APPARATUS FOR APPLYING WITH CLAMP TERMINAL CLIPS OF THE FLANGED TUBULAR TYPE

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References Cited

UNITED STATES PATENTS
3,186,075 6/1965 Vickery, Jr.......... 29/203 HC

ABSTRACT

A tool for the installation of flanged tubular type wire clamp terminal clips over a wire lead and post terminal includes a plurality of finger members pivotally mounted about a hollow central push rod such that they close radially toward the rod on the application of axial pressure. Means for applying axial pressure is provided whereby a flanged tubular type wire clamp terminal clip is gripped between the fingers and push rod. As pressure is increased the fingers and rod exert opposing axial forces on the terminal clip sufficient to deform the cylindrical clip wall inwardly thereby securing the wire to the terminal. In an alternative embodiment a solid central push rod is employed to effect removal of the terminal clips.

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10 Claims, 12 Drawing Figures
APPARATUS FOR APPLYING WITH CLAMP TERMINAL CLIPS OF THE FLANGED TUBULAR TYPE

BACKGROUND OF THE INVENTION

1. Field of the Invention
The present invention relates generally to the field of solderless electrical connections and more particularly to a tool for the installation of flanged tubular type wire clamp terminal clips.

2. Description of the Prior Art
Prior to the present invention, solderless electrical connection of a wire to a post-type terminal was usually accomplished in either of two ways. The so-called wire wrap approach involves wrapping the wire tightly about a sharp edged post as disclosed in U.S. Pat. No. 2,759,166 which issued to P. F. Mallina on Aug. 14, 1956. A hand tool for winding wire on terminals to provide this type of connection is described in U.S. Pat. No. 2,758,797 which issued to E. P. Miklau on Aug. 14, 1956. The other generally accepted solderless connection is provided by a spring loaded clip which holds the conductor against a square or rectangular terminal post as disclosed in U.S. Pat. No. 3,239,918 which was granted to R. F. Cobbaugh on Mar. 15, 1966. Apparatus for installing these spring loaded clips to terminal posts is described in U.S. Pat. No. 3,186,075 which issued to J. R. Vickery, Jr. on June 1, 1965. It will be apparent that each of these approaches to solderless connection involve the use of apparatus which is particularly adapted to the type of solderless connector to be used.

Co-pending application Ser. No. 66,933 now Pat. No. 3,678,176 of William A. Reimer which is assigned to the same assignee as the present application discloses and claims a wire clamp terminal clip of the flanged tubular type. This type of terminal clip provides electrical connection of a wire to a terminal post through inward deformation of the clip on the application of axial compression. Also disclosed in that application is a pliers-type tool for applying the compression necessary to the installation of the terminal clips. This type of compressing tool is, however, cumbersome to use in high density wiring fields commonly found in the so-called "bed-of-nails" back planes of sophisticated electronic systems.

OBJECTS AND SUMMARY

From the foregoing it will be understood that among the various objectives of the present invention are the following:

- to provide a new and improved tool for forming a solderless electrical connection between a terminal post and conductor;
- to provide apparatus of the above-described character particularly adapted to the installation of wire clamp terminal clips of the flanged tubular type; and
- to provide apparatus of the above-described character which may be adapted to effect removal of wire clamp terminal clips of the flanged tubular type with a minimum of structural modification.

These and other objectives of the present invention are efficiently achieved by providing an outer barrel in which an inner barrel is slidably disposed. A plurality of finger members are pivotally mounted about a hollow push rod which is centrally disposed within the inner barrel. Both the finger members and push rod extend beyond the end of the outer barrel. The finger members and push rod are formed and disposed such that when axial pressure is applied to the inner barrel the finger members close radially toward the push rod and the rod is axially extended outwardly from the outer barrel. In operation the finger members grip the flanged portion of the terminal clip and hold it axially against the hollow push rod. The terminal clip is then placed over the terminal post and wire and the axial pressure is increased sufficiently to deform the terminal clip in the desired manner.

The foregoing as well as other objects, features and advantages of the present invention will become more apparent from the following detailed description taken in conjunction with the various views of the appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-section view of apparatus for applying wire clamp terminal clips of the flanged tubular type in accordance with the principles of the present invention;

FIG. 2 is a partial cross-section view of the apparatus of FIG. 1 partially actuated to pick up and hold a terminal clip prior to its application to a terminal post;

FIGS. 3a through 3f are schematic illustrations of the operating sequence of the apparatus of FIG. 1; and

FIGS. 4a through 4c schematically illustrate the use of the apparatus of the present invention for removal of terminal clips.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to FIG. 1 there is illustrated in cross-section a tool for application of flanged tubular type wire clamp terminal clips including a first or outer barrel 10, a rear housing 12 and pistol grip 14. A second or inner barrel 16 is slidably disposed within the outer barrel 10 and what is herein termed a finger support member 18 is mounted to the outer barrel 10 through a slot (not shown) in each side of the slidable inner barrel 16. The inner barrel 16 is thus longitudinally slidable with respect to the finger support member 18 as well as the outer barrel 10. Four hardened tool steel fingers 20 (two of which are shown) disposed in a cruciform arrangement are pivotally mounted by pins 22 to the finger support member 18 and each finger rides in a keyway 24 in the inner barrel 16. A radially adjustable pin 26 is disposed near the forward end of each keyway 24.

When the inner barrel 16 is moved longitudinally with respect to the outer barrel 10 and finger support member 18 the adjustable pins 26 slide over the edges of the fingers 20 forcing them to radially open and close. The fingers 20 are each formed with a raised cam-shaped portion 28 rearward of the pivot pins 22. Thus when the inner barrel 16 is moved rearwardly the pins 26 engage the cam-shaped portions 28 of the fingers 20 causing them to rotate inwardly about the pivot pins 22 and provide radially outward expansion of the outer ends of fingers 20. When the inner barrel 16 is moved forwardly the pivot pins 22 engage the edges of the fingers 20 causing them to close radially inward.
A push rod 30 is disposed along the longitudinal axis of the tool, extends rearwardly through the finger support member 18 to the end cap 32 of inner barrel 16, and is thus axially movable with the inner barrel 16. The push rod 30 is hollow for at least the portion of its length which extends beyond the end of outer barrel 10. The forward end of outer barrel 10 may be closed by a finger and push rod guide 33 having slots 35 within which the fingers 20 may move radially and the push rod 30 may move axially.

Disposed within the rear housing 12 is a shaft 34 extending rearwardly from the inner barrel end cap 32. The shaft 34 is provided with a cross member 36 which serves to hold the yoke-shaped upper end 38 of a trigger handle 40 in engagement with the inner barrel end cap 32. The trigger handle 40 is pivotally mounted to a pistol-type grip 14 by a pivot pin 44 such that when the handle 40 is squeezed an axially outward pressure is applied to the end cap 32 of inner barrel 16. Thus the inner barrel 16 as well as the push rod 30 are driven axially forward and the fingers 20 are closed as described hereinabove.

The shaft 34 is further provided with an adjustment stop 46 which may be moved longitudinally back and forth to adjust the bias provided by the light spring 48 inserted through the rear of the rear housing 12 and held in position by a threaded spring holder 50.

When the tool is in its idle state the upper end 38 of trigger handle 40 is maintained in a withdrawn position by a trigger handle return spring 52 disposed between the handle 40 and pistol-type grip 14 and the fingers 20 are held in the radially extended position.

The grip 14 may further be provided with an adjustable stop 54 to limit the longitudinal distance over which the inner barrel 16 and push rod 30 are driven to a preselected maximum determined by the size of the flanged tubular wire clamp terminal clip to be installed.

FIG. 2 partially illustrates the apparatus of FIG. 1 in its partially operated state whereby a flanged tubular type wire clamp terminal clip is picked up and held prior to its application to a terminal post. Elements common to the views of Figures 1 and 2 are identified with like reference numerals. As the trigger handle 40 is moved rearwardly toward the grip (not shown) it pivots about pin 44 and the upper end 38 moves forwardly driving the inner barrel 16 axially forward. The pins 26 slide forward along the edges of the fingers 20 forcing them closed. As the fingers 20 close the hollow push rod 30 is also driven forward. The outer ends of the fingers 20 are formed in a hook shape corresponding to the shape of the flanged portion of the flanged tubular type wire clamp terminal 56. For convenience a supply of flanged tubular type wire clamp terminals 56 may be provided on pickup posts such as shown at 58 mounted on any convenient mounting board 60.

With reference now to FIGS. 3a through 3g there is illustrated a complete operating sequence of the apparatus of FIGS. 1 and 2. Again, elements of the apparatus previously described are identified with like reference numbers. Figures 3a–3c illustrate the wire clamp pickup sequence and installation of the clamp on a terminal post is shown in FIGS. 3d–3g. Only the forward ends of the fingers 20 and hollow push rod 30 are shown for the purposes of brevity and clarity.

In FIG. 3a the tool is in an unoperated state with the fingers 20 spread and the hollow end of the push rod 30 is ready for placement over the terminal clip pick-up post 56. It will be noted that the transverse cross-section of the hollow push rod 30 is substantially the same as that of the tubular portion of the terminal clip 58. In FIG. 3b the push rod 30 has been pushed over the pick-up post 58 until it stops on the top of the terminal clip 56. The trigger handle is partially depressed as shown in FIG. 2 such that the fingers close on the flanged portion of the terminal clip 56 and hold it against the end of push rod 30. In FIG. 3c the terminal clip 56 has been removed from the pick up post 58 and is ready for installation. FIG. 3d illustrates the stripped end of a wire 62 to be terminated inserted into the terminal clip 56. In FIG. 3e the terminal clip 56 and wire 62 are placed over a terminal post 64. In FIG. 3f the trigger handle 40 of FIG. 1 is fully depressed which drives the push rod 30 outwardly against the tubular portion of the terminal clip 56 which is held by its flanged portion by the fingers 20. The terminal clip 56 is thus compressed sufficiently that its walls deform inwardly clamping the wire 62 to the terminal post. FIG. 3g illustrates the tool returned to its original state with the fingers 20 spread and the push rod 30 withdrawn permitting detachment from the clamped terminal clip 56 and removal from the wiring field.

As schematically illustrated in FIGS. 4a through 4c removal of a terminal clip 56 from a terminal post 64 involves the same basic sequence of operation as installation. However, the hollow push rod 36 of FIGS. 1–3 is replaced with a solid rod 66 having substantially the same transverse cross-section as the terminal post 64 from which the clip 56 is to be removed. When the trigger handle (not shown) is operated, pressure is applied by the solid push rod 66 to the top of the terminal post 64 and to the bottom or flanged end of the terminal clip 56 thus pulling the clip and wire from the terminal post without application of undue forces on the post itself or its mounting board.

It will be apparent from the foregoing that the present invention provides a fast and simple apparatus for the installation and removal of wire clamp terminal clips of the flanged tubular type and is readily adaptable to accept a wide variety of terminal clip sizes as the situation may demand. The objectives set forth hereinabove are thus efficiently achieved in apparatus which is inexpensive in both manufacture and use.

It is to be understood that although the present invention is described in terms of a hand operated gun type tool, it may be readily adapted for automatic operation by any of a variety of electro-mechanical means without departure from the basic operating principles of the device. Since various changes in the above described construction will occur to those skilled in the art without departure from the principles of the present invention it is intended that all matter contained in the foregoing description or shown in the appended drawings shall be interpreted as illustrative and not in a limiting sense.

Having described what is new and novel and desired to secure by Letters Patent, what is claimed is:

1. Apparatus for the installation of flanged tubular type wire clamp terminal clips on terminal posts comprising:
a first hollow cylindrical member;
a second hollow cylindrical member coaxially disposed within said first cylindrical member and axially movable with respect thereto;
a plurality of finger members formed at one end in a configuration adapted to engage the flanged portion of said terminal clip;
means for pivotally mounting said finger members at a fixed axial position with respect to said first hollow cylindrical member such that said clip engaging portion of said finger members extend beyond the ends of said first and second hollow cylindrical members and rotate radially with respect to the longitudinal axis of said first and second hollow cylindrical members in response to longitudinal motion of said second hollow cylindrical member within said first hollow cylindrical member;
a push rod disposed substantially on the longitudinal axis of said first and second hollow cylindrical members, fixed at one end to said second hollow cylindrical member, and the other end thereof extending beyond the end of said first hollow cylindrical member; and
means for selectively driving said second hollow cylindrical member longitudinally with respect to said first hollow cylindrical member such that said fingers are rotated inwardly toward said push rod and said push rod is driven axially outward with respect to the end of said first hollow cylindrical member.

2. Apparatus as recited in claim 1 wherein the extended portion of said push rod is of a hollow tubular configuration having a transverse cross section substantially the same as that of said flanged tubular type wire clamp terminal clips.

3. Apparatus as recited in claim 1 wherein the extended portion of said push rod is of a solid tubular configuration having a transverse cross section substantially the same as that of said terminal posts.

4. Apparatus as recited in claim 1 wherein said selective driving means comprises a rear housing fixed to said first hollow cylindrical member, a hand grip fixed to said rear housing, and a trigger handle mounted on said housing, adapted to pivot about an axis displaced from and normal to the longitudinal axis of said first and second hollow cylindrical members and disposed such that compression of one end of said trigger handle toward said hand grip drives the other end of said handle against said second hollow cylindrical member thereby moving said second hollow cylindrical member axially within said first hollow cylindrical member.

5. Apparatus as recited in claim 4 further including spring return means disposed between said trigger handle and said hand grip such as to return said trigger handle to a preselected withdrawn position on removal of said compression.

6. Apparatus as recited in claim 4 further including means disposed between said trigger handle and said hand grip to limit the travel of said trigger handle to a preselected distance thereby limiting the axial distance over which said second hollow cylindrical member is moved within said first hollow cylindrical member.

7. Apparatus as recited in claim 5 further including means for retaining the driven end of said trigger handle in a fixed axial position with respect to said second hollow cylindrical member such that said second hollow cylindrical member is moved forwardly on compression of said trigger handle and is moved rearwardly on removal of said compression by said spring return means.

8. Apparatus as recited in claim 1 wherein said second hollow cylindrical member is provided with a plurality of internal longitudinal keyways, each said keyway being provided adjacent its forward end with a radially adjustable pin, each said finger formed opposite its extended end and rearward of the axis of rotation thereof in a raised cam portion, and disposed in a corresponding keyway such that said adjustable pins slidably engage the edges of said finger members thereby providing outward radial rotation of said extended ends of said fingers on rearward motion of said second hollow cylindrical member and inward radial rotation of said extended ends of said fingers on forward motion of said second hollow cylindrical member.

9. Apparatus as recited in claim 1 wherein four finger members are disposed in a cruciform arrangement about said push rod.

10. Apparatus as recited in claim 1 further including a guide plate fixed to the forward end of said first hollow cylindrical member and having a plurality of slots therein through which said finger members and push rod extend and within which said finger members are radially movable and said push rod is axially moveable.