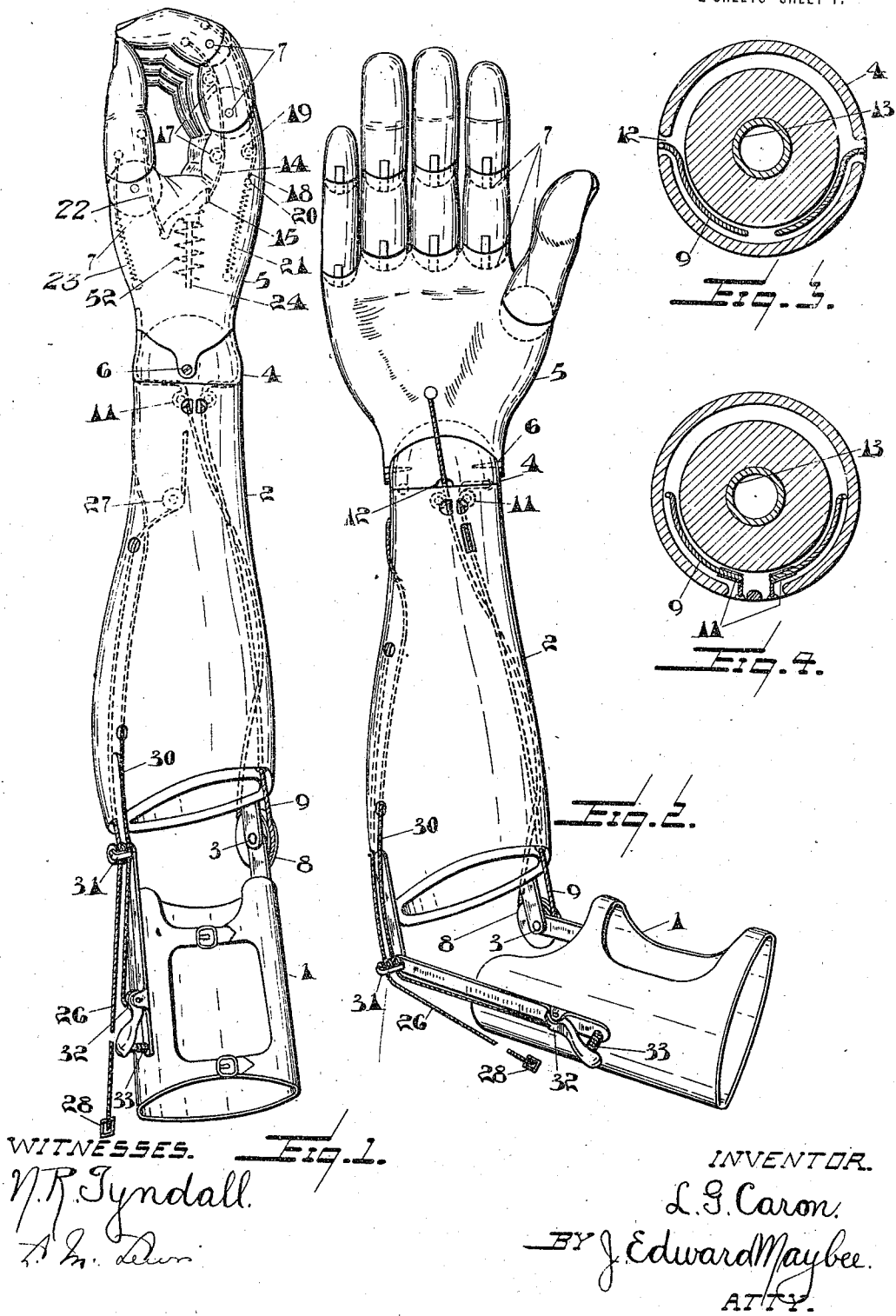


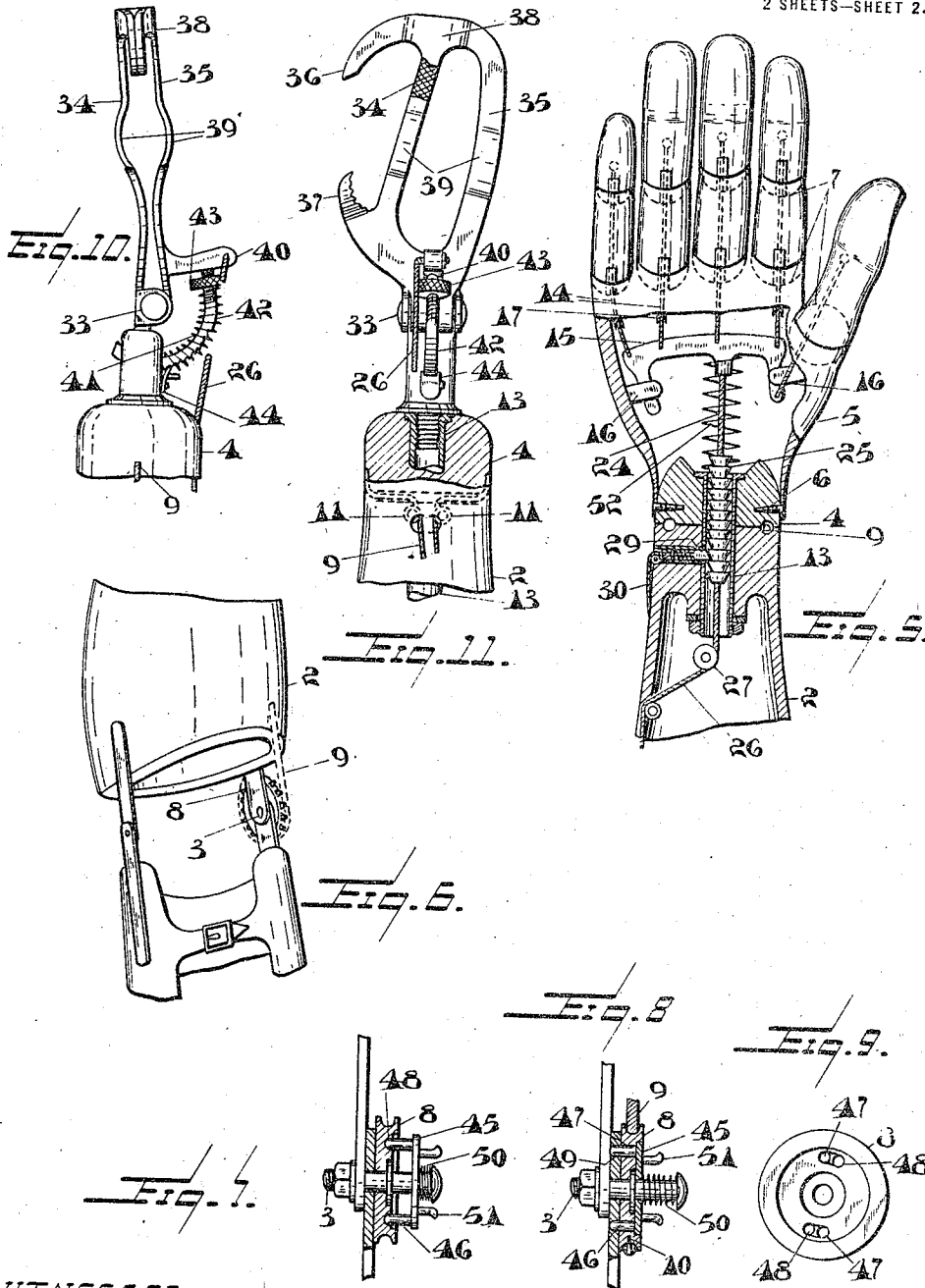
1,247,077.

Patented Nov. 20, 1917.
2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.



WITNESSES.
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UNITED STATES PATENT OFFICE.

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ARTIFICIAL HAND AND ARM.

Specification of Letters Patent.

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1,247,077.

Application filed March 12, 1917. Serial No. 154,193.

To all whom it may concern:

Be it known that I, LOUIS G. CARON, a citizen of the United States of America, residing in the city of Toronto, county of York, Province of Ontario, Canada, have invented certain new and useful Improvements in Artificial Hands and Arms, of which the following is a specification.

This invention relates to artificial hands and arms in which it is desired to provide means for flexing the fingers and thumb, for rotating the wrist on the fore arm, and for bending the hand on the wrist, and my object is to devise simple and efficient means for effecting the desired movements described in my divisional application filed May 4, 1917, Ser. No. 166,423. No claim is made in this application to the specific devices shown in Figures 10 and 11 as they are claimed in my said copending application, Ser. No. 166,423.

I attain my object by means of the constructions hereinafter described and illustrated in the accompanying drawings in which—

Fig. 1 is a perspective view, partly in section, of my improved hand and arm in extended position;

Fig. 2 a similar view showing the arm bent at the elbow;

Fig. 3 a cross section of the end of the wrist member which contacts with the forearm member;

Fig. 4 a cross section of the end of the forearm member which contacts with the wrist member;

Fig. 5 a front elevation, partly in section, of the hand, wrist member and part of the forearm member;

Fig. 6 a perspective detail illustrating a modification of the pulley actuating the cable for turning the wrist member and bending the hand;

Figs. 7 and 8 are sectional details in two different positions of the means for releasably locking the pulley illustrated in Fig. 6;

Fig. 9 a face view of the pulley;

Fig. 10 a side elevation of a working hand; and

Fig. 11 a front elevation of the same.

In the drawings like numerals of reference indicate corresponding parts in the different figures.

Referring particularly to Figs. 1 and 2, 1 is an upper arm member of ordinary construction and 2 a forearm member also of

ordinary construction. As my arm is intended to be used where the wearer has lost his arm below the elbow joint, no means are needed for bending the forearm member on the upper arm member. These members are jointed together at 3 in any ordinary manner.

The wrist end of the forearm member is finished with a substantially flat surface, and on this end is swiveled the wrist member 4, as hereinafter described, provided with a substantially flat face to contact with the end of the lower arm member.

The hand 5 is pivoted to bend on the wrist member, 6 being the pivots. The fingers, including the thumb, are each provided with one or more hinge joints 7 to enable them to be flexed. Preferably one joint is formed in the thumb and two in each of the other fingers.

It is desirable that the hand should occupy substantially the position shown in Fig. 1 when the arm is extended and that the hand should be turned at the wrist and bent toward the forearm when the forearm is bent on the upper arm as shown. To effect these movements I provide the following mechanism.

At one of the joints 3 concentric with the pivot I secure a pulley 8, which is so secured to the upper arm member that it does not rotate relative thereto. Around this pulley is passed a cable 9. This cable is also secured to the pulley so that it does not move relative thereto. A pin 10 is shown for this purpose in Fig. 8.

As a variation the cable may be formed as a sprocket chain, (see Fig. 6) and the pulley 8 as a sprocket wheel, the one arrangement being an exact equivalent for the other.

The two parts of the cable are led along the forearm, preferably through grooves formed in its shell. Close to the wrist end of the forearm and close to the periphery are located two guides 11, which may be of any form but are preferably small grooved rollers set close together. From these guides the parts of the cable are led one to one side and one to the other, and finally pass up grooves formed at opposite sides of the wrist members and extending in a direction longitudinal of the forearm member.

The ends of the cable are secured respectively to the front and back of the hand. To secure a proper lead for the parts of the

- cable, I form an annular groove between the wrist member and the forearm member extending at least half way around the arm. Preferably the groove extends entirely around the arm and is formed half in the wrist member and half in the forearm member as indicated particularly in Figs. 1, 2, 3 and 4. The cable is connected to the pulley 8 in such a position that when the arm is extended the end of the cable connected to the front of the hand is slacked up and the end connected to the back of the hand is drawn up. The hand thus occupies the position shown in Fig. 1. When the forearm is bent on the upper arm as shown in Fig. 2, the end of the cable connected to the front of the hand is drawn up, the first result being to twist the wrist member on its swivel joint until the groove 12 in the front of the hand comes in line with the space between the guides 11. Further bending movement of the elbow joint then results in the hand being bent forward on the pivots 6. When the arm is straightened out, the reverse movement takes place.
- The swivel joint between the wrist member and the forearm member is formed by a hollow journal 13 flanged at the wrist member end and provided with a lock nut at its opposite end by means of which it may be tightened up as may be necessary and locked. This gives free rotary movement for the wrist member and at the same time provides passage for the means for operating the fingers of the hand.
- For operating the fingers I provide cables 14 which are secured to a head 15 suitably guided by the guides 16 within the hand, which is hollow. The cables are led around suitably journaled guide rollers 17. These cables and guide rollers are arranged to flex the fingers in one direction, preferably to move them to the gripping position. To flex them in the reverse direction I provide the cables 18 which pass around suitable guide rollers 19 and are connected with a head 20 to which is secured a coil spring 21 secured at its other end to the hand. The thumb is provided with a separate cord 22 and the spring 23.
- The head 15 is connected by a flexible member 24 with a ratchet rack 25 adapted to slide in the hollow journal 13 as shown. To the ratchet rack 25 is connected the cable 26. This cable is led around suitable guides 27 and through the forearm member, terminating preferably in a buckle 28 which may be connected for operation to a shoulder strap as is common in the art. It is evident that by straining on the cable 26 the fingers may be flexed and that on releasing the pulley on the cable, by the springs contained in the hand, the fingers will be returned to normal position.
- It is desirable that when the fingers have been flexed that it shall be possible to retain them in the flexed position after the pull on the cable 26 has been relieved. I therefore provide the spring actuated dog 29 movable in the forearm member and adapted to engage the ratchet rack 25. As the hand turns relative to the forearm member the ratchet rack is preferably circular in cross section so that the dog will engage therewith no matter to what position it may be turned on its axis. This dog is actuated by the cable 30 led around suitable guides 31 at the elbow joint and to a lever 32 fulcrumed on the upper arm member. This lever normally stands out from the upper member as shown so that pressure on the lever tending to move it toward the upper arm member will strain on the cable 30 and release the dog, allowing the fingers to move to the position toward which the springs in the hand tend to draw them. The lever is normally extended by a coil spring 33. This lever will ordinarily be released by the wearer pressing the upper arm member against his side, thus pressing down on the lever.
- For ordinary purposes and during social intercourse, the hand as described is sufficient, but for actual work and the manipulation of tools better results can be attained by a hand such as shown in Figs. 10 and 11. This hand is bolted to the wrist member as shown, and comprises a fixed member and a hinged member pivoted at 33 on the fixed member. These members are substantially similar in form and each is shaped as an open frame work comprising two longitudinal spaced members 34 and 35 connected at their ends. A rearwardly facing hook 36 is formed at the forward end and a forwardly facing hook 37 at the rearward end. The forward ends of the frames are outwardly bent as shown at 38 to facilitate the gripping between the members of a cylindrical article with its axis longitudinal of the length of the hand. The longitudinal members are similarly bent at 39 to facilitate the grasping of a cylindrical article with its axis at right angles to the length of the hand. The inner faces of the members are preferably roughened as shown to prevent slipping.
- To operate the movable member I provide a short operating arm 40 to which may be connected the cable 26. The movable member is operated in the reverse direction by means of the coil spring 41 surrounding a quadrant guide 42 connected with the arm 40 and passing through a hole in the fixed member. An adjusting nut 43 threaded on the guide provides means for varying the tension of the spring. This guide is also preferably provided with notches with which may be engaged a pivoted catch 44 so that the movable member may be locked

open or closed as may be desired. This hand may be put to many uses which it will not be necessary here to described.

In some cases it may not be desirable to have the hand rotate at the wrist every time the elbow is bent. I therefore provide means whereby the pulley 8 may be released from its fixed relationship to the upper arm member whenever desired. For this purpose I elongate the pivot of the hinge joint and provide a plate 45 longitudinally movable on the pivot. This plate has one or more pins 46 secured thereto adapted to enter holes in the pulley 8. Two pairs of holes are provided. One pair 47 extends all the way through the pulley and the other pair 48 only half way through. Holes 49 are provided in the joint member of the upper arm into which the pins 46 may project after passing through the holes 47. The pulley is now locked to the joint member of the upper arm. By pulling back the plate and engaging the pins in the holes 48, the pulley is freed from the upper arm member and has no operative effect on the cable 9 when the forearm is flexed on the upper arm. A coil spring 50 engaging a head on the pivot and the back of the plate tends to hold the pins in the holes with which they may be engaged. Preferably finger grips 51 are provided on the plate to facilitate its movement or to give the operator a better grip when he desires to release the pulley as described.

It should be noted that a coil spring 52 is placed about the ratchet rod 25 which engages the head 20 and the end of the hollow journal 13. This spring tends to assist the springs in returning the fingers to their normal position.

From the above description it will be seen that I have devised simple and effective means for carrying out the objects of my invention as set out in the preamble to this

specification.

What I claim as my invention is:

1. The combination of a fore-arm member; a wrist member secured to the fore-arm member with a swivel joint; two cable guides located at the wrist end of the fore-arm member close together and close to the periphery of said member; a double cable the parts of which pass through the guides and are connected with the wrist member at opposite sides thereof; an upper arm member jointed to the fore-arm member; and a pulley secured to the upper arm member concentric with the pivot of the joint, around which pulley the cable passes and to which it is secured.

2. The combination of a fore-arm member; a wrist member secured to the fore-arm member with a swivel joint and having a groove formed in the end adjacent the fore-arm member, said groove extending ad-

jacent the periphery of the wrist member half way around said member; two cable guides located at the wrist end of the fore-arm member close together and close to the periphery of said member; a double cable the parts of which pass through the guides through the groove aforesaid and are connected to the wrist member at opposite sides thereof; an upper arm member jointed to the fore-arm member; and a pulley secured to the upper arm member concentric with the pivot of the joint, around which pulley the cable passes and to which it is secured.

3. The combination of a fore-arm member; a wrist member secured to the fore-arm member with a swivel joint and having grooves formed longitudinally in its surface at opposite sides thereof extending up from the end adjacent the wrist member; a hand jointed to bend on the wrist member; two cable guides located at the wrist end of the fore-arm member close together and close to the periphery of said member; a double cable, the parts of which pass through the guides across to and up the grooves aforesaid to the hand to opposite sides of which their ends are secured; an upper arm member jointed to the fore-arm member; and a pulley secured to the upper arm member concentric with the pivot of the joint, around which pulley the cable passes and to which it is secured.

4. The combination of a fore-arm member; a wrist member secured to the fore-arm member with a swivel joint having a groove formed in the end adjacent the fore-arm member, said groove extending adjacent the periphery of the wrist member half-way around said member and having grooves formed longitudinally in its surface at opposite sides thereof extending up from the groove in the end adjacent the wrist member; a hand jointed to bend on the wrist member; two cable guides located at the wrist end of the fore-arm member close together and close to the periphery of said member; a double cable, the parts of which pass through the guides across to and up the grooves aforesaid to the hand to opposite sides of which their ends are secured; an upper arm member jointed to the fore-arm member; and a pulley secured to the upper arm member concentric with the pivot of the joint, around which pulley the cable passes and to which it is secured.

5. The combination of a fore-arm member; a wrist member secured to the fore-arm member with a swivel joint; two cable guides located at the wrist end of the fore-arm member close together and close to the periphery of said member; a double cable the parts of which pass through the guides and are connected with the wrist member at opposite sides thereof; an upper arm member jointed to the fore-arm member; and a

pulley journaled on the pivot of one of the hinge joints between the upper-arm and fore-arm, around which pulley the cable passes and to which it is secured; and releasable means for locking the pulley to the upper-arm member.

6. The combination of a wrist-member; a hand-member jointed to bend on the wrist-member; fingers jointed on the hand-member; means operable by a pull to flex the fingers in one direction; spring means tending to flex the fingers in the opposite direction; a flexible member connected with the finger flexing means; a ratchet rack extending longitudinally through the wrist member and to which said flexible member is connected; and a spring actuated dog within the wrist member engaging said ratchet rack.

7. The combination of a fore-arm member; a wrist member; a hollow journal forming a swivel joint between the two members; a hand-member jointed to bend on the wrist-member; fingers jointed on the hand-member; means operable by a pull to flex the fingers in one direction; spring means tending to flex the fingers in the opposite direction; a flexible member connected with the finger flexing means; a ratchet rack of circular section extending longitudinally through the hollow journal of the wrist member and to which said flexible member is connected; and a spring actuated dog within the wrist member engaging said ratchet rack.

8. The combination of a wrist-member; a hand-member jointed to bend on the wrist-member; fingers jointed on the hand-member; cables for flexing said fingers; a head suitably guided within the hand to which said cables are connected; a flexible member

connected with said head; a ratchet rack extending longitudinally through the wrist-member and to which said flexible member is connected; and a spring actuated dog within the wrist-member engaging said ratchet rack.

9. The combination of a wrist-member; a hand-member jointed to bend on the wrist-member; fingers jointed on the hand-member; cables for flexing said fingers; guide rollers around which said cables pass; a head suitably guided within the hand to which said cables are connected; a flexible member connected with said head; a ratchet rack extending longitudinally through the wrist-member and to which said flexible member is connected; and a spring actuated dog within the wrist-member engaging said ratchet rack.

10. The combination of a wrist-member; a hand-member jointed to bend on the wrist-member; fingers jointed on the hand-member; means operable by a pull to flex the fingers in one direction; spring means tending to flex the fingers in the opposite direction; a flexible member connected with the finger flexing means; a ratchet rack extending longitudinally through the wrist member and to which said flexible member is connected; a spring actuated dog within the wrist member engaging said ratchet rack; a cable adapted to retract said dog extending through suitable guides; a trip lever fulcrumed on the side of the upper-arm adapted to draw on said cable when pressed toward the upper-arm member; and a spring tending to maintain the lever in normal position.

Signed at Toronto, Can., this 5th day of 80 March, 1917.

LOUIS G. CARON.