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SWAGING PLIERS FOR ELECTRICAL CONNECTIONS

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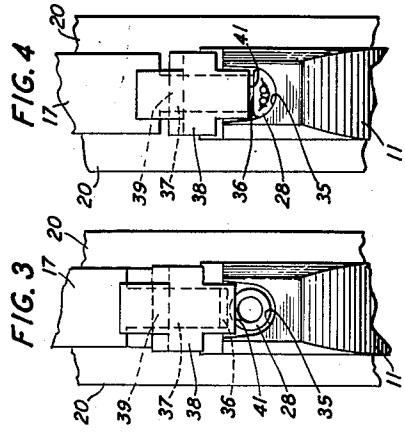

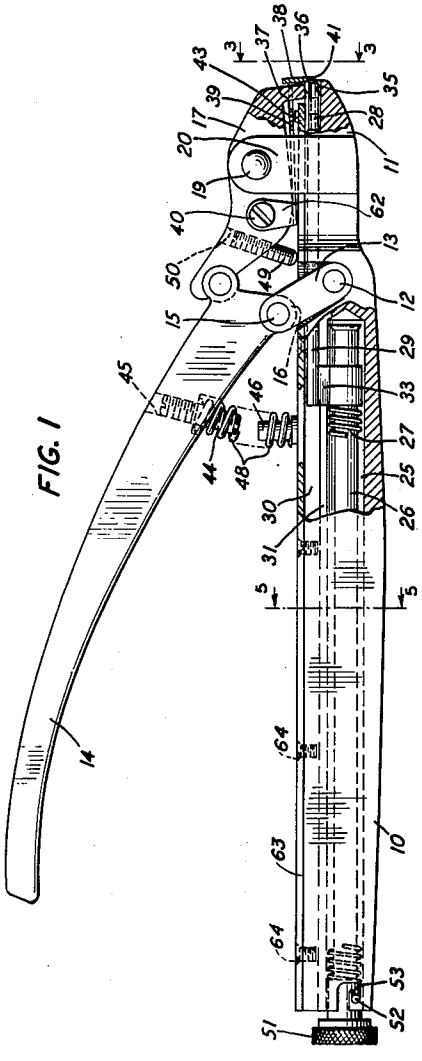

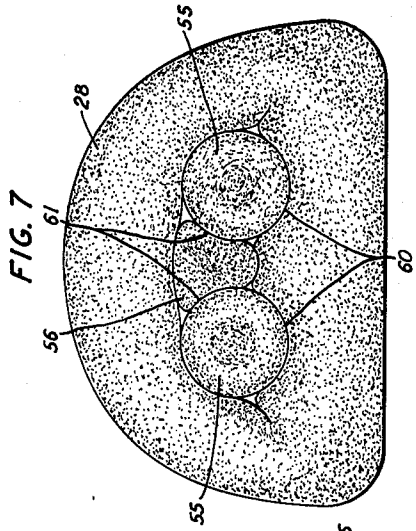

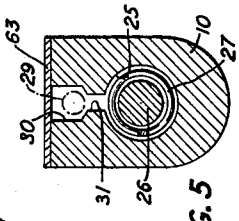

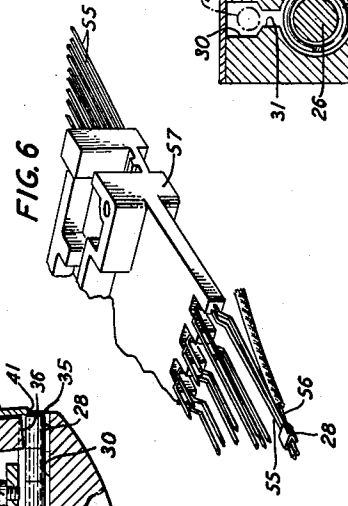

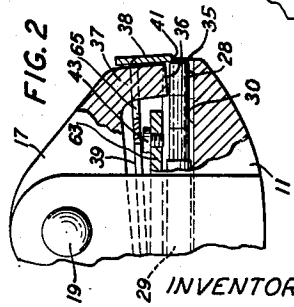

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SWAGING PLIERS FOR ELECTRICAL CONNECTIONS

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2 Claims. (Cl. 81—15)

1

This invention relates to wiring tools and more particularly to a tool for effecting a solderless connection between electrical conductors.

Constant, low resistance connections are of prime importance in communication and other systems. At present the connections to terminal strips, switch banks, jack strips, relays and the terminals of the various other pieces of equipment employed in telephone systems are generally solder joints. These connections require a considerable portion of the labor of manufacturing and installing telephone equipment. Further, if a high degree of care is not exercised in the making of solder connections, they are often defective.

It is therefore an object of this invention to positively form constant, low resistant electrical connections of the solderless type.

Another object is to simplify the production of gas-tight electrical connections.

A further object is to obtain quality connections having a high degree of uniformity.

In one illustrative embodiment of this invention, a wiring tool comprises a magazine-fed compound leverage plier which swages a sleeve upon the adjacent ends of a plurality of conductors to form a gas-tight low resistance joint between the sleeve and each conductor and between adjacent conductors. A quality insuring device is provided on the tool adjacent its swaging jaws. This device is adjustable to prevent the removal of a sleeve until it has been compressed to a predetermined minimum degree.

The invention and the various features thereof will be understood more clearly and fully from the following detailed description with reference to the accompanying drawing in which:

Fig. 1 is an elevational view of a connecting tool illustrative of one embodiment of this invention, partially broken away to more clearly reveal its elements in their cooperative relationship;

Fig. 2 is an enlarged fragmentary view of the head of the tool disclosed in Fig. 1 showing details of the jaws and the cooperating quality insuring device;

Fig. 3 is an enlarged end view taken on the line 3—3 of Fig. 1 showing the swaging jaws, a connector and the quality insuring device;

Fig. 4 represents the jaws of Fig. 2 as they appear in the compressed position and shows a connector securing a pair of conductors together;

Fig. 5 is a sectional view of the handle of the tool taken at the line 5—5 of Fig. 1 disclosing the relation between the connector magazine and its feed mechanism.

2

Fig. 6 illustrates a relay terminal group showing a connector formed by the tool of this invention joining a wire thereto; and

Fig. 7 is a reproduction of a photomicrograph of a transverse section of a connection formed by this tool, enlarged about forty times.

The tool as disclosed in Fig. 1 comprises a handle 10 having integral therewith at one end a jaw 11. Pivotally connected to the handle 10 by pin 12 are a pair of links 13 which are coupled to handle 14 by pin 15. The links 13 in cooperation with the projection 16 on handle 14 form a toggle point which exerts a moment on the movable jaw 17 to cause it to pivot around pin 19 on support member 20, secured to the jaw 11, when the handles 10 and 14 are brought together.

The handle 10 contains a magazine for the sleeve connectors. This magazine comprises a pair of connected axial slots or grooves, as disclosed in Fig. 5, including a lower slot 25 accommodatiing a rod 26 which coaxially supports a lower slot 25 accommodating a rod 26 which coaxially supports a helical feed spring 27. This feed spring 27 causes a positive feed of the sleeves 28 through the medium of the push rod 29 lying in the upper slot 30 which contains the sleeves. The push rod is actuated through the offset arm 33 which extends through the restricted slot 31 interconnecting slots 25 and 30. The slot 30 extends throughout the length of the handle 10 and into a matrix 35 longitudinal of and in the end of the jaw 11 to provide a means for continuously feeding sleeve connectors to the matrix as they are used.

Cooperating with the matrix 35 is a punch 36 carried on a projection 37 on the jaw 17. The punch 36 extends through an aperture 65 in a spring 39. A latch 38 is carried on a spring 39 which is secured to the jaws 17 by the screw 40, the screw 40 extending through an aperture ear 62 on one end of the spring 39 and into the jaw 17. The latch 38 provides the passage of uncompressed sleeves from the open end of the matrix 36 under the force of the feed spring 27. This latch 38 provides a means of controlling the quality of the connections produced since it will only release a connection from the matrix when the sleeve in the connection has been compressed sufficiently to pass the lower lip 41 of the latch 38. The latch 38 also serves to carry the upper edge of the next sleeve fed from the magazine as the compressed sleeve is withdrawn, thus conditioning the tool for the next connection to be made. The separation between the lower lip of the latch 38 and the bottom of the matrix

35 may be controlled by the screw adjustment stop 43 in cooperation with the screw 40 which positions the spring 39 so its lower surface is biased against the top 43. The screw adjustment stop 43 is supported in a tapped hole in an apertured top plate 63 which is secured to the handle 10 by screws 64 and extends over the upper surface of the jaw 11. Thus when the optimum degree of compression of the sleeve connected has been determined, the latch 38 can be adjusted to pass only these connectors which have been compressed to that degree and will serve as a mechanical gauge to determine the minimum amount of swaging which can be applied to the connector sleeve and still obtain a connection of satisfactory quality.

Further adjustment of the operation of the tool is possible through the threaded stop 44 which is screwed into the tapped hole 45 in the handle 14. The projection of this stop from the handle is controlled by turning to advance or retract it so that it limits the closure of the handles by contacting the upper surface of the mating column 46 which is immovably secured on the handle 10. This stop thus limits the swaging action of the jaw 17 to prevent excessive working of the sleeve connectors. Coaxial with the stop 44 and the column 46 is a helical spring 48 which biases the handles apart to open the jaws 17 and 11. The degree to which the jaws will open due to the bias of the spring 48 is limited by the threaded adjustable stop 49 which is screwed in the tapped hole 50 in the portion of the jaw 17 behind the pivot 19.

In operation, the tool is loaded with a quantity of the sleeve connectors 28 by pushing in and turning the knurled knob 51 on the end of the rod 26. This releases the bayonet 52 from the socket 53 and permits the removal of the rod 26 from the slot 25 and the push rod 29 from the slot 30. The sleeves to be employed advantageously are seamless and of a malleable low resistance material such as copper. They are furnished, in a quantity sufficient to provide one load for the tool, threaded upon a stiff wire having enlarged ends to prevent their loss. To load these sleeves an end of the wire is broken off and this free end is inserted in the slot 30, the wire is then withdrawn, while holding the last sleeve in slot 30, to leave the sleeves in the slot. The reinsertion of the push rod 29 and the rod 26 biases the first sleeve against the latch 38 and on securing the bayonet lock 52, 53 the tool is in condition for making connections.

The assembly of Fig. 6 is typical of the type to which connections formed by tools constructed in accordance with this invention can advantageously be employed. It comprises a terminal group for a relay including a plurality of wire spring conductors 55 molded in an insulating block 57 so that they extend continuously through and project from both sides of the block to provide terminals on one side to which conductors 56 can be attached, and contact bearing springs on the other side (no contacts being shown in the drawing).

Connections are made by sliding the connector sleeve 28, which lies in the longitudinal matrix of the tool so its axis is also longitudinal of the jaws, over the parallel adjacent ends of a plurality of conductors 55 and 56, shown in Fig. 6, and closing the tool jaws to swage a connector sleeve 28 on the conductors longitudinal of the jaws. This produces a connection, similar to that shown in Figs. 6 and 7, which is uniformly worked over its cross-section as a result of the matrix and punch being longitudinal of the jaws. The swaging action longitudinal of the jaws eliminates any tendency in the closing of the jaws to work one side of the sleeve more than the other side due to any rocking action of the jaws, which would cause one side of the punch to close upon the sleeve before and/or to a greater extent than the other side. Thus there is no tendency to crowd the material of the sleeve and the conductors to one side of the connection and a uniform joint as disclosed in Fig. 7 results. The matrix is semicircular in cross-section and the punch is flat, hence, they produce a D-shaped finished connection without fins, as shown in Fig. 7, so that full pressure is applied to the interior of the connection. This produces an intimate contact between the swaged sleeve 28 and the conductors 55 and 56 as shown at 60 in the reproduced photomicrograph in Fig. 7 to form a low resistance, gas-tight contact which, as a result of the gas-tight feature, is not subject to corrosion and therefore has a long life and does not alter its resistance on ageing. Also, if the conductors are of workable material as is the case with conductor 56 in Fig. 7, there is a slight deformation 61 of the conductor into intimate contact with adjacent conductors, this action being limited by the working of the conductor into the wall of the malleable sleeve.

Thus, the tool provides a simple means for making a long life low resistance connection requiring little skill in its formation and having a high degree of uniformity and quality without the use of solder. Further, the connections which can be made with this tool are not limited to those between wires for it has been found that an entirely satisfactory joint can be made to flat terminals by slotting them to a proper size to fit within the sleeve and crimping the sleeve over them in the same manner as above set forth.

What is claimed is:

1. A tool for swaging a sleeve, comprising a lower jaw and an upper jaw operable for relative movement to open and closed positions, operating means for said jaws, a support on said lower jaw extending upwardly to said upper jaw and serving as a pivotal point of support for said upper jaw, a matrix in said lower jaw to accommodate a sleeve and comprising an open-ended slot, a punch on said upper jaw operable to enter said matrix to swage the sleeve incident to the closing of said jaws, said matrix and punch being forward of the pivotal point of support of said upper jaw, a spring latch secured on said upper jaw at a point rearwardly of the pivotal point of support for said upper jaw, said spring latch extending underneath said upper jaw and outwardly beyond said punch, a lip portion on the outer end of said latch and extending into an open end of said slot to normally prevent an unswaged sleeve from passing outwardly through the open end of said matrix, and an adjustable stop for said spring latch located on said lower jaw and at a point forwardly of the pivotal point of support of said upper jaw and rearwardly of said punch, said adjustable stop engaging said spring latch incident to the closing of said jaws and operating to allow penetration of said lip portion into the open end of said matrix only far enough to prevent an incompletely swaged sleeve from being withdrawn from the tool, but permitting its withdrawal when swaged to a predetermined amount.

2. A tool for swaging a sleeve, comprising a lower jaw, an upper jaw, said jaws being relatively movable to open and closed positions, operating means for said jaws, stop means to limit the extent of opening and closing of said jaws, a support on said lower jaw extending upwardly to said upper jaw, a pin in said support extending into said upper jaw and serving as a pivotal point of support for said upper jaw, a matrix in said lower jaw and comprising an open-ended slot, a punch on said upper jaw operable to enter said matrix to swage the sleeve incident to the closing of said jaws, said matrix and punch being forward of the pivotal point of support of said upper jaw, a spring latch secured on said upper jaw at a point rearwardly of the pivotal point of support for said upper jaw, said spring latch extending underneath said upper jaw and outwardly beyond said punch, a lip portion on the outer end of said spring latch and extending downwardly to and into an open end of said matrix and normally preventing an unswaged sleeve from passing outwardly through the open end of said matrix, a plate supported on said lower jaw and below said spring latch, and a screw adjustably supported on said plate and extending into contact with said spring latch, said screw serving as an adjustable stop for said spring latch and being located forwardly of the

pivotal point of support for said upper jaw and rearwardly of said punch, said screw engaging said spring latch incident to the closing of said jaws and operating to allow penetration of said lip portion into the open end of said matrix, only far enough to prevent an incompletely swaged sleeve from being withdrawn from the tool, but permitting its withdrawal when swaged to a predetermined amount.

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