

Nov. 15, 1927.

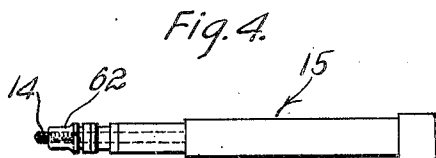
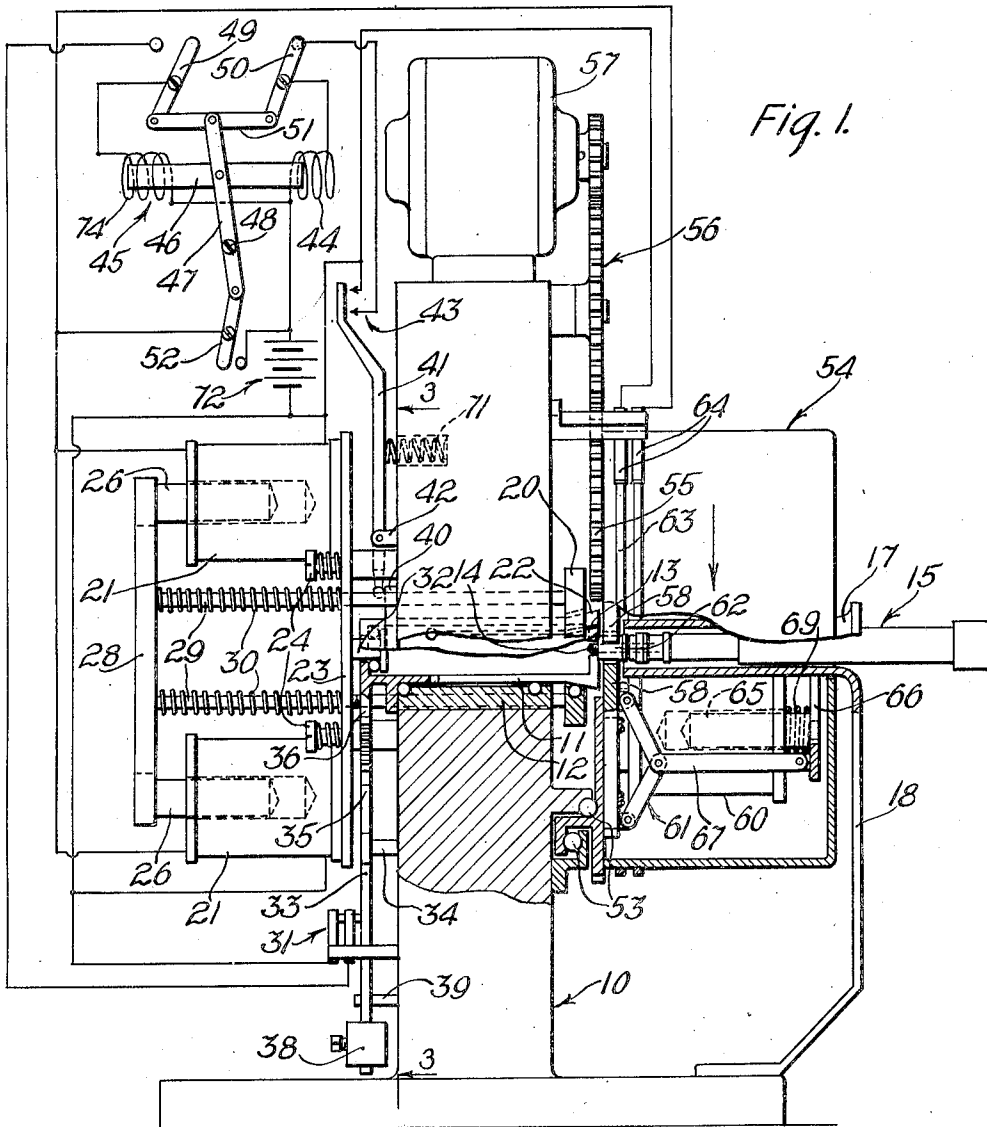
1,648,944

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NUT TIGHTENING APPARATUS

Filed Nov. 27, 1925

2 Sheets-Sheet 1



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Fig. 3.

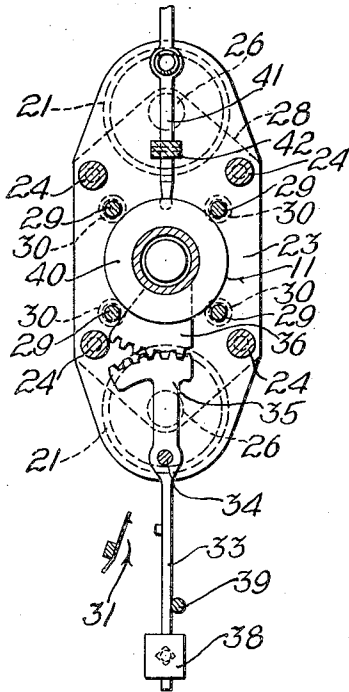
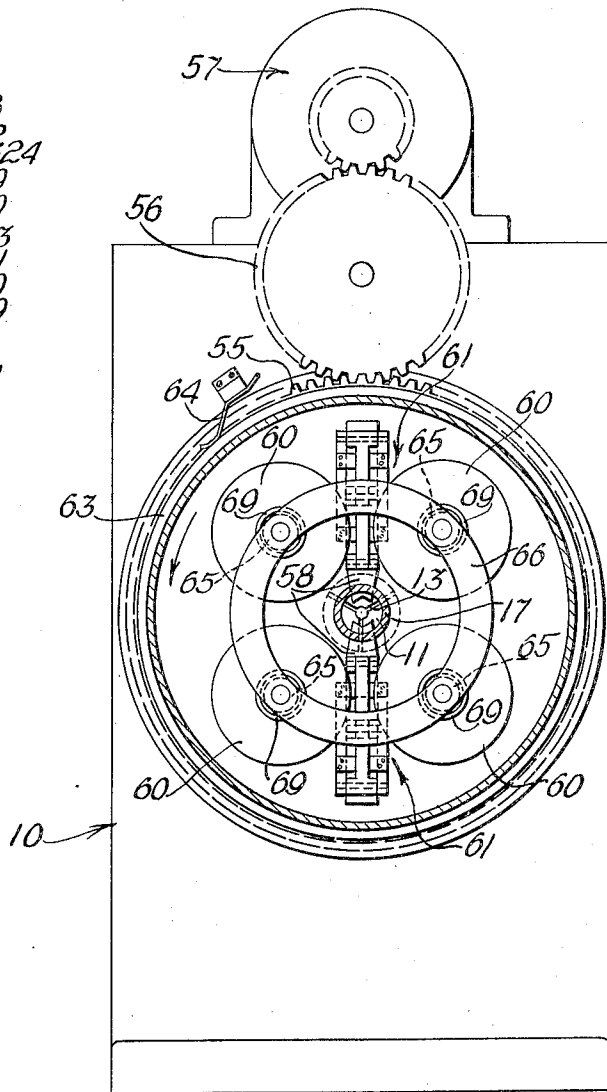


Fig. 2.



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UNITED STATES PATENT OFFICE.

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NUT-TIGHTENING APPARATUS.

Application filed November 27, 1925. Serial No. 71,874.

This invention relates to nut tightening apparatus, and has for its principal object the provision of an improved apparatus for readily and efficiently tightening nuts on threaded elements to a predetermined tension.

One form of the invention is embodied in an apparatus for assembling electrical connectors such as plugs used in telephone switchboards wherein adjustable elements are operated automatically to grip the tip nut portion of a plug and cause it to be tightened on the plug center to a predetermined tension whereupon the gripping elements are automatically released.

Other features and advantages of the invention will appear in the following detailed description, reference being had to the accompanying drawings, wherein—

Fig. 1 is a schematic front elevation, partially in section, of an apparatus embodying the features of the invention;

Fig. 2 is an end elevation, partially in section, of the apparatus shown in Fig. 1, with the plug removed;

Fig. 3 is a fragmentary vertical section taken on the line 3—3 of Fig. 1, and

Fig. 4 is a detail view of a telephone switchboard plug which has been partially assembled by the improved apparatus.

Referring now to the drawings in detail, the numeral 10 indicates a main supporting frame within which a collet 11 is slidably mounted in a suitable bearing 12. The collet 11 is slotted at one end, as indicated at 13, to receive a plug center 14 of a switchboard plug 15 of the type shown in detail in Fig. 4. A guide tube 17, supported by a bracket 18, is provided to facilitate the insertion of the plug center 14 into the slotted end of the collet 11. A collar 20 encircles the collet 11 near the slotted end thereof, which end is gradually increasing diameter, as indicated at 22 (Fig. 1), so that a relative movement between the collar 20 and the collet 11 causes the plug center to be firmly gripped by the latter.

The collet 11 is operated by electro-magnetic solenoids 21 secured to a vertical plate 23 which is slidably and resiliently mounted on a plurality of posts 24 secured to the frame 10. This construction permits longitudinal movement of the collet 11 which is necessary during the operation of the apparatus, as

will be hereinafter described. The ends of plungers 26 of the solenoids 21 are fastened to a vertical plate 28. Horizontally disposed bars 29 are each fastened, at one end thereof, to the plate 28 and secured, at their other ends, to the collar 20. The bars 29 are slidably mounted in suitable apertures provided therefor in the frame 10 and plate 23. Compression springs 30 encircling the bars 29 and interposed between the plates 23 and 28 serve to normally hold the solenoid plungers 26 in their projected positions as shown in Fig. 1. Integral with the plate 23 is an outwardly projecting stud 32 which is designed to form a thrust-bearing with the collet 11.

A lever 33, designed to operate a switch 31, is pivotally mounted on a post 34 secured to the frame 10 and has formed integral therewith, at one end, a gear sector 35 which meshes with a gear sector 36 formed integral with the collet 11 (Fig. 3). Adjustably secured at the opposite end of the lever 33 is a weight 38 whereby the lever normally holds the collet against rotation in a counter-clockwise direction. A stop pin 39 secured to the frame 10 limits the rotation of the lever 33 in a counter-clockwise direction.

Formed around the collet 11, near the rear end thereof, is an annular flange 40 which operatively engages one end of a lever 41 pivoted at 42 to the frame 10. The opposite end of the lever 41 operates a switch 43 controlling an electrical circuit within which is connected a winding 44 of a solenoid 45. A horizontal plunger 46 of the solenoid 45 is pivotally connected to a lever 47 which is pivoted intermediate its ends as indicated at 48. The upper end of the lever 47 operates a pair of electrical switches 49 and 50 which are interconnected by a link 51. The lever 47 also operates a switch 52 controlling two electrical circuits which include the windings of the chuck and collet solenoids. The mechanism just described may be supported by the frame 10 in any suitable manner (not shown).

The frame 10 is provided with suitable bearings 53 for rotatably supporting a chuck 54. Integral with the chuck 54 is a ring gear 55 whereby the chuck is constantly driven in a counter-clockwise direction (Fig. 2) through a train of gears 56 by an electrical motor 57 of any suitable type connected with a suitable source of electrical current

(not shown). Jaws 58 of the chuck 54 are actuated by a plurality of solenoids 60 through suitable toggle mechanisms indicated at 61 and are designed to grip a nut 62 of the plug 15. Suitable collector rings 63 and contact brushes 64 are provided for connecting the windings of the solenoids 60 in an electrical circuit hereinafter described. Plungers 65 of the solenoids 60 are secured, at their outer ends, to a ring shaped member 66 which is fastened to one end of horizontal rods 67, which rods are operatively connected, at their other ends, to the toggle mechanisms 61. Compression springs 69, encircling the solenoid plungers 65 and interposed between the member 66 and the frames of the solenoids 60, serve to normally hold the plungers in their projected positions where- in the jaws 58 of the chuck are open.

In the operation of the above described apparatus, a plug having a nut 62 loosely applied thereon in any suitable manner, is inserted in the guide tube 17, the plug center 14 thereof entering the slot 13 in the collet 11. Upon the nut 62 engaging the end of the collet 11, the plug is pushed inwardly forcing the collet to the left (Fig. 1), thereby rotating the lever 11 in a clockwise direction against the tension of a compression spring 71 interposed between the frame 10 and lever 41. This causes the upper end of the lever 41 to close the switch 43 which closes an electrical circuit which may be traced as follows: from one terminal of a battery 72, through the switch 43, the switch 50, the solenoid winding 44, to the other terminal of the battery.

The above described circuit, when closed, produces a magnetic action in the solenoid winding 44 which causes the plunger 46 to move to the right (Fig. 1). The lever 47 is thereby rotated in a clockwise direction whereby its upper end opens the switch 50 and closes the switch 49. Simultaneously therewith, the lower end of the lever 47 closes the switch 52, thereby closing two parallel electrical circuits over which an electrical current flows as follows: from one terminal of the battery 72 through the windings of the collet solenoids 21 and the windings of the chuck solenoids 60 and then through the switch 52 to the other terminal of the battery. These circuits, when closed, cause the energization of the collet solenoids 21 and the chuck solenoids 60 whereby they attract their plungers 26 and 65, respectively.

The plungers 26 of the collet solenoids move to the right when attracted, causing the collar 20 to move towards the end of the collet 11, the latter being held against longitudinal movement to the right by the thrust-bearing 32. The cam action between the collar 20 and the outer surface 22 of the collet 11 causes the jaws of the collet to close upon and firmly grip the plug center 14.

The plungers 65 of the chuck solenoids move to the left when attracted. This movement actuates through the member 66, the horizontal rods 67 and the toggle mechanisms 61 to close the jaws 58 of the rotating chuck, whereby the nut 62 is gripped and rotated in a counter-clockwise direction (Fig. 2), causing it to be tightened on the plug center 14. The collet 11 and the associated collar 20 move to the left to compensate for the longitudinal movement of the plug center 14 as the nut 62 is tightened thereon. This movement of the collet 11 and collar 20 is possible, due to the particular construction of the solenoid mounting 23 which permits longitudinal movement thereof.

As hereinbefore described, the weighted lever 33 serves to prevent rotation of the collet 20 together with the plug center 14 while the nut 62 is being tightened. However, when the nut has been tightened to a predetermined tension or turning moment, the resistance to such rotation due to the weight 38 is overcome, whereupon the collet starts to rotate in a counter-clockwise direction, thereby rotating the lever 33 in a clockwise direction. Rotation of the lever 33 closes the switch 31 thereby closing an electrical circuit which may be traced as follows: from one terminal of the battery 72 through the switch 31, the switch 49, a winding 74 of the solenoid 45 to the other terminal of the battery. This circuit, when closed, produces a magnetic action in the solenoid winding 74 which causes the plunger 46 to move to the left. The lever 47 is thereby rotated in a counter-clockwise direction whereby it opens the switch 49, closes the switch 50, and opens the switch 52, thus interrupting the flow of current through the windings of the collet and chuck solenoids 21 and 60 causing them to become de-energized whereupon the plungers 26 and 65 are projected to their normal positions by the compression springs 30 and 69, respectively. This causes the collet 11 and jaws 58 to release their grip on the plug center 14 and nut 62 whereupon the plug is withdrawn, thus completing one cycle in the operation of the apparatus.

Although the invention, as herein illustrated and described, is particularly well adapted for use in connection with an apparatus for assembling telephone switchboard plugs, it should be understood that the invention is capable of other applications and should be limited only by the scope of the appended claims.

What is claimed is:

1. In an apparatus for applying a nut to a threaded element, individual gripping means for the nut and the element, means for causing a relative movement therebetween to thread the nut on the element, means carried by and movable with the

means for gripping the element and responsive to the tension between the nut and the element, and an electrical circuit responsive thereto for controlling the gripping means.

2. In an apparatus for applying a nut to a threaded element, a frame, a collet for gripping the element slidably mounted in the frame, a chuck having a plurality of jaws for gripping the nut, means for rotating the chuck, and an electrical circuit including contacts closed in response to the sliding of the collet in the frame to control means for actuating the collet to grip the element and means for actuating the jaws to grip the nut to cause it to be tightened on the element.

3. In an apparatus for applying a nut to a threaded element, a frame, a collet for gripping the element slidably mounted in the frame, a chuck having a plurality of jaws for gripping the nut, means for rotating the chuck, an electrical circuit including contacts closed in response to the sliding of the collet in the frame to control means for actuating the collet to grip the element and means for actuating the jaws to grip the nut to cause it to be threaded on the element, and additional contacts controlled by and responsive to the turning moment between the nut and the element for controlling said circuit to release the element and the nut.

4. In an apparatus for applying a nut to a threaded element, a supporting frame, a collet slidable therein in response to an engagement of the element therewith, means for closing the collet upon the element, means responsive to the sliding of the collet to actuate the closing means to thereby grip the element, and a rotating chuck also supported by the frame for gripping and thereby tightening the nut upon the element.

5. In an apparatus for applying a nut to a threaded element, a supporting frame, a collet slidable therein in response to an engagement of the element therewith, means for closing the collet upon the element, means responsive to the sliding of the collet to actuate the closing means thereby gripping the element, a rotating chuck also supported by the frame and another closing means also responsive to the sliding of the collet to close the chuck upon and thereby tighten the nut upon the element.

6. In an apparatus for applying a nut to a threaded element, a supporting frame, a collet slidable therein in response to an engagement of the element therewith, means for closing the collet upon the element,

means responsive to the sliding of the collet to actuate the closing means thereby gripping the element, a rotating chuck also supported by the frame for gripping and thereby tightening the nut upon the element, and means responsive to the tension between the nut and the element to release the closing means and thereby release the element from the collet.

7. In an apparatus for applying a nut to a threaded element, a supporting frame, a collet slidable therein in response to an engagement of the element therewith, means for closing the collet upon the element, means responsive to the sliding of the collet to actuate the closing means thereby gripping the element, a rotating chuck also supported by the frame, another closing means also responsive to the sliding of the collet to close the chuck upon and thereby tighten the nut upon the element, and means responsive to the tension between the nut and the element to release the collet and chuck closing means thereby releasing the element and the nut.

8. In an apparatus for applying a nut to a threaded element, a collet, closing means therefor, an electrical circuit including electromagnetic means responsive to the operative engagement of the threaded element with the collet to actuate the collet closing means to thereby grip the element, and a rotating chuck for gripping and thereby tightening the nut upon the element.

9. In an apparatus for applying a nut to a threaded element, a collet closing means therefor, an electrical circuit including electromagnetic means responsive to the engagement of the threaded element with the collet to actuate the collet closing means to thereby grip the element, a rotating chuck, and an electromagnetic means also included in said electrical circuit and responsive to the operative engagement of the element with the collet to close the chuck upon and thereby tighten the nut upon the element.

10. In an apparatus for applying a nut to a threaded element, a collet for gripping the element, a rotating chuck for gripping and thereby tightening the nut upon the element, a swinging arm controlled by the collet, an electrical contact controlled by the arm and an electrical circuit including the contact and means for releasing the element from the collet.

In witness whereof, I hereunto subscribe my name this 11th day of November, A. D., 1925.

ROBERT HOFSTETTER.