Sept. 6, 1960 Q. BERG 2,951,409

SHEAR MEANS WITH INTEGRAL CAM SURFACES EFFECTIVE TO LONGITUDINALLY SHIFT WORKPIECE TO CORRECT SHEARING POSITION

Original Filed March 24, 1950

Fig. 1

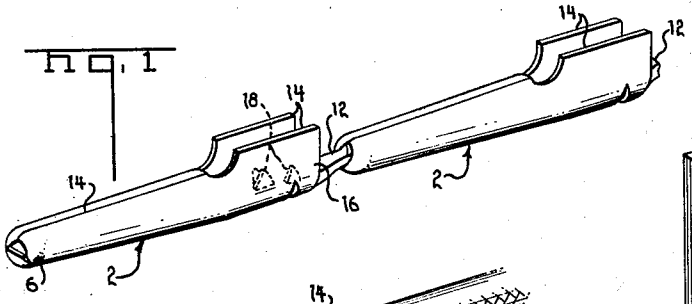


Fig. 2

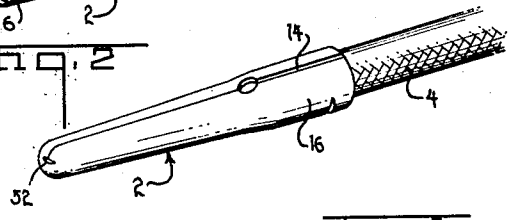


Fig. 3

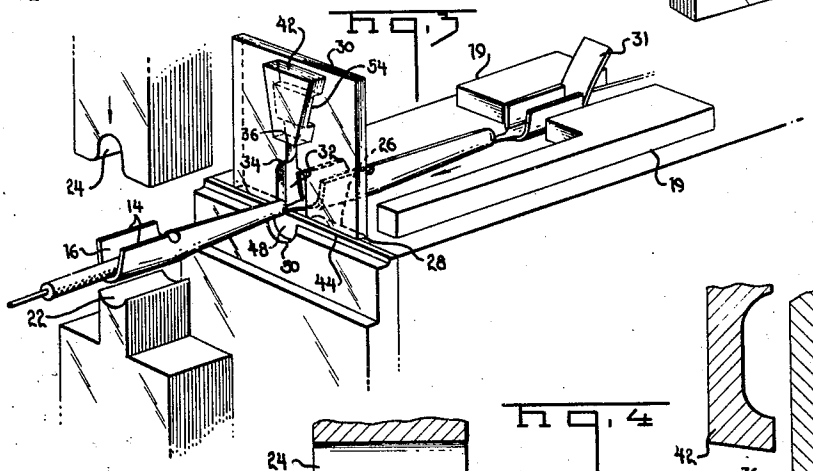


Fig. 4

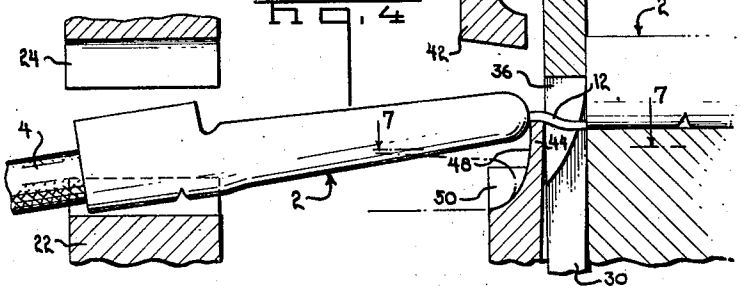


Fig. 5

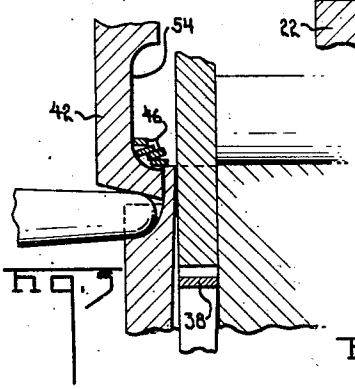


Fig. 6

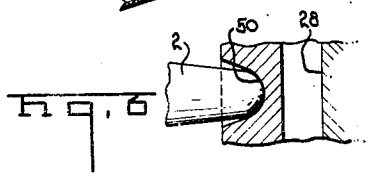


Fig. 7

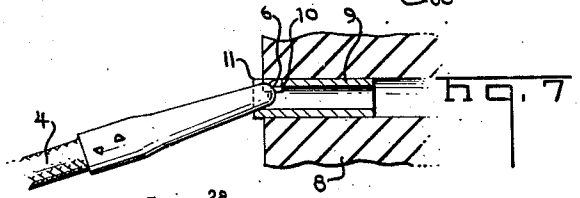
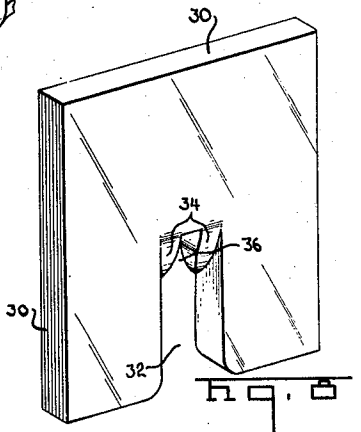


Fig. 8



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SHEAR MEANS WITH INTEGRAL CAM SURFACES EFFECTIVE TO LONGITUDINALLY SHIFT WORKPIECE TO CORRECT SHEARING POSITION

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Original application Mar. 24, 1950, Ser. No. 151,795. Divided and this application Feb. 27, 1956, Ser. No. 572,782

1 Claim. (Cl. 83—228)

This invention relates to applicators for applying plug-in connectors to wire leads and to an improved connector strip suitable for use with such applicators and is a division of my copending application, Serial No. 151,795, filed March 24, 1950. Wire leads, each having at each end a plug-in connector, especially of the smaller or pin type sizes, are used extensively, for example, in making the required numerous electrical connections in complicated, electrically-operated tabulating machines or the like, a comparatively large number of such leads being usually required for a single machine.

To facilitate the inserting of such connectors into the appropriate terminal sockets and the establishment of good electrical connections, it is important that the entering end of each plug or pin be substantially perfectly smooth and preferably rounded. Formerly such pins or plugs were made upon screw machines and a ferrule, attached to one end of the pin or plug, was used to connect the pin to the bared end of the lead wire. It is likewise important that the pin portions converge uniformly from the ferrule to the socket entering end of the pin.

One object of the present invention is to make such plugs or pins, with integral insulation piercing ferrules, by stamping up out of sheet metal the pin ends of the connectors being shaped into substantially as satisfactory final operative form as with those made by screw machines. Another object of the invention is to so make such plugs or pins that they can be supplied integrally connected in strips with the ferrule ends left open upon one side to receive the ends of the lead wires and thus facilitate the assembling of the leads and the insulation piercing or contact making action, and with the opposite shaped ends satisfactorily smooth for their intended use after severing from the strip. It is also an object to so design the converging or taper pin forming portions of these connectors and the strip that they can be satisfactorily applied without deformation by applicator machines used to complete the attachment of the pins or plugs to lead wires.

An object of the present invention is to provide improved means for applying the pin or plug connectors of the stamped up sheet metal type to the ends of lead wires which will both facilitate such application and insure good and permanent electrical connection between the taper pin or plug and the lead wire.

Another object of the invention is to provide an improved connector strip in which the connectors are so integrally connected endwise as to facilitate presenting them in wire end receiving position in the applicator machine, a further object of the invention being the provision of means for insuring a substantially smooth socket-entering end on the taper pin or plug after the connector has been severed from the succeeding connector of the strip.

Other objects, important features and advantages of the invention, to which reference has not specifically been made hereinabove will appear hereinafter when the following description and claim are considered in connection with the accompanying drawings in which—

Figure 1 is a perspective view, somewhat enlarged, of the novel connector strip of the present invention showing the plug or pin portion uniformly converging or tapering from ferrule to the end or tip;

Figure 2 is a view showing one of the finished connectors after it has been applied to the unstripped end of an insulated lead wire and been detached from the partially completed connector strip;

Figure 3 is a perspective detail of the essential operative elements of the applicator;

Figure 4 is a longitudinal section through the mechanism shown in Figure 3, with the parts in the positions which they assume just before the connector is applied to the lead wire, and with parts broken away;

Figure 5 is a sectional detail on the same section as Figure 4, but showing the position of the parts at a later stage of their operation just as the connector applying operation is completed;

Figure 6 is a horizontal section showing the connector end wiping die which cooperates with the shear plate, and

Figure 7 is a view of a contact socket ferrule and of a connector about to be inserted in the socket, the purpose of this view being to illustrate the importance of providing the connector with a smooth socket entering end.

Figure 8 is a perspective view illustrating the reverse side of the shear plate, shown in Figure 3, on an enlarged scale.

As just pointed out in the description of Figure 7, it is important that the taper pin connectors **2** which are to be applied to the circuit completing lead wires **4** have the socket-entering end **6** smooth and preferably rounded, as shown in Figure 7, or conical, so that there will be no excrescence on this end which might interfere with its easy insertion into the socket. Such sockets **9**, in one important use as shown, are mounted in panels of insulation **8** and are usually provided with connector guiding troughs **10** on the end of the metal ferrules **9** which are open at the top and spread laterally at **11**. If the end **6** of the connector **2** be not substantially smooth, any excrescence or roughness may catch upon the end edge **10** and interfere with the proper insertion of the connector **2** into the socket.

To facilitate rapid application of the connectors **2** to the lead wires **4**, the connectors are preferably formed in a continuous strip such as shown in Figure 1 in which the pin end of one connector is integrally connected to the ferrule end of the next connector throughout the strip, these connectors being stamped up from sheet metal, the lateral edges of the pin forming portions of the blank strip being shaped to form in the meeting of said shaped edges a pin uniformly converging from end to end thereof and the pin ends being substantially completed, as shown, except for the integral connecting short strip **12** which connects the center of the pin end of one connector to the ferrule of the next, the strip **12** being integral also

with the ferrule of the next connector. In shaping the socket entering end 6 of the connector in the manufacture of the connector strip, it will be seen that this end has been rounded over on all sides into approximately its finished condition except for this connecting strip 12 which projects from the rounded over tip of the pin, in this case from a point substantially opposite the tapering meeting edges 14—14' in the blank. This strip must, therefore, be severed both from the tip of the connector being applied and from the ferrule of the next connector in the process of applying the connector to the lead wire 4.

To facilitate the application of the ferrule end 16 of the connector upon the end of the lead wire 4 and the forming of a good electrical connection between the connector and the lead wire, the ferrule end 16 of the connector, as shown in Figure 1 and 3 is left open on top, that is, the edges 14' of the ferrule part of the connector are left upstanding or even flared out, and then crimped down after the wire is inserted to meet and form the completed ferrule.

In order to make a suitable electric connection between the connector and the insulated lead wire, insulation piercing teeth 18 are punched up on the inner face of the ferrule 16 into such a position that they will engage and pierce the insulation of the unstripped end of the lead wire 4 and thus be forced into good electrical contact with the lead wire when the upturned edges 14' of the ferrule are curled down into meeting relation to each other and the ferrule 16 is crimped into gripping relation to the lead wire end. Not only do the insulation piercing teeth 18 insure the desired good electrical connection between the connector and the lead wire, but, when the ferrule is crimped into gripping relation, these teeth 18 also increase the mechanical engagement (i.e. "the pull-out strength") of the connection.

A novel applicator is illustrated in Figures 3–6 inclusive for applying the connectors of the present invention to the ends of the lead wires successively inserted in the respective ferrules of the successive connectors, as they are successively presented in the end position shown in these figures. There are essentially four steps carried out by this applicator in timed relation:

(1) The strip 12 of connectors 2—16 is first fed forward between the guide plates 19 until the end connector is in the position shown in Fig. 3, just beyond that shown in Figure 4.

(2) The press head (not shown) moves down carrying the crimping die 24, the shear plate 30 and the pusher plate 42. As plate 30 moves down the inner edges of the part 34 guide or cam the connecting strip 14 into accurately centered position with respect to the forming notch 48. At the same time the backs of these curved portions 34 (as shown in Figure 4) engage the end edges of the ferrule 16 and cam them back to a precise position for shearing off the strip 12.

(3) Further movement of the press head brings the shear plate 30 at the end of recess 36 into contact with the strip 12; and at about the same instant the crimping die 24 engages the ferrule portion 141 of the connector 2.

(4) As the shear plate 30 begins to shear through the strip 12, the pusher 42 engages the tip of pin 2 and thus shears strip 12 at the tip 6 of pin 2, the strip 12 being thus put under tension as it is pushed down over the edge of the anvil shear plate 44. At this same time the crimping dies 22 and 24 are engaging the ferrule 16 more and more tightly.

(5) When the shearing of strip 12 is complete, one piece 38 thereof being pushed out between shear anvil 26 and anvil 44 and another piece 46 being pushed up into the recess 54 of plate 42 from which it is blown out, the ferrule 16 has become sufficiently engaged in the crimping dies 22—4 to resist longitudinal movement.

(6) Final movement of the press completes the crimping of the ferrule, with some longitudinal extrusion of its metal. Both this extrusion and the swinging of the pin from the position shown in full lines in Figure 4 to that indicated in broken lines, serve to press the tip 6 into the forming notch 48, so as by friction to burnish the end of the tip and form it in curved portion 50.

Thus the connector ferrule is crimped upon the unstripped end of the lead wire and the insulation piercing points 18 driven into good electrical contact with the wire; and, while the ferrule end 16 of the connector is held in the ferrule crimping dies the connecting strip 12 between it and the next connector is punched out in two pieces, one end of this section being sheared close to the end of the ferrule of the next connector and the other end being cut off close to the end 6 of the pin part of the connector which is being applied. Following the punching out of the connecting strip 12, the sheared end 6 is subjected to a frictional "wiping" or burnishing step to insure the smoothing down of any portion of the connector that may still have been left attached to the end 6 after the shearing operation.

The connector strip is fed, by any suitable feeding mechanism, ferrule end first, so that the ferrules of the successive connectors of the connector strip are brought successively into crimping relation to lower and upper crimping dies 22 and 24. When the ferrule is in crimping relation to the dies 22 and 24, the end of the next ferrule of the strip will be pressed against the rear face of the shearing plate 30 by a spring detent 31 engaging one of the connectors 2 in the strip being fed. Thus the shearing is accurately related to the end edge of ferrule 16. A punch opening 28 shaped to receive cooperating shear plate 30 serves as a precision guide for the shear plate.

The plate 30, as shown, has an opening 32 that straddles the strip 12 before shearing off and punching out a portion thereof, the lower part of the slot in the punch 30 being somewhat wider than the strip of connectors, while the narrow part 36 of the slot accurately fits the connecting strip 12. As shown particularly in Figure 5, the shearing off of the strip 12 leaves a straight edge on a round.

With the connector still held by the crimping dies 22 and 24, the operation of the pusher plate 42 forces the end 6 of the connector down over the face of plate 44 and into the forming notch 48 with such endwise pressure that the part of strip 12 still attached to the end 6 is forged into the tip 6 confronting to the shape of the notch 48. In the embodiment shown, the bottom edge of the pusher 42 is at about 92° with its face thus making it approximately tangent to the surface of the pin 2 which it contacts. The wiping action as the tip 6 is pushed down into notch 48, insures the smooth rounded surface on end 6 of the connector. The opening 52 between the inturned edges allows such flow of metal as may be necessary when any part of the strip 12 that may still remain attached to the connector end is forged into the tip.

To provide for the dischage of the pieces 46 sheared off from the successive pin ends 6 the sizing punch 42 is provided on its rear face with a recess 54 into which these pieces 46 may be received and from which they are discharged laterally, e.g., by an air blast.

It will be understood that the operations of the shear plate 30 and of the pusher plate 42 need not be a distinct or marked succession, but may be substantially simultaneous.

I claim:

In a machine for severing electrical connectors from an integral strip of connectors, each including a ferrule portion having an edge defining one end of the connector and a connecting portion extending from the end edge for joining the connector in the strip, a fixed member having a first shearing edge, means for feeding the strip to position the leading connecting portion slightly in advance of shearing position relative to said first shearing edge, means for resiliently holding the strip relative to lengthwise movement in the advance position, a shear

plate movable toward and away from said fixed member and having a pair of legs disposed to straddle the connecting portion during movement of the shear plate, said legs defining therebetween a slot inwardly terminating in a second shearing edge cooperable with said first shearing edge to sever a connecting portion disposed thereacross, a pair of integral cam elements on the opposed sides of said legs for engaging and camming back the end edge of the next leading connector upon movement of the shear plate to register the connecting portion in shearing position, the curved surface of said cam elements facing the direction of strip feed and merging smoothly into coplanar relation with the ends of said second shearing edge and the face of said shear plate.

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