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ARTIFICIAL HAND AND MEANS FOR ACTUATING THE SAME

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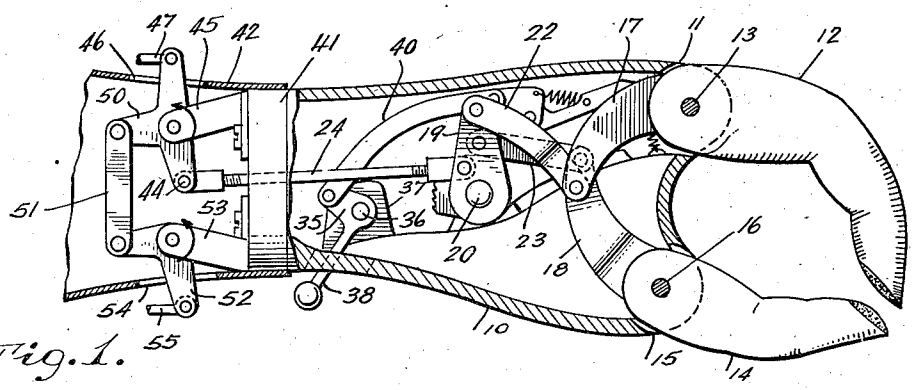


Fig. 1.

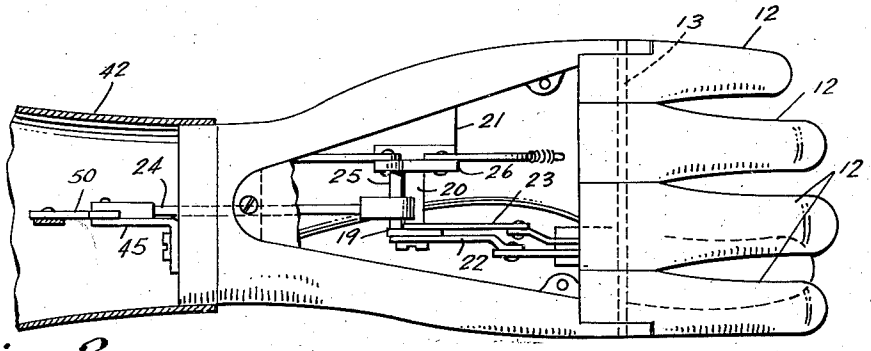


Fig. 2.

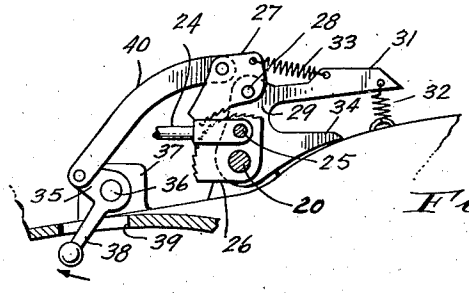
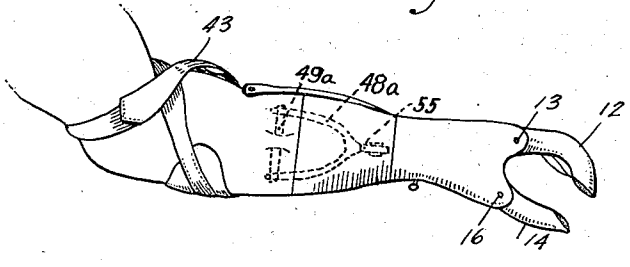


Fig. 3.

Fig. 4.



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ARTIFICIAL HAND AND MEANS FOR ACTUATING THE SAME

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2 Claims. (Cl. 3—12)

This invention relates to artificial limbs and more particularly to an improved artificial hand and means for actuating the same.

One of the objects of the invention is to provide an improved artificial hand which is immediately responsive even to minor impulses of the actuating muscles functioning by means of a cineplastic operation.

Another object is to provide an improved artificial hand of simple and economical construction by means of which complete closing and opening of the fist can be accomplished with a minimum of effort.

Other objects and advantages inherent in the invention will become apparent from the following specification taken in conjunction with the accompanying drawing which disclose by way of example an embodiment of the invention.

The fitting of physically handicapped persons into our social and economical structure has become one of the most vital problems of our present age. The daily toll taken by traffic and industrial accidents will be increased by recent developments. Those who suffer permanent injury and loss of limb will have to be rehabilitated by means of vocational training and physical restoration of the lost powers so as to enable the handicapped person to earn a livelihood.

Artificial appliances have heretofore been used to replace the missing member. However, because of the unsatisfactory experiences with the ordinary mechanical limb, attention has been directed toward the development of a substitute limb in which the control can be achieved by natural muscular action. In order to accomplish the intended purpose, it is imperative that the artificial limb be highly sensitive and immediately responsive to even minor impulses produced by the controlling muscles. In many instances, particularly in connection with amputations immediately above the wrist, the muscles lose practically all action and have to be re-educated.

It is, therefore, the particular purpose of the present invention to provide an artificial limb in which prosthesis can be activated by these muscles.

The invention can be used with particular advantage in connection with cineplastic amputations. In this type of amputation, pegs are passed through the canals in the muscles and attached to levers operating the artificial hand mechanism. The flexors and extensors in the lower arm control the grasp and release the fingers of the artificial hand.

In the drawing:

Figure 1 is a cross-sectional view of an artificial hand according to the invention with the adjacent portions of the wrist and the actuating lever mechanism;

Figure 2 is a top plan view with the top plate removed;

Figure 3 is a detailed view of the locking mechanism;

Figure 4 is a perspective view showing the artificial hand illustrated in Figures 1 and 2 connected to the stump and wherein the prosthesis is activated by the muscles after a cineplastic operation.

Referring in detail to the drawing, the frame or casing 10 represents the palm and the back of the hand. The front portion of the casing 10 is provided with an opening 11 in which the knuckle portions of the fingers 12 are pivoted on the shaft 13.

The thumb 14 is similarly pivoted in the opening 15 to the shaft 16.

An actuating lever 17 extends from the knuckle portion of the fingers 12 into the casing 10. A corresponding lever 18 extends from the thumb 14 in opposite relationship to the lever 17. The levers 17 and 18 are so disposed that their ends move in substantially parallel planes toward and away from one another.

A crank 19 is keyed to the shaft 20 which is rotatably mounted in the boss 21, which latter is preferably cast integrally with the casing 10.

A link 22 connects the lever 17 to the crank 19. A second link 23 connects the lever 18 to the crank 19. The pivot point of the link 23 is spaced from the pivot point of the link 22 on the crank 19 for the purpose of adjusting the relative movement between the fingers 12 and the thumb 14.

The crank 19 is actuated by linear movement of the rod 24 which is pivoted to the pin 25 which, in turn, is anchored to the crank 19.

To the shaft 20 is also keyed the toothed segment 26 so as to move jointly with the crank 19. For reinforcement purposes the pin 25 preferably is anchored to the toothed segment 26. The pawl 27 which is adapted to engage the toothed segment 26 is pivoted at 28 to the lever 29 which, in turn, is journaled upon the shaft 20.

The lever 29 is provided with an arm 31, the end of which is connected to the inside of the casing 10 by means of the spring 32. Another spring 33 connects the arm 31 with the pawl 27. By virtue of this construction, the pawl will become disengaged from the toothed segment 26 immediately upon release of the locking mechanism, which will be hereinafter described, and jump back to its normal position. The arm 34 constituting a part of the lever 29 limits the return movement of the lever 29 by striking against the underlying surface of the casing 10.

The locking mechanism comprises an eccentric 35 which is pivoted at 36 to the boss 37. The eccentric is rotated by the lever 38 which projects into the palm through the opening 39 in the casing. The link 40 is pivoted at one end to the

eccentric 35 and at the other end to the pawl 27 eccentrically of the pivot point 28.

When the lever 38 is pushed forward in the direction of the arrow in Figure 3, it first brings the pawl into engagement with the toothed segment 26. Further movement of the lever 38 will rotate the segment 26 together with the crank 19 and thus bring the segments 12 and the thumb 14 closer together. By reason of this construction the force of the grip can be increased once contact has been made between the object and the fingers and the thumb. It will also be understood that the fingers and thumb can be locked in any position intermediate the fully opened and fully closed position. Movement of lever 38 in the opposite direction unlocks the parts.

The casing 10 is provided with a wrist collar 41 which may be rotatable with respect to the casing so as to provide pronation and supination of the hand.

To the wrist collar 41 is attached the cuff 42 which, in turn, may be secured to the limb stump by means of straps 43.

Referring particularly to Figures 1, 2 and 4 of the drawing, the rod 24 is moved by the lever 44 which is pivoted to the bracket 45 carried by the wrist collar 41. The other arm of the lever 44 projects through the slot 46 in the cuff 42 and is pivoted to the rod 47 which, in turn, is connected to the shackle 48. The ends of the shackle 48 are connected to the peg 49 which is passed through the canal in the extensor muscle.

The lever 44 is provided with a rocker arm 50 to which is pivoted the link 51 which, at the other end, is pivoted to one arm of the bell crank 52 which, in turn, is pivoted to the bracket 53, extending from the wrist collar 41. The other arm of the bell crank projects through the slot 54 in the cuff 42 and is pivoted to the rod 55, which is connected to a shackle 48*a* similar to the shackle 48 and situated on the opposite side thereof, which is connected to a peg 49*a* passed through the flexor muscle in a manner similar to peg 49.

The hand is operated as follows: The extensor muscle will rock the lever 44 in the direction shown by the arrow in Figure 1 which will, in turn, push the rod towards the fingers. The movement of the rod 24 will rotate the crank 19 towards the fingers and the leverage arrangement will cause the fingers and thumb to spread apart.

An impulse from the flexor muscle will move the crank bell 52 in the direction of the arrow in Figure 1. This movement will be transmitted to the rocker arm 50 through the link 51 and thus cause the rod 24 to be returned to its original position.

What is claimed is:

1. An artificial hand to be actuated by the movements of two pegs of the class described, passed through suitable muscles of an arm stump and controlled by contractions of said muscles, said hand including a frame, a series of fingers and a thumb pivoted to said frame, a pair of arcuate levers connected to said fingers and thumb to open and close the hand, said levers being disposed in opposing relationship with their free ends movable in substantially parallel arcs, a crank, a longitudinally movable rod for actuating said crank, links connecting each of said levers to said crank, said links being so disposed as to transform the linear movements of said rod into pivotal clamping and unclamping movements of said fingers and said thumb, a toothed rack movable with said rod and connected to said crank, a pawl for engaging said rack, a leverage mechanism connected to said pawl for moving said rack a predetermined distance, a two-armed lever pivoted to said pawl, a spring between said lever and said pawl whereby said pawl will be disengaged from said rack immediately upon release of said leverage mechanism, a second spring between said lever and said frame for locking said pawl in a predetermined position of said leverage mechanism, a longitudinally movable bar, means pivotally connecting one end of said bar to one end of one of said pegs, a second longitudinally movable bar pivotally connected with one end to the other one of said pegs, a pivotally arranged bell crank having one arm pivotally connected to said longitudinally movable rod and a second arm pivotally connected to the other end of said first bar, and means operatively connecting said second longitudinally movable bar with said bell crank, whereby longitudinal movements of one of said bars cause longitudinal movements of said rod in one direction and longitudinal movements of the other of said bars cause longitudinal movements of said rod in the opposite direction.

2. An artificial hand to be actuated by the movements of two pegs of the class described, passed through suitable oppositely located muscles of an arm stump and controlled by contractions of said muscles, said hand including a frame, a series of fingers and a thumb pivoted to said frame, a pair of arcuate levers connected to said fingers and thumb to open and close the hand, said levers being disposed in opposing relationship with their free ends movable in substantially parallel arcs, a crank, a longitudinally movable rod for actuating said crank, links connecting each of said levers to said crank, said links being so disposed as to transform the linear movement of said rod into the pivotal movement of said fingers and said thumb, a toothed rack movable with said rod and connected to said crank, a pawl for engaging said rack, a leverage mechanism connected to said pawl for moving said rack a predetermined distance, a two-armed lever pivoted to said pawl, a spring between said lever and said pawl whereby said pawl will be disengaged from said rack immediately upon release of said leverage mechanism, a second spring between said lever and said frame for locking said pawl in a predetermined position of said leverage mechanism, a longitudinally movable bar connected with one end to one of said pegs, another longitudinally movable bar connected with one end to the other one of said pegs, attached to the base of said frame, a three-armed bell crank pivotally disposed within said sleeve, said bell crank having one arm extended through said sleeve and pivotally connected to the other end of said first bar, and a second arm pivotally connected to said longitudinally movable rod, a two-armed bell crank pivotally disposed within said sleeve, said two-armed bell crank having one arm extended through said sleeve and pivotally connected to the other end of said second longitudinally movable bar and a link pivotally connecting the third arm of said first bell crank to the second arm of said second bell crank, whereby longitudinal movements of one of said bars cause longitudinal movements of said rod in one direction and longitudinal movements of the other of said bars cause longitudinal movements of said rod in the opposite direction.

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