12 which is shown in section in Fig. 3 will be described in detail. This finger consists of two jointed mem-
100 bers 19 and 20 which simulate the phalanges of the finger and which are pivoted together at 21. The member 19 is formed with a lug 22 on the end thereof which has attached to it a rubber finger piece or button 23 having sufficient re-
105 siliency to readily grasp objects which it is desired to be handled with the hand. The member 20 is pivoted at 24 to an anchor plate 25 set into the portion 10 of the body A and which is held in place therein by means of pins 26 110

passing through said anchor plate and lodged within the body A. The members 19 and 20 and the plate 25 are constructed with shoulders 27 which limit the pivotal movement of said members when the fingers reach their outstretched position. The finger 12 further comprises a coil spring 28 constructed of resilient material and formed with spaced convolutions 29 gradually decreasing in diameter from the metacarpus of the hand to the finger tip. One end of the spring 28 is anchored to the anchor plate 25 while the other end thereof fits over a boss 30 on the tip 23 and is anchored to the member 19 in a similar manner. The spring 28 is formed with a rectilinear axis but is adapted to be bent into a form such as shown in Figs. 2 and 3 by the movement of the members 19 and 20. This spring serves to return these members to a rectilinear position normally holding the fingers outstretched.

The thumb 16 is similarly constructed to the finger 12 differing in that a single member 35 is employed instead of the two members 19 and 20. This member is directly pivoted on a pintle 36 lodged within the body A as best shown in Fig. 3. Similar to the fingers, a finger tip 37 is attached to this member and a coil spring 38 is secured to the body A at one end and to the said finger tip at its other end. It will be noted, however, that the pintle 36 forming the axis for movement of the thumb 16 is inclined relative to the hand so that the thumb has a movement toward and from the fingers more nearly simulating the actual movement of the thumb.

To the members 19 of the various fingers 12, 13, 14 and 15 are pivoted curved links 39, 40, 41 and 42 which are connected to said links at points eccentric of the pivots 21 so that longitudinal movement of said links serve to bring the fingers into closing position as shown in Fig. 2 against the action of spring 28. All of these links are pivoted to the flange 43 of an equalizer 44 by means of hooks 45 formed on the ends of said links. The equalizer 44 is disposed within the cavity 31 and has pivotally connected to it a tension coil spring 47 disposed within the groove 32 in the wrist portion 11 of body A. This spring is connected at one end to an angle plate 48 secured to body A within the groove 32 and having an upstanding leg 70 adapted to be positioned between the convolutions of said spring to hold the same from movement. The other end of spring 47 is constructed with a loop 49 which is hooked into the equalizer 44 near the center thereof and in fairly close proximity to the flange 43 of said equalizer. Due to the tension in the spring 47 the fingers 12, 13, 14 and 15 are normally maintained in closed position as shown in Fig. 2.

For the purpose of bringing the fingers of the hand into open position I employ a lever 46 which is pivoted on the loop portion 49 of spring 47 at one end and which is fulcrumed on a fulcrum bar 50. The bar 50 is formed with an eye 51 at its other end through which is threaded a pintle 52 mounted in the body A. A cord 53 secured to the end of lever 46 passes through an opening 54 in the wrist portion 11 of body A which communicates with the cavity 31 and extends out through the body portion proper. When tension is applied to the said cord the lever 46 is swung about the fulcrum point and equalizer 44 moved against the action of spring 47. The various coil springs 28 of the respective fingers serve to straighten out said fingers

so that movement of cord 50 articulates the fingers from closed to open position. When the cord 53 is released, coil spring 47 again acts upon the equalizer 44 to bring the fingers back to closed position.

For operating the thumb 16 a link 55 similar to the links 39, 40, 41 and 42 is utilized which is pivoted to the member 35 intermediate the ends thereof. This link has an upturned end 56 forming a shoulder 57 at the angle thereof. Portion 56 is adapted to pass through an opening 58 in the equalizer 44 disposed in relatively close proximity to the point of attachment of the loop 49 to said equalizer. As the equalizer 44 is released to cause the fingers to equalize the upturned portion 56 of link 55 slides through said equalizer, giving no appreciable movement to the thumb 16 until the shoulder 57 engages the underside thereof. Further movement of said equalizer causes the thumb 16 to open similar to the fingers 12, 13, 14 and 15.

To lock the fingers from movement so that the hand may be used for carrying satchels and similar articles, a locking mechanism is employed as best shown in Figs. 1 and 3. This locking mechanism includes a latch bar 59 which extends across the slot 32 and is held lodged in position within the wrist portion 11 of body A by means of screws 60 screwed to the body proper. An arm 61 formed at one end with a hook 62 is adapted to engage the edge of the bar 59 to hold said arm from movement. The other end of the arm 62 which is offset from the major portion thereof is apertured so that the same may be threaded upon the loop 49 of spring 47. This portion of said arm is disposed between the equalizer 44 and the lever 46 and the extreme end 67 of loop 49 is so disposed as to engage the offset portion 68 of said arm in a manner to hold the hook 62 in engagement with latch bar 59. When tension is applied upon the upper portion of loop 49 through the lever 46 which is eccentric with respect to the axis of the spring 47, the said loop is opened up sufficiently to release the extreme end 67 of said loop from engagement with the arm 61. The end of spring 47 causes the said arm to move upwardly disengaging the hook 62 from the bar 59 and permitting the further movement of the equalizer 44 to permit of opening the fingers and thumb of the hand. As soon as the tension on cord 53 is released the arm 61 drops and the hook 62 engages latch bar 59 to hold the fingers from being opened.

Due to the pivoting of the loop 49 of spring 47 to latch bar 44 intermediate the ends thereof, the positions of the various fingers 12, 13, 14 and 15 may be altered to cause the fingers to conform to the shape of various objects to be grasped thereby. When the fingers approach their open position I find that by terminating the movement of the little finger the forefinger may be caused to open more fully than would otherwise be possible. This is accomplished by employing a stop 69 within the cavity 31 which is adapted to engage the flange 43 of latch bar 44 between the points of attachment of the links 41 and 42 thereto. Upon drawing the cord 53 as tight as possible the forefinger can be practically straightened out which would otherwise be impossible due to the confined space within which the mechanism of my invention is disposed and due to the limited movement of the parts thereof possible within such space.

In the construction of my invention the cavity

31 and groove 32 are closed by means of a plate 71 secured to the body A by cement, screws, nails, or any other suitable fastening means. In the event that the mechanism requires attention 5 this plate may readily be removed to give access to the interior of the hand.

My improved hand may be operated by any of the usual methods now in common use. The cord 53 may be attached to a harrow passing 10 over the shoulder of the wearer so that movement of the shoulder serves to open the fingers. If desired the same may be operated by movement at the elbow. In use the wearer controls the operation of the fingers jointly by the manipulation of the cord while the hand is moved 15 about through the agency of the stump on which it is attached. In this manner the hand may be moved quite naturally and may be employed for diverse purposes.

20 The advantages of my invention are manifest. The hand simulates in appearance and function, the natural hand. Great flexibility is had in the use of the hand for various purposes, the fingers adjusting themselves to grasp 25 differently shaped objects. By means of the locking device the hand may be used for carrying suitcases, grips and similar articles without danger of opening and losing the same. Due to the resiliency of the coil springs giving shape 30 to the fingers, sufficient lateral movement of the same may be had to simulate the effect of movement of the flesh in the actual hand. By employment of the lever for operating the equalizing bar sufficient movement at the shoulder 35 of the user may be had to effectively operate the device, thereby reducing the force necessary to give the required movement. By having the thumb move a different amount than the fingers a more life-like structure is provided and by 40 pivoting the thumb in an angular manner relative to the fingers, the thumb is caused to move in the direction most frequently moved by the real thumb.

Changes in the specific form of my invention, 45 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 50 is:

1. An artificial hand comprising a body terminating in a wrist portion and having fingers articulated thereon, an equalizer, links pivoted 55 to said equalizer and connected to said fingers for articulating the same, a pintle secured to said body, a link forming a fulcrum pivoted to said pintle, a lever pivotally connected to said link and to said equalizer, a spring connected to said equalizer and to said body for drawing 60 said fingers into closing position, and means connected to said lever for operating the same.

2. An artificial hand comprising a body portion having cavity in the metacarpus thereof and having a slot communicating therewith and 65 extending along the wrist, fingers articulated on said body, an equalizer disposed within said cavity, links connected to said equalizer and to said fingers for articulating said fingers, a coil spring disposed within said slot and secured at 70 one end to the body of said hand and being formed at its other end with a loop extending through said equalizer, a bar secured to said body within said groove and forming a latch member, an arm having a hook for engage- 75 ment with said bar and being threaded on said

loop to lock said equalizer from movement, the end of said loop bearing down upon said arm to hold the hook portion thereof in engagement with said bar, and means connected with 80 said loop for drawing the end thereof from engagement with said arm to release the hook portion from said bar and moving said equalizer in opposition to said spring.

3. An artificial hand comprising a body having fingers articulated thereon, including a fore- 85 finger and a little finger, an equalizer, links pivoted to said equalizer and connected to said fingers for articulating the same, and a stop for engaging said equalizer to eliminate the movement of said little finger when the fingers approach fully opened position said equalizer being unobstructed at the other end thereof to 90 cause the further movement of said forefinger upon cessation of movement of said little finger.

4. An artificial hand comprising a body hav- 95 ing a cavity in the metacarpus thereof and a slot communicating therewith and extending along the wrist, fingers articulated on said body, an equalizer disposed within said cavity, means connecting said equalizer with said fingers for 100 articulating said fingers, a coil spring disposed within said slot and secured at one end to the body of said hand and secured at its other end to said equalizer, a link pivotally connected to 105 said body, and a lever pivotally connected to said link and to said equalizer for moving said equalizer in opposition to said spring.

5. An artificial hand comprising a body having fingers articulated thereon, an operating bar, 110 members connecting said fingers with said operating bar, a lever for operating said bar, a pivot for pivoting said lever to said bar, said pivot having a fixed location with respect to said bar, means providing a floating connection 115 between said lever and body, and means for swinging said lever.

6. An artificial hand comprising a body having fingers and a thumb articulated thereon, an equalizer having a planiform portion mounted 120 within said body, links connecting said fingers and equalizer and extending at their points of attachment to said equalizer in a plane substantially parallel to the planiform portion of said equalizer, a link connecting said thumb and 125 equalizer and extending in an inclined direction relative to the planiform portion of said equalizer, said link extending through said equalizer and having a sliding connection therewith and means for operating said equalizer.

7. An artificial hand comprising a body hav- 130 ing fingers and a thumb articulated thereon, an equalizer mounted for movement in a given direction within said body, links connecting said fingers and equalizer and movable in part in the same direction as said equalizer, a link di- 135 rectly connecting said thumb and equalizer and extending in an angular direction relative to the direction of movement of the equalizer, said link having a movement in the direction of movement of said equalizer and said equalizer 140 and link having relative movement with respect to said equalizer and in the direction of extent of said link, and means for operating said equalizer.

8. An artificial hand comprising a body hav- 145 ing normally retracted fingers articulated thereon, an equalizer bar, links connected to said equalizer bar and fingers for moving the fingers into closed position, resilient means engaging 150 said equalizer bar for holding said fingers re-

tracted, a lever pivoted to said equalizer bar and to said body for moving said equalizer bar in opposition to the action of said resilient means, causing said fingers to move into extended position, and means connected to said lever for operating the same.

9. An artificial hand comprising a body having a thumb and fingers articulated thereon, an equalizer, links connected to said fingers and pivoted to said equalizer at relatively equal intervals throughout its length, a fulcrum point substantially at the center of said equalizer bar, operating means for moving said equalizer connected therewith at said fulcrum point, a link for operating said thumb, said link being directly connected to said equalizer at a locality between said fulcrum point and the adjoining link on the thumb side of the bar, and a slidable connection between said thumb link and equalizer whereby said thumb has a lesser maximum movement than said fingers.

10. An artificial hand comprising a body having a cavity in the metacarpus thereof and a slot communicating therewith and extending

along the wrist, fingers articulated on said body, an equalizer disposed within said cavity, means connecting said equalizer with said fingers for articulating said fingers, a coil spring disposed within said slot and secured at one end to the body of said hand and secured at its other end to said equalizer, said spring being guided by the walls of said slot, and yieldably supporting said equalizer for lateral movement and laterally yieldable means for moving said equalizer in opposition to said spring.

11. An artificial hand comprising a body having a thumb and fingers articulated thereon, an equalizer connected with said fingers and movable longitudinally of the hand, a link connected to said thumb and having a portion slidable through said equalizer and swingable relative thereto in a path angularly disposed with respect to the path of travel of said equalizer, said slidable portion reducing the movement of said thumb in the direction of movement of said equalizer.

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