

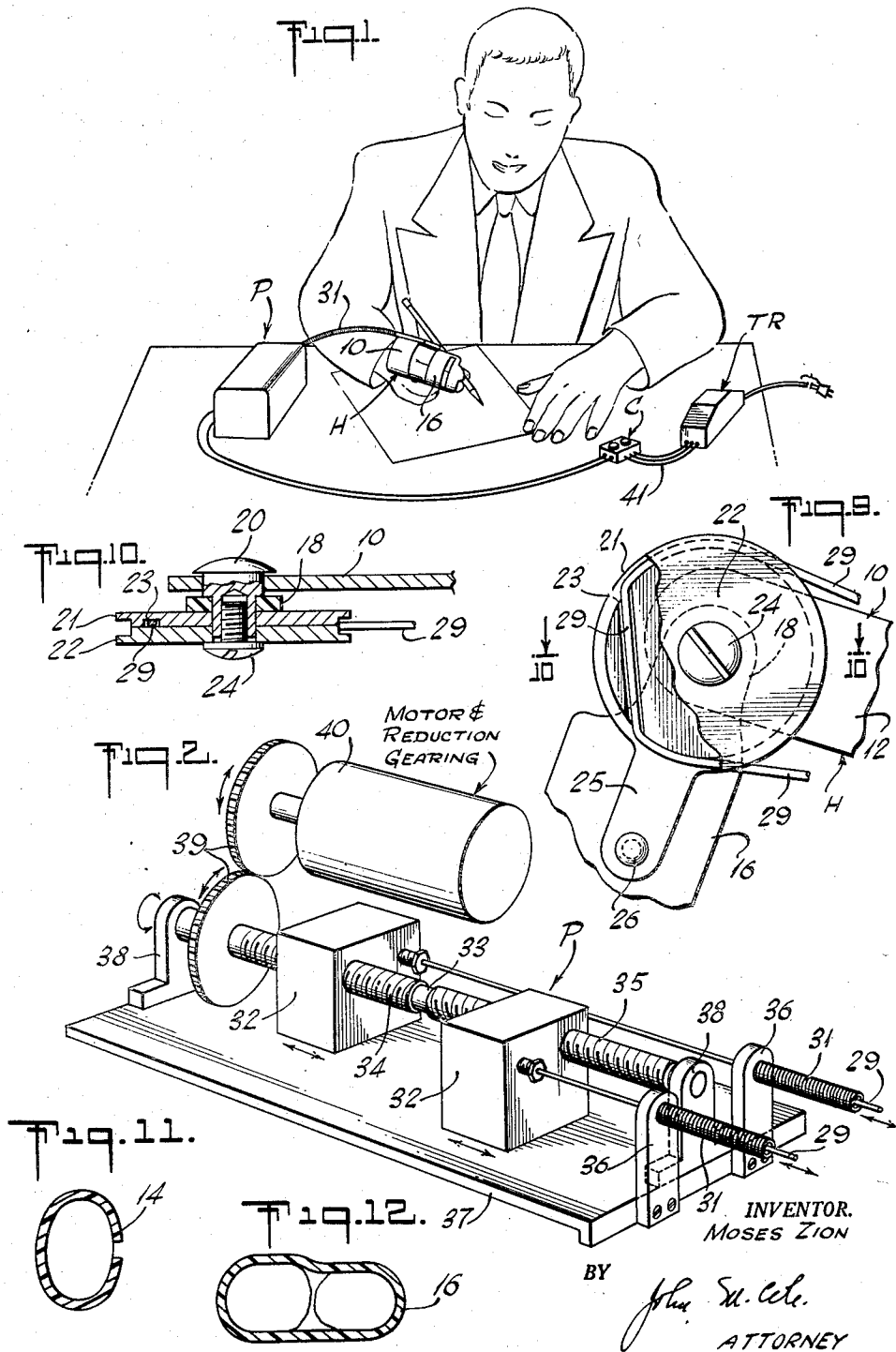
July 7, 1959

M. ZION
PROSTHETIC DEVICES

2,893,016

Filed Jan. 27, 1956

2 Sheets-Sheet 1



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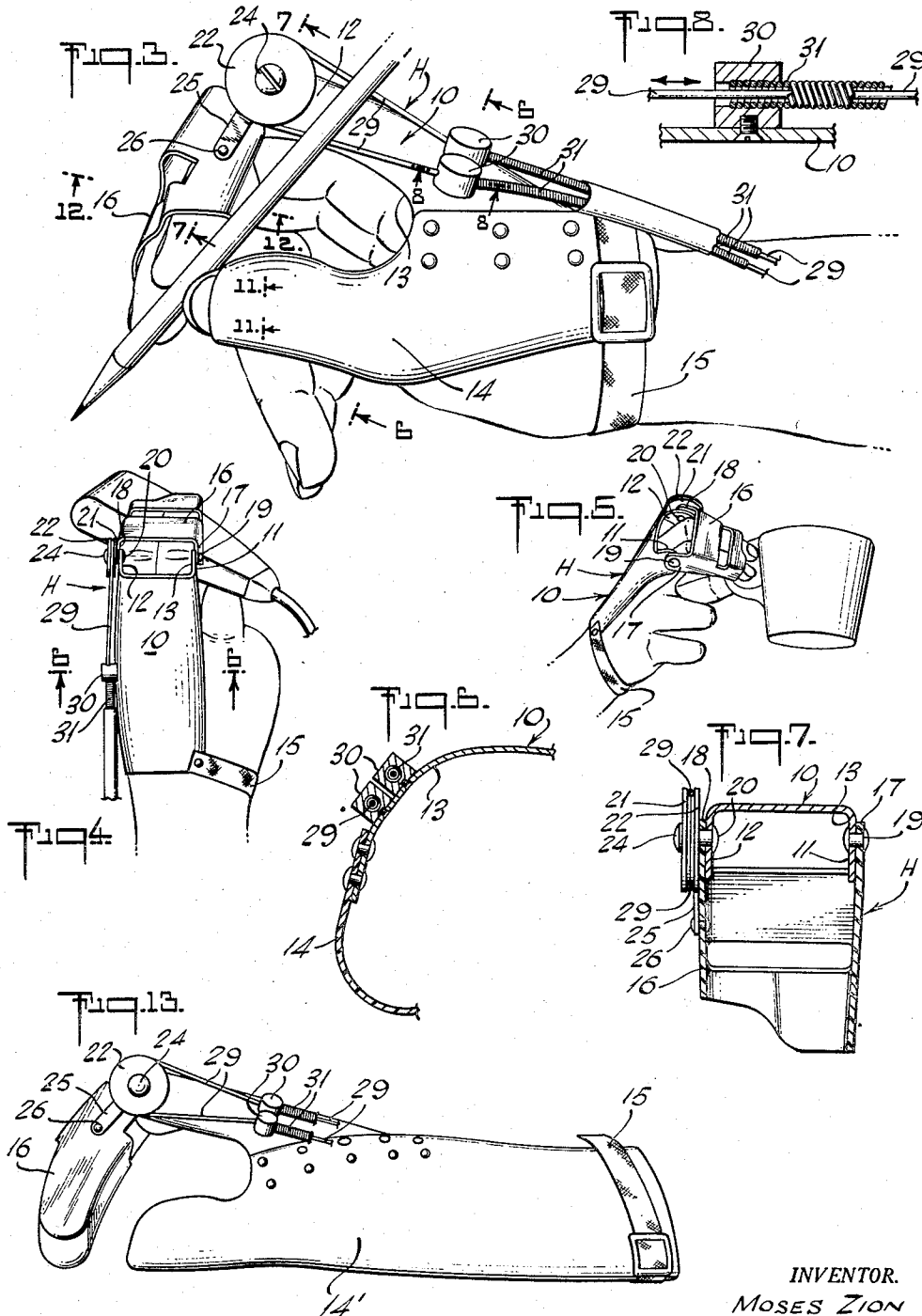
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2 Sheets-Sheet 2



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PROSTHETIC DEVICES

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1 Claim. (Cl. 3—1)

The present invention relates to prosthetic devices and is more particularly directed toward prosthetic devices forming artificial hands for use by patients whose hands do not function normally.

The use of the hand to grip tools, implements and other objects is a very important bodily function and the loss of this use of the hand imposes a great handicap in the life of the unfortunate person.

The present invention contemplates an artificial hand suitable to be worn by one who has the thumb and fingers, but has lost the ability to manipulate them by the usual muscles.

According to the present invention there is provided an artificial hand adapted to be secured to the person's hand, to receive the thumb and one or more fingers after the fashion of a glove and when in use to shift the fingers relative to the thumb so that articles may be gripped between them or released at will. The thumb is held relatively immobile and motive power for actuating the fingers toward and away from the thumb is derived from a reversible electric motor actuating pull cables. Tension on one cable closes the hand and holds it closed. Upon release of closing tension and application of tension on the other cable the hand opens.

In carrying out the present improvements the artificial hand is provided with a back plate adapted to be secured against the back of the hand, a rigid thumb receiving member and an articulated finger receiver. Power is applied to the finger receiver to shift it and the fingers which are carried in it.

Owing to the great differences in size of the hands of different patients, it is not practicable to construct a device for universal use. The present invention contemplates making the thumb and the finger receivers out of heat softenable plastic material so that a custom fitting may be had for each patient.

The accompanying drawings show, for purposes of illustrating the present invention, one embodiment in which the invention may take form, it being understood that the drawings are illustrative of the invention rather than limiting the same.

In the accompanying drawings:

Figure 1 is a perspective view illustrating the artificial hand in use by a wearer who has normal wrist control, also showing the operating accessories;

Figure 2 is a diagrammatic perspective view of a motor operated drive for actuating the hand;

Figure 3 is a side elevational view of the hand showing it in use in grasping a pencil;

Figure 4 is a back view of the hand in use in grasping an electric shaver;

Figure 5 is a front view illustrating the use of the hand to grasp a drinking cup;

Figure 6 is a section on the line 6—6 of Figures 3 and 4;

Figure 7 is a section on the line 7—7 of Figure 3;

Figure 8 is a section on the line 8—8 of Figure 3;

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Figure 9 is an enlarged perspective view showing the cable connections to the articulated finger receiver;

Figure 10 is a section on the line 10—10 of Figure 9;

Figures 11 and 12 are sections on the lines 11—11 and 12—12, respectively, of Figure 3; and

Figure 13 is an elevational view of a form of construction suited for a patient who has lost control of the wrist.

In Figure 1 the artificial hand is designated generally at H, the power unit which actuates the hand at P, the manual control switch at C and the combined transformer and rectifier unit adapted to deliver direct current to the control switch at TR.

The hand attachment includes a metal back plate 10 preferably of a width to cover the portion of the back of the hand which carries the second and third metacarpal bones. It is shaped as indicated at 11 and 12 to extend beyond the knuckles and bent to fit about part of the thumb-forefinger interdigital space, as indicated at 13. The portion 13 carries a thumb piece 14, made of flesh colored, heat softenable sheet plastic. It is shaped as indicated in Figure 11 to fit about the thumb in such a manner as to hold the thumb immobilized. This shaping is done to fit the wearer. A strap 15 secures the parts 10 and 14 in place on the hand.

The bifurcations 11 and 12 of the back plate pivotally support a finger receiver 16 about an axis approximately that of the first joint of the first finger. This receiver is also made of flesh colored, heat softenable, sheet plastic and capable of being fitted to the fingers, usually two.

The finger receiver 16 has extensions 17 and 18 shown outside the bifurcations 11 and 12 of the back plate. The parts 11 and 17 are held together by a rivet 19. The parts 12 and 18 are held together by a rivet 20 which passes through a rockable member here shown as a pulley having two disks 21 and 22, one of which is cut away as indicated at 23, Figure 8, so as to accommodate a cable 29, 29. The two disks 21 and 22 are held together by a screw 24. The two disks are shaped preferably as indicated to form a pulley for the cable 29, 29. The inner disk 21 has an arm 25 secured to the finger member 16 by a rivet indicated at 26. When tension is applied to the upper cable 29 and the lower cable 29 is released, the finger receiver may be swung in a clockwise direction, Figs. 3 and 9, to shift the fingers away from the thumb, and when tension is applied in the other direction, the finger piece is moved to shift the fingers toward the thumb.

The back plate 10 carries two anchorages 30, 30 through which the cables 29, 29 pass. These anchorages are internally threaded to receive the closely wound cable sheaths 31, 31. The other ends of the cable 29, 29 are secured in any convenient manner to traveling nuts 32, 32, see Fig. 2, carried on a screw member 33 having opposite threads as indicated at 34, 35.

The other ends of the cable sheaths 31 are secured to anchorages 36, 36 mounted on the base plate 37 of the operating unit, Fig. 2. The screw 33 is mounted in suitable bearings 38, 38 and driven in one direction or the other by gearing indicated at 39.

Low voltage direct current is delivered by the transformer-rectifier through a three wire connection 41 to the control switch C having two buttons, as indicated. This switch is able to operate the permanent field electric motor 40 in one direction or the other so as to pull on one end or the other end of the cable 29 so that the finger piece may be moved in or out. The stalling torque of the motor may be relied upon to limit the closing pressure so that injury to the hand or damage to objects may be readily avoided. The maximum open position is achieved when the rockable member or pulley is shifted as far as the cable pull is effective. Normally,

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the patient has both the opening and closing operations under close control so that mechanical or electrical limiting need not be relied upon.

The form shown in Figure 13 is the same as that shown in detail above, except that the thumb piece 14' has been extended beyond the wrist so that when it is strapped in position on the forearm, the wrist is held up. Some patients need this additional assistance because they have lost the power to control the wrist.

The power unit, the control switch, which may be manual, or breath controlled, and the transformer-rectifier are diagrammatically indicated herein, so as to show a suitable means for operating and controlling the artificial hand. They form no part of the invention intended to be covered by the present application.

Since it is obvious that the invention may be embodied in other forms and constructions within the scope of the claim, I wish it to be understood that the particular form shown is but one of these forms and, various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

An artificial hand for use by a person having a hand with thumb and fingers and comprising a rigid metallic body member adjusted to fit about the back of the hand, a pair of spaced bearing forming portions extending beyond the knuckles at the forward end of said body member, a rigid thumb receiving portion of heat

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softenable plastic material carried by the body member, means for securing the body member to the hand, a rigid hinged member of heat softenable plastic material secured to said bearing forming portions for movement about an axis substantially parallel to the knuckle axis and adapted to accept the outer end of at least one finger with the finger tip protruding so that when the hinged member is moved inwardly it brings the tip of the inserted finger against the thumb, a rocker member carried by said hinged member, a pair of cable sheath anchors on said body member adjacent said rocker member, a pair of cables extending through said sheath to said rocker member whereby actuation of one of said cables will draw said hinged members towards said thumb portion and actuation of the other of said cables will move said hinged portions away from said thumb portion.

References Cited in the file of this patent

UNITED STATES PATENTS

39,578 Kimball _____ Aug. 18, 1863
2,553,277 Robinson et al. _____ May 15, 1951

OTHER REFERENCES

Brennan: "Plastic Appliances Moulded Direct to Patient," The Lancet, April 23, 1955, pp. 841-844. 128-290.