Sept. 20, 1966 A. H. TAYLOR ET AL 3,273,169

REMOTE ALTERNATOR FOR SELECTIVE ACTUATION OF PROSTHETIC LIMBS AND SURGICAL APPLIANCES

Filed Aug. 6, 1963 3 Sheets-Sheet 1

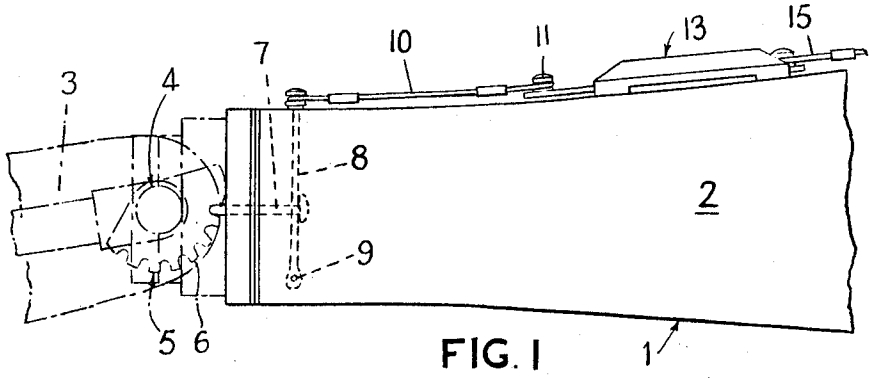


FIG. 1

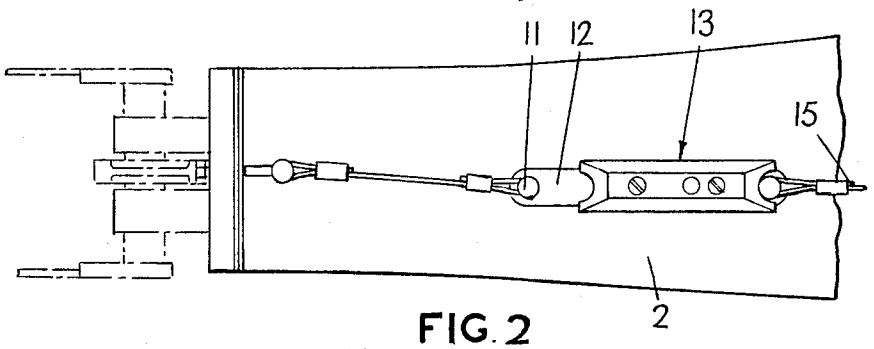


FIG. 2

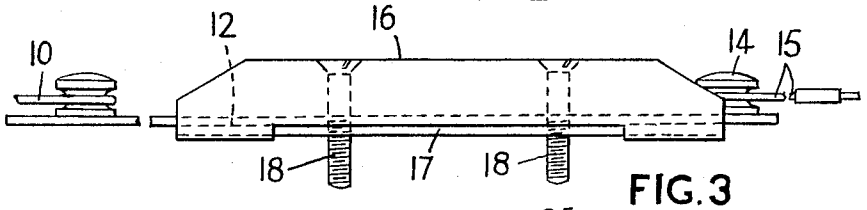


FIG. 3

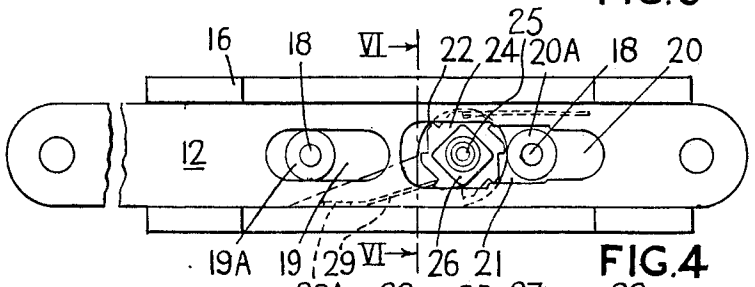


FIG. 4

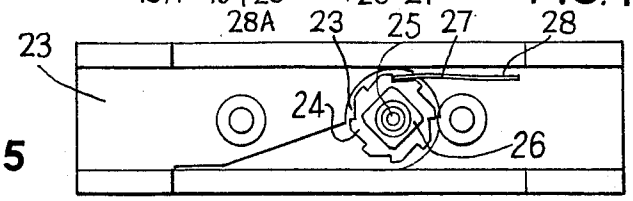


FIG. 5

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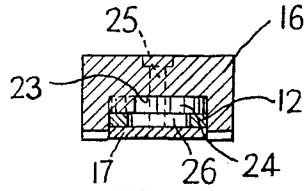


FIG.6

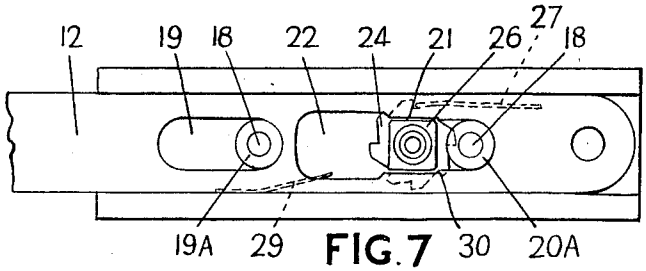


FIG.7

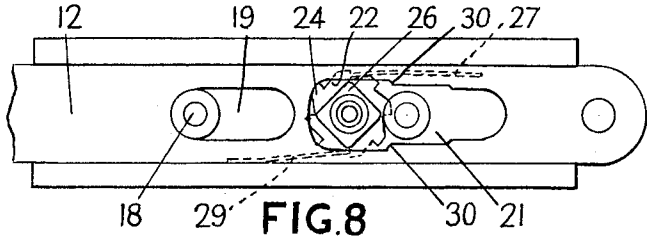


FIG.8

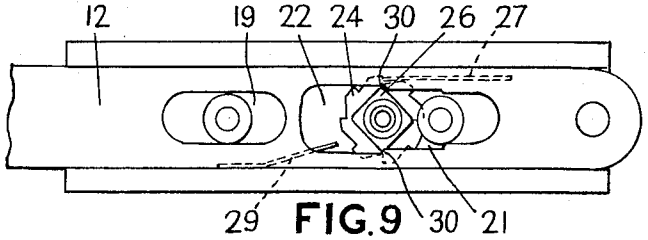


FIG.9

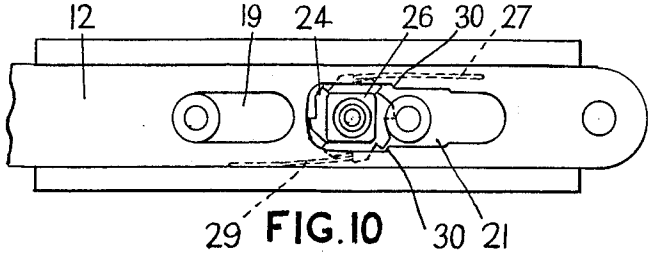


FIG.10

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Fig. 11

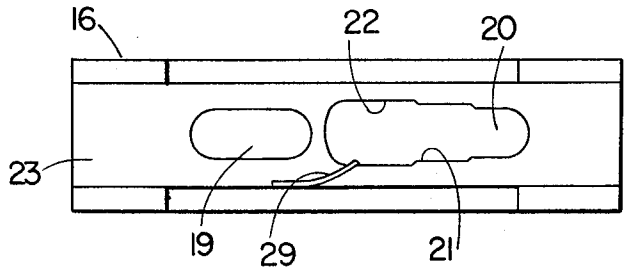


Fig. 12

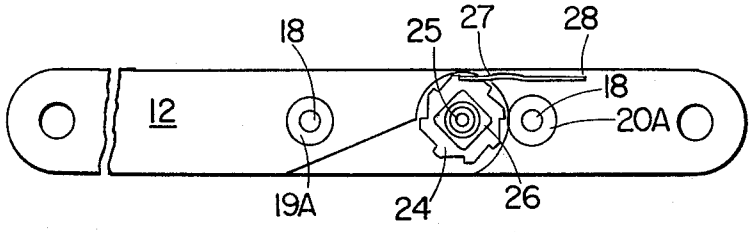
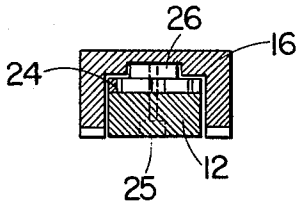


Fig. 13



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Patented Sept. 20, 1966

3,273,169

REMOTE ALTERNATOR FOR SELECTIVE ACTUATION OF PROSTHETIC LIMBS AND SURGICAL APPLIANCES

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Claims priority, application Great Britain, Aug. 9, 1962, 30,597/62
10 Claims. (Cl. 3—12.3)

This invention relates to a mechanism for actuation of alternate functions at locations remote from the mechanism, and more particularly to an alternating mechanism for use with artificial limbs and surgical appliances whereby alternate locking and unlocking operations may be actuated from a remote location.

Although the mechanism of the invention is of general application, it will be described herein with reference to an artificial arm elbow mechanism, by way of example. In a known artificial elbow mechanism the forearm is angularly adjustable with respect to the upper arm and is lockable in any one of a number of angularly adjusted positions. Such a known elbow mechanism is in the form of a unit which comprises a locking quadrant and a locking bolt or latch engageable with the quadrant, which locking bolt or latch is operated from an operating cord controlled by the patient alternately for engagement and disengagement of the bolt or latch with and from the quadrant respectively.

An object of this invention is to provide a mechanism for remote actuation of alternate functions, more especially the locking and unlocking of a device for the angular adjustment of the members of an artificial limb, which mechanism may be located remote from the said device.

Another object of the invention is to provide such a mechanism which is small, light and compact.

A further object of the invention is to provide such a mechanism as to permit easy operation of a surgical appliance, particularly an artificial arm or leg.

According to this invention a mechanism for actuation of alternate functions at locations remote from the said mechanism comprises a base, an actuating member movable to and fro on the base, a ratchet wheel rotatably mounted on the base, driving means on the actuating member for rotating the ratchet wheel, an abutment member rotatable by the ratchet wheel, and means on the actuating member selectively engageable with the rotatable abutment member according to the rotative position thereof, the said means on the actuating member permitting different amounts of to and fro movement thereof, thus permitting different amounts of movement to be transmitted to a remote location.

An embodiment of the invention will now be described by way of example, as applied to an artificial arm, with reference to the accompanying drawings, in which:

FIGURE 1 is a diagrammatic side elevation of part of an artificial arm, with the mechanism of the invention applied thereto;

FIGURE 2 is a top plan of the artificial arm of FIGURE 1;

FIGURE 3 is an enlarged side elevation of the mechanism removed from the artificial arm of FIGURES 1 and 2;

FIGURE 4 is an underneath plan of the mechanism;

FIGURE 5 is the same as FIGURE 4, but with the slidable actuating member removed to show the internal arrangement of the housing;

FIGURE 6 is a section on the plane VI—VI of FIGURE 4;

FIGURES 7 to 10 are diagrammatic views which, together with FIGURE 4 show the various stages of operation;

FIG. 11 is a view similar to FIG. 5 showing the housing of a second embodiment of the invention;

FIG. 12 is an underneath plan view of the slide mechanism of the second embodiment of the invention; and

FIG. 13 is a cross-sectional view similar to FIG. 6 of the second embodiment of the invention in assembled condition.

Referring to FIGURES 1 and 2, an artificial arm **1** has an upper part or upper arm **2**, a lower part or forearm **3**, a pivotal connection or elbow joint **4** and a control device **5** comprising a toothed quadrant **6** fixed to forearm **3** and a latch **7** carried in upper arm **2**. Latch **7** is urged by a spring (not shown) to the left, that is, into the locking position. ("Locking" in this context means that the control device **5** prevents flexion of the arm parts **2** and **3** about the elbow joint **4**). Latch **7** can be moved to the right for "unlocking" by a lever **8** pivotally mounted at **9** and moved by a pull cord **10**. The above-described artificial arm is well-known in the art, and it is usual that it function alternately to lock and unlock flexion of the arm. Thus at one actuation of the control device by the patient the control device will be unlocked, to permit free flexion. At the next actuation the control device will be locked, by latch **7** entering between adjacent teeth of quadrant **6**. The next actuation will withdraw latch **7**, and again the control device will be unlocked.

The end of the pull cord **10** remote from lever **8** is connected to one end **11** of a slidable actuating member **12**, which forms part of the mechanism, generally indicated at **13**, in accordance with the invention. At the other end **14** of slidable member **12** a second pull cord **15** is connected, for operation by for instance the shoulder harness of the wearer of the artificial arm.

Mechanism **13**, known in the art as an "alternator" is, as will be seen, remote from control device **5**. Although all pulls on second pull cord **15** are identical, mechanism **13** permits different amounts of to and fro movement of slidable member **12**, thus permitting different amounts of movement to be transmitted through first pull cord **10**, lever **8** and consequently latch **7**, whereby successive pulls on second pull cord **15** produce the desired locking and unlocking of control device **5**, which is at a remote location from mechanism **13**.

Referring now more particularly to FIGURES 3 to 6, slidable within a housing **16** closed by an underneath cover plate **17** is actuating member **12**, in the form of a flat metal slide. Slide **12** is guided, and its end positions determined, by pins or screws **18** which project downwardly from housing **16** through slots **19**, **20** in slide **12**. Slot **20** is part of a larger slot which includes wider slot portions **21**, **22**. It will be noted that slots **19**, **20** receive bosses **19A**, **20A** through which screws **18** pass. Screws **18** fasten housing **16** to upper arm **2**.

Housing **16** is recessed at **23** to receive a ratchet wheel **24** rotatably mounted on a pin **25** in housing **16**. Ratchet **24** rotates in a plane above the plane in which slide **12** moves to and fro. Integral with ratchet wheel **24** and rotatable therewith is a square abutment member **26**. Ratchet wheel **24** is rotatable only anti-clockwise (as viewed in FIGURES 4, 5 and 7 to 10); clockwise rotation is prevented by a leaf spring **27**, fixed in a slot **28** in housing **16**.

Slide **12** has fixed thereto at **28A** driving means **29** for rotating ratchet wheel **24**. Driving means **29** is in the form of a leaf spring which is seen in FIGURE 4 in engagement with a tooth of ratchet wheel **24**. When slide **12** moves a full stroke to the right (on being pulled in that direction by second pull cord **15**) leaf spring **29** causes ratchet wheel **24**, and with it square abutment

member **26**, to be turned through 45°. The teeth of ratchet wheel **24** are so spaced that every such movement to the right slide **12** causes square abutment member **26** to turn through 45°. Thus member **26** is always either disposed as shown in FIGURES 7 and 10 or as shown in FIGURES 8 and 9. As slide **12** returns to the left, leaf spring **29** rides over a tooth of ratchet wheel **24**, which is held by the other left spring **27** against clockwise rotation.

Slot portion **21** can receive square abutment member **26** when it is in its FIGURES 7 or 10 state, but not when it is in its FIGURES 8 and 9 state, so that in the latter state abutment member **26** prevents a full stroke of leftward movement of slide **12**, thus preventing engagement of latch **7** with quadrant **6**.

Referring to FIGURES 7 to 10, FIGURE 7 shows slide **12** at the leftward end of a stroke, to which it has been pulled by the latch-operating spring. Square abutment member **26** is in slot portion **21**. To unlock latch **7**, slide **12** is pulled to the right and during this movement square abutment member **26** is turned, until the FIGURE 8 position is reached. On release of the pull, the latch spring pulls slide **12** a short distance to the left, until square abutment member abuts shoulders **30** between slot portions **21**, **22**, and prevents further movement of slide **12** to the left, and thus holds latch **7** clear of quadrant **6**, permitting free flexion of the arm. On the next pull, slide **12** moves to the right, leaf spring **29** drives ratchet wheel **24** and square abutment member **26** through a further 45° until the FIGURE 10 position is reached, where slot portion **21** can ride over square abutment member **26**, and latch **7** can engage between any desired pair of adjacent teeth of quadrant **6**.

Any desired means may be used whereby the movements of slide **12** are transmitted to control devices **5**, for example, Bowden wire.

The mechanism is accordance with the invention may be used in any desired position on an artificial limb or other surgical appliance. It may also be employed to an advantage in the body control of elbow mechanism. Another advantage of the mechanism according to the invention is that it can be suitably positioned on for example an artifical arm, for operation by a natural hand of a patient to initiate simple operations of a lock or bolt. Since the mechanism may be adapted for pressure operation, it may be used for "nudge" control of a bolt or lock by the chin or elbow of the patient.

The mechanism in accordance with the invention can be made very compact, so as to save space. This is important where the patient's stump fills all the space normally used for operating mechanism of an artificial arm, since the present mechanism can be fixed externally on the arm, as shown.

Referring to FIGS. 11 through 13, a second embodiment of this invention is illustrated. In this second embodiment, ratchet wheel **24** is mounted on slide **12** and driving means **29** is mounted on housing **16**. Housing **16** is formed with an elongated, stepped recess corresponding to the slot **20**, **21** and **22** of the first embodiment of this invention. Otherwise, the structure of the second embodiment of the invention is similar to the structure of the first embodiment, and the second embodiment of the invention functions in a manner similar to the first embodiment of the invention.

It is to be understood that the mechanism according to the invention is not necessarily restricted in its application to artificial limbs, but may be used in any circumstance where it is desired to actuate alternate functions at remote locations.

We claim:

1. For use in a prosthetic device, mechanism for actuation of alternate functions at a location remote from the said mechanism, comprising:

a base,

an actuating member movable to and fro on the base,

a ratchet wheel rotatably mounted on the base,

driving means on the actuating member for rotating said ratchet wheel,

an abutment member rotatable by the ratchet wheel, and

means on the actuating member selectively engageable with the rotatable abutment member according to the rotative position thereof,

the said means on the actuating member permitting different amounts of to and fro movement thereof, thus permitting different amounts of movement to be transmitted to a remote location.

2. For use in a prosthetic device, mechanism for actuation of alternate functions at a location remote from the said mechanism comprising:

a base,

an actuating member movable to and fro on the base,

a ratchet wheel rotatably mounted on the actuating member,

driving means on the base for rotating the ratchet wheel,

an abutment member rotatable by the ratchet wheel, and

means on the base selectively engageable with the rotatable abutment member according to the rotative position thereof,

the said means on the base permitting different amounts of to and fro movement of the actuating member, thus permitting different amounts of movement to be transmitted to a remote location.

3. For use in a prosthetic device, mechanism for actuation of alternate functions at locations remote from the said mechanism, comprising:

a housing,

an actuating member, slidable to and fro in a linear direction in the housing, a ratchet wheel rotatably mounted in the housing,

driving means carried by the actuating member for rotating the ratchet wheel unidirectionally,

an abutment member on the ratchet wheel and rotatable about the axis thereof, the abutment member having two different transverse dimensions normal to the said linear direction according to the rotative position of the abutment member, and

a slot in the actuating member, the slot having a wide portion and a narrow portion, the wide portion receiving the abutment member in either of its rotative positions and the narrow portion receiving the abutment member only in its rotative position presenting the lesser transverse dimension, so that movement of the slidable actuating member is limited when the abutment member presents its greater transverse dimension, thus permitting different amounts of movement of the slidable actuating member to be transmitted to a remote location.

4. Mechanism according to claim **3** wherein the driving means is a left spring which engages a tooth of the ratchet wheel for rotation thereof in one direction of movement of the actuating member, the spring riding over the ratchet wheel in the other direction of movement of the actuating member.

5. Mechanism according to claim **4** wherein rotation of the ratchet wheel in a direction opposite to that caused by the spring is prevented by a leaf spring carried in the housing and engageable with a tooth of the ratchet wheel.

6. Mechanism according to claim **3** wherein the abutment member is square and integral with the ratchet wheel.

7. Mechanism according to claim **3** wherein the housing has two spaced upstanding pins and wherein the slidable actuating member has two slots, each receiving one pin, for guiding and location of the actuating member.

8. An artificial limb having an upper part,

a lower part,

a pivotal connection between the upper and lower parts,
a control device connected to said parts for permitting or preventing, by means of alternate movements, flexion of one part relative to the other part about the pivotal connection, and
mechanism remote from the control device for actuation of the alternate movements thereof,
the said mechanism comprising:
a housing fixed to one of said parts of the limb,
an actuating member, slidable to and fro in a linear direction, in the housing,
a ratchet wheel rotatably mounted in the housing,
driving means carried by the actuating member for rotating the ratchet wheel unidirectionally,
an abutment member on the ratchet wheel and rotatable about the axis thereof, the abutment member having two different transverse dimensions normal to the said linear direction according to the rotative position of the abutment member, and
a slot in the actuating member, the slot having a wide portion and a narrow portion, the wide portion receiving the abutment member in either of its rotative positions and the narrow portion receiving the abutment member only in its rotative position presenting the lesser transverse dimensions, so that movement of the slidable actuating member is limited when the abutment member presents its greater transverse dimension, thus permitting different amounts of movement of the slidable actuating member to be transmitted to the control device.

9. An artificial limb according to claim **8** wherein one end of the slidable actuating member has means connected it to the control device and the other end of the slidable actuating member has means connecting it to an operating device operable by the person wearing the artificial limb.

10. For use in a prosthetic device, mechanism for actuation of alternate functions at a location remote from the said mechanism comprising: a first member, a second member movable to and fro on said first member, a ratchet wheel rotatably mounted on said first member, driving means on said second member for rotating the ratchet wheel, an abutment member rotatable by the ratchet wheel, and means on said second member selectively engageable with the rotatable abutment member according to the rotative position thereof, the said means on said second member permitting different amounts of to and fro movement of the second member, thus permitting different amounts of movement to be transmitted to a remote location.

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R. L. FRINKS, *Assistant Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,273,169 September 20, 1966

Alfred Henry Taylor et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 35, for "devices" read -- device --; column 4, line 4, for "said" read -- the --; line 58, for "left" read -- leaf --; column 5, line 27, for "dimensions" read -- dimension --.

Signed and sealed this 26th day of September 1967.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents