July 8, 1952 P. W. MEYER ET AL 2,602,361

STEP-BY-STEP OPERATED, PARTIAL REVOLUTION WRENCH

Filed June 30, 1949 3 Sheets-Sheet 1

Fig. 1.

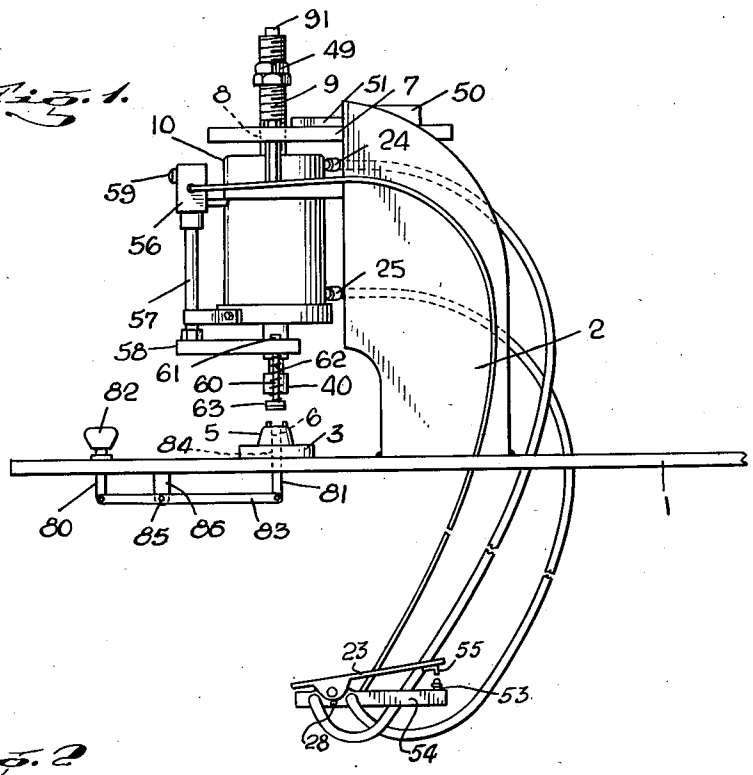


Fig. 2

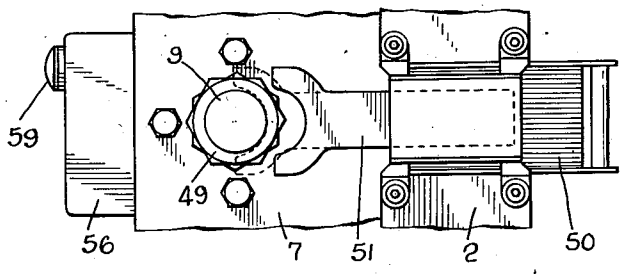
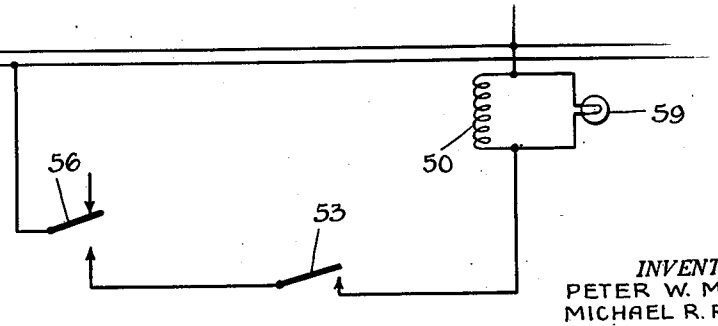


Fig. 3.



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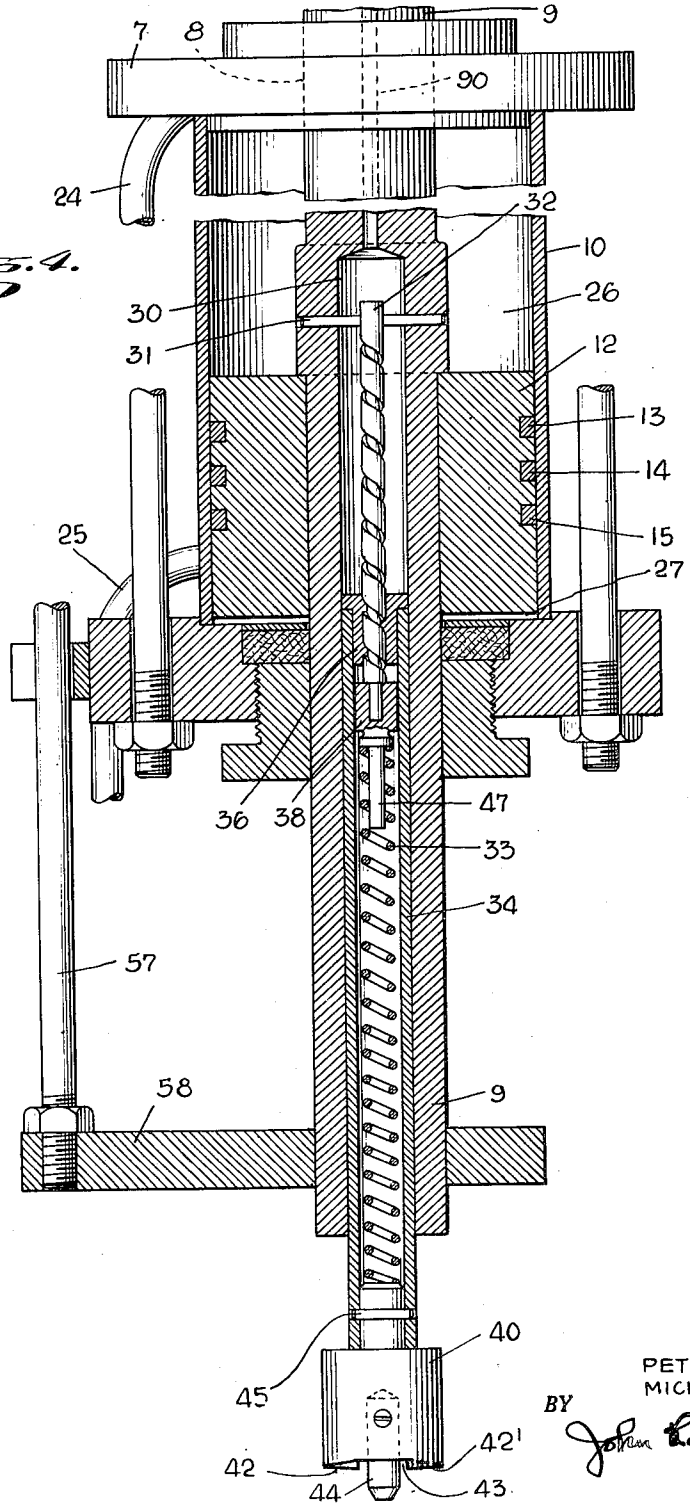
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Fig. 4.



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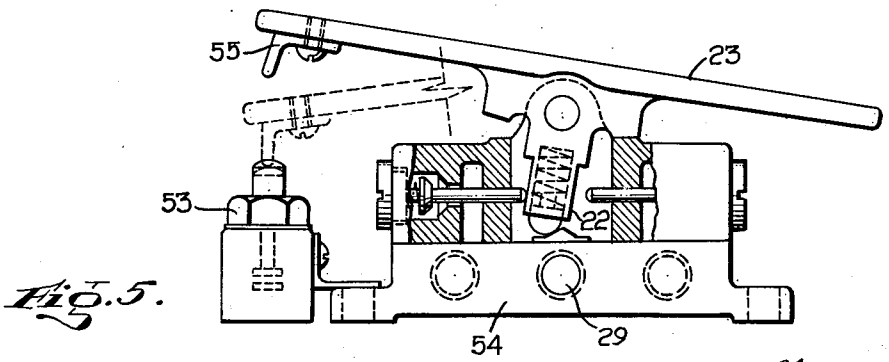


Fig. 5.

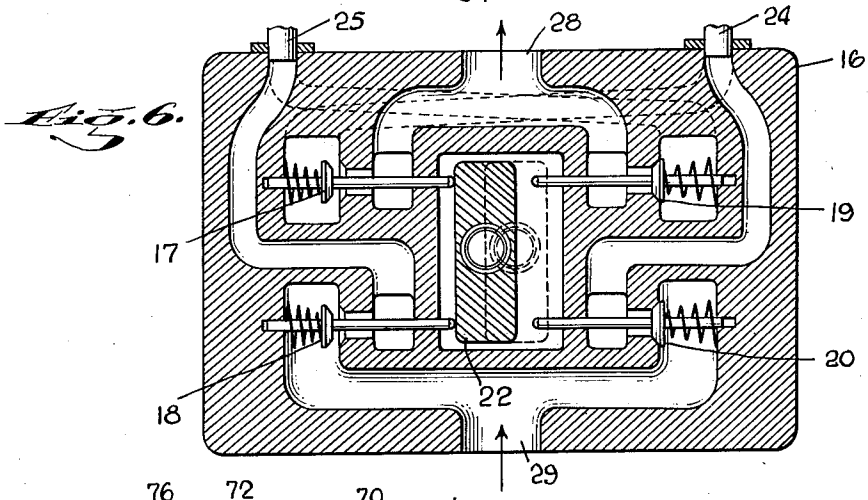


Fig. 6.

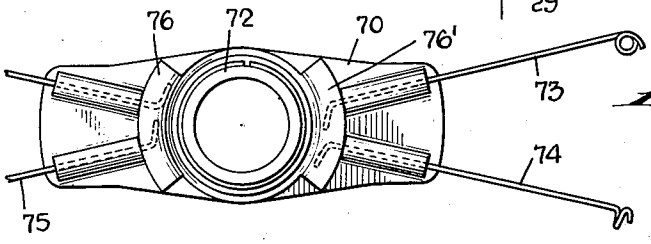


Fig. 7.

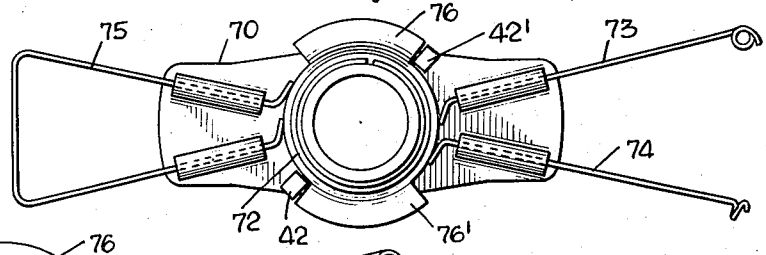
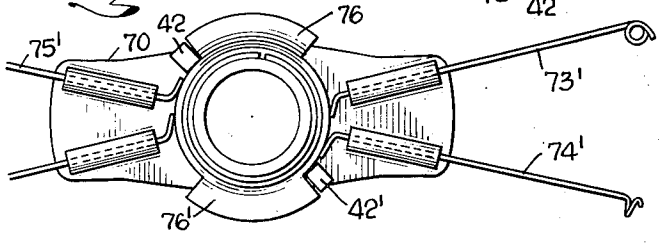


Fig. 8.

Fig. 9.



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UNITED STATES PATENT OFFICE

2,602,361

STEP-BY-STEP OPERATED PARTIAL REVOLUTION WRENCH

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Application June 30, 1949, Serial No. 102,308

15 Claims. (Cl. 81—53)

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The present invention relates to wrenches having predefined stroke and, more particularly, to wrenches adapted for rotating flyer hub assemblies.

When rayon or silk single yarns require twisting without doubling, they are passed through an up-twister. The bobbin of untwisted yarn is placed upon a vertical spindle, and the yarn is twisted as it passes through two eye wires projecting from a rotatable flyer. The twisted yarn is thereafter wound upon a horizontal bobbin.

In normal usage the projecting eye wires of these flyers become bent or broken, and the flyers are therefore so constructed that the wires are replaceable. In a widely used standard construction, the wires are fitted snugly in guides and their inner ends are bent around a rotatable hub and are locked in place beneath a locking disc which is affixed to the hub. The locking disc has two flanges which are separated by arcs of 110° and each of which spans an arc of 70°. Thus, by rotating the flanged locking disc through 90°, the wire ends are released, while a further rotation through 90° in either direction locks them into position again.

In the past this disc rotating operation has been performed with a manually operated wrench, using a fixture to hold the flyer immovable. This operation has been troublesome and time-consuming, because the flyers are quite small (usually not exceeding 1¾ inches in length and ⅝ inch in width), thus making rotation of the flanged disc into locking and releasing position a delicate task, and because the rotatable disc is hard to turn, as it must fit tightly in order to prevent loosening of the wires during use.

It is an object of the present invention to provide an apparatus for producing rotational motion through a predetermined arc of rotation.

It is a further object of the invention to provide a wrench of predefined stroke for releasing and then locking flyer wires in place in two successive operations without need of special adjustment by the operator.

These and other objects and advantages of this invention will be apparent to those skilled in the art from the following description, taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a diagrammatic side elevation of an apparatus in accordance with the invention;

Fig. 2 is a partial top plan view on an enlarged scale of the apparatus of Fig. 1.

Fig. 3 shows the electrical circuit of the apparatus of Fig. 1;

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Fig. 4 is a detail view on an enlarged scale of the cylinder and wrench assembly of Fig. 1;

Figs. 5 and 6 are details on an enlarged scale of the foot pedal assembly of Fig. 1;

Figs. 7, 8 and 9 are detail views on an enlarged scale of a flyer in position on the holding fixture of the apparatus of Fig. 1, showing different stages of rotation of the locking disc during operation of the apparatus.

Broadly speaking, the apparatus of the present invention comprises a reciprocating member, the axial motion of which serves to operate a rotary member associated therewith, and including means for regulating the length of the arc of rotation of the rotary member. More particularly, a reciprocating member is provided for moving a wrench into and out of engagement with a locking disc of a flyer positioned upon a fixture and the wrench is caused to rotate through an arc of rotation determined by the axial stroke of the reciprocating member, at least when the wrench is in engagement with the flyer.

The following description applies to the apparatus shown in Figs. 1 to 6 inclusive.

Reference character 1 indicates a base having a support 2 and a platform 3 fixedly mounted thereon. Integrally constructed with the platform 3 is a fixture or anvil 5 adapted to receive a flyer, and having a central recess 6 in which the hub of the flyer fits. At the upper portion of support 2 there is mounted a platform 7 having a port 8 therethrough, in which port is mounted the reciprocable piston rod 9 of a pneumatic cylinder 10 of conventional type. The pneumatic cylinder is likewise fixedly fastened to the support 2. The piston 12, which is equipped with three rings 13, 14 and 15, is affixed to the piston rod 9 and is reciprocated within the chamber by air pressure which is regulated by the four-way valve 16 of conventional design, such as Type 881 M1 (Foot), manufactured by the Ross Operating Valve Company of Detroit, Michigan (best shown in Figs. 5 and 6).

The valve 16 comprises four spring-mounted plungers 17, 18, 19 and 20 whose position is controlled by the stop 22. The stop is integral with the pedal 23 and is reciprocated or pivoted by the movement thereof, suitable detent means being provided to maintain the pedal in either of two positions, raised or lowered, as is generally shown in Figure 5. Four lines run into the valve. Air pressure lines 24 and 25 run to the upper chamber 26 and lower chamber 27, respectively, of the cylinder 10, while line 28 is for exhaust of air and line 29 runs to the source of compressed

air. When the pedal 23 is in the raised solid-line position shown in Fig. 5 the stop 22 is in the solid-line position shown in Fig. 6 and plungers 17 and 18 are held open while plungers 19 and 20 are urged by their respective springs to a closed position. Thus, air pressure line 24 is connected to air exhaust line 28, plunger 17 being open, while line 25 is connected to the compressed air line 29 through open plunger 18. Compressed air, while the valve is in this position, is delivered through lines 25 and 29 to the lower chamber 27 of the cylinder 10, while air is exhausted from the upper chamber 26 of the cylinder 10 through lines 24 and 28. The piston rod 9 is thus raised.

On the other hand, when the pedal 23 is in the depressed dotted-line position shown in Fig. 5, stop 22 is moved to the dotted-line position shown in Fig. 6 and plungers 17 and 18 return to a closed position under the urging of their respective springs. Thus, when the pedal is in the depressed position, line 24 is connected to the compressed air line 29 and line 25 to the exhaust 28. Thus, compressed air is delivered through lines 24 and 29 to the upper chamber 26 of the cylinder, while air is exhausted from the lower chamber 27 of the cylinder through lines 25 and 28. The piston rod 9 is thus lowered.

The piston rod 9 has at its lower portion (best shown in Fig. 4) a recess 30 in which is immovably affixed (by the pin 31) a shaft 32 with a thread having a helical angle beyond the coefficient of friction. The pin 31 pierces the shaft and both walls of the piston rod, holding the shaft against rotation. The ends of the pin are flush with the outer surface of the piston rod. The pin is removable for removal and repair of the shaft 32 and other parts associated therewith. The recess 30 and the shaft 32 are in axial alignment with the central recess 6 of the fixture 5. Spring mounted (by the spring 33) upon the end of shaft 32 is a sleeve 34, to whose upper end is affixed the spiral nut 36. The sleeve 34 screws into the recess 30 over the shaft 32 by means of the spiral nut 36, and is partly screwed over the shaft and depends from the recess. At the lower end of the shaft 32 is affixed a bronze bushing 38, which facilitates rotation of the sleeve about the shaft and also acts as a stop to prevent the spiral nut 36 from unscrewing completely, thus detaching the sleeve from the shaft.

At the bottommost portion of the sleeve 34 there is located a wrench 40 having two cleats 42 and 42', spaced apart by an arc of 180°, in a recessed portion 43 at the bottom of the wrench. These cleats engage the flanges 76 and 76' of a flyer locking disc 72 (see Figs. 7, 8 and 9). The wrench may also have only one cleat, if desired. In this event, the wrench engages one flange of the locking disc. A post 44 disposed in the recess engages the center hole of a flyer upon the anvil 5 and enters the central recess 6 of the anvil. Thus it aligns the wrench on the flyer for positive engagement with the flange thereof. The wrench is immovably affixed to the end of sleeve 34 by the pin 45. This pin is similar to pin 31, since both its ends pierce the sleeve and are flush with the outer walls thereof, and it is removable for easy removal or replacement of the wrench. The spring mounting 47 rests within the sleeve 34 below the bushing 38, and it and the top of the wrench 40 serve as supports for the ends of the spring 33.

The apparatus is so constructed that the wrench rotates 90° at one stroke of the piston and 180° at the next succeeding stroke of the piston, this cycle being repeated automatically. To this end the following means (best shown in Figs. 1, 2 and 4) are provided. The electric circuit in which they are associated is shown in Fig. 3.

Exteriorly of the piston rod 9 above the platform 7 is threaded the stop nut 49. This stop is adapted to be screwed up and down the piston rod 9. Ordinarily, this stop nut is so adjusted that, at the time that the wrench 40 makes a rotation of 180°, the stop nut is brought against the top of the platform 7, halting further downward movement of the piston rod 9, and thus further rotation of the wrench.

At one side of the piston rod 9, upon the platform 7, there is mounted the electric solenoid 50. A slide 51 is reciprocated by the solenoid 50 into and out of the dotted-line position shown in Fig. 2, in which position it engages the stop nut 49 upon downward movement of the piston rod 9, and prevents further downward movement of the same thereafter. The slide 51 is made of such a thickness that at the time the stop nut 49 on the piston rod, during a downward stroke thereof, engages it, the wrench has made a 90° rotation. Thereafter, further rotation of the wrench is prevented.

The solenoid is operated electrically by the following means: A spring-mounted microswitch 53 is placed upon the base 54, upon which the foot pedal 23 is mounted. This switch is normally in the open or "off" position, but is closed ("on") upon contact of the angular bar 55 therewith when the foot pedal 23 is depressed, and opens automatically when the foot pedal is raised.

Positioned upon the outside of the cylinder 10 and affixed thereto is a spring-loaded dimmer switch 56. This switch is flipped successively to the closed ("on") and then to the open ("off") position (shown in Fig. 3) upon each engagement of the shaft 57 therewith. The shaft 57 is affixed to one end of the triangular plate 58, the other end of which is fixedly mounted upon the piston rod 9. Thus, the plate 58 and the shaft 57 reciprocate with the piston rod 9, and the switch 56 is flipped first to the "on" position on one stroke of the piston rod, and then flipped to the "off" position on the next stroke of the piston rod.

The dimmer switch, microswitch and solenoid are connected together in series in the electric circuit, shown in Fig. 3, to a standard 110 volt alternating current line. When the dimmer switch 56 is closed (in the "on" position) and the microswitch 53 is closed (in the "on" position) the solenoid 50 is actuated. When, however, the dimmer switch 56 is in the "off" position, then the circuit is open, even though the microswitch 53 is in the "on" position, and the solenoid 50 is not actuated. Since the dimmer switch is flipped to the "on" and then to the "off" position on successive strokes of the piston by operation of the shaft 57, the solenoid 50 is actuated only on alternate strokes of the piston rod 9, even though the microswitch 53 is closed each time the pedal 23 is depressed. A light 59 on the dimmer switch is illuminated when the circuit is closed, i. e., when both switches 53 and 56 are closed.

As has been stated, the position of the stop nut 49 is so adjusted that the wrench 40 makes a maximum rotation of 180°. When the solenoid 50 is actuated, and the slide 51 which has a predetermined thickness contacts and halts downward movement of the piston rod, the wrench 40 rotates only 90°. Thus, the wrench alternately is

caused to rotate first 90° and then 180° on successive strokes of the piston rod, because the solenoid 50 is actuated only on alternate strokes thereof.

Two rods, only one of which is shown (at 60) pass through the plate 58 for reciprocation therein. A stop nut (61 on rod 60) prevents the rods from falling through the plate. Each rod is enveloped by a compression spring (62 on rod 60) and the springs are compressed between the lower surface of the plate 58 and the upper surface of the rubber-surfaced pads (63 on rod 60), respectively, which are affixed to the lower ends of the rods. The rods are normally held in the position shown, but are so positioned on the plate 58 that the pads engage the wires of a flyer mounted upon the anvil 5 upon a lowering of the piston rod 9 before the wrench 40 engages the flange thereof, and hold the flyer firmly in place for action thereon by the wrench.

Operation of the apparatus is extremely simple, and can be carried out by relatively unskilled operators. The steps of operation are illustrated in Figs. 7, 8 and 9 and reference is now made to these figures in conjunction with Figs. 1–6, inclusive.

During this stroke of the piston rod 9, the dimmer switch 56 is in the "on" position. Thus, when the operator depresses the pedal 23 and the microswitch 53 is closed, the circuit is closed, light 59 is illuminated, the solenoid 50 is actuated, and the slide 51 engages the stop nut 49 and prevents further downward movement of the piston rod after contact therewith, thus halting rotation of the wrench 40 after it has rotated through an arc of 90°.

A flyer 70, the locking disc 72 of which is in the position shown in Fig. 7 is placed in the fixture 5. The operator depresses the pedal 23, thus closing the switch 53, and the electric circuit, so that slide 51 engages the piston rod 9, and admitting air under pressure to the upper chamber 26 of the cylinder 10 through the lines 24 and 29. Simultaneously, air is released from the lower chamber 27 of the cylinder through the lines 25 and 28, and thereby under the influence of the increased air pressure above the piston 12, a downward stroke of the piston rod 9 is caused to occur. Thus, the spring-mounted pads (only pad 63 is shown) are brought into engagement with the flyer wires 73, 74 and 75, holding the flyer steady while the central guide post 44 guides the wrench 40 into precise engagement with the flyer locking disc 72.

As the piston rod 9 continues its downward stroke, pressure is exerted upon the wrench 40, causing the sleeve 34 to rotate with the spiral nut 36 upwardly over the shaft 32, and turning the wrench 40 to the right. The cleats 42 and 42′ of the wrench 40 thus engage the flanges 76 and 76′ and rotate the flyer locking disc 72. As the sleeve and wrench rotate, the spring 33 is compressed. After the wrench has rotated 90°, the stop nut 49 engages the slide 51, halting further downward movement of the piston rod, and rotation of the wrench.

The operator then raises the pedal 23, thus opening the microswitch 53, and shifting the valve stop 22 to the solid-line position shown in Fig. 6. By this movement of the valve stop, line 25 is connected to the compressed air line 29 while line 24 is connected with the exhaust line 28; thus, under the force of the increased air pressure in the lower chamber 27 of the cylinder upon the bottom of the piston 12, combined with exhaust of air from the upper chamber 26, the piston rod 9 is raised to its initial position. At the same time, under the force of the compressed spring 33, the sleeve 34 is caused to unscrew itself from the shaft 32 by means of the spiral nut 36, returning the wrench to its original position, and the spring-mounted pads (only pad 63 is shown) are also returned to their original position. When the piston rod 9 reaches its uppermost position, the shaft 57 flips the dimmer switch 56 to the "off" position, thus preparing the electric circuit for the next stroke, and making it impossible to actuate the solenoid 50 when the microswitch 53 is closed the next time the pedal 23 is depressed.

At this point the flanges 76 and 76′ of the flyer locking disc 72 are in the position shown in Fig. 8. The operator may now easily remove the original wires 73, 74 and 75 and insert new wires.

The operator now causes the piston rod 9 to make a second downward stroke by depressing the pedal 23, which returns the valve stop 22 to the dotted-line position shown in Fig. 6 and results in application of air pressure to the upper surface of the piston 12 in the upper portion 11 of the cylinder chamber as set forth above. This again brings the spring-mounted pads and the wrench 40 into engagement with the flyer. On this stroke, however, even though switch 53 is "on," the electric circuit is open, because the dimmer switch 56 is in the "off" position, so that the solenoid 50 cannot be actuated, and the piston rod 9 makes a full stroke, rotating the wrench 40 through its maximum arc of 180° by the time stop nut 49 contacts the plate 7.

When the wrench 40 first engages the locking disc 72, the cleats 42 and 42′ are in the position shown in Fig. 8. After the wrench 40 has rotated through its first 90° arc, the cleats 42 and 42′ are in the position shown in Fig. 9, and at this point first engage the flanges 76 and 76′, respectively. As the wrench 40 rotates through its second 90° arc with the cleats in engagement with flanges, it returns the disc 72 to a position similar to that shown in Fig. 7, except that the two flanges 76 and 76′ are now reversed in position. The new wires are thus locked in place.

The operator now elevates the pedal 23, which opens the microswitch 53 and returns the valve stop 22 to the solid-line position shown in Fig. 6. This again causes the piston rod 9 to rise, returning the spring-mounted pads and the wrench to their original position. At the same time, the shaft 57 engages and flips the dimmer switch 56 to the "on" position, thus preparing the electric circuit for the next stroke of the piston, so that when the microswitch 53 is closed upon the next depression of the pedal 23, solenoid 50 and slide 51 are actuated, once again limiting the stroke of the piston rod and the rotation of the wrench 40 to an arc of 90°. The flyer 70 is then removed from the fixture 5 and the apparatus is ready to repeat the cycle of operations on another flyer.

The particular embodiment of the invention illustrated has a mechanical lift 80 comprising an ejector pin 81, and a hand control 82 affixed to a lever 83. The pin 81 reciprocates in a vertically aligned orifice 84 in base 1, and platform 3, connecting directly to the recess 6 in the anvil 5. The lever is pivoted on the rod 85, which is supported upon the plate 86 depending from base 1. Thus the pin 81 is raised or lowered through orifice 84 by operation of the hand control 82. The pin 81 engages a flyer hub from beneath and ejects it from the fixture 5. Obviously this lift may be controlled by a foot pedal instead of by hand, or may be omitted entirely.

The particular embodiment illustrated also includes means for oiling the parts disposed in the recess 30 of the piston rod 9. For this purpose, a passage 90 is disposed in the center of the piston 9, connecting the top of the recess 30 with the top of the piston 9. A cap 91 is provided at the top of the passageway. It will be evident to those skilled in the art that this is not an essential part of the apparatus of the invention.

It will also be apparent that it is not necessary that a pneumatic cylinder be used for operation of the device, as an electric motor or other source of power may be employed. Various additional changes may be made in the particular constructions illustrated without departing from the spirit of the invention.

From the foregoing description, it will be apparent that the wrench of the invention is simple of construction, requires a minimum of adjustment and is relatively compact. It permits rapid and easy replacement of flyer wires in standard or custom-made flyer hubs, the wrench itself being easily removable upon removal of a pin so that a wrench with cleats arranged to fit any desired type and size of hub flange may be inserted.

The following is claimed:

1. In a device for rotating a part of a work piece of the type having a member mounted for reciprocatory movement toward and from a work piece, a wrench keyed to said member and adapted to be brought into engagement with a part of a work piece during movement of said member toward the work piece, and to rotate relative to the member while in engagement with said part upon further movement of said member toward the work piece, the improvement comprising stop means mounted adjacent the reciprocatory member and movable from a position out of engagement with said reciprocatory member to a position engaging said reciprocatory member and means actuated electrically only on alternate strokes of said member toward the work piece to move said stop means into engagement with said reciprocatory member in order to limit the extent of reciprocation thereof and thus to limit the extent of rotation of said wrench.

2. A device according to claim 1 in which said wrench and said reciprocatory member are formed with cooperating parts permitting said wrench to rotate in one direction from its original position, relative to said member, to another predetermined position, relative to said member, while in engagement with said part upon movement of said member toward the work piece, and then to rotate in the reverse direction relative to said member upon movement of said member away from the work piece until it has returned to said original position.

3. The device according to claim 1 including means for electrically actuating said stop means comprising, connected in series in an electric circuit, an electric switch adapted to be thrown open upon one full reciprocation of reciprocatory member and then to be thrown closed upon the next succeeding full reciprocation thereof, and a second switch adapted to be thrown closed upon each stroke of said reciprocatory member toward the work piece, and to be thrown open upon each stroke of said reciprocatory member away from the work piece.

4. The device according to claim 3 including means adapted to reciprocate with said reciprocatory member to operate said first switch upon completion of each full reciprocation thereof.

5. The device according to claim 3 including means responsive to the control of an operator for throwing said second switch closed upon each stroke of said reciprocatory member toward the work piece, and then to throw said switch open upon the next succeeding stroke of said reciprocatory member away from the work piece.

6. In a device of the type including a vertically disposed non-rotatable shaft mounted for longitudinal reciprocatory movement toward and from a work piece, a cylinder rotatively mounted upon said shaft, a wrench keyed to said cylinder so as to rotate therewith upon engagement with a part of said workpiece during downward movement of the shaft, the improvement which comprises a detent mounted adjacent said shaft and movable from a position out of engagement with said shaft to a position engaging said shaft and electrically actuated means responsive to the movement of said shaft, to move said detent into engagement with said shaft on alternate strokes, limiting the downstroke of said shaft to control the angle of rotation of the wrench.

7. The device according to claim 6 wherein said stop means comprises a member adapted to engage said reciprocatory shaft, a solenoid adapted to thrust said member into and out of engagement with said reciprocatory shaft, connected in series with an electric switch adapted to be thrown open upon one full reciprocation of said shaft, and then to be thrown closed upon the next succeeding full reciprocation of said shaft, and a second electric switch adapted to be thrown closed prior to each downward stroke of said reciprocatory shaft and to be thrown open prior to each upward stroke of said reciprocatory shaft.

8. The device according to claim 7 including means associated with said reciprocatory shaft for automatically actuating said first switch upon completion of each full reciprocation of said shaft.

9. A device according to claim 7 including means responsive to the control of an operator to actuate said second switch upon completion of each stroke of said reciprocatory shaft, whereby said stop means engages said reciprocatory shaft on alternate downward strokes thereof so as to limit rotation of said wrench, whereby when the work piece is a flyer having a flanged flyer wire locking hub, reciprocation of the shaft causes the wrench part to engage the flange and to rotate it on the first stroke into wire unlocking position and on the second stroke into wire locking position.

10. A device according to claim 9 wherein said wrench part is so positioned as to rotatably engage a flange of a flyer hub on one downstroke immediately after said wrench begins to rotate and on the other downstroke after said wrench has rotated through an arc of 90°, and said first and second switches are thrown closed on said first-mentioned downstroke of said switch so as to limit rotation of said wrench to 90°, and said first switch is thrown open on said last-mentioned second downstroke of the shaft so as to allow rotation of said wrench to a full 180°, whereby the wrench part engages and rotates a flyer hub flange through an arc of 90° into wire unlocking position on the first stroke, and on the second stroke rotates through the first 90° arc, then engages the flange and rotates it through a further arc of 90° into wire locking position.

11. In a device for rotating a part of a work piece of the type having a wrench mounted on

the free end of a sleeve dependent from a spiral nut, which nut rides on a spiral shaft mounted for reciprocatory movement toward and away from the work piece, said wrench being adapted to be brought into engagement with the part of the work piece to be rotated, the combination comprising means adapted when actuated to limit the angle of rotation of the part of the work piece by the wrench by limiting the extent of movement of the shaft member toward the work piece and electrical means for actuating said limiting means.

12. The device according to claim 11 wherein said last mentioned means comprises a solenoid adapted when energized to actuate said limiting means, a normally open energizing circuit for said solenoid and means for closing said circuit only on alternate strokes of said member toward the work piece.

13. The device according to claim 12 wherein said circuit closing means comprise a pair of series connected switches, means movable with said member for reversing the condition of one of said switches on each stroke of said member toward the work piece and means for maintaining the other of said switches closed during each stroke of said member toward the work piece and for maintaining such latter switch open during movement of said member away from the work piece.

14. The device according to claim 13 including power means for moving said member toward the work piece and operator controlled means for coupling said power means to said member, said last mentioned switch being mechanically connected to said operator controlled means for closure thereby.

15. In a device of the type including a vertically disposed spiral shaft mounted for longitudinal reciprocatory movement toward and from a work piece, a spiral nut riding on said shaft, a sleeve dependent from said nut and rotatable therewith, and a wrench carried by the free end of said sleeve so as to rotate upon engagement with a part of the work piece during downward movement of the shaft, the improvement which comprises electrically actuated stop means limiting the downward stroke of said shaft to control the angle of rotation of the wrench whereby when the work piece is a flyer having a flanged flyer wire locking hub and said wrench is moved downward to engage the hub flange and rotate the hub, rotation thereon is stopped when the flyer wires are unlocked.

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