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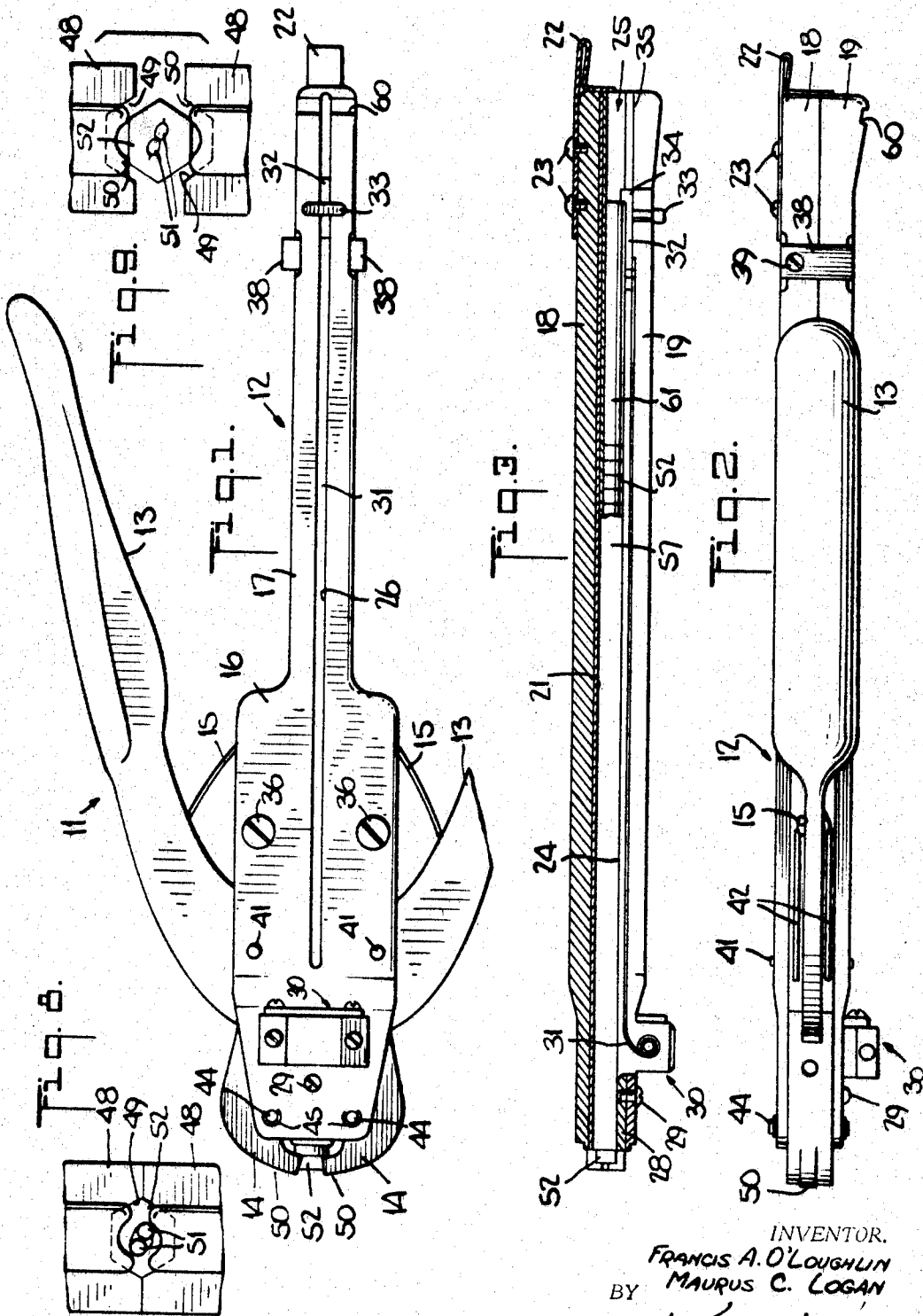
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3,427,852

COMPRESSION TOOL FOR ELECTRICAL CONNECTORS

Filed Aug. 10, 1966

Sheet 1 of 3



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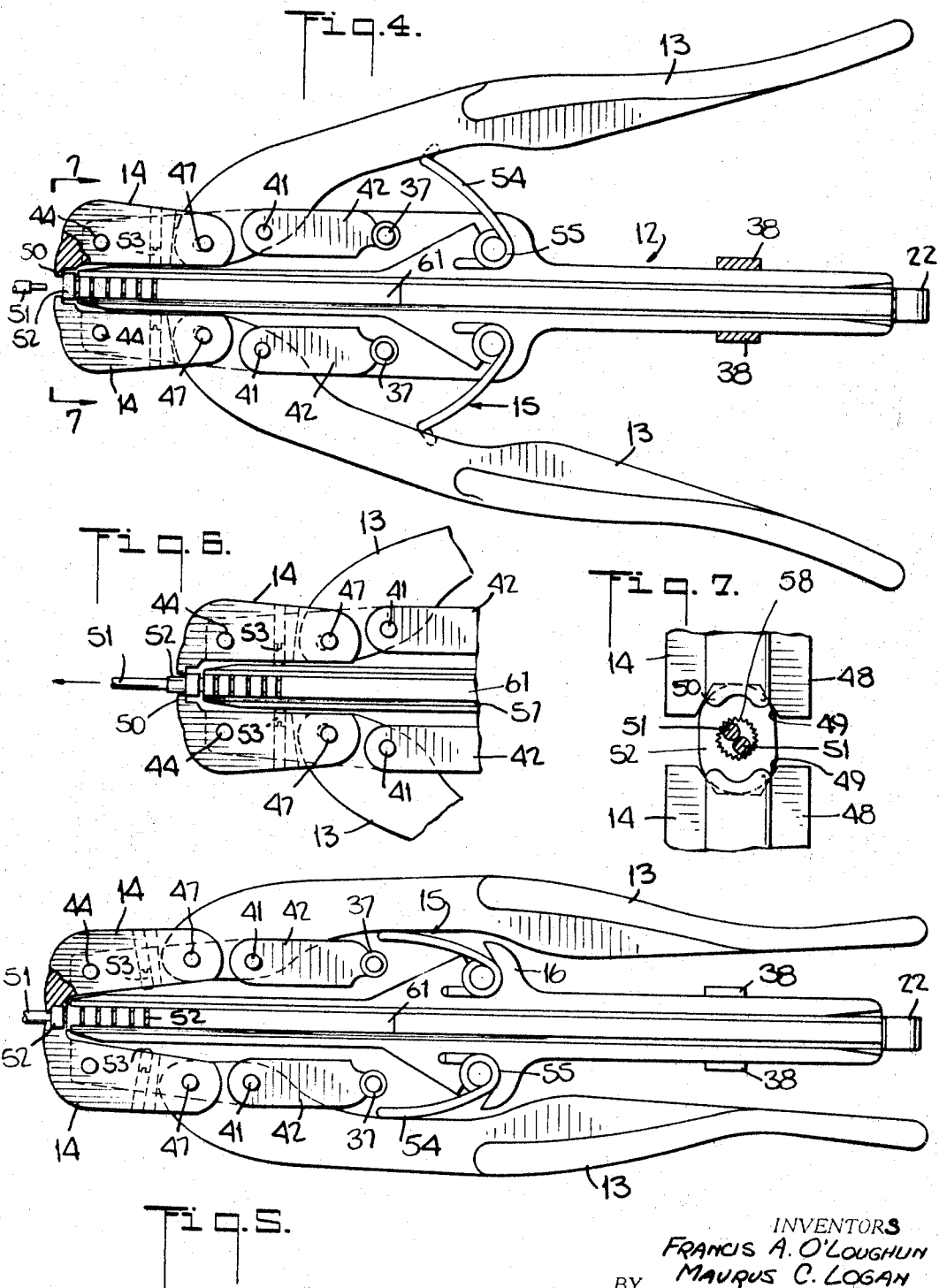
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Sheet 2 of 3



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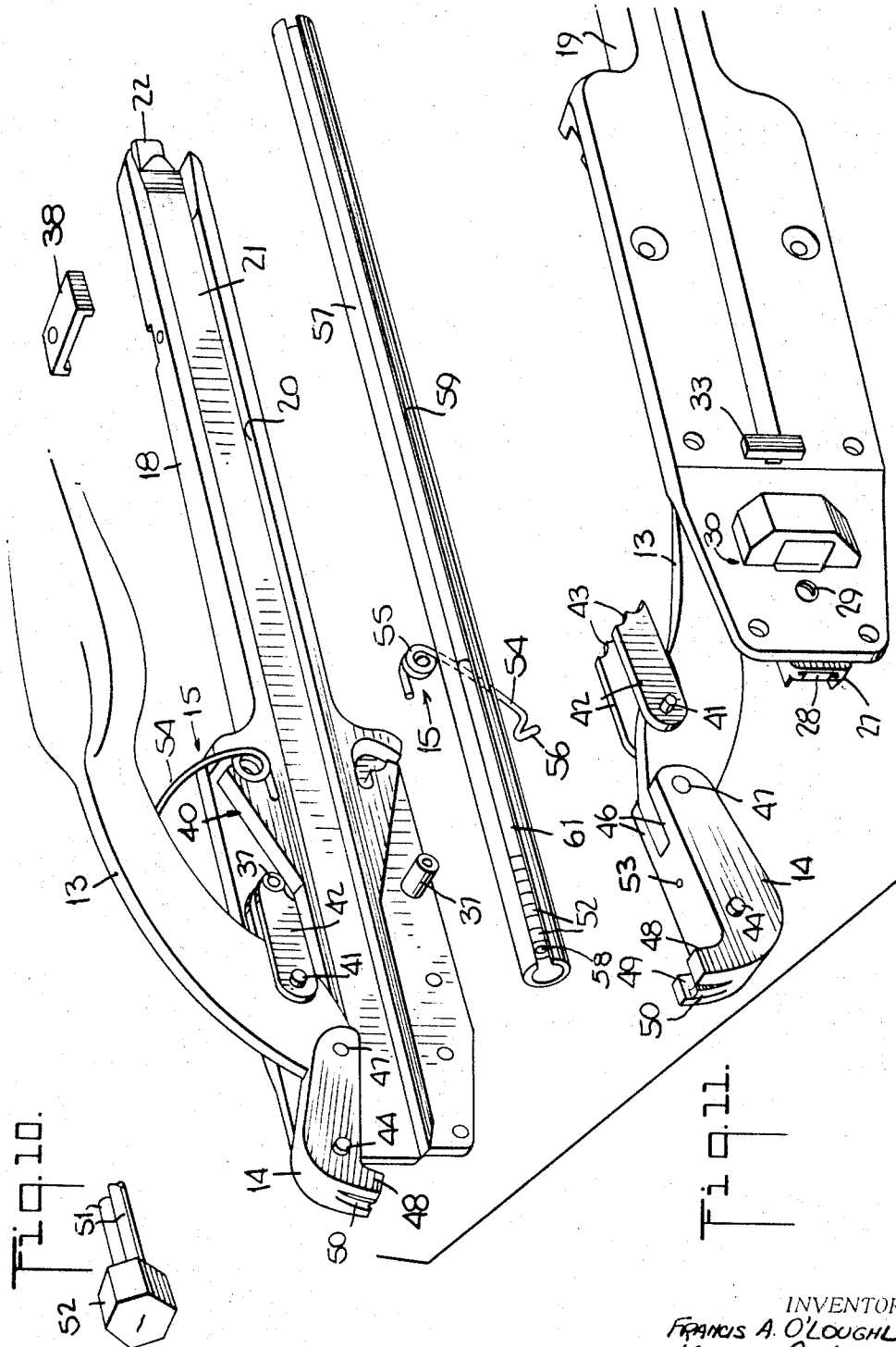
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Sheet 3 of 3



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## 3,427,852 COMPRESSION TOOL FOR ELECTRICAL CONNECTORS

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Filed Aug. 10, 1966, Ser. No. 571,465

U.S. Cl. 72-410  
Int. Cl. B21d 9/08, 43/20

9 Claims

### ABSTRACT OF THE DISCLOSURE

The tool is constructed with a pair of pivotally mounted jaws on spaced sides of the magazine frame as well as with a pair of handles pivotally mounted on the frame and connected to the jaws. The spring loaded handles pivot towards each other so as to close the jaws on a deformable connector between the jaws. Upon closing of the jaws the connector is radially deformed under compression about a plurality of conductors inserted therein.

This invention relates to a compression tool for compressing connectors. More particularly, this invention relates to a compression tool for compressing connectors on a plurality of conductors to mechanically and electrically bond the conductors together. Still more particularly, this invention relates to a compression tool for compressing connectors on a plurality of conductors to effect a gastight connection.

Heretofore, in order to make an electrical connection between a pair of electrical conductors, the electrical conductors have been soldered together. However, the manner used to effect a soldered connection has been cumbersome, time-consuming and inefficient. Further, soldered connections have not always been made accurately and have thus caused subsequent inefficient operation of the circuitry and apparatus in which they have been installed.

Therefore, in order to avoid the use of soldered connections for making electrical connections between a pair of conductors, various kinds of sleeves have been compressed over the conductors to effect the connections. Among these compression devices has been a swaging pliers which has been used to compress a sleeve over a pair of wire relay conductors and a conductor. This swaging pliers has utilized a pair of jaws, one of which has been pivotally mounted on the other and provided with a punch to cooperate with a slotted matrix in the other jaw for swaging the sleeve on the conductors upon relative movement of the jaws into a closed position.

Accordingly, it is an object of this invention to provide a compression tool for effecting a mechanical and electrical connection between electrical conductors.

It is another object of this invention to provide a compression tool for effecting efficient electrical connections of a plurality of electrical conductors under repetitive use.

It is another object of this invention to provide a compression tool for electrical connections which is simple and economical to use.

Generally, the compression tool of the invention is formed of a frame having a pair of jaws pivotally mounted therein for relative movement with respect to each other and a pressure-applying means pivotally mounted therein in pivotal connection with the jaws for moving the jaws relative to each other.

Each jaw is formed with a pressure-applying compression surface of semi-polygonal shape directed towards the other jaw and a bead on the extreme end which projects into the plane of the compression surface.

The jaws are normally spaced apart to define a con-

necting receiving cavity which is supplied with sleeve-type connectors from a magazine-feed portion located centrally of the tool frame and are actuated by the pressure-applying means to close on the connector received in the cavity so as to deform the connector into the polygonal shape defined by the compression surfaces. The beads on the jaws are spaced apart so as to prevent passage of the connector past the jaws before being deformed; however, the beads permit passage of a properly deformed connector after deformation has taken place and the jaws are returned to normal position.

In operation, the jaws are normally spaced from each other and a sleeve-type connector is fed from the magazine-feed into position between the jaws in restraining abutment against the respective beads on the jaws. Conductor wires are then inserted in the bore of the connector. Thereafter, the jaws are closed by applying pressure on each of the handles in a direction towards each other. As the jaws close, the compression surfaces impose a deforming force on the connector and enclosed conductors which deforms the connector peripheral surface into a shape conforming to the polygonal shape defined by the jaws. At the same time, the connector is compressed on the enclosed conductors to form an electrical connection therewith.

These and other objects and advantages will become more apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 illustrates a partially broken plan view of a compression tool of the invention;

FIG. 2 illustrates a side view of the compression tool of FIG. 1;

FIG. 3 illustrates a cross sectional view of the compression tool showing a magazine-feed arrangement for the connector;

FIG. 4 illustrates a plan view of the interior mechanism of the compression tool with the jaws in a normally opened position;

FIG. 5 illustrates a plan view of the interior mechanism of the compression tool with the jaws in closed position on a connector;

FIG. 6 illustrates a broken plan view of the compression tool showing the manner of removing a compressed connector on a conductor;

FIG. 7 illustrates a view taken on line 7-7 of FIG. 4;

FIG. 8 illustrates a view similar to FIG. 7 at the completion of the compression operation;

FIG. 9 illustrates a view similar to FIG. 8 after the jaws are opened to permit removal of the compressed connector;

FIG. 10 illustrates a perspective view of the compressed connector and conductors; and

FIG. 11 illustrates an exploded view of the compression tool in normally open position.

Referring to FIGS. 1, 2, 3 and 11, a compression tool 11 has a central portion 12, a pair of opposed handles 13 pivotally mounted on the central portion 12, a pair of jaws 14 pivotally mounted on the central portion 12 and pivotally secured to the respective handles 13 for actuation thereby, and a pair of springs 15 mounted in the central portion 12 and biased outwardly against a respective handle 13 to urge the pair of handles 13 apart.

The central portion 12 is formed with a transversely enlarged forward portion 16 and a stem-like rear portion 17 of two-piece construction with a lower piece 18 and a mating upper piece 19. The lower piece 18 is internally formed with a longitudinal channel 20 which extends from one end to the other of the piece 18 and which can be provided with a suitable hardened guideway strip 21 externally provided at the rear end with a spring element 22 which is suitably secured thereto, as by screws

23, for projection into the plane of the channel 20 so as to form a resilient stop therefor.

The upper piece 19 is internally formed with a longitudinal channel 24 which extends from one end to the other of the piece 19 and which mates with the channel 20 in the lower piece 18 to form a passage 25 through the tool 11. In addition, the upper piece 19 is formed with a longitudinal slot 26 intermediately of the top surface which communicates with the channel 24. The forward end of the upper piece 19 is provided internally with a suitably formed channel member 27 in alignment with the passage 25 which receives a suitable metal block 28 therein. The block 28 is suitably secured in the channel member 27, for example, by a screw 29 which threads into the channel member 27 from the exterior surface of the upper piece 19.

The upper piece 19 also has a spring housing 30 mounted on the exterior face thereof which suitably mounts one end of a coiled flat spring 31 therein. The free end of the spring 31 is attached to a suitable tab means 32 having a pivotally mounted T-shaped stem 33 thereon and a depending tang 34 thereon. The spring 31 and tab means 32 are installed in the upper piece 19 so that the stem 33 protrudes through the slot 26 to the exterior of the tool 11, the tang 34 projects into the passage 25 and the spring 31 is guided within suitable grooves 35 in the walls of the slot 26.

The lower piece 18 and upper piece 19 are joined together by a pair of suitable flat-headed bolts 36 which pass through each piece with the shanks protected by suitable sleeve 37 and by a pair of suitable U-shaped clamps 38 which fit within recesses in the stem-like portion of each piece 18, 19 and which are secured to at least one of the pieces by suitable means, such as, screws 39.

Each handle 13 is secured within suitable recesses 40 in the enlarged portions 16 of the pieces 18, 19 by a pivot pin 41 which is fixed in the lower piece 18 and which extends through the handles 13 and upper piece 19. In addition, a pair of links 42 are mounted on the pivot pin 41 on either side of the handle 13 within the recesses 40 to guide the handle 13 within the central portion 12. The links 42 are restrained against rotation about the pivot pin 41 by suitable grooves 43 which mate with sleeves 37 surrounding the bolts 36.

Each jaw is pivotally secured independently of each other within the recesses 40 in the pieces 16, 17 and which is secured thereto as by spring clips 45. In addition, each jaw 14 is formed with a pair of legs 46 which envelop the handle 13 and which are pivotally secured thereto by a pin 47 which passes through the handle 13 and the legs 46 and which is positioned between the pins 41 and 44.

Further, each jaw 14 is formed with a head portion 48 which projects inwardly towards the other jaw and which is positioned on one side of the projected plane of the passage 25. Each head 48 has a pressure-applying compression surface 49 in the periphery directed toward the other head 48 which is formed of a plurality of flat portions to define a semi-polygonal shape so that when the respective jaws 14 are brought together a polygonal shaped passage is formed by the compression surfaces 49 in alignment with the passage 25 formed in the central portion 12. In addition, each head 48 is formed or provided with a bead 50 on the outmost end which projects into the plane of the compression surfaces 49, as well as the passageway 25 in the central portion. The beads 50 of the respective jaws 14 are formed with suitable mating surfaces which permit the passage of one or more conductors 51 therethrough and are sized to prevent the passage of a connector 52 therethrough outwardly of the tool 11 until after the connector 52 has joined the conductors 51.

In addition, each jaw 14 is provided with an adjustable stop means 53, such as, a blunted screw, which projects from the jaw 14 inwardly towards the central portion 12. The stop means 53 is positioned so as to be capable of

preventing pressure contact of the mating surfaces of the heads 48 or of slightly spacing the surfaces of the heads upon closure.

Each spring 15 is formed with a leg 54 which projects from a coiled portion 55. The coiled portion 55 is retained in the enlarged portion 16 between the pieces 18, 19 within a space located behind the wall of recess 40 and the leg 54 is directed outwardly of the central portion 12. The leg 54 has a foot portion 56 which is sized to abut the handle 13 at a point inwardly of its unrestrained position so as to bias the handle 13 outwardly of the central portion. Thus, because of the pivotal relation existing between the handles 13 and the jaws 14, as the springs 15 bias the handles 13 to an outward position they simultaneously bias the jaws 14 into a spaced-apart or open position. Any subsequent pressure on the handles 13 to urge them together also causes movement of each of the jaws 14 toward the other.

In operation, a suitable magazine 57 containing a plurality of aligned extrudable connectors 52 of oval shape or any other suitable shape having suitably serrated central bores 58 such as disclosed in our co-pending patent application is inserted past the spring element 22 through the rear end of the tool 11 into the passage 25 formed in the central portion 12. The magazine 57 is formed with a longitudinal slot 59 which is aligned with the slot 26 of the upper piece 19 so as to permit entry of the tang 34 of the flat spring 31. In order to facilitate the proper relationship between the tang 34 and the connectors 52 in the magazine, the upper piece 19 is formed with an upwardly tapered end and the grooves 35 therein are correspondingly inclined so that the tang 34 can be pulled to the rear of the central portion 12 before insertion of a full magazine to allow passage of the connectors 52 under the tang. Further, in order to maintain the tang 34 in position at the rear of the central portion 12, the upper piece 19 has a recess 60 transverse to the slot 26 for receiving the T-shaped stem 33 therein. Thereafter, upon release of the stem 33 from the recess 60, the tang 34 will advance into the slot 59 of the magazine 57 to urge the connectors 52 forwardly into the cavity between the jaws 14.

In order to aid the positioning of the connectors 52 in the connector receiving cavity between the jaws 14 and to avoid damage of the rearmost connector, an elongated blank 61 is inserted into the magazine 57 behind the rearmost connector 52 for abutment with the tang 34.

Referring to FIGS. 4 to 9, after the magazine 57 is inserted in the central portion 12 and the spring element 22 is returned to a position astride the passage in the central portion and magazine 57, the spring 31 is allowed to urge the connectors forwardly so that the forwardmost connector is positioned between the compression surfaces 49 of the jaws 14 and in abutment with the beads 50 (FIG. 4).

Thereafter, a plurality of conductors 51 are inserted into the bore 58 of the connector 52 between the jaws 14 (see FIG. 7).

Next, a pressure-applying force is applied to the handles 13 to urge them towards the central portion 12 so as to effect the closing of the jaws 14 on the conductor enveloping connector 52 therebetween. The pressure exerted through the compression surfaces 49 of the jaws 14 on the surface of the connector 52 is sufficient to radially deform the connector 52 into a shape conforming to the polygonal shape defined by the compression surfaces 49 (FIGS. 5 and 8). As the connector deforms under the radially applied forces, the serrations in the bore 58 of the connector 52 displace the insulation coating of the conductors 51 and bite into the conductor wires while simultaneously scoring the surface of the wire due to a longitudinal extrusion of the connector 52 under deformation. At the same time, the bore 58 of the connector 52 deforms around the conductors 51 so as to form a gas tight connection (see FIG. 9).

After the pressure-applying force is removed, the handles 13 and jaws 14 spring back to the normally open position. The connector 52 which has been mechanically and electrically joined to the conductors 51 is now of a size which is less than the distance between the beads 50 on the jaws 14 so that the connector 52 with the conductors 51 connected thereto can be removed from the tool 11 (FIGS. 6 and 9).

As a connector 52 is removed from the tool 11, the next following connector is urged under action of the spring 31 into the vacated space between the jaws 14 for a subsequent connection-forming operation.

The invention provides a compression tool which is not only simple to use for the formation of solderless electrical connections but also reliable in forming gas tight joints in the connections upon repeated use. The compression tool can be easily and rapidly manipulated either manually or automatically and, because of the spring loaded magazine feed assembly, can rapidly form a large output of solderless electrical connections of constant size and constant low resistance.

Further, the invention provides a compression tool which is easily constructed of simple parts so that any repairs or replacements which may become necessary after normal wear and tear can be easily made.

Having thus described the invention, it is not intended that it be so limited as changes may be made therein without departing from the scope of the invention. Accordingly, it is intended that the subject matter described above and shown in the drawings be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A compression tool comprising an elongated frame, a pair of jaws pivotally mounted independently of each other in said frame in opposed spaced relation, each of said jaws including a compression surface directed towards the other of said jaws to form a connector receiving cavity therebetween, and pressure applying means pivotally mounted in said frame for moving said jaws relative to each other whereby a connector positioned in said cavity between said compression surfaces can be radially deformed on a plurality of conductors inserted therein to form a gas tight mechanical and electrical connection therewith upon movement of said jaws towards each other.

2. A compression tool as set forth in claim 1 wherein each of said compression surfaces is formed of a plurality of flat portions to define a semi-polygonal shape whereby the connector is deformed into a polygonal shape on the conductors.

3. A compression tool as set forth in claim 2 wherein each of said jaws includes a bead on the exterior thereof projecting into the plane of said cavity between said jaws for restraining the removal of a conductor from said cavity until after deformation thereof.

4. A compression tool as set forth in claim 1 further comprising a magazine feed portion centrally of said frame for supplying deformable connectors to said cavity between said jaws.

5. A compression tool comprising a frame, a pair of jaws pivotally mounted in said frame in opposed relation, each of said jaws including a compression surface directed towards the other of said jaws to form a connector receiving cavity therebetween, pressure applying means pivotally mounted in said frame for receiving said jaws relative to each other, a magazine feed portion centrally of said frame for supplying deformable connectors to said cavity between said jaws, said magazine feed portion including a passage extending longitudinally thereof in alignment with said cavity between said jaws and a flat spring means having a depending tang projecting into said passage, said flat spring means being biased towards said jaws whereby the connectors located in said passage are advanced towards said jaws upon positioning of said tang behind the connectors with respect to said jaws.

6. A compression tool as set forth in claim 5 further comprising a spring element secured to said frame at the end opposite said jaws, said spring element projecting into the plane of said passage in said magazine portion to form a resilient stop therefor whereby the connectors in said passage are retained therein.

7. A compression tool as set forth in claim 1 further comprising spring means mounted in said frame biasing said pressure-applying means outwardly thereof.

8. A compression tool as set forth in claim 1 wherein said pressure-applying means includes a pair of handles, each of said handles being independently pivotally mounted on said frame in opposed relation and pivotally secured to a respective one of said jaws whereby movement of said handles towards each other causes simultaneous movement of said jaws towards each other.

9. A compression tool as set forth in claim 8 further comprising a pair of spring means, each of said spring means being mounted in said frame biasing a respective one of said handles outwardly thereof.

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U.S. Cl. X.R.

72-424

UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 3,427,852

February 18, 1969

Francis A. O'Loughlin et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 53, "conductor" should read -- connector --.

Signed and sealed this 31st day of March 1970.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.

Commissioner of Patents