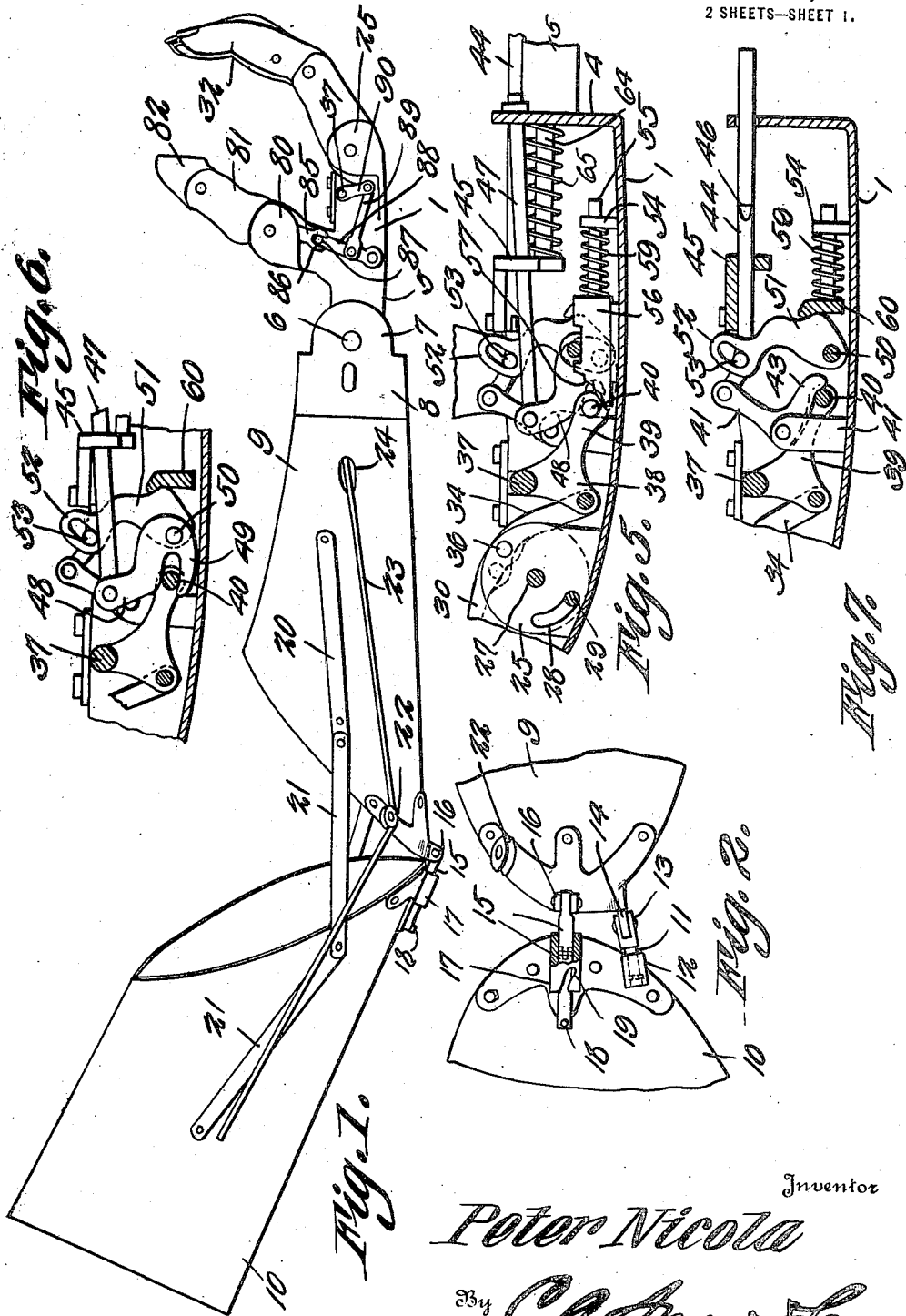


P. NICOLA.
ARTIFICIAL ARM.
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1,422,468.

Patented July 11, 1922.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

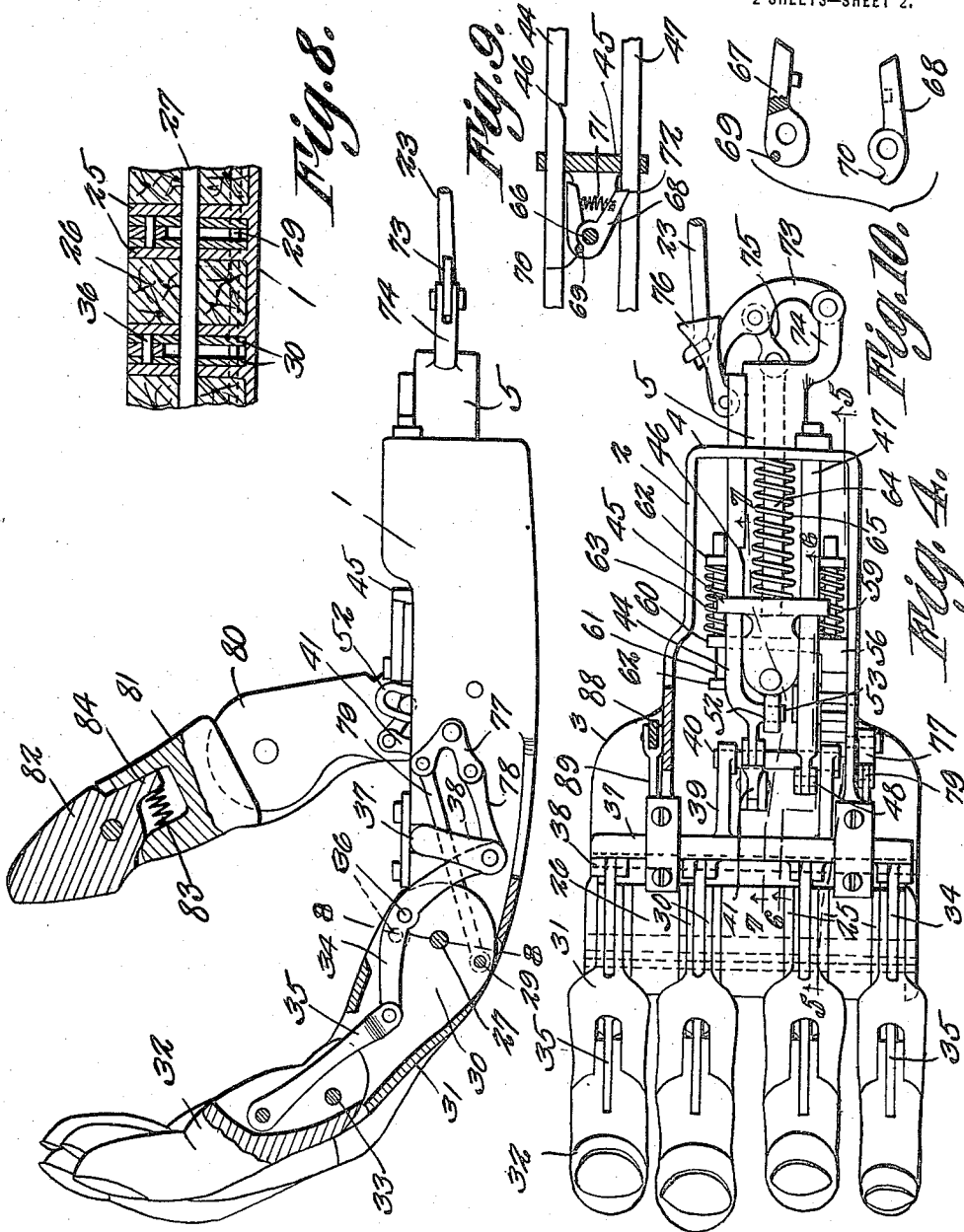


Fig. 3.

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UNITED STATES PATENT OFFICE.

PETER NICOLA, OF DANVILLE, PENNSYLVANIA.

ARTIFICIAL ARM.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, PETER NICOLA, a citizen of the United States, residing at Danville, in the county of Montour and State of Pennsylvania, have invented a new and useful Artificial Arm, of which the following is a specification.

This invention relates to an artificial arm, one of its objects being to provide a device of this character designed primarily for use where the stump extends below the elbow so that by manipulating the stump it becomes possible not only to bend the artificial arm but also to impart a turning motion to the hand portion thereof, thus to enable the device to be used in handling a spoon, in tipping the hat, and for similar purposes.

Another object is to provide an artificial arm with an articulated hand portion the members of which are shiftable by the movement of the shoulders of the user so as to cause said members to close together or to open as desired.

Another object is to provide a hand mechanism which is compact and durable, the parts of which are all neatly housed, and which, when closed, in a glove, will have the appearance of a natural hand.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that, within the scope of what is claimed, changes in the precise embodiment of the invention shown can be made without departing from the spirit of the invention.

In the accompanying drawings the preferred form of the invention has been shown.

In said drawings

Figure 1 is a side elevation of the artificial arm.

Figure 2 is a view partly in elevation and partly in section of the elbow joint.

Figure 3 is a side elevation of the hand portion, the little finger and thumb being shown partly in section.

Figure 4 is a plan view of the hand mechanism.

Figure 5 is a section on line 5—5, Figure 4.

Figure 6 is a section on line 6—6, Figure 4.

Figure 7 is a section on line 7—7, 55 Figure 4.

Figure 8 is a section on line 8—8 Figure 3.

Figure 9 is a plan view of portions of the notched slides and the pawls cooperating therewith.

Figure 10 is a view showing in detail the two pawls.

Referring to the figures by characters of reference 1 designates the body portion of the hand, the same having a narrow wrist portion 2 and a widened hand portion 3. The wrist portion 2 is closed at one end as shown at 4 and has a shank portion 5 extending therefrom and pivotally mounted as at 6 between ears 7 projecting from a sleeve 8. This sleeve is secured to the forearm portion 9 of the arm. The upper arm portion 10 is connected to the forearm portion by a stem 11 swiveled within a pivotally mounted sleeve 12 and having a forked end 13 pivotally connected to an ear 14. Ear 14 is secured to the forearm portion 9 while sleeve 12 is movably mounted on the upper arm portion 10, these parts being located at one side of the center line of the two arm portions. Arranged along the center line of the two arm portions is a jointed stem 15 one end of which is pivotally connected to ears 16 on the forearm 9 while the other end portion is slidable within a guide sleeve 17 on the upper arm portion 10. A pin 18 extends from this end portion of the stem 15 and is adapted during the sliding movement of the stem 15 to enter an oblique slot 19 in sleeve 17. Thus when the forearm portion 9 is swung upwardly relative to the upper arm portion 10 about the parts 11, 12 and 14 as the connection, the stem will be shifted longitudinally and the pin 18, entering slot 19, will cause stem 15 to rotate and impart a twist to the forearm 9 sufficient to bring the hand portion in proper position to direct a spoon to the mouth or to carry the fingers to the hat worn by the user.

A reenforcing strap 20 is secured along the forearm 9 and links 21 connect this strap to the upper arm portion 10. A sheave 22 is mounted on the forearm portion 9 and is

engaged by an actuating cord 23 extending through an opening 24 in the forearm and adapted to be extended across the back of the shoulders of the wearer so that by manipulating the shoulders the wearer is enabled to pull on the cord while the arm is being held stationary.

Extending from the body portion 1 of the hand at that end thereof remote from the end 4 is a transverse series of ears 25 arranged in pairs, one pair of ears being provided for each of the four fingers and the space between the pairs of ears being filled with any suitable material such as blocks of cork 26. A pivot bolt 27 is extended transversely through these ears and formed within the ears are arcuate slots 28 in which is slidably mounted a stop rod 29. This rod extends through strips 30 which are arranged in pairs, one pair being mounted between the ears 25 of each pair. The strips of each pair are formed integral with the inner member 31 of one of the fingers and pivotally mounted to the outer end of this inner member is the outer member 32 of the finger, the point of connection between the members being indicated at 33. A lever 34 is fulcrumed between the strips 30 of each finger and is connected by a link 35 to the outer member 32 of the finger. Thus when lever 34 is swung on its fulcrum 36 it will pull or push the link 35 so as to cause the finger member 32 to swing relative to the member 31 of said finger.

A transverse shaft 37 is fulcrumed in the sides of the body 1 near the ears 25 and extending inwardly from this shaft are arms 38 to which the respective levers 34 are pivotally connected. Thus by rotating shaft 37 all of the fingers will shift.

Shaft 37 also has a pair of arms 39 extending therefrom and connected by a rod 40. A bracket 41 is extended from the body 1 and pivotally mounted on this bracket is a bell crank 42 one arm 43 of which bears downwardly on the rod 40. The other arm is pivotally connected to a rod 44 slidable in a cross head 45 and within the closed end 4 of the body. This rod has an angular notch 46 therein. Another rod 47 is slidably mounted in the cross head 45 and in the closed end 4, this rod being pivotally connected to the stem 48 of a lifting hook 49 which extends under the rod 40 as shown particularly in Figure 6. This lifting hook is pivotally connected as at 50 to a cam lever 51 having a slotted arm 52 movably engaged by a lug 53 extending from the rod 44.

An ear 54 is provided on the body 1 and is slidably engaged by a stem 55 projecting from a slide 56, this slide having a stepped end 57 which is normally pressed against one of the arms 39 by a spring 58 mounted on the stem 55 and bearing against ear 54.

Said arm 39 has a flat face adapted to engage any one of the steps 57. Thus it will be seen that the slide 56 constitutes a bolt for holding arm 39 when shifted to any position away from that shown in Figure 5. This slide has a laterally extending finger 60 against which the cam lever 51 bears. This finger slides on a rod 61 supported by ears 62 and a spring 63 bears against the finger and cooperates with the spring 59 to hold the slide 56 normally pressed toward the arm 39.

The cross head 45 has a stem 64 projecting therefrom and slidable within the shank portion 5. A spring 65 is mounted on this stem and thrusts against the cross head so as to hold it normally pressed toward the fingers. A pivot pin 66 is arranged in the cross head and oppositely disposed dogs or pawls 67 and 68 are mounted on this pin, there being cooperating projections 69 and 70 on the dogs or pawls for limiting their relative movement under the action of a spreading spring 71 located between said dogs or pawls. A notch 72 is provided in the rod 47 and the pawls or dogs 67 and 68 are arranged between the two rods 44 and 47 and are designed to engage the respective notches.

A lever 73 is fulcrumed on a bracket 74 extending from the shank portion 5 and a link 75 connects this lever to the stem 64. A yoke 76 is pivotally attached to the free end of the lever 73 and is engaged by the knotted end of the cord 23.

A bell crank 77 is fulcrumed on one side of the body 1 (see Figure 3) and is connected to one of the arms 38 of shaft 37 by a link 78. Thus each time shaft 37 is rotated the link 78 will actuate bell crank 77 which, in turn, will transmit motion through a link 79 to the rod 29. Obviously, therefore, while the levers 34 are pulling on the strips 30 so as to rotate them about the pivot 27, the link 79 is thrusting on the pin 29 so as to push on said strips. A very strong power transmitting connection is therefore provided between the operating shaft 37 and the fingers of the hand.

The thumb includes an inner member 80, a pivoted intermediate member 81 and a pivoted outer member 82, there being a spring 83 housed within the member 81 and bearing against a tongue 84 extending from the member 82 as shown in Figure 3. Thus the member 82 is held yieldingly. The intermediate member 81 of the thumb has a lever 85 extended therefrom and forked, as at 86 for engagement by a lug 87 extending laterally from a lever 88. This lever is fulcrumed on one side of the body 1 near the wrist portion thereof and is connected by a link 89 to an arm 90 extending from one end of the shaft 37. Thus when the shaft is rotated to pull on levers 34 and bend the fingers, arm 90

will press through link 89 against lever 88 and cause lever 85 to swing the thumb members 81 and 82 toward the folding fingers, thereby to grip an article inserted between the fingers and the thumb.

As heretofore explained the shoulders of the user can be shifted so as to pull upon the cord 23. A certain movement of this cord will cause lever 73 to pull stem 64 back against the action of spring 65 so that the dog or pawl 68 which is normally seated in the notch 72 will pull on the rod 47. Thus hook 49 will be swung so as to lift up on the rod 40 and cause shaft 37 to rotate. This will result in the bending of the fingers and the movement of the fingers and thumb toward each other. Cord 23 is then slackened whereupon spring 65 will move the cross head 45 back to its initial position. This will cause the pawl or dog 68 to move out of notch 72 and the spring 71 will be placed under compression. When it is desired to open the hand the cord 23 is again pulled taut and will slide the cross head until the pawl or dog 67 springs into notch 46 whereupon rod 44 will be pulled. This will actuate bell crank 41 which will thrust the rod 40 downwardly and open the fingers and shift the thumb. At the same time the cam lever 51 will thrust against finger 60 and push the bolt 56 out of engagement with the adjacent arm 39 so that the parts are free to operate. It is to be understood of course that when the hand is closed the stepped portion 57 of bolt 56 wedges between one of the arms 39 and the body 1 so as to prevent the fingers from opening.

Obviously the hand portion of this device can be provided with a suitable housing, not shown so as to present a smooth surface to a glove or other covering placed on the hand. The movement of the fingers is limited by the rod 29 coming against the end walls of the slots 28.

What is claimed is:—

1. In an artificial arm a hand portion including a body, a shaft mounted for rotation, jointed fingers and a jointed thumb operatively connected to said shaft for movement toward or from each other, separate pivotally mounted members for rotating the shaft in opposite directions respectively, a cross head, means for actuating the cross head, and separate means operated by successive movements of the cross head in one direction for actuating the respective pivoted members.

2. In an artificial arm a hand portion including a finger and a thumb oppositely disposed and mounted for swinging movement, a shaft, connections between the shaft and the finger and thumb for moving said finger and thumb toward or from each other, separate pivoted members for rotating the shaft in either direction respec-

tively, a slidable cross head, means for actuating it, and means operated by successive movements of the cross head in one direction for actuating the pivoted members successively.

3. In an artificial arm a hand portion including pivotally mounted finger and thumb portions, a shaft, means operated by the rotation of the shaft for swinging said members toward or from each other, separate pivoted members, means operated thereby for rotating the shaft in either direction respectively, a cross head, means operated by the movement of the cross head in one direction for shifting one of said members to move the thumb and finger portions toward each other, means released by the same movement of the cross head for locking the thumb and finger portions against return movement, and means operated by a second movement of the cross head in the same direction for unlocking the thumb and finger portions and for moving them apart.

4. In an artificial arm a hand portion including a thumb portion and a finger portion pivotally mounted, a shaft, means operated by the shaft for moving the thumb and finger portion toward or from each other, a bolt, means on the shaft and cooperating with the bolt for holding the thumb and finger portion against movement in one direction, a cross head, means for shifting the cross head in one direction, and separate means actuated by successive movements of the cross head for rotating the shaft in opposite directions respectively.

5. In an artificial arm a hand portion including pivoted thumb and finger portions, said portions being jointed, levers mounted within the thumb and finger portions, connections between said levers and parts of the thumb and finger portions for flexing said portions when the levers are actuated, a shaft, connections between the shaft and levers for moving the thumb and finger portions toward or from each other, a cross head, means for shifting the cross head in one direction, separate means operated by successive movements of the cross head in one direction for rotating the shaft in opposite directions respectively, and means for automatically returning the cross head to its initial position after each shift thereof.

6. An artificial hand including opposed finger and thumb portions pivotally mounted, a shaft, means operated by the shaft for moving said portions toward or from each other, a pin movable with the shaft and parallel therewith, separate levers co-operating with the pin for shifting it in opposite directions respectively, slidable rods connected to the respective levers, a string controlled cross head slidably mounted on the rods, said rods being notched, spring con-

5 trolled dogs carried by the cross head for engagement with the respective notched rods, and means for shifting the cross head successively to successively couple the cross head to the respective rods through the dogs and notches.

7. An artificial hand including opposed finger and thumb portions pivotally mounted, a shaft, means operated by the shaft for moving said portions toward or from each other, a pin movable with the shaft and parallel therewith, separate levers cooperating with the pin for shifting it in opposite directions respectively, slidable rods connected to the respective levers, a spring controlled cross head slidably mounted on the rods, said rods being notched, spring controlled dogs carried by the cross head for engagement with the respective notched rods, and means for shifting the cross head successively to successively couple the cross head to the respective rods through the dogs and notches, a spring pressed bolt having a stepped end, means on the shaft cooperating with said end for holding the shaft against rotation in one direction, and

means operated by one of the rods for shifting the bolt to release the shaft.

8. In an artificial arm the combination with an upper arm portion and a forearm portion, of a stem hingedly connected to one of said arm portions at one side of the center line thereof, a universal connection between said stem and the other arm portion, a stem hingedly connected to one arm portion along the center line thereof, a sleeve mounted on the other arm portion and slidably engaged by the stem, said sleeve having an oblique slot, and means on the slidable stem for entering the slot to rotate the stem during the sliding movement thereof, said stems cooperating to impart a turning motion to the forearm portion during its swinging movement relative to the upper arm portion.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

PETER NICOLA.

Witnesses:

C. HENRY,
JAS. RYAN.