May 10, 1949. F. M. ANTHONY 2,469,426

DEVICE FOR CRIMPING TUBULAR ARTICLES

Filed Jan. 29, 1946 2 Sheets-Sheet 1

Fig. 1.

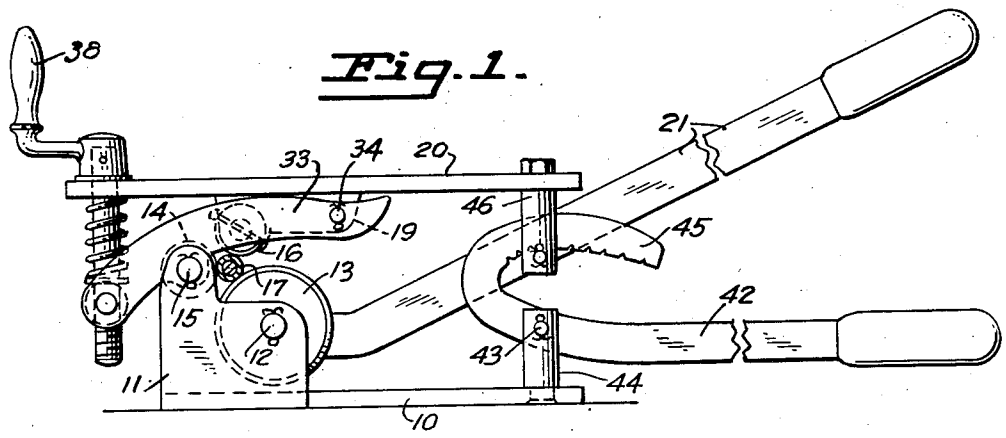



Fig. 2.

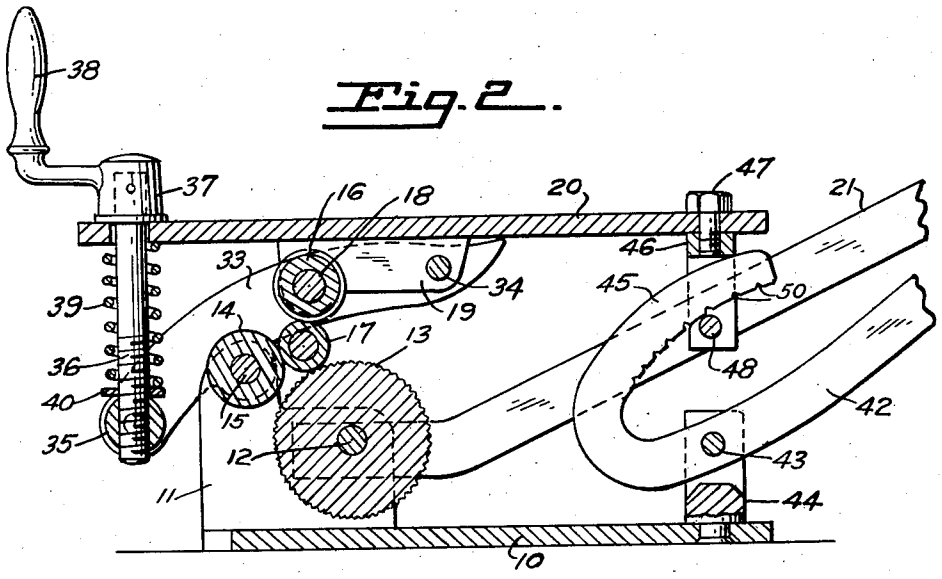
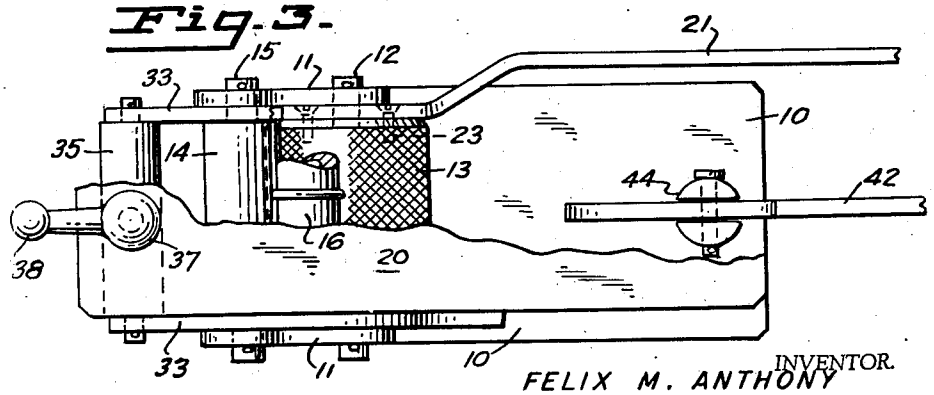



Fig. 3.




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May 10, 1949. F. M. ANTHONY 2,469,426

DEVICE FOR CRIMPING TUBULAR ARTICLES

Filed Jan. 29, 1946 2 Sheets-Sheet 2

Fig. 4

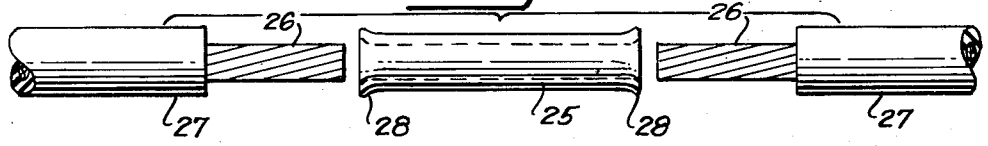



Fig. 5.

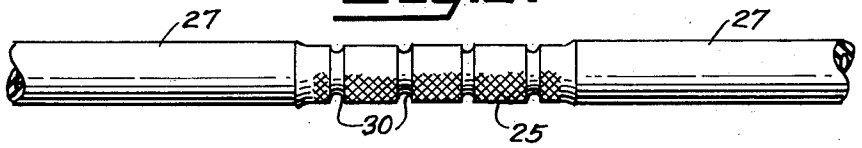



Fig. 6.

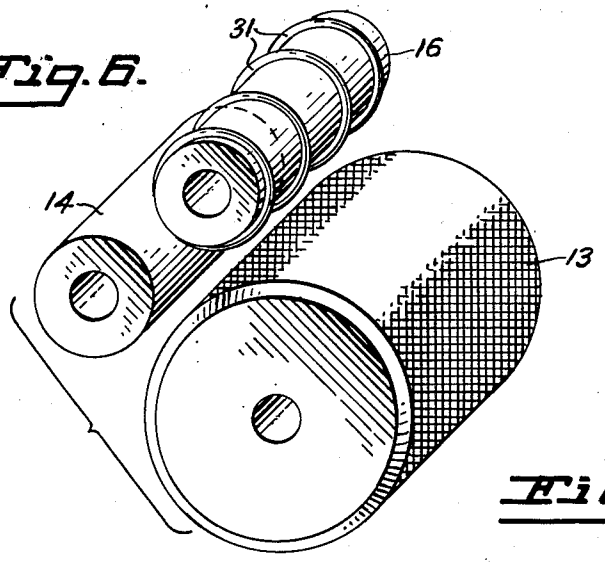



Fig. 7.

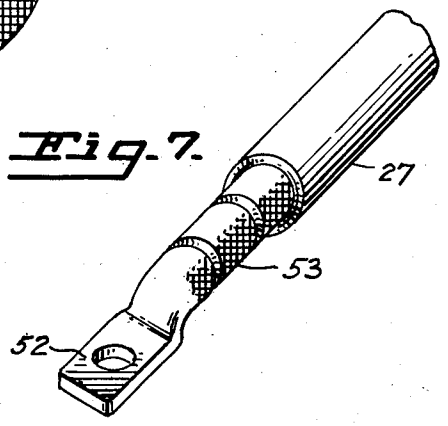
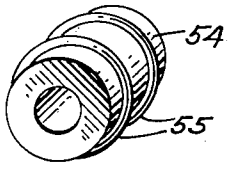



Fig. 8.




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Patented May 10, 1949 2,469,426

# UNITED STATES PATENT OFFICE

2,469,426

## DEVICE FOR CRIMPING TUBULAR ARTICLES

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Application January 29, 1946, Serial No. 644,116

2 Claims. (Cl. 153—9)

1

The present invention relates to forming or crimping devices designed particularly for the application of tubular metal connecting members to electrical conductors but capable of other uses as well.

One method of forming a connection between the ends of electrical conductors which insures an unusually strong connection and permits unrestricted flow of electrical current, includes the use of a metal tube or sleeve into which the conductor ends are inserted and retained by deforming the sleeve. More specifically this method employs a metal sleeve with an inside diameter just sufficient to receive the ends of the conductor to be connected. After the ends are inserted in the sleeve to meet about midway of its length, the sleeve is crimped and deformed preferably at several points throughout its length. This crimping consists of forming annular grooves in the exterior surface of the sleeve to produce corresponding annular beads or ridges protruding from its inner surface to clamp the conductor and prevent its separation from the sleeve. As the method described is particularly useful with relatively large conductors which may be subjected to rough usage, as is welding cable or the like, and which carry heavy electric load, the tubular connecting members must be of fairly heavy gauge metal so that the application of considerable pressure is required for the crimping process. It is also desirable that any apparatus employed in crimping the connecting sleeves be of fairly small dimensions and sufficiently light in weight for convenient portability and that a single apparatus be capable of crimping cable connectors of a wide range of sizes.

With these requirements in view, it is therefore an object of the present invention to provide a device for crimping tubular articles which is simple in construction and operation, which is small and light to facilitate portability and which is readily adapted to accommodate tubular articles to be crimped of many different sizes. A further object of the invention is the provision of a crimping or deforming device for tubular articles in which the article to be deformed is subjected to pressure and a rolling action and in which convenient means are included for applying increasing pressure as the rolling action continues until the required deformation is obtained. Still further and more specific objects and advantages of the invention are made apparent in the following specification wherein reference is made to the accompanying drawings for disclosure of a preferred form of the invention.

2

In the drawings:

Fig. 1 is a view in side elevation of a device for crimping tubular articles which embodies the principles of the present invention;

Fig. 2 is an enlarged central vertical section through the device illustrated in Fig. 1;

Fig. 3 is a plan view of the same device with a portion of its top plate broken away to disclose underlying parts;

Fig. 4 is a view in elevation of a connecting sleeve with which the device may be used, illustrating two cable ends in readiness to be inserted into the sleeve before it is deformed;

Fig. 5 is a similar view of the sleeve after the cable ends have been inserted and after the sleeve has been crimped by the device of the present invention;

Fig. 6 is an isometric view illustrating a set of three rollers which are employed in the device illustrated in Figs. 1 to 3;

Fig. 7 is an isometric view of a lug or terminal connection secured to the end of a cable by a modified form of the device shown in Fig. 1; and

Fig. 8 is an isometric view of one of the rollers employed in applying the terminal connector illustrated in Fig. 7.

Referring first to Figs. 1, 2 and 3 of the drawings, the crimping device illustrated therein is shown as having a base plate 10 and a pair of spaced side plates 11 which extend upwardly from opposite edges of the base plate adjacent one of its ends. Journaled between the side plates 11 for rotation about the pin 12 upon which it is supported is a driving roller 13 which is also illustrated in Fig. 6 and is relatively large in comparison with the other rollers employed and the surface of which is mutilated or knurled so that it will tend positively to rotate a tubular article with which it comes in contact as it turns about its supporting pin 12. Also disposed between the side plates 11 for cooperation with the driving roller 13 is an idler roller 14 which is rotatable with relation to a supporting pin 15. A crimping or forming roller 16 is supported above and in a plane between the axes of the driving roller and idler so that a tubular article to be crimped, assuming the position illustrated at 17 in Figs. 1 and 2 where it lies between and contacts the driving roller and idler roller, may be engaged and deformed by the forming roller.

The forming roller is rotatable with relation to a supporting pin 18 which is journaled between a pair of brackets 19 which brackets depend from opposite sides of a top plate shown at 20. The

top plate is pivotally supported in a manner which will hereinafter be described in detail so that the forming roller may be swung to and away from its operative position shown and so that pressure may be applied for deforming the surface of the tubular article 17 as it is caused to rotate in contact with the driving roller and idler roller. The desired rotational movement of the driving roller may be imparted by a hand lever 21 which may be secured directly to one side of the roller by any suitable means such, for example, as by screws indicated in dotted lines at 23 in Fig. 3. When the handle 21 is raised and lowered through an angle of say one hundred degrees or more, it imparts oscillation to the driving roller 13 and as the roller is considerably larger in circumference than the tubular article 17, a single partial rotation or oscillation of the driving roller will serve to turn the tubular article through more than a complete rotation, thus subjecting its entire surface to action by the forming roller.

An example of the manner in which the device operates to crimp the connecting sleeve on a pair of cable ends to be joined is illustrated in Figs. 4 and 5 of the drawings. In Fig. 4 a tubular metal sleeve is illustrated at 25 in readiness to receive the prepared ends 26 of two pieces of cable, the insulation 27 of the cable having been removed from the ends to be connected in the process of its preparation. The open ends of the sleeve 25 are preferably slightly flared as illustrated at 28 to facilitate introduction of the cable ends and to eliminate sharp edges from the position in which they might tend to cut into or abrade the wire strands of which the cable is formed. Fig. 5 shows the same sleeve 25 after the cable ends have been inserted and after it has been deformed or crimped by application of the device of the present invention to produce a plurality of grooves 30 circumscribing its outer surface and resulting in beads or ridges on its interior surface which compress and grip the cable ends to prevent their removal and to supply the necessary pressure for satisfactory conduction of an electrical current. The grooves 30 as illustrated in Fig. 5 are produced by annularly formed ridges 31 which circumscribe the forming roller 16 as illustrated in Fig. 6 wherein the three rollers are shown in approximately the relative positions which they assume during the deforming operation.

It is desirable that this device be capable of deforming cable connecting sleeves of different diameters. Obviously, as the forming roller 16 is supported by a top 20 which is pivoted relative to the base 10 carrying the other rollers, it may be swung to and away from the other rollers so that tubular articles of different sizes can be admitted to the space between the three rollers. It is necessary, however, in order to obtain the best efficiency that the forming or crimping roller always occupy substantially the same position with relation to the other rollers as it comes into contact with the article to be crimped or formed. Therefore, a simple pivotal connection between the top plate 20 and the base member 10 would not be satisfactory as adjustment of the forming roller to accommodate articles of different sizes would carry it through an arc so as to vary the position assumed by it with relation to the driving roller and idler roller. To overcome this objection to a conventional pivotal connection between the base and the top member, the top



member 20 is pivotally connected to a pair of adjusting arms 33 by means of a pin 34 which extends through the adjusting arms at what may be termed their forward ends and also through the brackets 19 which depend from the top member. These adjusting arms 33 are in turn pivotally supported with relation to the side plates 11 which are secured to the base 10 and may conveniently be supported by the same pin 15 which supports the idler roller 14. The adjusting arms 33 have ends which extend rearwardly beyond the base member and which carry between them a rod 35 which is provided with a centrally disposed vertical bore threaded for the reception of a jack screw 36. The jack screw 36 extends through a suitable perforation in the top plate 20 and has secured to it above said plate an enlarged head 37 carrying an operating handle 38 by means of which the screw may be rotated. A spring 39 is preferably interposed between the top plate and a collar 40 bearing against the bar 35 to maintain the maximum adjusted distance between the top plate and the bar.

With the construction just described, the top plate 20 which carries the forming roller 16 is pivotally supported with relation to the axis 15 and this support is disposed on a triangle defined by the pivot 34, the bar 35 and the head 37 of the jack screw. The proportions of this triangle may be adjusted by rotating the jack screw so that through its threaded connection with the bar 35 the arms 33 are swung about their pivot 34 to and away from the top plate 20. When the arms are drawn upwardly toward the top plate, the top plate assumes a lower position with the forming roller relatively close to the other rollers. When this condition is reversed, the top plate and forming roller are raised but the forming roller follows a substantially vertical line in its movement, thus maintaining its proper position relative to the driving roller and forming roller, and articles of different diameters may be handled between the rollers with substantially uniform efficiency.

It is, of course, necessary to apply continuous pressure to the article between the rollers as it is being deformed and beecause of the fact that the metal of which the connecting sleeves, illustrated in Figs. 4 and 5, are made is of relatively heavy gauge, it is desirable that they be rolled several times in succession with a continued application of pressure drawing the rollers closer together as the rolling process proceeds.

The present invention provides a combined latch and cam device which serves the purpose of holding the top plate down with the forming roller in engagement with the article being rolled and also of moving it downwardly step by step under pressure as the rolling progresses. As shown in Figs. 1 and 2, a latch lever 42 is pivotally supported as by a pin 43 which extends through a bifurcated bracket 44 suitably secured to the base 10 adjacent its forward end. This latch lever has a latching end 45 which extends through a bifurcated latch post 46 secured to the top plate 20 adjacent its forward end as by a cap screw 47 and engages with a pin 48 which extends through the post 46. The curved end 45 of the latch member which engages with the pin 48 is formed on an arc which is eccentric to the pivot 43 so that it has a cam action which, upon depression of the lever 42, draws the top plate downwardly. The edge engaging the pin 48 is preferably provided with a series of spaced indentations or notches 50 which register with the pin

48 and serve to hold the lever 42 in any desired position of adjustment and to overcome its tendency to slide away from the position in which it is set. Thus, if the top plate 20 is latched down by engagement with the first notch 50 and with the pin 48, it will remain in that position until the lever 42 is depressed and the second of the notches 50 comes into registry with the pin 48. By this means the lever 42 is effective to latch the top plate 20 in its lowered position with the forming roller 16 in engagement with the article 17 and it may be manipulated to lower the top plate in step by step fashion as the deforming process proceeds and as the ridges 31 on the roller 16 press more deeply into the surface of the article being deformed.

In the operation of the device herein disclosed, the latch lever 42 is first raised to free it from engagement with the pin 48 so that the top 20 may be raised about its pivotal support 15 and the article 17 may be placed between the rollers 13 and 14. The top 20 is then swung downwardly and the lever 42 is moved downwardly until the first notch on its latching end engages with the pin 48 to latch the top plate in its down position. If the device is not already adjusted for the size of the article just inserted, the crank 38 is manipulated to turn the jack screw 36 to raise or lower the top 20 until the ridges on the roller 16 just engage the article 17. The lever 21 is then raised and lowered to rotate the driving roller 13 which rotates the article 17 against the rollers 14 and 16 to start the desired crimping. The levers 42 and 21 are then actuated in alternate succession and each time that the roller 42 is moved to lower the top 20 a single notch the lever 21 is manipulated to cause turning of the article to deepen the annular grooves which are formed in its surface as illustrated at 30 in Fig. 5. The design of the cam surface on the latch member 45 is such that the grooves in the article will have been completely and properly formed when the lever 42 reaches its normal position at which time the lever may again be raised to release the top 20 so that the article may be removed.

Each of the rollers 14, 15 and 16 are preferably mounted on suitable anti-friction bearings, not illustrated, to facilitate their operation. The device herein so far disclosed is particularly designed for the application of a sleeve like connecting device in splicing together two cable ends. A similar but smaller connection is sometimes made between the end of a cable and some other article such, for example, as a detachable cable connector or the terminal connector or lug, illustrated in Fig. 7, which comprises a flat perforated portion 52 adapted to be connected with an electric terminal in a conventional manner, and a tubular portion 53 which may be secured to the end of a cable by crimping or deforming in the same manner as the sleeve illustrated in Figs. 4 and 5. For this and similar uses a smaller roller may be employed in place of the forming roller 16 and such a roller is illustrated at 54 in Fig. 8 as having but two of the ridges 55 which correspond to the ridges 31 shown in Fig. 6. When such a roller is employed, the width of the driving roller and the idler roller



are also correspondingly reduced. Such smaller rollers may be inserted in the machine of the type herein disclosed in place of the wide rollers or a separate machine may be provided which is reduced in width to just accommodate the smaller rollers.

I claim:

1. A device for crimping tubular articles comprising a base, a driving roller and an idler roller supported relative to the base for rotation on parallel axes to support between them a tubular article to be crimped, a top plate overlying the base and said rollers, a forming roller carried by the top plate on an axis parallel to the axes of the driving and idler rollers and in a position to engage the article supported by them, means supporting the top plate comprising an arm pivoted intermediate its ends relative to the base and extending forwardly and rearwardly of all of the rollers, a pivotal connection between the forward end of said arm and the top plate, and adjustable pivotal means connecting the rearward end of the arm and the top plate for adjustment of the forming roller relative to the other rollers without substantial alteration of the relative positions of the top plate and base at their forward ends.

2. A device for crimping tubular articles comprising a base, a driving roller and an idler roller supported relative to the base for rotation on parallel axes to support between them a tubular article to be crimped, a top plate overlying the base and said rollers, a forming roller carried by the top plate on an axis parallel to the axes of the driving and idler rollers and in a position to engage the article supported by them, means supporting the top plate comprising an arm pivoted intermediate its ends relative to the base and extending forwardly and rearwardly of all of the rollers, a pivotal connection between the forward end of said arm and the top plate, adjustable pivotal means connecting the rearward end of the arm and the top plate for adjustment of the forming roller relative to the other rollers without substantial alteration of the relative positions of the top plate and base at their forward ends, and a pivoted cam latch device connecting the base and top member adjacent their forward ends to impart pressure to an article being crimped by the rollers.

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