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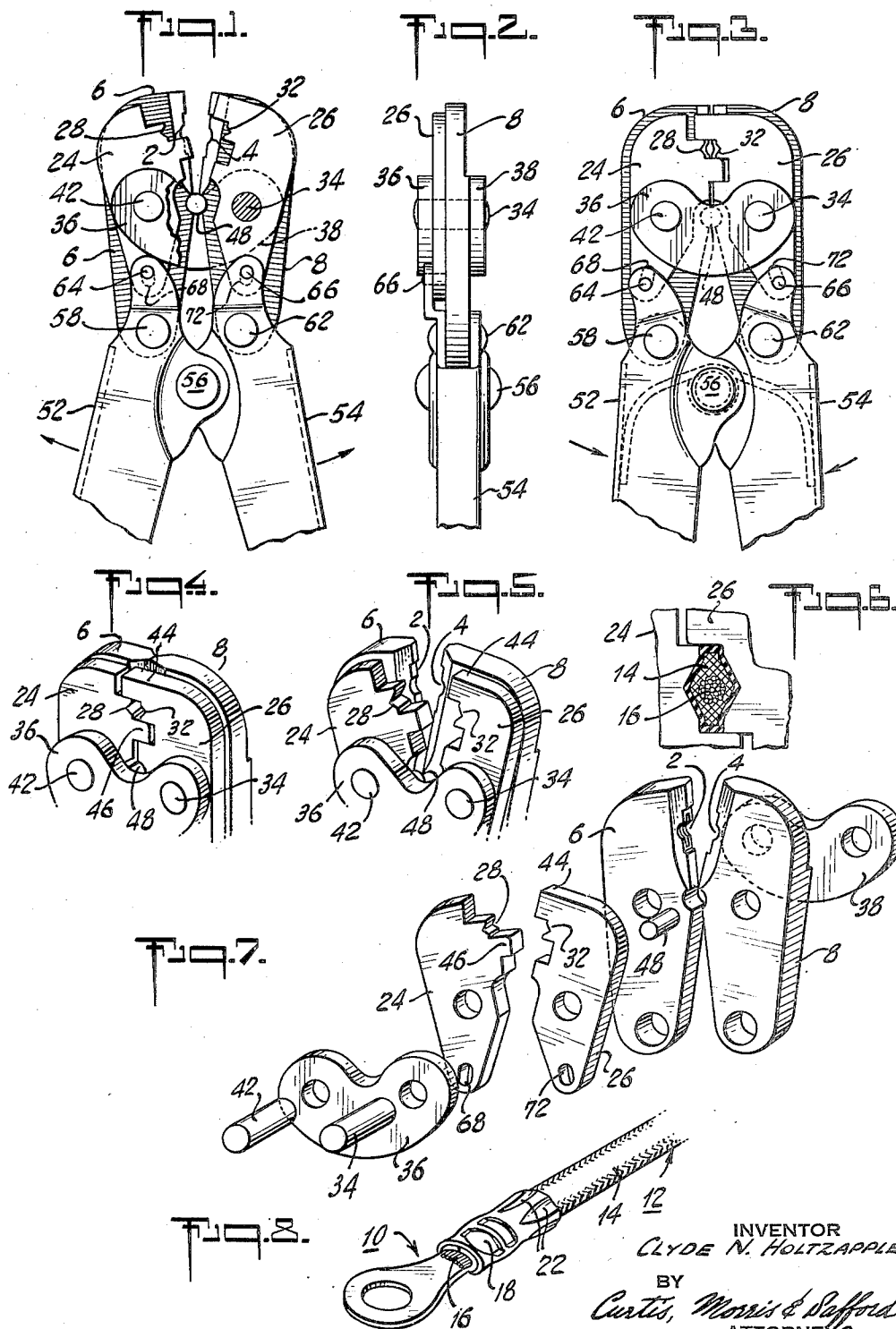
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TOOL FOR CRIMPING ELECTRICAL CONNECTORS

Filed Aug. 11, 1950

2 Sheets-Sheet 1



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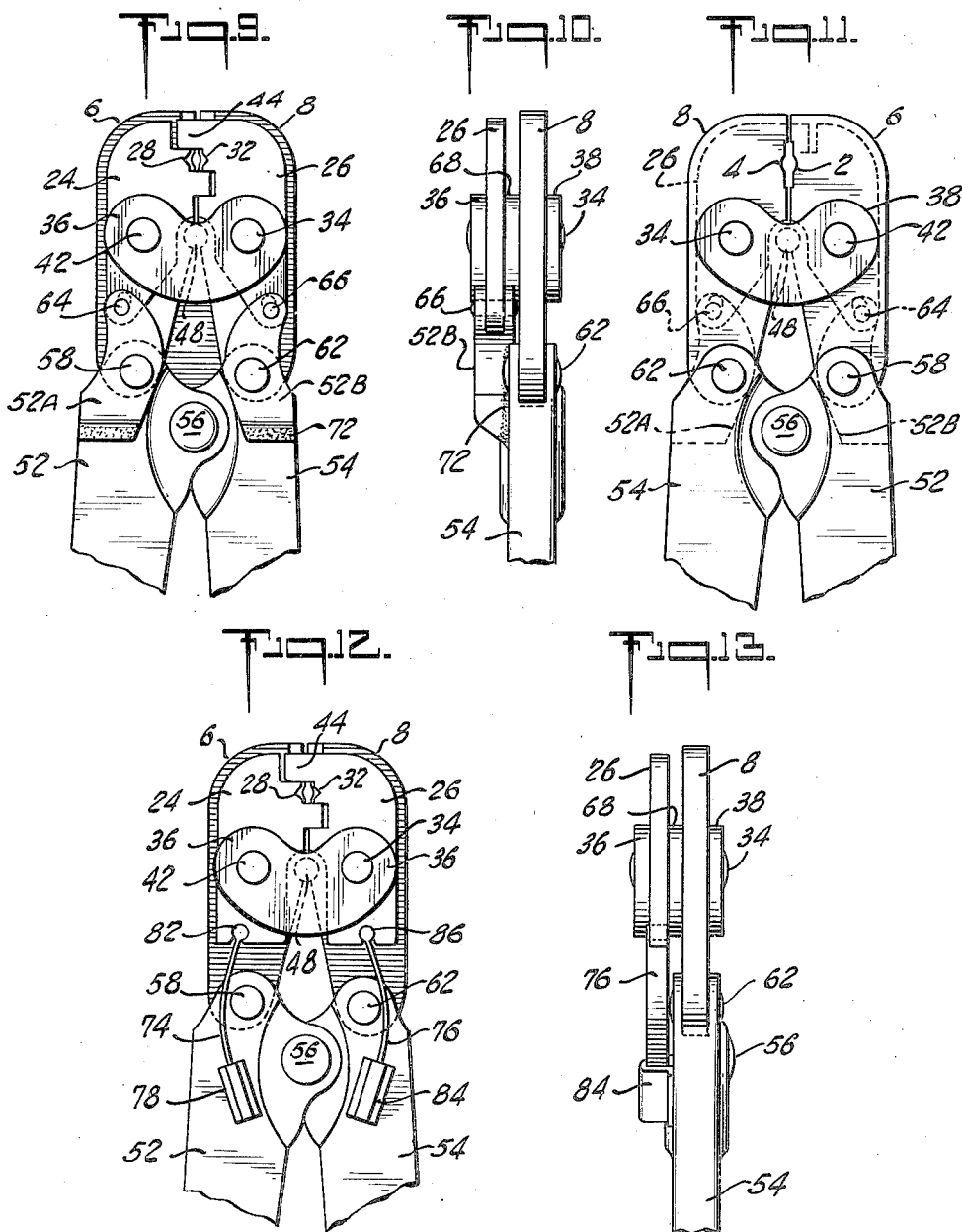
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UNITED STATES PATENT OFFICE

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TOOL FOR CRIMPING ELECTRICAL CONNECTORS

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5 Claims. (Cl. 81-15)

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This invention relates to crimping tools for applying solderless connectors to electric conductors and is described as particularly embodied in a tool for crimping connectors of the type in which one portion of the connector ferrule is crimped directly to the bare inner conductor and another portion is crimped around the insulating covering.

Solderless connectors are often formed with an inner metal ferrule portion which is intended to be crimped directly to the metal conductor of the wires after the insulating covering has been removed, and an outer barrel or sleeve portion, which is somewhat larger in diameter and extends beyond the end of the wire-gripping portion, that is intended to be crimped around the adjacent insulation to increase the mechanical strength of the connection. Separate pairs of jaws are utilized to perform the two crimping operations simultaneously.

The insulation-gripping sleeve or barrel is made either of plastic or thin metal, and it is desirable, therefore, to utilize overlapping or interlocking members adjacent the connector-crimping die surfaces which crimp this portion of the connector so as to prevent extrusion of the thin metal or plastic into the space between the jaws. This overlapping jaw construction has made it necessary to open both sets of jaws a substantial distance to allow enough space to position the connector between the jaws. However, the necessity for opening both sets of jaws so wide reduces the mechanical advantage available for operating the connector-crimping jaws and makes it difficult to position the connector properly between the jaws prior to the crimping operation.

In accordance with the present invention, the two sets of jaws are moved at different rates of speed so that the insulation-crimping jaws are opened wider than the connector-crimping jaws.

The insulation-crimping jaws and the connector-crimping jaws are operated from the same driving mechanism but a compound leverage system is utilized so that the insulation-crimping jaws move a greater distance between the open and closed positions, thus permitting the connector to be easily positioned in crimping position, and permitting greater mechanical advantage in the operation of the connector-crimping jaws.

Other features, objects, and advantages of the present invention will be in part pointed out in and in part apparent from the following description considered in connection with the accompanying drawings in which:

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Figure 1 is a partial elevational view, with certain parts cut away, of a crimping tool embodying the invention;

Figure 2 is a partial side view of the tool shown in Figure 1;

Figure 3 is a view similar to Figure 1 showing the crimping jaws in closed position;

Figure 4 is a partial perspective view showing the relative position of the jaws when in closed position;

Figure 5 is a view similar to Figure 4 showing the jaws in open position;

Figure 6 is an enlarged partial elevational view showing a section of a connector and wire positioned between the connector-crimping surfaces at the completion of the crimping operation;

Figure 7 is an exploded perspective view showing certain components of the tool shown in the preceding figures;

Figure 8 shows a connector after being crimped to the end of an electric conductor;

Figure 9 is a partial front elevational view of a second embodiment of the invention;

Figure 10 is a partial view of the crimping tool shown in Figure 9;

Figure 11 is a rear partial elevational view of the tool shown in Figure 9;

Figure 12 is a partial elevational view illustrating another embodiment of the invention; and

Figure 13 is a partial side view of the crimping tool shown in Figure 12.

In order to crimp the connector to the bare wire of an electric conductor, the tool shown in Figures 1 to 7 is provided with opposed die surfaces 2 and 4 (see particularly Figure 7) formed on the inner faces of two connector-crimping jaws 6 and 8. Figure 8 shows a connector, generally indicated at 10, after being crimped to an insulated wire, generally indicated at 12, having an outer insulating covering 14 and a central metal strand or core 16. The jaws 6 and 8 are effective in crimping the connector to the core 16 as indicated at 18 in Figure 8.

In order to crimp the insulation-gripping portion of the connector to the insulating-covering 14, as indicated at 22 in Figure 8, an additional set of insulation-crimping jaws 24 and 26 are provided with opposing die surfaces 28 and 32.

The connector-crimping jaw 8 and the insulation-crimping jaw 26 are pivotally supported on a pin 34 which extends through openings in these jaws and through openings in two kidney-shaped end plates 36 and 38 positioned on opposite sides of the jaws, the pin 34 being maintained in position by forming a head portion on each end of the pin, as by riveting, or by the use of lock rings

or other suitable means. The opposing jaws 6 and 24 are pivotally supported on a pin 42, which extends through holes in the jaws and through holes in the opposite ends of the end plates 35 and 33, and is maintained in position by similar riveting or other means.

In order to prevent undesired extrusion of the insulation-gripping portion of the connector into the space between the insulation-crimping jaws 24 and 26, the jaw 26 is provided with an overlapping portion 44 which nests with a complementary surface in jaw 24; and jaw 24 is provided with projection 46, beneath the die surface 23, which nests with a complementary surface of the jaw 26.

In order to maintain proper alignment of the connector-crimping jaws 6 and 8, an alignment pin 48 is positioned between semi-cylindrical surfaces formed on the inner faces of the jaws 6 and 8 and is prevented from moving longitudinally out of this space by the inner surfaces of the end plates 36 and 38.

In the illustrated embodiments of the invention, the movement of the jaws is obtained by manually-operated handles 52 and 54, formed of channel steel or other suitable material, although it is to be understood that pneumatic, hydraulic, or other types of driving mechanisms can be employed if desired. These handles are pivoted on a pin 56, which extends through internal overlapping flanges of the handles 52 and 54.

The connector-crimping jaws 6 and 8 are pivotally connected, respectively, to the handles 52 and 54 by pins 58 and 62 (Figure 1) which extend through the handles 52 and 54 and through holes near the lower ends of the jaws 6 and 8, the pins 58 and 62 being maintained in position by riveting or other suitable means. As can be seen from Figure 1, as the handles 52 and 54 are moved together so as to rotate oppositely about the pivot 56, the lower ends of the connector-crimping jaws 6 and 8 are spread apart, thus bringing the die surfaces 2 and 4 of these jaws into crimping position. (See also Figure 3.)

The relative movements of the jaws are shown best in Figures 4 and 5, the overlapping relationship of the insulation-crimping jaws 24 and 26 being clearly shown in Figure 4. It will be noted in Figure 5 that the insulation-crimping jaws 24 and 26 have been opened by a greater amount than the connector-crimping jaws 6 and 8, so that the overlapping portion 44 of jaw 26 will not interfere with positioning the connector between the jaws.

In order to obtain this differential movement of the jaws, the insulation-crimping jaws 24 and 26 are somewhat shorter than the connector-crimping jaws 6 and 8 (Figure 1) and are connected, respectively, at their lower ends to handles 52 and 54 by pins 64 and 66 which extend through slotted openings 68 and 72 in the jaws 24 and 26. (See also Figure 7.) These slotted openings are provided to prevent binding of the two linkage mechanisms and to provide cam surfaces against which the pins 64 and 66 exert the closing force on the jaws 24 and 26.

It will thus be seen that the insulation-crimping jaws 24 and 26 are connected to the handles 52 and 54 at points farther removed from the pivot 56 than are the connector-crimping jaws 6 and 8, and so that relatively greater movement is imparted to the lower ends of the jaws 24 and 26, and also that the distances between the points where the jaws are pivotally supported on pins 34 and 42 and the linkage pins 64 and 66 is less

than the corresponding distances on the jaws 6 and 8, so that a given movement of the lower ends of the insulation-crimping jaws 24 and 26 produces a correspondingly greater movement of the die surfaces formed on the upper portion of these jaws. This compound or double action is best observed by comparison of Figures 1 and 3, which, respectively, show the crimping tool in open and closed positions.

The illustrated driving arrangement produces a high mechanical advantage in the operation of the connector-crimping jaws 6 and 8, which is desirable because this portion of the connector, which is crimped directly to the core 15 of the insulated wire 12, is ordinarily of relatively heavy metal. It is essential that good electrical contact be made between the connector and this core. Because the insulation-gripping portion of the connector is substantially thinner or is formed of plastic, less crimping force is required to be exerted by the insulation-crimping jaws 24 and 26. Thus, although less force is applied to the jaws 24 and 26, an entirely satisfactory crimp is obtained.

Figures 9, 10, and 11, in which some components corresponding to similar parts of the preceding drawings have been indicated by similar reference characters, show a modified construction in which the operation is substantially similar to that described above. In this example, however, a spacer 63 (Figure 10) is positioned between the connector-crimping and insulation-crimping jaws so that the crimping force is applied at points spaced a greater distance apart than in the earlier-described examples. The connector-crimping jaws 6 and 8 are driven, in the same manner as in the earlier described embodiment, by the handles 52 and 54, but, in this example, the insulation-crimping jaws 24 and 26 are connected, respectively, to the handles 52 and 54 by forked-extension members 52A and 52B.

As best shown in Figure 10, the extension 52B is welded to the surface of handle 54 as at 72 and extends upwardly with its forked end straddling the lower end of the insulation-crimping jaw 26. The pin 66 extends between the two forked portions of the extension 52B and passes through the slotted opening 72 in the jaw 26. The other extension 52A is connected between handle 52 and the other insulation-crimping jaw 24 in the same manner.

The operation of the crimping tool shown in Figures 9, 10, and 11 is substantially the same as that described in connection with the preceding figures and will be apparent from the earlier description.

Figures 12 and 13, in which some parts similar to those shown in the earlier figures are indicated by corresponding reference characters, show another embodiment of the invention. As best shown in Figure 12, the operating handles 52 and 54 are operatively connected with the insulation-crimping jaws 24 and 26 by heavy, flat spring members 74 and 76. One end of the spring member 74 is secured to the surface of handle 52, for example, by a U-shaped bracket 78. The opposite end of the spring 74 is engaged by a slot 32 in the lower end of the insulation-crimping jaw 24. The other spring 76 is secured in identical manner by U-shaped bracket 84 to the handle 54 and is engaged by a slot 36 in the lower end of insulation-crimping jaw 26. In Figure 12 the crimping jaws are shown in closed position. When the handles 52 and 54 are moved outwardly, the lower ends of springs 74 and 76

are moved along arcuate paths such that the upper ends of these springs exert an inward force on the lower ends of the insulation-crimping jaws 24 and 26, thus opening these jaws simultaneously with the connector-crimping jaws, but by a substantially greater amount. When the crimping jaws are closed by bringing the handles 52 and 54 together, closing force is applied to the jaws 24 and 26 through the springs 74 and 76. With this arrangement, a substantial range of sizes of insulation-crimping ferrules can be successfully crimped without adjustment of the tool, springs 74 and 76 deforming under the crimping force by the amount necessary to accommodate the various sizes.

It is thus seen that the crimping tool embodying my invention is well adapted to attain the ends and objects hereinbefore set forth, the insulation-crimping jaws being opened a sufficient distance to permit maximum ease in operation, while the most advantageous leverage system is maintained for the operation of the connector-crimping jaws. It is to be understood that the illustrated embodiments are subject to a variety of modifications, and that the examples set forth herein are for the purpose of teaching those skilled in the art how to adapt and apply the principles and features of my invention so that it may be modified to the form best suited for each particular use, and are not presented for the purpose of limitation.

I claim:

1. In a connector-crimping tool for applying solderless connectors to insulated wire wherein crimping forces are applied to at least two spaced portions of the connector, one of said forces serving to crimp one portion of said connector directly to the conductive core of said wire and the other force serving to crimp another portion of said connector to the insulating covering of said wire, a die mechanism comprising a pair of opposing and cooperating connector-crimping jaws each having a crimping surface, a pair of opposing and cooperating insulation-crimping jaws each having a crimping surface, means pivotally mounting said jaws in side-by-side relationship for movement along predetermined paths, movable operating means for moving said jaws along said paths to bring said crimping surfaces into and out of crimping relationship, a first force-multiplying linkage mechanism operatively connected between at least one of said connector-crimping jaws and said operating means, and a second force-multiplying linkage mechanism having less mechanical advantage than said first mechanism and operatively connected between at least one of said insulation-crimping jaws and said operating means, each jaw to which said second linkage mechanism is connected having a slot near one end thereof, said second linkage mechanism including a pin engaging said slot, whereby the crimping surfaces of said insulation-crimping jaws are caused to move toward each other at a faster rate of speed than are the crimping surfaces of said connector-crimping jaws.

2. In a connector-crimping tool for applying solderless connectors to insulated wire wherein crimping forces are applied to at least two spaced portions of the connector, one of said forces serving to crimp one portion of said connector directly to the conductive core of said wire and the other force serving to crimp another portion of said connector to the insulating covering of said wire, a die mechanism comprising a pair of opposing and cooperating connector-crimping jaws

each having a crimping surface, a pair of opposing and cooperating insulation-crimping jaws each having a crimping surface, means pivotally mounting said jaws for movement along predetermined paths, movable operating means for moving said jaws along said paths to bring said crimping surfaces into and out of crimping relationship, a first force-multiplying linkage mechanism operatively connected between at least one of said connector-crimping jaws and said operating means, and a second force-multiplying linkage mechanism having less mechanical advantage than said first mechanism and operatively connected between at least one of said insulation-crimping jaws and said operating means, each jaw to which said second linkage mechanism is connected having a slot near the lower end thereof, said second linkage mechanism including a pin engaging said slot, whereby the crimping surfaces of said insulation-crimping jaws are caused to move toward each other at a faster rate of speed than are the crimping surfaces of said connector-crimping jaws.

3. In a connector-crimping tool for applying solderless connectors to insulated wire wherein crimping forces are applied to at least two spaced portions of the connector, one of said forces serving to crimp one portion of said connector directly to the conductive core of said wire and the other force serving to crimp another portion of said connector to the insulating covering of said wire, a die mechanism comprising a pair of opposing and cooperating connector-crimping jaws each having a crimping surface, a pair of opposing and cooperating insulation-crimping jaws each having a crimping surface, means pivotally mounting said jaws for movement along predetermined paths, movable operating means for moving said jaws along said paths to bring said crimping surfaces into and out of crimping relationship, a first force-multiplying linkage mechanism operatively connected between at least one of said connector-crimping jaws and said operating means, and a second force-multiplying linkage mechanism including a cam driving member and having less mechanical advantage than said first mechanism and operatively connected between at least one of said insulation-crimping jaws and said operating means, each jaw to which said second linkage mechanism is connected having a slot therein, said second linkage mechanism including a forked end member straddling one of said slotted jaws and having a pin extending therebetween and engaging said slot, whereby the crimping surfaces of said insulation-crimping jaws are caused to move toward each other at a faster rate of speed than are the crimping surfaces of said connector-crimping jaws.

4. In a connector-crimping tool for applying solderless connectors to insulated wire wherein crimping forces are applied to at least two spaced portions of the connector, one of said forces serving to crimp one portion of said connector directly to the conductive core of said wire and the other force serving to crimp another portion of said connector to the insulating covering of said wire, a die mechanism comprising a pair of opposing and cooperating connector-crimping jaws each having a crimping surface, a pair of opposing and cooperating insulation-crimping jaws each having a crimping surface, said insulation-crimping jaws being shorter than said connector-crimping jaws and each having a slot near its end, means pivotally mounting said jaws for

movement along predetermined paths, movable operating means for moving said jaws along said paths to bring said crimping surfaces into and out of crimping relationship including a pair of manually operated handles, means pivotally connecting said handles, and means pivotally connecting each of said connector-crimping jaws to one of said operating handles, each of said handles including a portion extending beyond the point at which it is connected to a connector-crimping jaw, each of said extended portions including a pin slidably engaging one of said slots in said insulation-crimping jaws, whereby the crimping surfaces of said insulation-crimping jaws are caused to move toward each other at a faster rate of speed than are the crimping surfaces of said connector-crimping jaws.

5. In a connector-crimping tool for applying solderless connectors to insulated wire wherein crimping forces are applied to at least two spaced portions of the connector, one of said forces serving to crimp one portion of said connector directly to the conductive core of said wire and the other force serving to crimp another portion of said connector to the insulating covering of said wire, a die mechanism comprising a pair of opposing and cooperating connector-crimping jaws each having a crimping surface, a pair of opposing and cooperating insulation-crimping jaws each having a crimping surface, said insulation-crimping jaws being shorter than said connector-crimping jaws and each having a slot near its

end, means pivotally mounting said jaws for movement along predetermined paths, a pair of manually operated handles for moving said jaws along said paths to bring said crimping surfaces into and out of crimping relationship, means pivotally connecting said handles, and means pivotally connecting each of said connector-crimping jaws to one of said operating handles, each of said handles including an extension having a forked end portion extending beyond the point at which it is connected to a connector-crimping jaw, each of said extensions including a pin slidably engaging one of said slots in said insulation-crimping jaws, whereby the crimping surfaces of said insulation-crimping jaws are caused to move toward each other at a faster rate of speed than are the crimping surfaces of said connector-crimping jaws.

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