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3 Sheets-Sheet 1

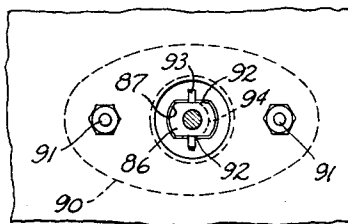


Fig. 3.

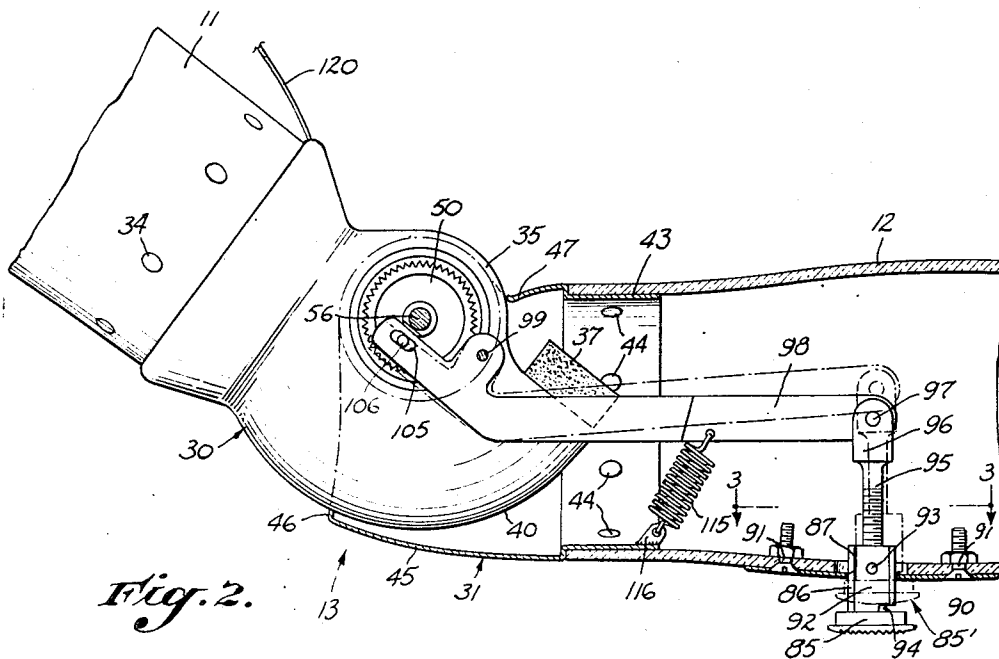


Fig. 2.

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May 22, 1951

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2,553,830

ELBOW AND LOCK MECHANISM FOR ARTIFICIAL ARMS

Filed May 7, 1949

3 Sheets-Sheet 2

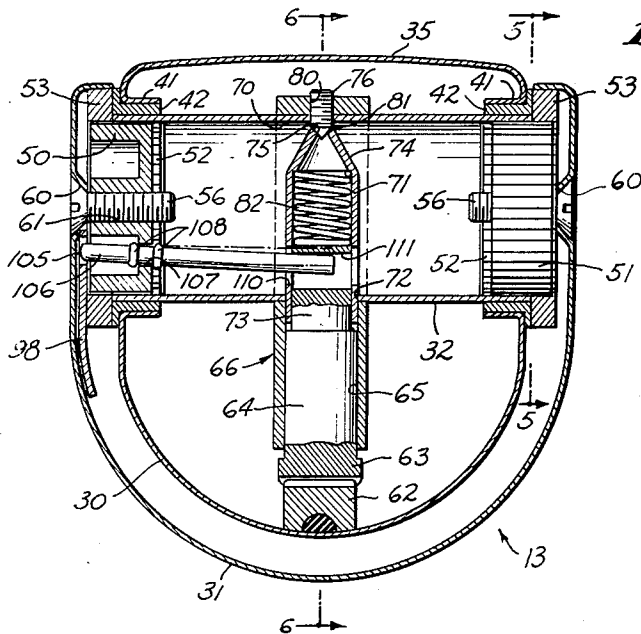


Fig. 5.

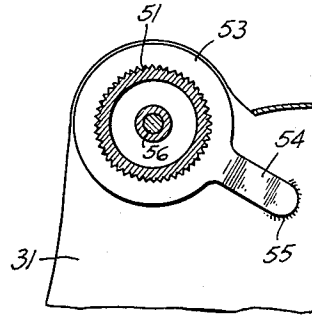
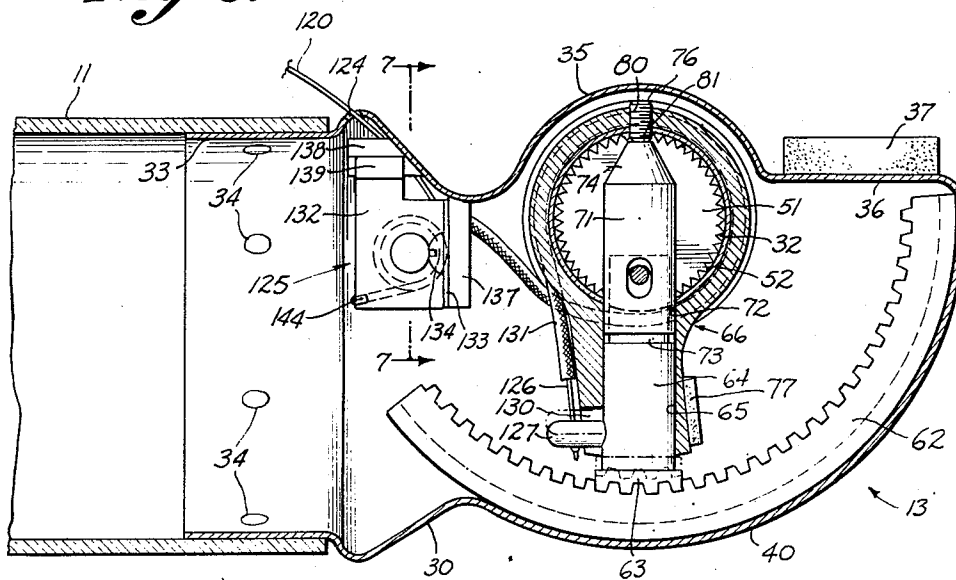


Fig. 6.



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ELBOW AND LOCK MECHANISM FOR ARTIFICIAL ARMS

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3 Sheets-Sheet 3

Fig. 7.

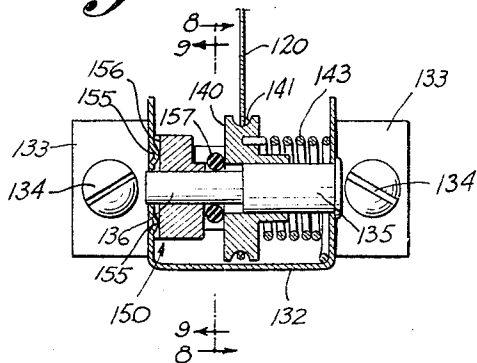


Fig. 8.

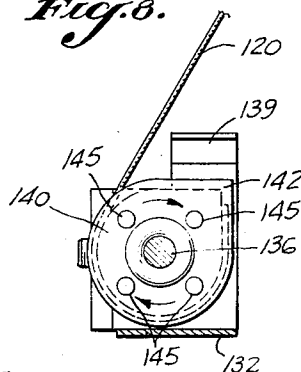


Fig. 9.

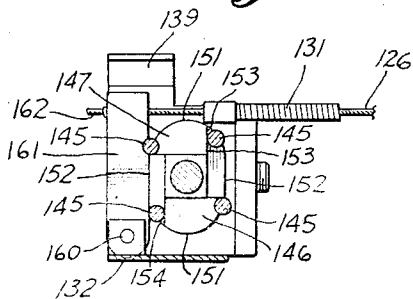


Fig. 10.

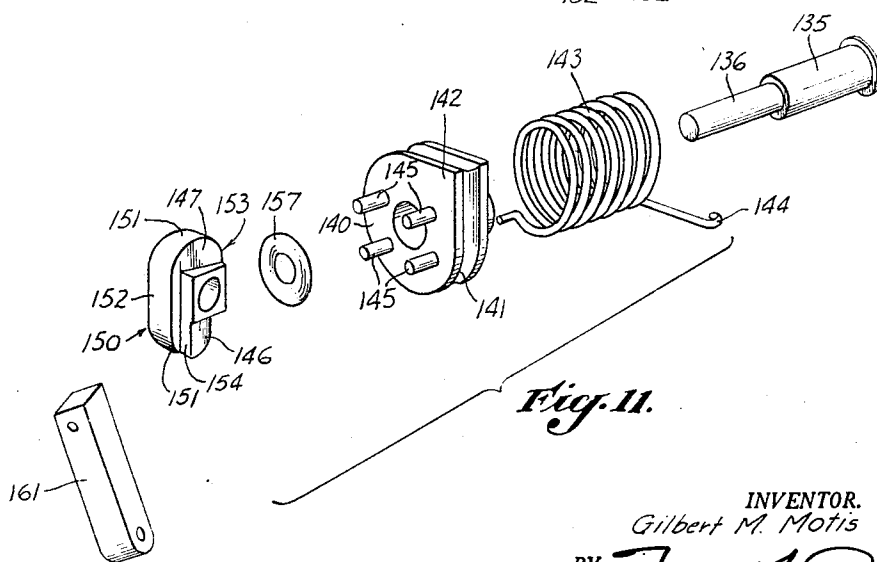
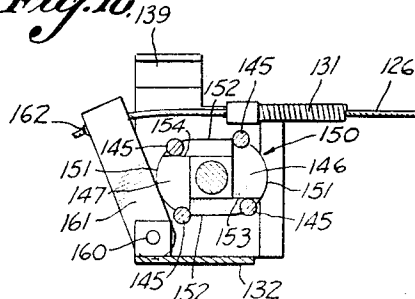


Fig. 11.

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UNITED STATES PATENT OFFICE

2,553,830

ELBOW AND LOCK MECHANISM FOR
ARTIFICIAL ARMS

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Application May 7, 1949, Serial No. 91,902

12 Claims. (Cl. 3—12)

1

The present invention relates generally to artificial arms, and its primary object is to provide a new and improved arm that is inexpensive, strong, light in weight, and natural in appearance. A more specific object of the invention is to provide an elbow joint of novel construction, embodying a multi-position lock that can be operated by either a shoulder shrug or by pressing a button on the underside of the forearm. This arrangement gives the amputee a choice of operating means, and enables him to lock or unlock the elbow by whichever of the operating means is more convenient to use at the time. Another advantage of this feature is that the forearm button can be used to override the shoulder control in maintaining the elbow in the unlocked condition, so that the elbow will not be locked inadvertently by an unintentional tug on the shoulder harness of the lock control when the arm is swinging, as while walking or driving.

Another important object of the invention is to provide an elbow lock having a minimum number of parts, and in which there are no critical dimensional tolerances. The elimination of critical tolerances is particularly important, as it makes possible the use of sheet metal shell construction in the upper and lower elbow housings, which provides great strength with the minimum weight. One of the chief problems heretofore blocking the use of sheet metal shell construction for the elbow housings has been the relatively wide range of dimensional variation obtained in the finished housings, which are usually made up of two or more stampings that are welded together. This excessive variation in housing dimensions cannot be tolerated in the conventional elbow lock, where certain of the dimensional tolerances are relatively critical, but provides no particular problem in the case of the present elbow lock, which is designed to accommodate itself to the dimensional variations of the sheet metal housings. It is a further object of the present invention, therefore, to provide an elbow lock particularly adapted for use in an elbow joint wherein the upper and lower housings are of sheet metal shell construction.

Other advantageous features of the invention resulting from the use of sheet metal shell housings are: (1) the locking mechanism is fully enclosed within the elbow housings, giving a smooth exterior which will not catch on clothing; (2) large area bumpers of soft rubber can be used to limit the travel of the lower arm in both directions, giving a quiet, more resilient

2

bumper action; and (3) large diameter bearings can be used on the elbow hinge pivot.

Another advantage of the present invention is that ample clothing clearance is obtained at the inside of the elbow, even when the arm is fully flexed; and such clearance is obtained without the use of cut-outs in the forearm portion, which seriously weaken the arm. This is accomplished by moving the elbow hinge axis forwardly to a point closely adjacent the front side of the arm, and flattening the arm cross section where it joins the elbow housings to a substantially elliptical cross section.

The foregoing and other objects and advantages of the present invention will become apparent to those skilled in the art upon consideration of the following detailed description of the preferred embodiment thereof, reference being had to the accompanying drawings, wherein:

Figure 1 is a perspective view of an artificial arm embodying the principles of my invention;

Figure 2 is an enlarged, partially cutaway view of the elbow joint, showing certain details of the forearm lock control;

Figure 3 is a sectional view through the forearm lock control button, taken at 3—3 in Figure 2;

Figure 4 is a transverse section through the elbow at the axis of the hinge pivot;

Figure 5 is a fragmentary view of a detail, taken at the section line 5—5 in Figure 4;

Figure 6 is a sectional view through the elbow, taken at 6—6 in Figure 4;

Figure 7 is a sectional view through the alternator device, taken at 7—7 in Figure 6;

Figure 8 is a sectional view through the same, taken at 8—8 in Figure 7;

Figure 9 is another sectional view taken at 9—9 in Figure 7, showing the alternator in the elbow locking position;

Figure 10 is a view similar to Figure 9, but showing the alternator device in the unlocking position; and

Figure 11 is an exploded perspective view of the parts in the alternator device.

In the drawings, the arm is designated in its entirety by the reference numeral 10 and is seen to comprise an upper arm portion 11 and a lower arm portion 12, which are connected together for relative swinging movement by an elbow 13. Mounted on the distal end of the lower arm portion 12 is a normally closed hook 14 which is opened by a Bowden cable control wire 15. The control wire 15 passes through a length of spring-wound conduit 16 which is attached by a leather

loop 17 to the forearm portion 12 adjacent the elbow. Further up on the arm, the wire 15 passes through another length of spring-wound conduit 20 which is attached to the upper arm portion 11 by a detachable anchor fitting 21. Fixed to the upper end of control wire 15 is a yoke 22 to which a leather strap 23 is attached, said strap being adapted to be secured to the usual shoulder harness so that a forward movement of the shoulder produces a pull on the control wire 15 which may either open the hook 14 or raise the forearm 12. If the elbow is locked, the pull on the control wire opens the hook against the tension of a rubber band 24; whereas, if the elbow is unlocked, a pull on the control wire will lift the forearm unless the force required to lift the forearm exceeds the force required to open the hook.

Both the upper arm portion 11 and lower arm portion 12 are preferably, although not necessarily, formed of plastic shell construction, built up by laminating fabric such as cotton stockinet over suitable plaster forms, impregnating the fabric with a liquid resin, and then curing the resin in an oven. The upper arm portion 11 is the stump socket and is therefore shaped to provide a snug fit over the stump. D-rings 24 are attached by straps 25 to the inner and outer sides of the upper arm portion 11, and straps of the harness pass through the D-rings to hold the arm 10 on the stump.

The elbow 13 is comprised of an upper elbow housing 30 and a lower elbow housing 31, which are connected together for relative swinging movement by a transversely extending tubular shaft 32. Each of the housings 30, 31 is preferably formed of sheet metal stampings which are welded together to form hollow shells. The upper housing 30 is provided with an end flange 33 of elliptical shape which is inserted into the elliptically curved end of the upper arm shell 11 and secured thereto by rivets or screws 34. The end of the arm shell 11 is formed so that when the arm is hanging down at the side, the major axis of the ellipse is turned inwardly at an angle of about 15° to the transverse body plane, whereby the plane of movement of the forearm is inclined inwardly across the front of the body, at an angle approximating the plane of movement of the natural arm. The tubular pivot shaft 32 extends through the upper elbow housing 30 parallel to the major axis of the ellipse but spaced forwardly therefrom, so that the axis of the shaft is closely adjacent the front side of the elbow.

The front side of the upper elbow housing 30 is formed with a generally cylindrically curved portion 35 of relatively small radius which is concentric with the pivot shaft 32, and projecting outwardly from the side of the curved portion 35 opposite the flange 33 is a flat shelf portion 36, to which is cemented a sponge rubber "down" bumper 37 of relatively large area. The back side of the housing 30 has the configuration of a portion of an oblate spheroid, the axis of revolution of which is the axis of shaft 32. Thus, the circularly curved portion 40 (Figure 6) of the housing 30 is also concentric with the shaft 32, but of considerably larger radius than the curved portion 35. The flattened sides of the housing 30 have inwardly flanged holes 41 formed therein, into which bushings 42 are inserted and soldered, and the ends of the tubular shaft 32 are journaled in these bushings.

The lower elbow housing 31 is likewise provided with an end flange 43 of elliptical shape which

is inserted into the proximal end of the forearm shell 12 and secured thereto by rivets or screws 44. As in the case of the upper arm 11, the ellipse of the forearm shell 12 is also disposed with its major axis parallel to the axis of the tubular shaft 32. The portion of the housing 31 projecting beyond the end of the forearm shell 12 forms a saddle 45 which surrounds the back side of the upper elbow housing 30 and fits closely over the flattened sides of the latter. An inwardly turned lip 46 closes the clearances between the lower elbow housing 31 and the back side of the upper elbow housing 30, while another lip 47 extends in toward the curved surface 35 on the front side of the upper elbow housing to close the gap between them.

The tubular pivot shaft 32 is non-rotatably secured to the lower elbow housing 31 by means of two serrated plugs 50 and 51 which fit into the ends of the shaft. The serrations on the outer peripheries of the plugs 50, 51 engage companionate serrations 52 on the inside of the shaft 32 at the extreme ends thereof, and the ends of the plugs project beyond the ends of the shaft 32 and are received within internally serrated rings 53 which are soldered or welded to the inside surfaces of the lower elbow housing 31 at opposite sides thereof. Each of the rings 53 has a radially outwardly extending tongue 54 which is welded at 55 to the lower elbow housing 31, so that the rings 53 are strongly held thereby against rotation with respect to the housing.

The serrated plugs 50, 51 are slidable axially between the position shown in Figure 4, wherein both the rings 53 and internal serrations 52 on the ends of the tubular shaft 32 are engaged by the serrated plugs, to another position wherein the plugs are shifted inwardly so that they are completely enclosed within the ends of the tubular shaft, thereby releasing the lower elbow housing 31. The serrated parts 50, 51 are pulled outwardly by screws 56 which extend through indented holes 60 in the side of the housing 31, and are threaded into tapped holes 61 in the center of the plug.

The elbow lock mechanism is comprised of two cooperative locking members, preferably in the form of an arcuate sector gear 62 which is welded or otherwise suitably fixed to the inside of the upper elbow housing 30 concentric with the pivot shaft 32, and a swingable plunger gear 63 which is mounted on the tubular shaft 32 for rotation therewith. The plunger gear 63 has a cylindrical shank portion 64 which is slidably received within a bore 65 in a plunger gear housing 66, said housing having a transversely extending circular aperture 70 formed therein, through which the shaft 32 projects. The housing 66 is secured against rotation relative to the shaft 32 by means of a tubular key 71 which is disposed within the shaft 32 and projects downwardly through an opening 72 into the bore 65 of housing 66. The shank of the plunger gear 63 has a reduced-diameter portion 73 which extends up into the tubular key 71 and is slidable therein.

The tubular key 71 terminates at its top end in a tapered nose 74 having an opening 75 formed in its extremity. A set screw 76 which is threaded into a tapped hole 80 in the top of housing 66 and passes downwardly through another hole 81 in the shaft 32 engages the opening 75 in the end of the tubular key to hold the upper end of the latter in place. The housing 66 is thus attached to the top of the tubular shaft

32 by the set screw 76, and to the bottom of the shaft by the tubular key 71, thereby locking the housing solidly to the shaft so as to rotate therewith. An "up" bumper 77 of sponge rubber is cemented to the front side of the housing 66 and is engageable with the underside of the shelf 36 to limit the flexion movement of the forearm.

A compression coil spring 82 within the tubular key 71 bears downwardly against the top end of the shank of plunger gear 63, pressing the latter down into engagement with the sector gear 62 to lock the elbow. The plunger gear 63 may be lifted out of engagement with the sector gear 62 to unlock the elbow by means of either a forearm lock control or a shoulder lock control, both of which will now be described.

The forearm lock control is operated by a push button 85 projecting downwardly from the underside of the forearm shell 12. The button 85 is mounted on the outer end of a short length of rod 86 which extends through a hole 87 in a plate 90 that is secured by screws 91 to the outside of the arm shell. The opposite sides of the rod 86 are flattened at 92, as best shown in Figure 3, and the edges of the hole 87 in plate 90 are correspondingly shaped so as to prevent the push button from turning. A pin 93 extends transversely through the rod 86 and projects outwardly from both of the flat sides 92; said pin engaging the inside surface of the plate 90 to limit the outward movement of the push button. A notch 94 is also provided in the forward side of the rod 86 directly beneath the button 85, and this notch is engageable over the lip of the hole 87 to hold the push button in the depressed position, as shown at 95' in Figure 2.

A tapped hole extends lengthwise into the rod 86 from the inner end thereof, and threaded into this hole is a screw fitting 95 having a yoke 96 at the top end thereof which is connected by a pin 97 to one end of a lever 98. The lever 98 extends toward the elbow 13 and passes between the sheet metal side wall of the housing 31 and the serrated ring 53 at the left hand end of the elbow, as viewed in Figure 4. Lever 98 is pivoted for swinging movement about a pin 99 which extends through aligned holes in the housing 31 and ring 53 a short distance outwardly beyond the axis of shaft 32, and the rear end of the lever is bent upwardly and projects beyond the pin 99 to a point below the axis of the shaft. Formed in this rearward extension of the lever 98 parallel to the sides thereof is an elongated slot 105 which receives the outer end of a fulcrummed lever 106.

The lever 106 extends into the tubular shaft 32 through an off-centered hole 107 in the inner end wall of the serrated plug 50, and has circumferential beads 108 formed thereon at either side of the hole 107, whereby the lever is constrained against axial movement with respect to the plug. The inner end of the lever 106 extends through a longitudinally extending slot 110 in the tubular key 71 and into a hole 111 in the shank portion 73 of the plunger gear 63. The slot 110 permits the inner end of the lever 106 to be raised from the position shown in solid line in Figure 4 to the position shown in phantom line, thereby lifting the plunger gear 63 out of engagement with the sector gear 62.

Normally, the plunger gear 63 is urged outwardly into engagement with the sector gear 62 by spring 82, and the lock control push button 85 is pressed outwardly by a spring 115 which is anchored at one end to a tab 116 on the flange 43,

and is attached at its other end to the lever 98. To release the elbow lock, the push button 85 is pushed inwardly until the notch 94 catches onto the plate 90. This raises the right hand end (Figure 2) of the lever 98 about the pivot pin 99, and causes the left hand end of the lever to swing downwardly, pulling the outer end of the lever 106 down with it. Since the lever 106 is fulcrummed intermediate its ends on the serrated plug 50, the inner end of the lever is thus raised, lifting the plunger gear 63 out of engagement with the sector gear 62, and thereby releasing the elbow lock so that the forearm member is free to swing relative to the upper arm.

Shoulder control of the elbow lock is obtained by exerting successive pulls on a flexible control wire 120, the upper end of which is attached to an over-travel spring 121 which is connected, in turn, to a strap 122. The strap 122 is adapted to be attached to the usual shoulder harness so that a shrug of the shoulder produces a pull on the wire 120. The over-travel spring 121 is designed to transmit the tension required to operate the elbow lock without stretching, but to yield whenever an excessive force is applied, and thereby protects the relatively light control wire 120 from being broken.

The lower end of the control wire 120 enters the upper elbow housing 30 through a small hole 124 and is operatively connected to a shoulder control lock alternator 125 which is operatively connected, in turn, by a coupling cable 126 to a pin 127 projecting laterally from the shank portion 64 of the plunger gear. The pin 127 extends laterally outward through a slot 130 in the housing 66, and is slidable therein so that the plunger gear is permitted a limited amount of axial movement but is constrained against rotation with respect to the housing. The cable 126 extends through and is slidable within a spring-wound flexible conduit 131 which is wrapped loosely around the tubular shaft 32 and is attached at its opposite ends to the housing 66 and bracket 132 of the alternator 125, respectively. The bracket 132 is provided on opposite sides thereof with outwardly turned mounting flanges 133 which are secured by screws 134 to ears 137 projecting downwardly from the inside surface of the housing shell, as seen in Figure 6. The bracket 132 is U-shaped, and extending transversely between the side portions thereof is a shaft 135 having a reduced-diameter portion 136.

Journalled on the shaft 135 and slidable axially thereon is a sheave wheel 140 having a circumferential groove 141 on its periphery, in which the control wire 120 is laid. The sheave wheel 140 is provided with an angular corner portion 142 which is engageable with the bottom of the bracket 132 to limit the clockwise (Figure 8) rotation of the wheel to approximately 90° from the position shown. The control wire 120 is guided into the groove 141 of the sheave wheel by a composition fiber block 138 which is held between upstanding ears 139 on bracket 132, and is wrapped around the wheel and attached thereto in any suitable manner. A torsion spring 143 encircles the shaft 135 between the sheave wheel 140 and the right hand side member (Figure 7) of the bracket 132; one end of said spring being bent parallel to the axis of the coils and inserted into a hole in the adjacent side of the sheave wheel, and the other end thereof extending tangentially to the coils and having a hook 144 provided thereon which is hooked over one edge of the adjacent bracket side.

Projecting axially from the other side of the sheave wheel 140 are four pins 145 which are spaced equi-distantly from the axis of rotation, and which are also spaced apart 90° from one another. The ends of pins 145 are engageable with two inclined ramp surfaces 146 and 147 on the adjacent end of a cam member 150 which is journaled on the reduced-diameter portion 136 of the shaft 135. The cam member 150 is generally elliptical in shape, with two diametrically opposite high portions 151 on its periphery, separated by two low portions 152. The inclined ramps 146, 147 terminate in shoulders 153 and 154, respectively, which are engageable by two of the pins 145 when the sheave wheel 140 is turned in the counterclockwise direction, as viewed in Figure 10. With the pins 145 thus abutting against the shoulders 153, 154, the cam member 150 is turned with the sheave wheel 140 for 90° of rotation. As the pull on control wire 120 is relaxed, the torsion spring 143 returns the sheave wheel 140 to its initial position, during which time the pins 145 ride up on the inclined ramps 146, 147 until they pass the shoulders 153, 154 and drop down behind the latter in position to drive the cam member 150 again the next time that the sheave wheel 140 is rotated by a pull on control wire 120. The frictional drag of the pins 145 over the inclined ramps 146, 147 creates a tendency on the part of the cam member 150 to turn with the sheave wheel 140, and this tendency is resisted by a pair of dimples 155 (Figure 7) in the side wall of the bracket 132 which are engageable in a longitudinally extending groove 156 in the side of the cam member. When the groove 156 is thus seated on the dimples 155, the cam member is yieldingly restrained against turning with the sheave wheel, but when sufficient turning force is applied to the cam member, the latter can be forced to override the dimples 155. A soft rubber O-ring 157 encircles the reduced-diameter portion 136 of the shaft between the cam member 150 and sheave wheel 140, and serves to cushion the impact of the latter as it drops against the cam member under the pressure of spring 143. The axial movement of sheave wheel 140 to accommodate the climbing movement of the pins up the inclined ramp is allowed by the free-sliding support of the sheave wheel on the shaft 135.

Pivotaly mounted on a pin 160 adjacent the periphery of the cam member 150 is a lever arm 161, the top end of which is connected at 162 to the coupling cable 126. The lever arm 161 is swingable in the plane of rotation of the cam member 150, and is movable between the two positions shown in Figures 9 and 10. The lever arm takes the position shown in Figure 9 when it is engaged by one of the low portions 152 of the cam and is moved over to the position shown in Figure 10 when engaged by one of the high portions 151. Since the other end of the coupling cable 126 is connected to pin 127 on the plunger gear 63, it will be seen that a pull on cable 126 acts to lift the plunger gear out of engagement with the sector gear 62. Thus, when the lever arm 161 is swung over to the position shown in Figure 10, the plunger gear is lifted out of engagement with the sector gear to unlock the elbow. When the lever arm 161 is restored to the position shown in Figure 9, the plunger gear is permitted to move back down into engagement with the sector gear under the urging of spring 82.

From the foregoing description, it will be seen

that each time that a pull is exerted on the control wire 120 by a shoulder shrug, the sheave wheel 140 is turned a quarter turn against the torsional resistance of spring 143, causing the pins 145 to drive the cam member 150 through a quarter turn. When the tension is relaxed on the control wire 120, the sheave wheel 140 is restored by spring 143 to its initial position, in readiness to engage the cam 150 and drive the same through another quarter turn the next time that tension is applied to the control wire by another shoulder shrug. Since each shoulder shrug produces a quarter turn of the cam member 150 it will be seen that the lever arm 161 is engaged first by the high portions 151 of the cam and then by the lower portions 152 thereof, alternately locking and unlocking the elbow.

The method of operation is believed to be self-evident from the foregoing description. Whenever the amputee wishes to lock or unlock the elbow, he has the choice of using either the shoulder lock control or the forearm lock control, depending upon which is the more convenient to use at the moment. Whenever the amputee wishes to maintain the elbow in the unlocked condition, so that the arm will swing freely in a natural manner while walking, and to prevent inadvertent locking due to an unintentional pull on the control wire 120, he can override the shoulder lock control by pressing the forearm button 85 inwardly and catching the notch 94 on the plate 90. The plunger gear 63 is then lifted and held out of engagement with the sector gear 62, and the plunger gear is therefore unaffected by tension in the coupling cable 126.

While I have shown and described in considerable detail what I believe to be the preferred form of my invention, it is to be understood that such details are not restrictive and that various changes may be made in the shape and arrangement of the several parts thereof without departing from the broad scope of the invention, as defined in the appended claims.

I claim:

1. In an artificial arm having upper and lower arm portions connected together at the elbow for relative swinging movement, an elbow lock comprising a stationary arcuate sector gear fixed to said upper arm portion concentric with the pivot axis of said elbow, a swingable gear member attached to said lower arm portion for movement therewith, said swingable gear member being movable radially with respect to said pivot axis between a locked position in engagement with said sector gear and an unlocked position, an operating button on said lower arm portion connected with said swingable gear member for shifting the same from one of said positions to the other, harness-connected means for shifting said swingable gear member from one of said positions to the other responsive to a shoulder shrug, and means for securing said operating button in the elbow-unlocked position, whereby said harness-connected means is prevented from inadvertently locking the elbow by an unintentional tug on the shoulder harness.

2. In an artificial arm having upper and lower arm portions connected together at the elbow for relative swinging movement, an elbow lock comprising a stationary arcuate sector gear fixed to said upper arm portion concentric with the pivot axis of said elbow, a swingable gear member attached to said lower arm portion for movement therewith, said swingable gear member being

movable radially with respect to said pivot axis between a locked position in engagement with said sector gear and an unlocked position, an alternator device connected to said swingable gear member and operable to shift the same alternately to one and then the other of said positions upon successive operations thereof, and means for operating said alternator device by a shoulder shrug.

3. In an artificial arm having upper and lower arm portions connected together at the elbow for relative swinging movement, an elbow lock comprising a stationary arcuate sector gear fixed to said upper arm portion concentric with the pivot axis of said elbow, a swingable gear member attached to said lower arm portion for movement therewith, said swingable gear member being movable radially with respect to said pivot axis between a locked position in engagement with said sector gear and an unlocked position, an operating button projecting from said lower arm portion, and linkage means connecting said button with said swingable gear member, whereby the latter is shifted to said unlocked position when the button is pressed inwardly, and is shifted to said locked position when said button is moved out to its extended position.

4. In an artificial arm having upper and lower arm portions connected together at the elbow for relative swinging movement, an elbow lock comprising a stationary member fixed to said upper arm portion adjacent the pivot axis of said elbow, a swingable member attached to said lower arm portion to cooperate with said stationary member, one of said members being movable between a locked position in engagement with the other member and an unlocked position, an alternator device comprising a lever arm pivoted for swinging movement, means connecting said lever arm to said one member for shifting the latter between said locked and unlocked positions when the lever arm is rocked between two positions, a rotatable cam member engageable with said lever arm to move the same from one of said positions to the other as the cam member is progressively advanced by equal angular increments, and means connected to a shoulder harness for advancing said rotatable cam member by a shoulder shrug.

5. In an artificial arm having upper and lower arm portions connected together at the elbow for relative swinging movement, an elbow lock comprising a stationary member fixed to said upper arm portion adjacent the pivot axis of said elbow, a swingable member attached to said lower arm portion to cooperate with said stationary member, one of said members being movable between a locked position in engagement with the other member and an unlocked position, an alternator device comprising a lever arm pivoted on said upper arm portion for swinging movement, means connecting said lever arm to said one member for shifting the latter between said locked and unlocked positions when the lever arm is rocked, a rotatable cam member engageable with said lever arm to rock the same, a pulley arranged coaxial with said cam member and having a shoulder harness connection whereby the pulley is rotated in one direction responsive to a shoulder shrug, means on said pulley engageable with said cam member to turn the latter in said one direction of rotation to advance the cam member by a predetermined angular increment, and a torsion spring connected with

said pulley to return the same to its initial position when the shoulder is relaxed.

6. In an artificial arm having upper and lower arm portions, a transversely disposed tubular shaft fixed to said lower arm portion and journaled for rotation with respect to said upper arm portion, a sector gear fixed to said upper arm portion concentric with said shaft, a plunger gear slidably supported on said shaft for movement in the radial direction, a spring urging said plunger gear into engagement with said sector gear, a fulcrumed lever extending into said tubular shaft from one end thereof and engaging said plunger gear, and means engaging the outer end of said lever for rocking the same on its fulcrum to lift said plunger gear out of engagement with said sector gear.

7. In an artificial arm having upper and lower arm portions, a transversely disposed tubular shaft fixed to said lower arm portion and journaled for rotation with respect to said upper arm portion, a sector gear fixed to said upper arm portion concentric with said shaft, a plunger gear slidably supported on said shaft for movement in the radial direction, a spring urging said plunger gear into engagement with said sector gear, a fulcrumed lever extending into said tubular shaft from one end thereof and engaging said plunger gear, a lock control push button projecting from said lower arm portion, and a lever arm pivoted on said lower arm portion adjacent said shaft, one end of said lever arm being connected to said push button and the other end thereof being connected to said fulcrumed lever, whereby the latter is rocked on its fulcrum to lift said plunger gear out of engagement with said sector gear when said push button is depressed.

8. In an artificial arm having upper and lower arm portions, an upper elbow housing fixed to said upper arm portion, a lower elbow housing fixed to said lower arm portion, a transversely disposed tubular shaft journaled in said upper elbow housing and fixedly attached to said lower elbow housing to rotate therewith, a sector gear fixed to said upper elbow housing concentric with said shaft, a plunger gear housing non-rotatably mounted on said shaft, a plunger gear slidably disposed within said plunger gear housing for movement in the radial direction, a spring urging said plunger gear into engagement with said sector gear, a fulcrumed lever extending into said tubular shaft from one end thereof and engaging said plunger gear, a lock control push button projecting from said lower arm portion, a lever arm pivoted on the inside of said lower elbow housing adjacent said shaft, one end of said lever arm being connected to said push button and the other end thereof being connected to said fulcrumed lever, whereby the latter is rocked on its fulcrum to lift said plunger gear out of engagement with said sector gear when said push button is depressed, harness-connected means for lifting said plunger gear out of engagement with said sector gear responsive to a shoulder shrug, and a catch for securing said push button in the elbow-unlocked position, whereby said harness-connected means is prevented from inadvertently locking the elbow by an unintentional tug on the shoulder harness.

9. In an artificial arm having upper and lower arm portions, an upper elbow housing fixed to said upper arm portion, a lower elbow housing fixed to said lower arm portion, a transversely disposed shaft journaled in said upper elbow housing and fixedly attached to said lower elbow

11

housing to rotate therewith, a sector gear fixed to said upper elbow housing concentric with said shaft, a plunger gear housing non-rotatably mounted on said shaft, a plunger gear slidably disposed within said plunger gear housing for movement in the radial direction, a spring urging said plunger gear into engagement with said sector gear, a pin projecting laterally from said plunger gear, a tension-transmitting control wire attached at one end to said pin, and means connected to the other end of said control wire for exerting a pull thereon responsive to a shoulder shrug, whereby said plunger gear is lifted out of engagement with said sector gear.

10. In an artificial arm having upper and lower arm portions, an upper elbow housing fixed to said upper arm portion, a lower elbow housing fixed to said lower arm portion, a transversely disposed shaft journaled in said upper elbow housing and fixedly attached to said lower elbow housing to rotate therewith, a sector gear fixed to said upper elbow housing concentric with said shaft, a plunger gear housing non-rotatably mounted on said shaft, a plunger gear slidably disposed within said plunger gear housing for movement in the radial direction, a spring urging said plunger gear into engagement with said sector gear, a pin projecting laterally from said plunger gear and sliding within a slot in said plunger gear housing, a tension-transmitting control wire attached at one end to said pin, and a shoulder-controlled alternator device mounted on said upper elbow housing and operatively connected to the other end of said control wire, whereby said plunger gear is lifted and held out of engagement with said sector gear by a shoulder shrug, and then released and lowered into engagement with said sector gear by the next succeeding shoulder shrug.

11. In an artificial arm having upper and lower arm portions, an upper elbow housing fixed to said upper arm portion, a lower elbow housing fixed to said lower arm portion, a transversely disposed tubular shaft journaled in said upper elbow housing and fixedly attached to said lower elbow housing to rotate therewith, a sector gear fixed to said upper elbow housing concentric with said shaft, a plunger gear housing non-rotatably mounted on said shaft, a plunger gear slidably disposed within said plunger gear housing for movement in the radial direction, a spring urging said plunger gear into engagement with said sector gear, a fulcrumed lever extending into said tubular shaft from one end thereof and engaging said plunger gear, a lock control push button projecting from said lower arm portion, a lever arm pivoted on the inside of said lower elbow housing adjacent said shaft, one end of said lever arm being connected to said push button and the other end thereof being connected to said fulcrumed lever, whereby the latter is rocked on its fulcrum to lift said plunger gear out of engagement with said sector gear when said push button is depressed, a pin projecting laterally from said plunger gear, a tension-transmitting control wire attached at one end to said

12

pin, a shoulder-controlled alternator device mounted on said upper elbow housing and operatively connected to the other end of said control wire, whereby said plunger gear is lifted and held out of engagement with said sector gear by a shoulder shrug, and then released and lowered into engagement with said sector gear by the next succeeding shoulder shrug, and a catch for securing said push button in the elbow-unlocked position, whereby said shoulder-controlled alternator device is prevented from inadvertently locking the elbow by an unintentional shoulder shrug.

12. In an artificial arm having upper and lower arm portions, an elbow joint comprising a hollow sheet metal upper elbow housing attached to said upper arm portion, a hollow sheet metal lower elbow housing attached to said lower arm portion and enclosing the outer end of said upper elbow housing, a tubular shaft extending transversely through said upper elbow housing and journaled for rotation therein, means for non-rotatably connecting said lower elbow housing to the ends of said shaft, an arcuate locking member fixed to the inside surface of said upper elbow housing concentric with said shaft, another locking member extending diametrically through said tubular shaft and movable radially with respect thereto between positions of engagement and disengagement with said arcuate member, operating means disposed within said tubular shaft and projecting from one end thereof, said operating means being engageable with said other locking member closely adjacent the axis of the tubular shaft for shifting said other locking member between engaged and disengaged positions, and control means connected to the projecting end of said operating means for actuating the same.

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