

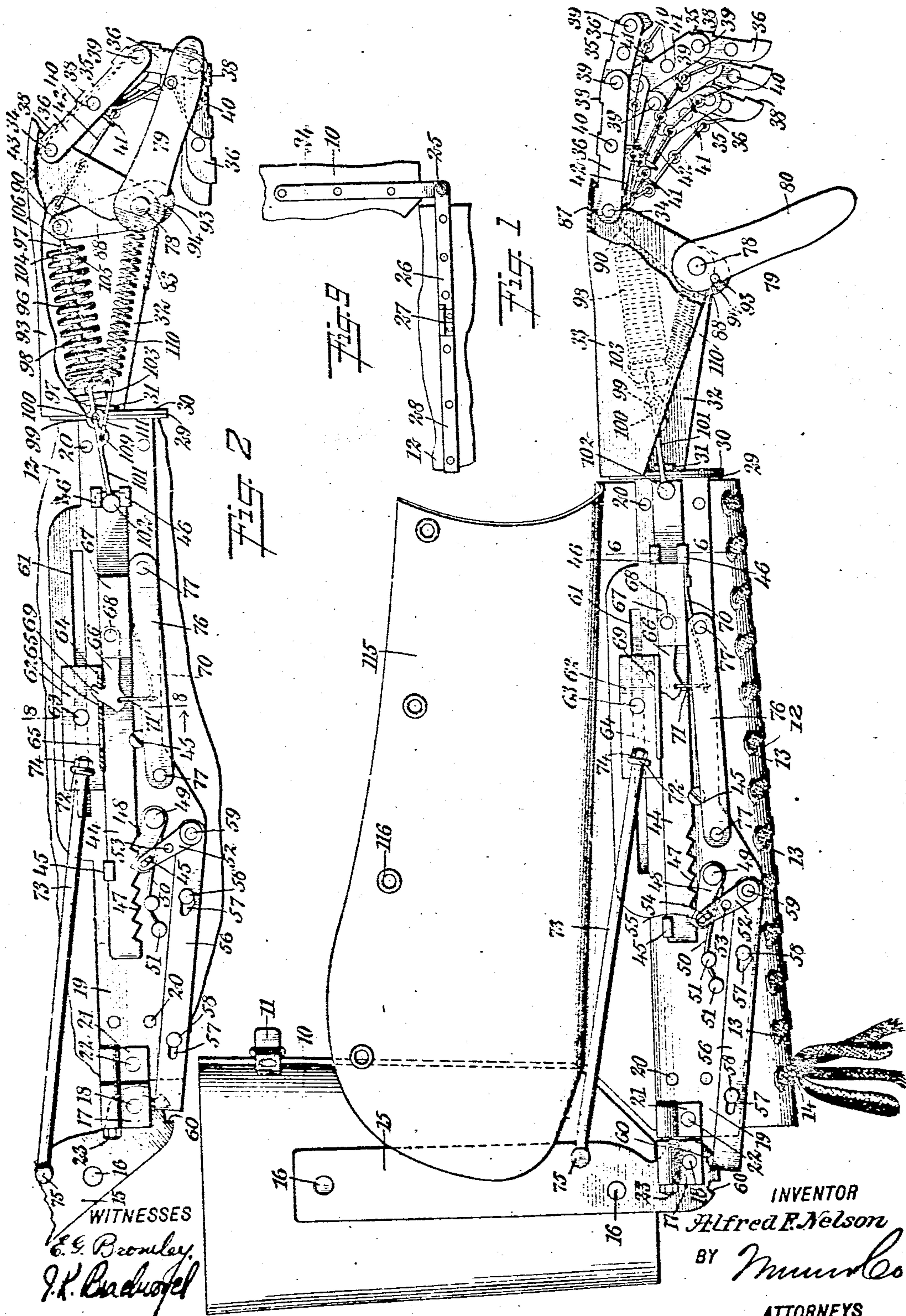
908,881.

A. F. NELSON.
ARTIFICIAL HAND.

APPLICATION FILED SEPT. 1, 1908.

Patented Jan. 5, 1909.

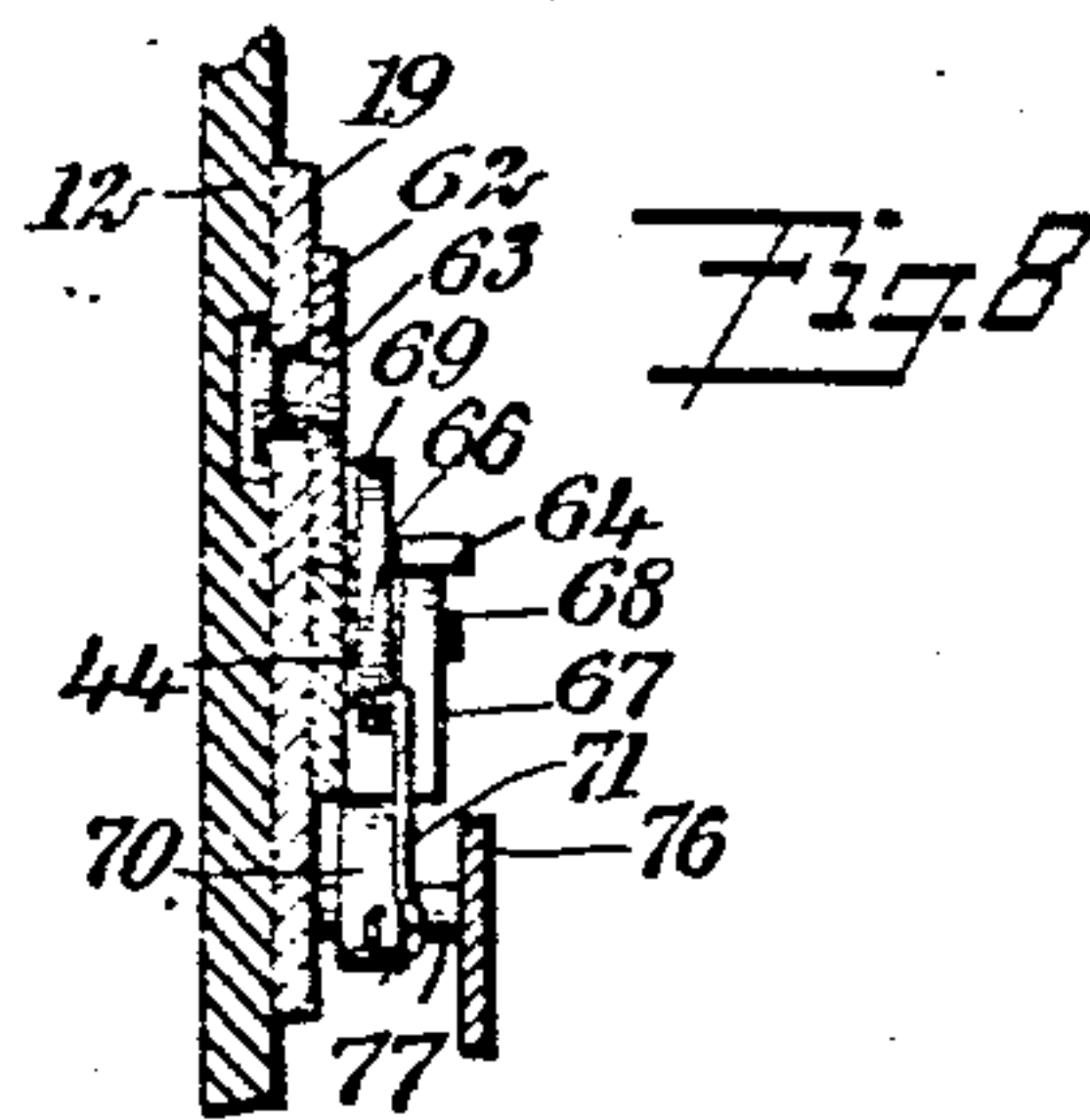
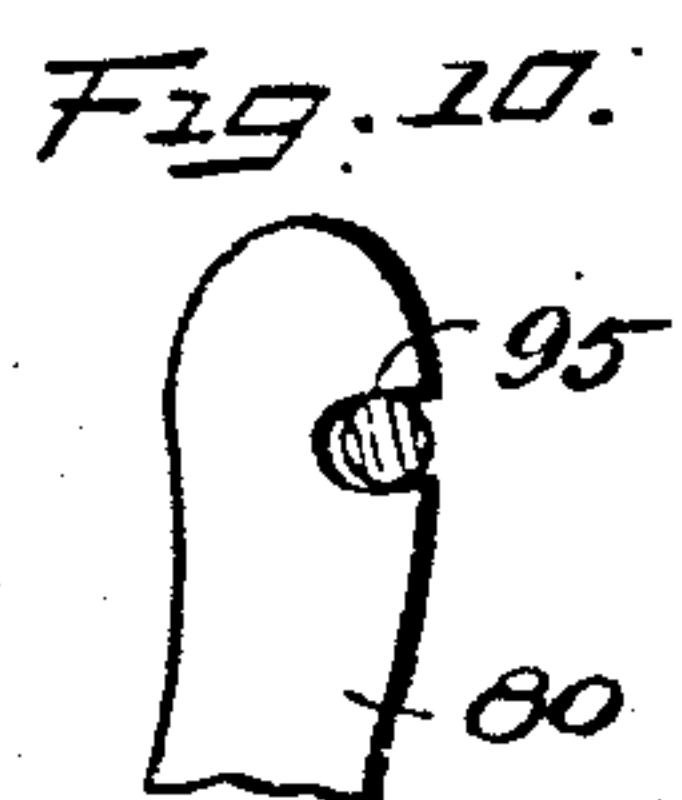
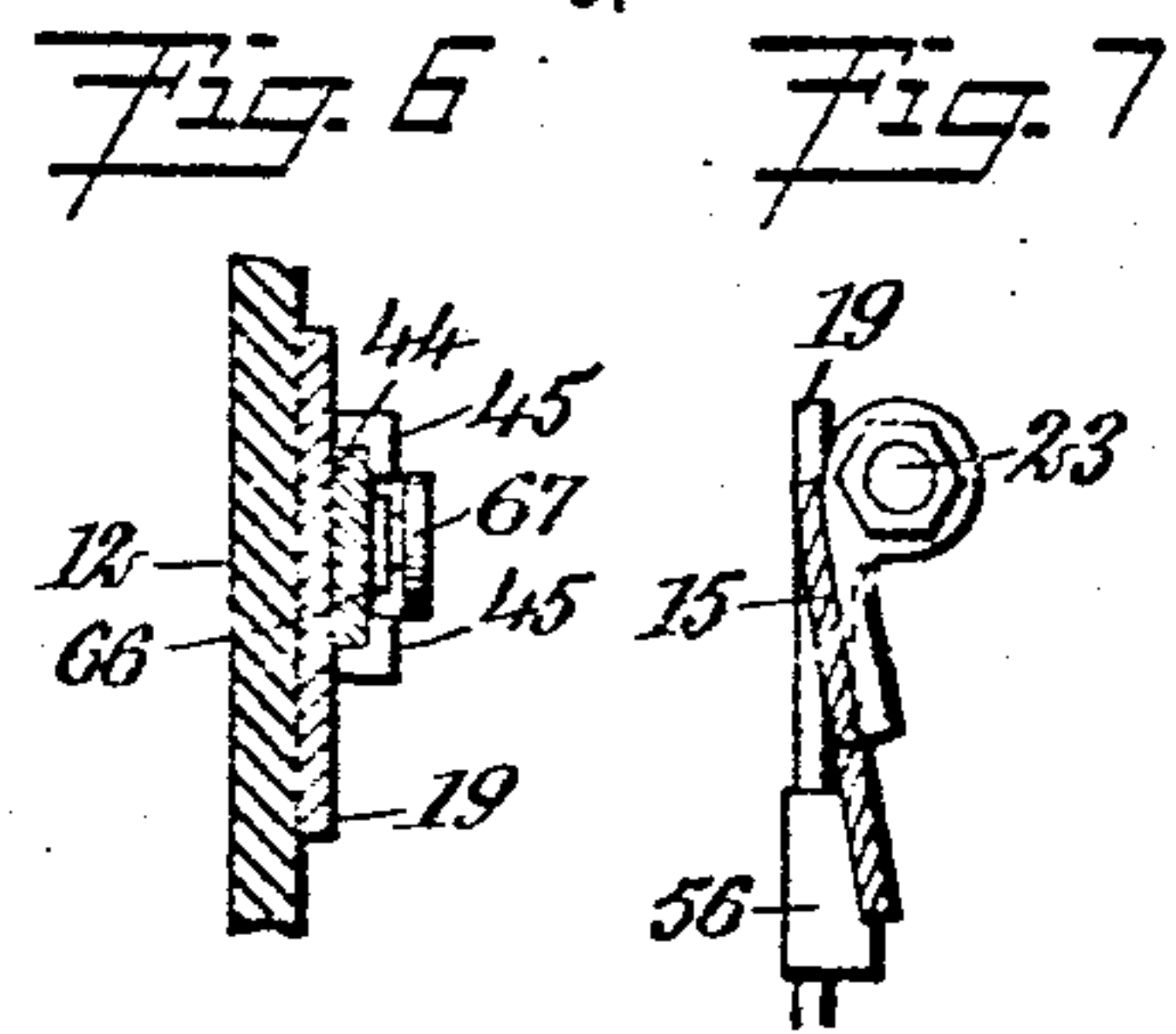
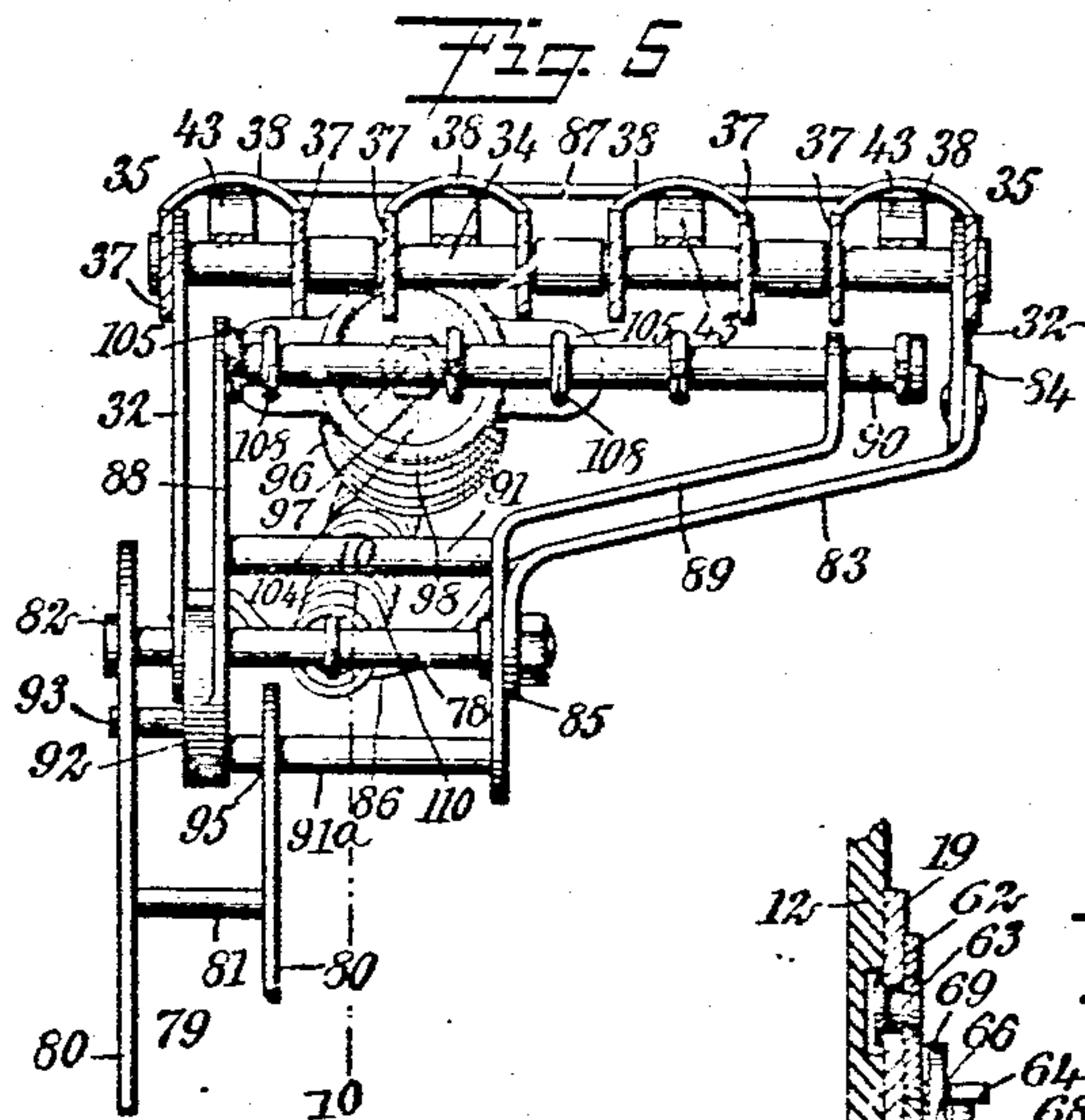
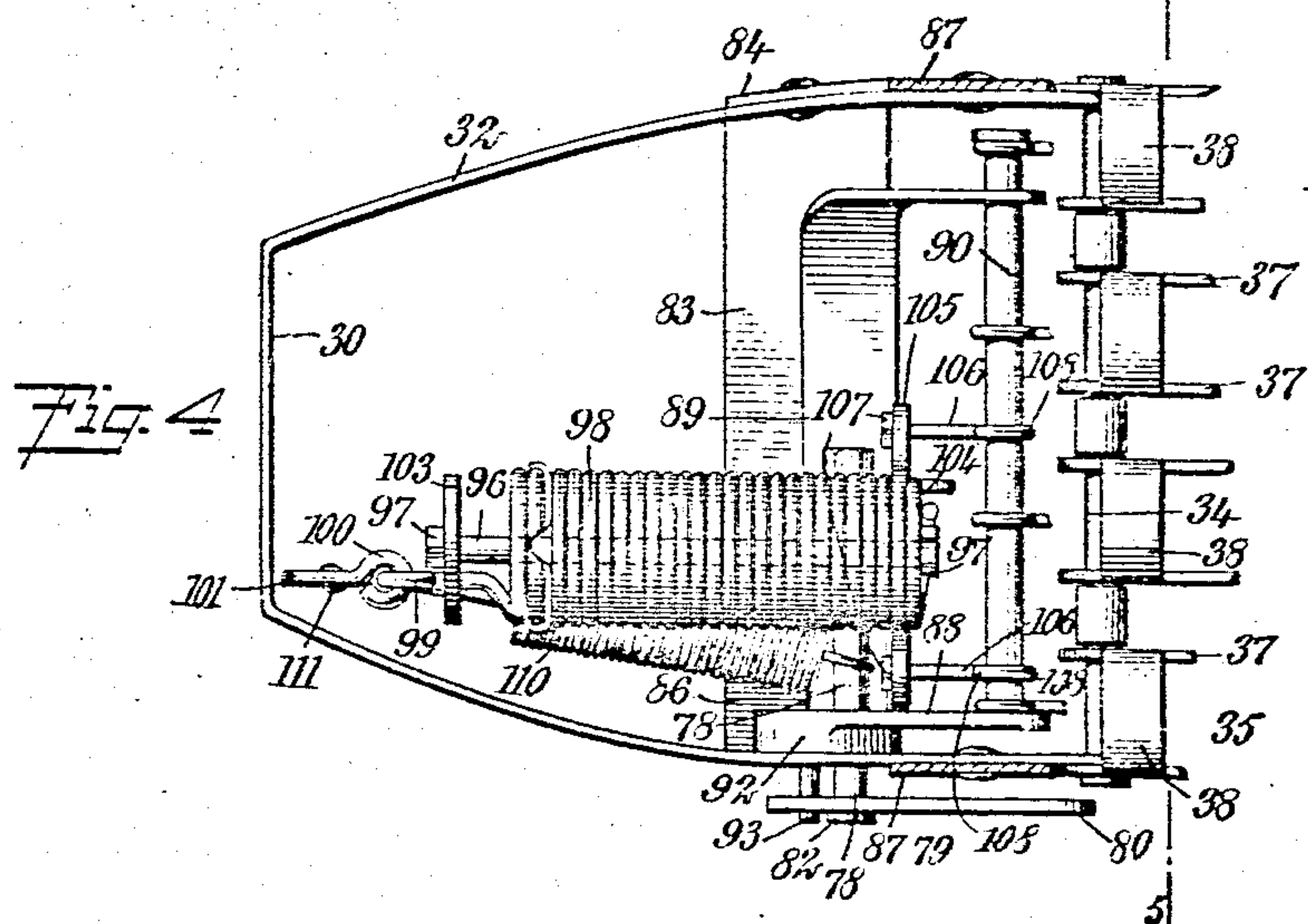
2 SHEETS—SHEET 1.



APPLICATION FILED SEPT. 1, 1908.

Patented Jan. 5, 1909.

2 SHEETS—SHEET 2.



INVENTOR
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UNITED STATES PATENT OFFICE.

ALFRED F. NELSON, OF RENTON, WASHINGTON.

ARTIFICIAL HAND.

No. 908,881.

Specification of Letters Patent.

Patented Jan. 5, 1909.

Application filed September 1, 1908. Serial No. 451,147.

To all whom it may concern:

Be it known that I, ALFRED F. NELSON, a citizen of the United States, and a resident of Renton, in the county of King and State of Washington, have invented a new and Improved Artificial Hand, of which the following is a full, clear, and exact description.

This invention relates to artificial hands, and is particularly useful in cases where persons have lost one or the other of their hands but retain the corresponding upper arms and forearms.

Specifically, the invention relates to an artificial hand having a frame comprising an upper arm sleeve or section, and a forearm sleeve or section to which is attached a hand, including both fingers and a thumb, together with mechanism controlled by the relative movements of the forearm and the upper arm, for contracting and releasing the fingers and the thumb.

An object of the invention is to provide a simple and efficient artificial hand, which can be easily worn without inconvenience, by the user, which simulates closely the appearance of a natural hand, and which can be operated to reproduce many of the functions of the natural hand, such for example, as the holding and using of tools and utensils, and the like.

A further object of the invention is to provide a device of the class described, in which the hand consists of jointed fingers and a movable thumb, together with means for contracting the fingers, and moving the thumb toward the same, so that objects can be easily grasped, held, and used by the hand, the device being operable to release the fingers and the thumb when desired, by a movement of one part of the arm relative to the other, the hand being closed by another movement of one part of the arm relative to the other.

The invention consists in the construction and combination of parts to be more fully described hereinafter and particularly set forth in the claims.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views, and in which—

Figure 1 is a side elevation of an embodiment of my invention, showing parts broken away, and having a guard flap or cover displaced, so that the mechanism lying there-

under is disclosed to view; Fig. 2 is a side elevation showing the mechanism for operating the fingers and the thumb of the hand, part of the latter being broken away, the parts being in different relative positions; Fig. 3 is a side elevation showing a part of the operating mechanism, Fig. 4 is an enlarged transverse section through the hand, showing the mode of attaching the fingers and the thumb, and parts of the mechanism for operating the same; Fig. 5 is a transverse section on the line 5—5 of Fig. 4; Fig. 6 is an enlarged transverse section on the line 6—6 of Fig. 1; Fig. 7 is a similar view on the line 7—7 of Fig. 3; Fig. 8 is a similar view on the line 8—8 of Fig. 2; Fig. 9 is a side elevation of parts of the upper arm sleeve and the lower arm sleeve, showing the stiffening bars; and Fig. 10 is a cross section on the line 10—10 of Fig. 5.

Before proceeding to a more detailed explanation of my invention, it should be clearly understood that while the same is particularly useful in cases where persons have lost a hand in such a manner that the member has been severed at or near the wrist, leaving the upper arm and the forearm intact, it can also be advantageously employed where part of the forearm has been removed, provided a sufficient length of the forearm remains to permit a movement of the remainder, relative to the upper arm. The fingers and the thumb of my artificial hand are closed and opened by swinging or moving the forearm in one direction or the other relative to the upper arm, a suitable frame being provided for attaching to the forearm and the upper arm, so that the artificial hand itself can be suitably secured in position. The hand is so constructed that it simulates as nearly as possible, the appearance of a natural hand, and by the provision of suitable mechanism, as will appear more clearly hereinafter, it is operable so that it possesses certain of the functions of a natural hand and can be used for various purposes, successfully to replace the same. The device may be fashioned from any suitable material, preferably from iron or steel, and leather. The hand can be "finished" by the use of cork or wax parts, for instance, at the finger tips, but is preferably covered with a glove. Certain of the details of construction can be varied in accordance with individual preference or special conditions, without departing from the underlying principles of the

invention, which consist in the provision of an artificial hand having jointed fingers and a movable thumb, together with mechanism for operating the fingers and the thumb, and preferably by the movement of one part of the arm relative to the other, a suitable frame being provided for mounting the device upon the arm.

Referring more particularly to the drawings, I provide a frame for mounting the hand upon the arm of the user, and consisting of an upper section or sleeve 10 preferably fashioned from leather and having straps and buckles 11 by means of which it can be secured in place, and a forearm sleeve or section 12 having eyelets 13 so that it can be secured in position by means of a lacing 14 or in any other convenient manner. An elongated plate member 15 is arranged longitudinally of the upper arm sleeve 10 and is secured thereto in any suitable way, for example, by means of rivets 16. The member 15 projects beyond the lower end of the sleeve 10 and has pivoted thereon a hinge leaf 17 movably mounted in place by means of a pivot pin or rivet 18. The forearm sleeve 12 has arranged longitudinally thereof, a fixed plate 19, rigidly secured in place by means of rivets 20 or any other suitable means. A hinge leaf 21 is secured at the rear end of the fixed plate 19, by means of a rivet 22. A hinge pin or bolt 23 connects the hinge leaves 17 and 21 so that in effect, the connection between the frame sections or sleeves 10 and 12 is a universally jointed one, permitting the frame sections to be moved in a plurality of directions relative to one another.

At the side of the upper arm sleeve remote from the plate 15, is riveted or otherwise fashioned, a stiffening bar 24 pivotally secured by means of a rivet 25 to a similar bar 26 riveted or otherwise secured to the forearm section 12 at the side remote from the plate 19. The bar 26 extends part way of the length of the forearm section and is secured by means of a hinge 27, to a similar bar 28 extending the remainder of the length of the forearm section, and likewise riveted or otherwise secured thereto. The provision of the hinge 27 and the pivotal connection between the bar 26 and the bar 24, permit the frame sections to be moved in a plurality of directions relative to one another, that is, to be moved relatively without interfering with the universal joint connections therebetween.

The forward ends of the plate 19 and the stiffening bar 28 are inwardly disposed and carry therebetween a wrist plate 29, secured thereto by means of bolts or rivets. A similar wrist plate 30 is swiveled upon the wrist plate 29 by means of a bolt or rivet 31 and forms a part of a substantially U-shaped member 32 forming the back of the hand. Preferably, the member 32 is covered at the

upper portion and at the sides, by means of a leather covering 33 or the like.

Arranged transversely of the member 32, between the sides thereof, at the forward end, is a pintle 34 forming a finger pivot upon which the fingers 35 are movably mounted. Each of the latter consists of the natural number of joints 36, pivoted together so that the fingers can be bent as in the case of an actual hand. Each of the joints 36 consists of similar spaced sides 37 connected by cross-pieces 38 integral therewith. Rivets 39 arranged at the ends of the joints pivotally connect the same. The third joint of each finger, which is the largest one, is pivotally mounted upon the pintle 34. The first or outer joints have the lower edges rounded at the extremities, and if so desired may be provided with cork tips, or may be otherwise suitably fashioned to imitate natural fingers. Intermediate the ends, each joint has a cross bar 40. The cross bars of the second and third joints carry eyes 41. Flexible members 42 consisting preferably of links forming chains, are secured at the cross bars of the first joints and are movably arranged in the eyes 41 of the remaining joints, for a purpose which will appear hereinafter. Each of the fingers has an elongated resilient strip 43 forming a spring which tends normally to straighten the fingers, and which is arranged between the cross-pieces 38 and the pivot pins 39 and the cross bars 40.

A slide bar 44 is movably arranged upon the fixed plate 19 which is provided with guide studs 45 and 46, preferably under-cut to engage at the edges of the slide bar to constrain the same to move in predetermined directions. At the lower edge, near the rear end, the slide bar has teeth 47 forming a ratchet adapted to be engaged by a dog 48 pivoted upon the fixed plate by means of a rivet 49. A spring 50 held in place by means of studs 51 engages the dog to force the same normally toward the slide bar and into engagement with the ratchet 47. A lever 52 is pivoted by means of a pin 53 upon the fixed plate and has a slot 54 engaging a stud 55 carried by the dog. A releasing rod 56 has slots 57 which receive pins 58 carried by the fixed plate so that the releasing rod is slidably mounted upon the same. It is pivotally connected by means of a rivet 59 or the like, with the lever 52. The free end of the releasing rod projects rearwardly beyond the forearm sleeve or frame section, and is bent for engagement by notches 60 formed at the lower end of the plate member 15, for a purpose which will appear more clearly hereinafter.

The upper part of the fixed plate 19 is extended and has an elongated slot 61. An actuating slide 62 has a stud 63 arranged to move along the slot within the same, being

provided with a head at the back of the slot, to hold the actuating slide movably in place. The latter has an outwardly extending flange 64 provided with spaced openings 65 therethrough. A catch 66 is movably mounted upon the slide bar 44 between the latter and an offset plate 67, by means of a rivet pin 68. The catch has a nose 69 formed to extend into one of the openings 65 operatively to connect the actuating slide and the slide bar. A spring 70 mounted at the lower edge of the slide bar and connected with the catch by means of a link 71, tends normally to hold the latter out of engagement with the actuating slide. The slide has a swiveled eye 72 in which is arranged the end of a link 73. The link has the extremity threaded and is held in place by means of a nut 74. The opposite end of the link 73 is pivoted by means of a rivet pin 75 upon the plate member 15 at a point intermediate the ends thereof and preferably somewhat nearer the lower end than the upper end. A guard 76 for the spring 70 is mounted by means of suitable rivets 77, upon the fixed plate 19, below the slide bar, and is spaced from the fixed plate so that the spring 70 can move between the guard and the fixed plate. The arrangement is such that when the slide bar is advanced to a position adjacent to the wrist end of the frame 12, the rivet 77 at the end of the guide near the hand engages the spring 70 and holds the same in a position such that the nose 69 of the catch 66 projects above the upper edge of the slide bar so that it can be engaged by the actuating slide, as will appear more clearly hereinafter.

Rotatably mounted at one side of the U-shaped member forming the back of the hand, is a pin 78 constituting a pivot for the thumb 79. The latter comprises spaced sides 80 connected by cross bars 81. One only, of the sides 80 is mounted upon the thumb pivot 78, which has a head 82 serving to hold the thumb in place. A cross brace 83 having one end 84 laterally disposed and secured at a side of the U-shaped plate 32, is arranged transversely of the hand at the under side thereof, and has a downwardly disposed ear 85 which carries the inner end of the thumb pivot 78. An extension 86 of the cross brace is secured to the side of the U-shaped plate 32 opposite to that at which the end 84 of the brace is positioned. A cross plate 87 joins the opposite sides of the plate 32 at the upper edges, adjacent to the fingers. A bracket comprising sides 88 and 89 is pivotally mounted upon the thumb pivot 78. The side 89 is outwardly offset and with the side 88 carries a bar 90 forming a yoke to which the ends of the flexible members or chains 42 are secured. The sides of the bracket are connected and rigidly held relative to one another, by rivet pins 91 and 91*. The side 88

has a reinforced portion 92 of greater thickness, at the end adjacent to the thumb pivot, and carries a stud 93 adapted to engage in a recess 94 of the thumb. The pin 91* is arranged to seat in a recess 95 similar to the recess 94, and located in the opposite side 89 of the thumb.

A tension bar 96 is located within the hand and has removable nuts 97 at the ends. A helical spring 98 is loosely mounted upon the bar 96 and has one extremity formed into an eye 99 formed to receive an eye 100 provided at the end of a connecting member 101. The free end of the latter is secured by means of a pivoted post 102 at the forward end of the slide bar 44. A disk 103 is arranged upon the tension rod adjacent to the head 97 remote from the finger. A retainer 104 is positioned between two adjacent coils of the spring 98 near the forward end of the same, and has laterally extending wings 105. Tie members 106 are arranged in openings of the wings 105 and are held therein by means of nuts 107. At the ends remote from the wings 105, the tie members are formed into eyes 108 which serve to secure them to the yoke 90.

The connecting member 101 has an extension 109 at which is attached the end 111 of a helical spring 110. The other end of the spring is secured upon the thumb pivot 78.

Owing to the universal joint connection between the upper arm section and the forearm section, the latter can be swung or pivoted relatively to the former without causing the engagement of the releasing rod by the end of the plate member 15. A lateral or twisting movement of the forearm however, throws the parts into relative positions such that the releasing rod is engaged by one of the notches 60 when the arm is straightened out. If it is desired to close the fingers of the hand, the forearm is swung toward the upper arm, the slide bar being in its forward position, until the actuating slide comes into engagement with the catch, that is, until the nose 69 enters one of the openings 65 of the actuating slide. The arm is then straightened out, the parts being held in such positions that the releasing rod is not engaged by the plate member 15. This movement of the arm draws the actuating slide longitudinally of the slot 68 and the slide bar is constrained to move with the actuating slide, the dog 48 moving inoperatively along the ratchet. The movement of the slide bar is transmitted to the yoke 90 by means of the connecting members 101, the tension rod 96 and the spring 98, the result being that the contractile chains 42 cause the fingers to clench, as is shown most clearly in Fig. 2. At the same time, the movement of the bracket 89, about the thumb pivot brings the stud 93 into engagement with the recess 94 to swing the thumb toward the fingers, thereby effecting

the closing or clenching of the hand. When the arm has been straightened sufficiently to close the hand, a reverse movement can be effected without releasing the hand, the dog 48 serving by its engagement with the ratchet to hold the slide bar in position. At the same time, the actuating slide can move toward the wrist of the device without carrying the slide bar with it, as the catch falls out of the openings 65 under the influence of the spring 70. When the hand is clenched in this fashion it can securely grip an implement or the like. The spring 110 is under tension when the hand is clenched and tends to draw the slide bar toward the wrist of the device.

When it is desired to release the hand, the forearm is twisted so that the end of the plate member 15 is brought into line with the releasing rod and the arm is then straightened out. This causes the engagement at the end of the releasing rod, of one of the notches 60, whereby the releasing rod is moved forward and through the lever 52 swings the dog 48 out of engagement with the ratchet 47 against the tension of the spring 50. The slide bar then moves toward the wrist of the device, under the pull of the spring 110, the fingers being allowed thereby to straighten out, while the bracket 89 swings backward about the thumb pivot, a rivet pin 91^a engaging the recess 95 to return the thumb to its normal, open position. When the hand has been opened, the forearm can be twisted so that the releasing rod remains inoperative and the hand can then be closed in the manner described above. By providing a number of openings 65 in the actuating slide, the catch can engage at different points of the actuating slide so that in closing the hand, the arm can be straightened to a greater or less degree. Similarly, the provision of a plurality of notches 60 permits a variety in the movements of the arm to release the hand. The finger-straightening springs 43 cause the fingers to extend or unclench when the device is released.

The tightness of the grip of the fingers as afforded by the strength of the user, and the material used in the construction of the hand, will be in proportion to the stiffness of the finger springs and the extent to which they are distorted, or that is to say, the grip will be proportional to the extent to which the slide bar has been moved toward the elbow. It will be understood that the frame must be suitably secured upon the arm, the upper arm sleeve and the lower arm sleeve fitting respectively upon the upper arm and the stump of the lower arm of the user.

I prefer to provide the forearm section with a guard flap 115 adapted to cover the mechanism carried by the lower section, to protect the same. The guard flap may be provided with uprights 116 by means of which it can

be secured in place at the lacing 14, or in any other convenient manner.

I am aware that previously to my invention, artificial hands have been constructed, having jointed fingers operated by mechanism co-acting with the arm and I therefore do not claim such construction broadly, as my invention.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent:

1. In an artificial hand, a universally jointed frame adapted to be mounted upon the arm and carrying a hand having jointed fingers, and actuating mechanism controlled by said frame and adapted to contract said fingers by a predetermined movement of said frame, and to relax said fingers by a further predetermined movement of said frame.

2. In an artificial hand, an upper arm sleeve and a lower arm sleeve, a universal joint therebetween, a hand carried by said lower arm sleeve, jointed spring-actuated fingers carried by said hand, and means co-acting between said sleeves and said hand, for contracting said fingers and controlling the release thereof.

3. In an artificial hand, the combination with an upper and a lower arm section, and a universal joint connecting said sections, of a hand and resiliently actuated jointed fingers carried thereby, means between said sections and connected to said fingers, for contracting the same when one of said sections is moved relatively to the other of said sections, and means for releasing said fingers when a further movement of one of said sections relative to the other of said sections is effected.

4. In an artificial hand provided with jointed fingers and means for securing the hand to a forearm stump, the combination with said fingers and said means, of mechanism adapted to coöperate with the upper arm and the stump, and connected to said fingers whereby said fingers are contracted when the arm is straightened, and whereby said fingers are released when the arm is first twisted and then straightened.

5. In an artificial hand, jointed fingers, actuating mechanism for contracting said fingers, means adapted to be controlled by an upper arm and a forearm, for operating said actuating mechanism, and means controlled by the upper arm and the forearm, for releasing said fingers, said first-mentioned means being operated when the arm is straightened, said lastmentioned means being operated when the arm is straightened after a twisting movement of the forearm relative to the upper arm has been effected.

6. In an artificial hand, a frame comprising jointed sections, means for removably attaching said sections respectively to an upper arm and the stump of a forearm, and

hand frame carried by said section adapted to be mounted upon the forearm, jointed fingers carried by said hand frame, means tending normally to relax said fingers, means
5 for contracting said fingers, and actuating mechanism carried by said sections and controlling said means for contracting said fingers, said actuating mechanism being operated to contract said fingers when said
10 section adapted to be mounted upon the forearm is swung in one direction relative to said other section, means for releasing said actuating mechanism, and means for returning said actuating mechanism to a
15 normal position.

7. In an artificial hand, a frame comprising an upper and a lower section adapted to be secured respectively to an upper arm and a forearm, a universal joint connecting said
20 sections, a hand secured to said lower section and having jointed fingers and a movable thumb, means for holding said fingers and said thumb in normal open positions, mechanism for closing said fingers and said thumb,
25 means for operating said mechanism by a swinging movement of said lower section relative to said upper section, means for holding said mechanism whereby said hand is maintained closed, and means for releasing
30 said mechanism by a further swinging movement of said lower section relative to said upper section.

8. In an artificial hand, a frame comprising an upper and a lower section adapted to
35 be secured respectively to an upper arm and a forearm, a universal joint connecting said sections, a hand secured to said lower section and having jointed fingers and a movable thumb, means for holding said fingers
40 and said thumb in normal open positions, mechanism for closing said fingers and said thumb, means for operating said mechanism by a swinging movement of said lower section relative to said upper section, means for holding
45 said mechanism whereby said hand is maintained closed, means controlled by a twisting movement of said lower section for releasing said holding means, and means tending to return said mechanism to a normal position
50 such that said hand is opened.

9. In an artificial hand, a frame comprising an upper and a lower section having a
55 universal joint connection, a hand secured to said lower section and having jointed fingers, mechanism for closing said fingers, means operable by a movement to straighten said frame, for actuating said mechanism
60 when said upper section and said lower section are in certain relative positions, means for holding said mechanism in position such that said fingers are closed, and means operable by a movement to straighten
65 said frame, for releasing said holding means when said sections are in further relative positions.

10. In an artificial hand, a frame comprising an upper section and a lower section having a universal joint connection, a hand secured to said lower section and having
70 jointed fingers, contractile members for releasing said fingers, a slidable member carried by said lower section and controlling said contractile members, a further slidable member independent of said first slidable
75 member and controlled by said upper section, means for operatively connecting said slidable members, means for holding said first slidable member in a plurality of positions, and means controlled by said upper
80 section for releasing said holding means.

11. In an artificial hand, a frame comprising an upper section and a lower section having a universal joint connection, a hand secured to said lower section and having
85 jointed fingers, contractile members for releasing said fingers, a slide bar mounted upon said lower section, an actuating slide carried by said lower section, means for operatively connecting said slide bar and said actuating
90 slide, said last mentioned means being normally inoperative, means for rendering said last mentioned means operative, means for holding said slide bar in a plurality of positions, means controlled by said upper section,
95 for releasing said holding means, and means for operatively connecting said actuating slide and said upper section.

12. In an artificial hand, a frame comprising an upper section and a lower section having a universal joint connection, a hand secured to said lower section and having jointed
100 fingers, contractile members for releasing said fingers, a slide bar mounted upon said lower section and having a movable catch, an actuating slide movably mounted upon said lower section and adapted to be operatively
105 engaged by said catch, means for holding said catch normally out of engagement with said slide, a guide controlling said catch whereby the same engages said slide in a predetermined position of said slide bar, a dog
110 adapted to engage said slide bar to hold the same in a plurality of positions, means normally forcing said dog toward said slide bar, a link operatively connecting said slide and
115 said upper section, and a releasing rod controlling said dog and adapted to be operated by said upper section when said lower section is twisted into a predetermined position relative to said upper section.
120

13. In an artificial hand, a frame comprising an upper section and a lower section having a universal joint connection, a hand secured to said lower section and having jointed
125 fingers, contractile members for releasing said fingers, a slide bar mounted upon said lower section and having a movable catch, an actuating slide movably mounted upon said lower section and adapted to be operatively
130 engaged by said catch, means for holding

ing said catch normally out of engagement with said slide, a guide controlling said catch whereby the same engages said slide in a predetermined position of said slide bar, a dog adapted to engage said slide bar to hold the same in a plurality of positions, means normally forcing said dog toward said slide bar, a link operatively connecting said slide and said upper section, a plate member mounted upon said upper section and extending beyond the lower end of the same, a link pivoted upon said actuating slide and said plate member, and a releasing rod movably mounted upon said lower section and controlling said dog, said plate member at the projecting end having a plurality of notches, said releasing rod having a part engaged by any one of said notches when said lower section has been twisted into a predetermined position relative to said upper section, whereby said releasing rod can be actuated by a movement to straighten said sections.

14 In an artificial hand, a frame comprising an upper and a lower section, a hand mounted upon said lower section and having a finger pivot, a plurality of jointed fingers mounted upon said pivot, springs tending normally to straighten said fingers, contractile members controlling said fingers and adapted to close the same, a thumb pivot, a thumb movably mounted upon said thumb pivot, a bracket mounted upon said thumb

pivot and constituting a crank adapted to swing said thumb in opposite directions, resilient means for controlling said contractile members and said bracket, and mechanism controlled by said sections, for operating said controlling means.

15. In an artificial hand, a frame comprising an upper section and a lower section, a hand carried by said lower section and having a finger pivot, a plurality of jointed fingers mounted upon said finger pivot, springs tending to straighten said fingers, contractile members controlling said fingers, a thumb pivot, a thumb movably mounted upon said pivot, a bracket mounted upon said thumb pivot and adapted to swing said thumb in opposite directions, resilient means having an extensible part and controlling said contractile members and said bracket, a spring connecting said thumb pivot and said connecting means, and mechanism controlled by said sections, for operating said connecting means to close said hand and for releasing said connecting means.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALFRED F. NELSON.

Witnesses:

D. B. WILLIAMS,
WILLIAM R. GRIFFITH.