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WIRE CONNECTING TOOL

Herman A. Miloche, Teaneck, N. J., assignor to
Bell Telephone Laboratories, Incorporated, New
York, N. Y., a corporation of New York

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This invention relates to wire connecting tools and more particularly to hand tools for connecting wire to electrical terminals.

The invention provides a shaft rotatably housed in a body member which may be grasped in the hand. The shaft is provided with a hole axially therein and opening on one end of said shaft. It is not necessary, as will be appreciated by skilled persons from a reading of subsequent description, that the hole be exactly symmetrical with respect to the axis of the shaft. It is necessary only that such hole be substantially axial. In addition to the axial hole, the shaft is provided with another hole or aperture or groove situated longitudinally of said shaft and opening on the said one end thereof but offset radially from said axial hole. An end of a wire is intended to be placed in the said other hole or aperture or groove and may be gripped frictionally thereby. An electrical terminal, to which said wire is to be connected, is insertable into the said axial hole. With the wire and terminal in this position a rotary motion is imparted to the shaft such that the gripped end of said wire is wrapped spirally about the said terminal. Axial motion may be imparted to said shaft simultaneously with the rotary motion to insure that the spiral of wire conforms to a helical spiral about said terminal.

A detailed description of one embodiment of the invention, generally described above, is hereinafter set forth in conjunction with the drawing forming a part of this disclosure. The various figures of said drawing are described generally as follows:

Fig. 1 shows the invention embodied in a plier-type tool in position for use;

Fig. 2 is a perspective enlargement of certain details of the invention to be explained;

Fig. 3 is a perspective enlargement similar to Fig. 2 but disclosing a modified structure;

Figs. 4 and 5 are views of the operating end of the shaft of the tool of Fig. 1;

Fig. 6 is an end view of the tool of Fig. 2 when in condition for operation;

Fig. 7 is an enlarged view of the shaft and its gearing whereby both rotary and axial motion may be imparted to said shaft if so desired; and

Fig. 8 is an end view of a modified form of the said tool.

Referring to Fig. 1, a plier-like construction is shown as an exemplary embodiment of the invention. A body member 1 has hinged or pivoted thereto two levers or arms 2 and 3. Arm 3 is normally separated from the handle portion 4 of body member 1 by being biased under the ac-

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tion of a spring 5 fixed to arms 3 at 6 and engaging handle 4 at 7. Attached to handle 4, by means of rivets or other suitable fastening means 8, is an angle frame 9 comprising a base portion 10 and a web portion 11. Housed in body member 1, as a bearing journal, is a shaft 12 which has fixed to its rearward portion a pinion gear 13, secured to shaft 12 by such means as a set screw 14. The outermost rearward end of the shaft 12 may, in one type of tool, be upset at 15 to provide, in cooperation with pinion 13, confining means to preclude axial movement of shaft 12, the upright 11 having a suitable hole therein to accommodate shaft 12 in the nature of a bearing surface. Attached to the free end of arm 3 is a rack 16 located between pinion 13 and the base 10 of angle frame 9. Rack 16 is intended to engage pinion 13 in a well-known manner to rotate shaft 12 when arm 3 is squeezed toward the handle 4 by the hand of an operator. A lug 17 on the end of rack 16 is located so as to engage a pin 18 in the base 10 in order to fix the position of shaft 12 when in its normal position, as shown in Fig. 1, and as subsequently explained. The forward portion 19 of the body member 1 is more clearly explained with reference to other figures of the drawing, as also is the movable jaw 20 actuated by arm 2. In Fig. 1 the tool is shown in proper relation to an electrical terminal 21, attached to an electrical apparatus 22, such as a relay. The tool has engaged therein a wire 23 which the tool is capable of attaching to terminal 21 as will be explained.

Referring to Figs. 4 and 5 in particular, the end of shaft 12 which is housed in the forward portion 19 of the body 1 of the tool is formed as a somewhat conical or countersunk surface 24. A hole or bore 25 is provided along the axis of the shaft 12 and may be of any suitable length, such as to point 26 of Fig. 1. Such hole or bore 25 need not be exactly and symmetrically axial of the shaft 12. As long as the hole or bore 25 is substantially axial the tool will function properly, as will be appreciated by those skilled in the art. The bore 25 should be of sufficient diameter such that it can accommodate freely a terminal, such as the wire terminal 21 of Fig. 1, or such as a flat terminal or for that matter any configuration of electrical terminal to which said wire is to be connected. A slot or groove 27 is cut in shaft 12, the depth of which in the radial direction of said shaft 12 is not sufficient to connect same with bore 25. In Fig. 5 the slot 27 is shown to nearly enter the bore 25 and in Fig. 6 the slot 27 is likewise illustrated as being radial and nearly entering

bore 25. Of course the depth is arbitrary as is the direction of the depth of slot 27, it being perfectly feasible and practical to have the slot 27 offset from a radial position or in any other direction desired. The width of slot 27 is made approximately the same as the diameter of wire to be accommodated therein, as shown in Fig. 6. The leading edges 28 of the slot 27 are purposefully made sharp in order more efficiently to frictionally grip the skinned or bare end 29 of wire 23.

As previously mentioned, a stop pin 18 is provided on base 10 of frame 9 in order to determine the normal rotary position of shaft 12. This normal position is represented in Figs. 2 and 6 where the slot 27 of shaft 12 communicates with a similar cut 30 in the top of the forward end 19 of body member 1. This cut 30 is located at the bottom of a V groove 31 formed in the the forward end 19 to facilitate entry of bare wire 29 into slot 27 of shaft 12. The underside of the movable jaw 20 is constructed as a wedge 32 which is arranged to cooperate with the V groove 31 as shown best in Fig. 6. A ridge 33 is provided along the bottom of wedge 32 and this ridge 33 is intended to assist wire 29 in becoming accommodated in slot 27 as shown by Fig. 6.

With wire 29 in slot 27 and movable jaw 20 in position as shown by Fig. 6, a lip 34 provides a securing means for wire 29 so that said wire cannot revolve with shaft 12. An alternate means of securing said wire against rotation is illustrated in Fig. 3 as a lug 35. Motion of arm 3 of the tool of Fig. 1 will move rack 16 which in turn will rotate shaft 12 by means of pinion 13. When the tool, in the normal condition shown in Fig. 6, is brought into operating position it will engage a terminal 21 in the bore 25 as shown by Fig. 1 and as indicated by arrow 36 of Fig. 2. When shaft 12 is at this time rotated in the direction of arrow 37 of Fig. 2, bare wire 29 will be dragged about terminal 21 to form two or three tight turns (see 38 of Fig. 3). The end of bare wire 29, having been gripped by the sharp edges 28 of slot 27, has remained in slot 27 and the rest of wire 29 was dragged about terminal 21, this motion pulling the insulated wire 23 in the direction of arrow 39 of Fig. 3 to a position shown by Fig. 3.

In Fig. 7 is illustrated an enlargement of the pinion 13, set screw 14, shaft 12, rack 16, base plate 10 and upright 11. This figure provides, instead of upset end 15 of shaft 12 as in Fig. 1, a threaded end 40 for shaft 12, which threaded end 40 is in cooperation with suitable threads in the hole through upright 11. This modification permits shaft 12 to be moved axially in the direction of arrows 41 as rack 16 is moved in the direction of arrows 42. This axial motion 41 of shaft 12 will insure that the turns 38 (see Fig. 3) of wire 29 will conform as nearly as possible to a helix about terminal 21 due to a recession of shaft 12 in the direction 43 (see Fig. 3) as wire 29 is dragged about terminal 21.

The modification of the construction of the operating end of shaft 12 shown in Fig. 8 is of a type contemplated by the scope of this invention. That is, the bore 25 may cooperate with a hole 44 equally as well as with such slots or grooves as 27 of the type of shaft as shown in Figs. 4 and 6 for instance. In case such a hole 44 is preferred the forward portion 19 of the body member 1 of the tool will preferably confine shaft 12 on all sides as shown in Fig. 8, instead of having a V groove opening on the top of the shaft 12 such as 31 of Fig. 2. Likewise the movable jaw 20 of Fig. 1 would be unnecessary. The construc-

tion of Fig. 8 may be provided with a lug 35 similarly to the structure of Fig. 3 and for the same purpose. It of course would be necessary with the structure of Fig. 8, that the wire be inserted into hole 44 instead of being deposited in a slot or groove such as shown in Fig. 2. The terminal would still be accommodated by the axial bore 25 as with the other types and the action of the tool would be the same.

There are numerous embodiments of this invention other than the particular ones disclosed and since it is not intended that the scope of the invention be limited to the particular disclosures set forth herein claims are appended which alone define the scope of this invention.

What is claimed is:

1. A hand tool for securing wire to electric terminals comprising a body member housing a rotatable shaft therein, means associated with said body member for rotating said shaft, the forward portion of said shaft having a circular substantially axial bore into which bore one end of said terminal may be inserted, said forward portion of said shaft being provided with an opening separated radially from said axial bore and extending substantially longitudinally of said shaft and substantially parallel to said axial bore, said opening adapted to have inserted therein one end of said wire, and arranged to position said one end of said wire substantially parallel to said axial bore and guiding means for said wire on the forward end of the body of said tool, said tool adapted when said shaft is rotated to secure the said wire spirally about said one end of said terminal.

2. A hand tool for securing wire to electric terminals comprising a body member housing a rotatable shaft therein, means associated with said body member for rotating said shaft, the forward portion of said shaft having a circular substantially axial bore into which bore one end of said terminal may be inserted, said forward portion of said shaft being provided with a hole opening on the forward end of said shaft and separated radially from said axial bore and extending substantially longitudinally of said shaft and substantially parallel to said axial bore, said hole adapted to have inserted therein one end of said wire and arranged to position said one end of said wire substantially parallel to said axial bore, and guiding means for said wire on the forward end of the body of said tool, said tool adapted when said shaft is rotated to secure the said wire spirally about said one end of said terminal.

3. A hand tool for securing wire to electric terminals comprising a body member housing a rotatable shaft therein, means associated with said body member for rotating said shaft, the forward portion of said shaft having a circular substantially axial bore into which bore one end of said terminal may be inserted, said forward portion of said shaft being provided with a circular hole opening on the forward end of said shaft and separated radially from said axial bore and extending substantially longitudinally of said shaft and substantially parallel to said axial bore, said circular hole adapted to have inserted therein one end of said wire and arranged to position said one end of said wire substantially parallel to said axial bore, and guiding means for said wire on the forward end of the body of said tool, said tool adapted when said shaft is rotated to secure the said wire spirally about said one end of said terminal.

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4. A hand tool for securing wire to electric terminals comprising a body member housing a rotatable shaft therein, means associated with said body member for rotating said shaft, the forward portion of said shaft having a substantially axial opening into which opening one end of said terminal may be inserted, said forward portion of said shaft being provided with a groove opening on the surface of said shaft and on the forward end of said shaft and extending substantially longitudinally of said shaft and substantially parallel to said axial opening, said groove adapted to have inserted therein one end of said wire, and guiding means for said wire on the forward end of the body of said tool, said tool adapted when said shaft is rotated to secure the said wire spirally about said one end of said terminal.

5. A hand tool for securing wire to electric terminals comprising a body member housing a rotatable shaft therein, means associated with said body member for rotating said shaft, the forward portion of said shaft having a circular substantially axial bore into which bore one end of said terminal may be inserted, said forward portion of said shaft being provided with a groove opening on the surface of said shaft and on the forward end of said shaft and extending substantially longitudinally of said shaft and substantially parallel to said axial bore, said groove adapted to have inserted therein one end of said wire, and guiding means for said wire on the forward end of the body of said tool, said tool adapted when said shaft is rotated to secure the said wire spirally about said one end of said terminal.

6. A hand tool for securing wire to electric terminals comprising a body member housing a rotatable shaft therein, means associated with said body member for rotating said shaft, the forward portion of said shaft having a circular substantially axial bore into which bore one end of said terminal may be inserted, said forward portion of said shaft being provided with a circular hole opening on the forward end of said shaft and separated radially from said axial bore and extending substantially longitudinally of said shaft and substantially parallel to said axial bore, said circular hole adapted to have inserted therein one end of said wire and arranged to position said one end of said wire substantially parallel to said axial bore, and guiding means for said wire on the forward end of the body of said tool, said tool adapted when said shaft is rotated to grip said one end of said wire by means of said hole and to drag said wire spirally about said one end of said terminal.

7. A hand tool for securing wire to electric terminals comprising a body member housing a rotatable shaft therein, means associated with said body member for rotating said shaft, the forward portion of said shaft having a circular substantially axial bore into which bore one end of said terminal may be inserted, said forward portion of said shaft being provided with a groove opening on the surface of said shaft and on the forward end of said shaft and extending substantially longitudinally of said shaft and substantially parallel to said axial bore, said groove adapted to have inserted therein one end of said wire, and guiding means for said wire on the forward end of the body of said tool, said tool adapted when said shaft is rotated to grip said one end of said wire by means of said groove and to drag said wire spirally about said one end of said terminal.

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8. A hand tool for securing wire to electric terminals comprising a body member housing a rotatable shaft therein, means associated with said body member for rotating said shaft, the forward portion of said shaft having a circular substantially axial bore into which bore one end of said terminal may be inserted, said forward portion of said shaft being provided with a groove opening on the surface of said shaft and on the forward end of said shaft and extending substantially longitudinally of said shaft and substantially parallel to said axial bore, said groove having a sharp forward edge and adapted to have inserted therein one end of said wire, and guiding means for said wire on the forward end of the body of said tool, said tool adapted when said shaft is rotated to grip said one end of said wire by means of the sharp edge of said groove and to drag said wire spirally about said one end of said terminal.

9. A hand tool for securing wire to electric terminals comprising a body member housing a rotatable shaft therein, manually operable means for rotating said shaft, the forward portion of said shaft having a circular substantially axial bore into which bore one end of said terminal may be inserted, said forward portion of said shaft being provided with a circular hole opening on the forward end of said shaft and separated radially from said axial bore and extending substantially longitudinally of said shaft and substantially parallel to said axial bore, said circular hole having a sharp forward edge and adapted to have inserted therein one end of said wire and arranged to position said one end of said wire substantially parallel to said axial bore, and a lug on the forward end of the body of said tool for guiding said wire, said tool adapted when said shaft is rotated to grip said one end of said wire by means of the sharp edge of said circular hole and to drag said wire spirally about said one end of said terminal.

10. A hand tool for securing wire to electric terminals comprising a body member, an arm integral with said body member, a second arm pivoted to said body member, a shaft rotatable within said body member and accessible through a hole in the forward end of said body member, a pinion secured to said shaft, a rack pivoted to said second arm and engageable with said pinion to rotate said shaft, the forward portion of said shaft provided with a substantially axial bore into which bore one end of said terminal may be inserted, said forward portion of said shaft being provided with a groove opening on the surface of said shaft at the forward end thereof and extending substantially longitudinally of said shaft and substantially parallel to said axial bore, said groove adapted to have inserted therein one end of said wire, and guiding means for said wire on the forward end of the body of said tool, said tool adapted when said shaft is rotated by the movement of said second arm to secure said wire spirally about said one end of said terminal.

11. A hand tool for securing wire to electric terminals comprising a body member having a slotted jaw, an arm attached to said body member, a second arm pivoted to said body member, a shaft rotatable within said body member and accessible through a hole in the forward end of said body member, a pinion secured to said shaft, a rack pivoted to said second arm and engageable with said pinion to rotate said shaft, the forward portion of said shaft provided with a circular sub-

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stantially axial bore into which bore one end of said terminal may be inserted, said forward portion of said shaft being provided with a groove opening on the surface of said shaft at the forward end thereof and extending substantially longitudinally of said shaft and substantially parallel to said axial bore, said groove adapted to have inserted therein through the slot in said jaw one end of said wire, and a movable jaw pivoted to the forward end of the body of said tool to cooperate with said slotted jaw to guide said wire, said tool adapted when said shaft is rotated to grip said one end of said wire by means of said groove and to drag said wire spirally about said one end of said terminal.

12. A hand tool for securing wire to electric terminals comprising a body member having a slotted jaw, an arm attached to said body member, a second arm pivoted to said body member, a shaft rotatable within said body member and accessible through a hole in the forward end of said body member, a pinion secured to said shaft, a rack pivoted to said second arm and engageable with said pinion to rotate said shaft, the forward portion of said shaft provided with a circular substantially axial bore into which bore one end of said terminal may be inserted, said forward portion of said shaft provided with a groove opening on the surface of said shaft and on the forward end of said shaft and extending substantially longitudinally of said shaft and substantially parallel to said axial bore, said groove having a sharp forward edge and adapted

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to have inserted therein through the slot in said jaw one end of said wire, a movable jaw pivoted to the forward end of the body of said tool to cooperate with said slotted jaw to guide said wire, said tool adapted when said shaft is rotated to grip said one end of said wire by means of the sharp edge of said groove and to drag said wire spirally about said one end of said terminal, said shaft having a threaded portion on the rear end thereof which in cooperation with a mating threaded portion in said first arm imparts receding motion to said shaft when said shaft is rotated to thereby insure a helical spiral configuration to said secured wire.

HERMAN A. MILOCHE.

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