

- [54] **EXTRUSION TOOL**
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- [51] Int. Cl. **B21c 23/00**
- [58] Field of Search..... 72/259, 273, DIG. 1; 425/517; 29/628, 630 A, 517, 520, DIG. 47, 203 D

- [56] **References Cited**
UNITED STATES PATENTS
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 Attorney, Agent, or Firm—David Teschner; Jesse Woldman

- [57] **ABSTRACT**
 Plunger means for use in connection with an extrusion

tool or the like comprises a displaceable auxiliary plunger portion longitudinally slidable along a recessed portion of the main plunger and normally biased to a first position wherein its first end extends forwardly of the first end or front end of the main plunger. When suitably contacted, the auxiliary plunger may be displaced rearwardly so that its front end is generally coincident with the front end of the main plunger. The resulting self-adjusting plunger assembly thus provides means for extruding differently sized connectors through a particularly sized orifice in an extrusion tool or the like. In operation, the auxiliary plunger portion precedes the main plunger into the extruding orifice when used in connection with the smaller connector, thereby selectively restricting the size of the orifice to that commensurate with the smaller connector. The larger sized connector will displace the auxiliary plunger portion rearwardly when contacted thereby so that both the main and auxiliary plunger portions operate to advance the connector through the extruding orifice. Biasing means which may comprise a compression spring or the like is provided to return the auxiliary plunger portion to its initial position after being displaced rearwardly along the main plunger recessed portion.

14 Claims, 9 Drawing Figures

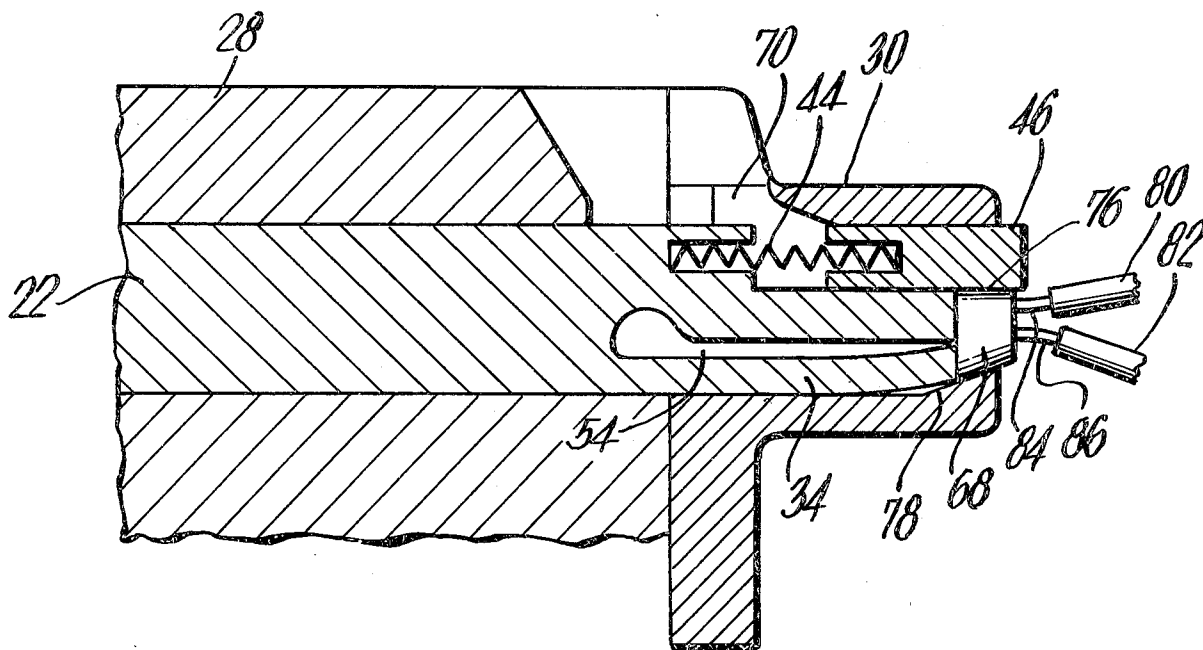
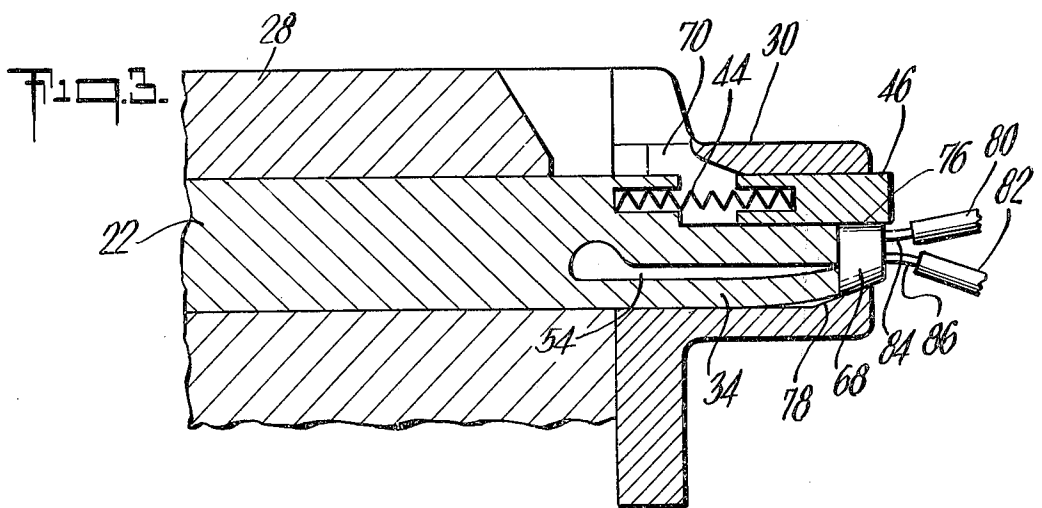
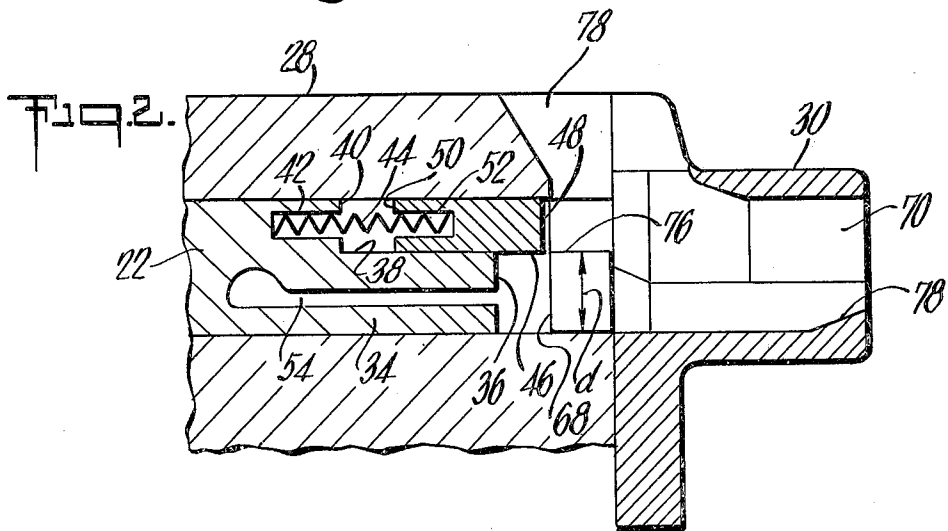
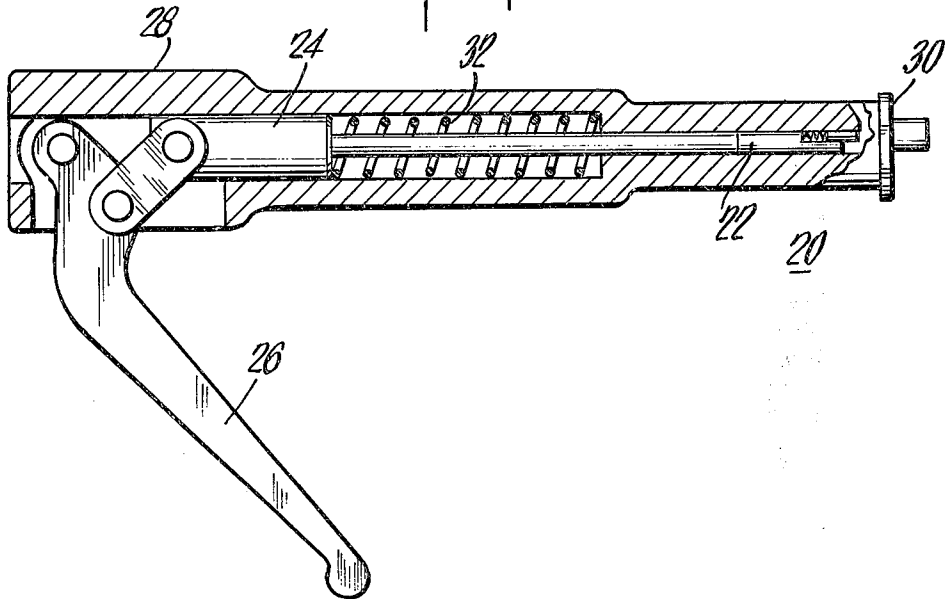


Fig. 1.



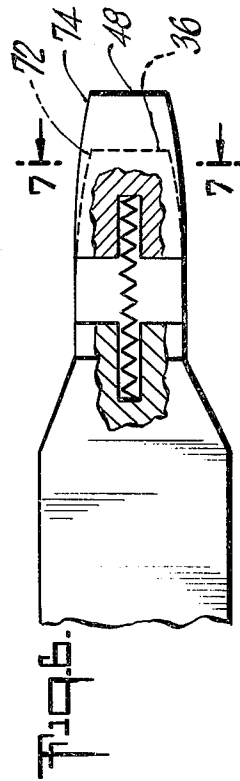
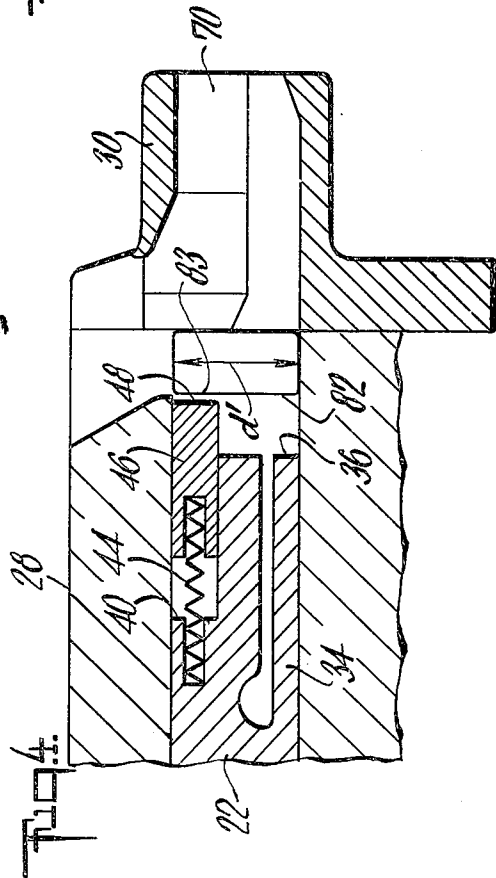
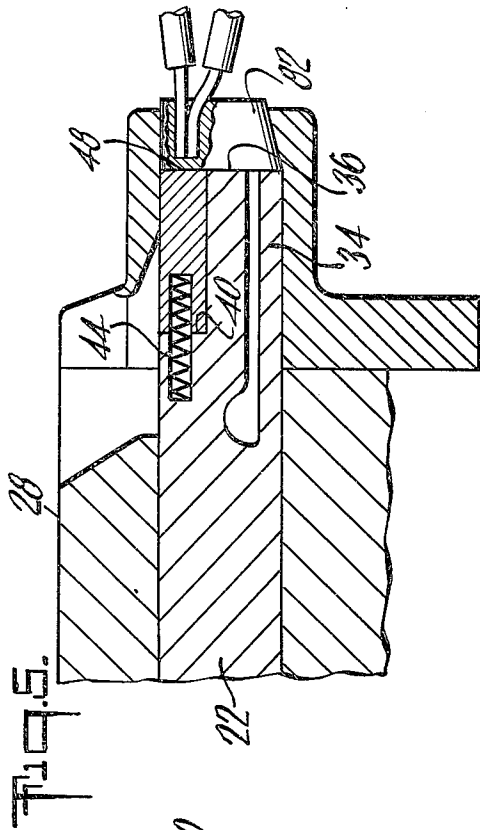
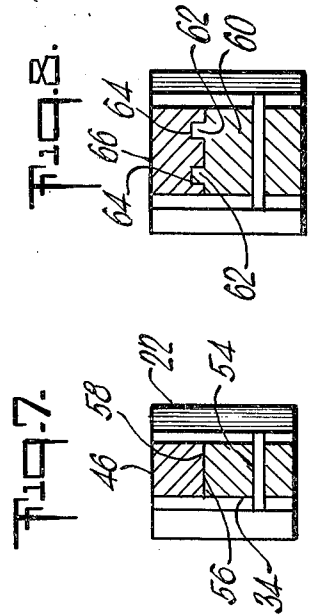
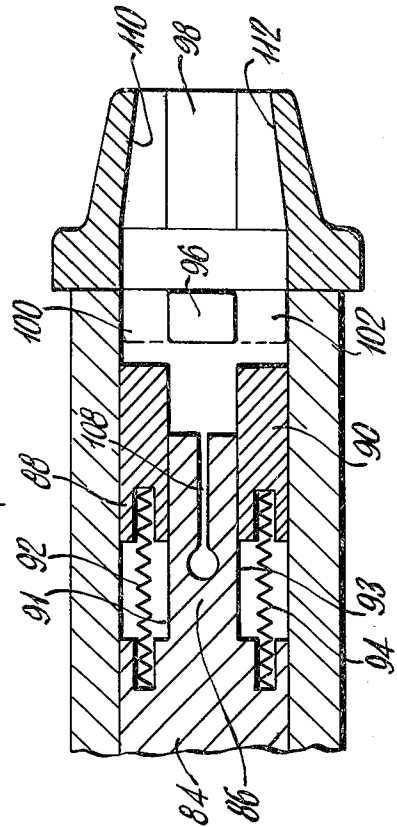


FIG. 8.



EXTRUSION TOOL**BACKGROUND OF THE INVENTION****1. Field of the Invention**

The invention is directed to the field of plunger means for extrusion tools or the like.

2. Description of the Prior Art

In U.S. Pat. No. 3,674,392, issued July 4, 1972 to D. Eppler and assigned to the assignee of the instant invention, there is shown an extrusion tool having a plunger, the end of which is bifurcated to provide a slight variation in the size of the plunger upon entrance into a tapered extrusion orifice. This feature permits the plunger to follow a connector through the restrictively tapered orifice of the extrusion tool sufficiently to eject the connector from the exit end of the orifice while substantially filling the tapered orifice during the extrusion operation. The extrusion orifice, however, is designed to accept a connector having a fixed dimension and, accordingly, restrictively limits the use of the tool in applications where a plurality of connector sizes are to be employed. In U.S. Pat. No. 3,614,885, issued Oct. 26, 1971 to the same D. Eppler and assigned to the assignee of the instant invention, there is disclosed a plunger arrangement comprising coaxially arranged outer and inner members, the inner member being telescopically movable within the outer member and so positioned as to provide a pocket or recess therebetween for accepting a portion of the connector therein as the connector is extruded through the extrusion orifice of the extrusion tool. The extrusion orifice of this tool is similarly dimensioned to accept only a single size connector and the versatility and convenience of the tool is therefore limited in essentially the same way as the first described device. Consequently, where the user is required to apply differently sized connectors in a particular application, it is necessary to have available a plurality of tools, each provided with a specifically designed extrusion orifice, an arrangement which is generally quite costly, cumbersome, and inconvenient in practice.

SUMMARY OF THE INVENTION

The invention overcomes the difficulties and limitations noted above with respect to prior art devices by providing a composite plunger arrangement operative in an extrusion tool or the like to permit the use of a single tool in conjunction with differently sized connectors in a manner more convenient, versatile, and economical than with such prior art devices. The plunger means comprises a first or main plunger portion having a first end provided with a recessed portion adjacent which is disposed a second or auxiliary plunger portion longitudinally slidable along the recessed portion and normally biased towards a first position in which the front end of the auxiliary or second plunger portion extends forwardly of the front end of the main or first plunger portion. The auxiliary plunger portion may be rearwardly displaced longitudinally so that its front end is substantially coincident with the front end of the first or main plunger portion to provide an essentially contiguous surface thereat. Thus, in one case, the auxiliary plunger portion is carried by the main plunger portion towards and into the extrusion orifice of an extrusion tool in such manner as to selectively restrict the opening thereof and provide an auxiliary supporting surface

for a connector having a transverse dimension essentially equal to the corresponding transverse dimension of the main plunger portion alone where the extruding orifice has a transverse dimension essentially equal to the combined dimensions of both the main plunger portion and the auxiliary plunger portion. In the other case, the second or auxiliary plunger portion is displaced rearwardly upon contacting a connector having a transverse dimension essentially equal to the corresponding combined transverse dimensions of both the main and auxiliary plunger portion front ends and assumes a position essentially coincident with the front end of the main plunger portion so that the front ends of both the main and auxiliary plunger portions cooperate to advance the connector through the extruding orifice. It is therefore an object of this invention to provide improved plunger means for an extrusion tool or the like.

It is a further object of this invention to provide a self-adjusting plunger means for an extrusion tool or the like.

It is yet a further object of this invention to provide plunger means so constructed as to permit the extrusion of differently sized connectors through a given orifice of an extrusion tool or the like.

It is still another object of this invention to provide a segmented plunger means for an extrusion tool or the like wherein the size of the front working surface of the plunger means is selectively regulated by the size of the connector to be extruded through the orifice of the extrusion tool.

It is yet another object of this invention to provide a plunger means having a biased auxiliary plunger portion slidably displaceable on a main plunger portion for use in connection with differently sized connectors extrudable through a given orifice of an extrusion tool or the like.

Other objects and features will be pointed out in the following description and claims and illustrated in the accompanying drawings which disclose by way of example the principle of the invention and the best modes contemplated for carrying it out.

BRIEF DESCRIPTION OF THE DRAWINGS**In the Drawings**

FIG. 1 is a side elevational view, partly cut away and partly in section, of an extrusion tool employing an improved plunger means constructed in accordance with the concepts of the invention.

FIG. 2 is a fragmentary side elevational view, in section, showing the details of a plunger means constructed in accordance with the concepts of the invention.

FIG. 3 is a fragmentary side elevational view, in section, showing the plunger means of FIG. 2 selectively advanced into the orifice of an extrusion tool.

FIG. 4 is a fragmentary side elevational view, in section, similar to FIG. 2, showing the initial relative positions of the plunger means of FIG. 2 and a given connector prior to extrusion.

FIG. 5 is a fragmentary side elevational view, partly cut away and partly in section, showing the elements of FIG. 4 in an advanced state of operation.

FIG. 6 is a fragmentary top plan view, partly cut away and partly in section, of the plunger means of the device of FIG. 2.

FIG. 7 is a front elevational view, in section, taken along the line 7—7 of FIG. 6.

FIG. 8 is a front elevational view, in section, similar to FIG. 7, but showing a further embodiment of plunger means constructed in accordance with the concepts of the invention.

FIG. 9 is a fragmentary top plan view, in section, of yet another embodiment of plunger means constructed in accordance with the concepts of the invention.

Similar elements are given similar reference characters in each of the respective drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to FIGS. 1, 2, 3, 4, 5, 6, and 7 there is shown an extrusion tool 20 including a plunger means 22 constructed in accordance with the concepts of the invention. The plunger means 22 is affixed to a support 24 operatively coupled to a handle 26 pivotably mounted to a housing 28 having a nose portion 30 comprising an extrusion orifice arranged to selectively deform a connector advanced therethrough. A return spring 32 provides a biasing force against the plunger support 24 to maintain the plunger means 22 in a retracted position prior to operation of the handle 26. It will of course be appreciated by the those skilled in the art that although a manually operated tool is shown, the particular means employed to advance the plunger means 22 forms no part of the invention and may include pneumatically or hydraulically operated devices cooperative with the plunger means 22. As best seen in the enlarged view of FIG. 2, the plunger means 22 comprises a first plunger portion 34 having a first end 36 and a recessed portion 38 extending longitudinally rearwardly from the first end 36 and terminating in an upstanding surface 40. Extending rearwardly from the upstanding surface 40 is a chamber 42 providing a seat for one end of a biasing means such as a compression spring 44. Slidably mounted on the first plunger portion 34 and moveable along the recessed portion 38 is a second plunger portion 46 having a first end 48 and a second end 50. A chamber 52, similar to chamber 42, extends forwardly from the second end 50 of the second plunger portion 46 towards its first end 48 to provide a seat for the other end of the compression spring 44. The first plunger portion 34 is notched as at 54 to provide a bifurcated arrangement employable in a manner which will be described in greater detail hereafter. As best seen in FIG. 7, the second plunger portion 46 is provided with a generally planar surface 56 slidable on a planar surface 58 defining the base of the recessed portion 38. As further illustrated in FIG. 7, the first and second plunger means 34 and 46 respectively, have substantially rectangular cross sections of substantially equal transverse dimension. Accordingly, the sides of each of the first and second plunger portions may be closely confined within a suitable bore extending lengthwise of the housing 28 to provide at least a partial guide therefore. In a further embodiment, as illustrated for example in FIG. 8, a first plunger portion 60 may be provided with rib means 62 engaged within complementary slot means 64 in a second plunger portion 66 which, accordingly, is effectively guided by the ribs 62 between a first position wherein the first end 48 of the second plunger portion 46 is disposed generally forwardly of the first end 36 of the first plunger portion 34 (FIG. 2) and a second position wherein the first end 48

of the second plunger portion 46 is generally coincident with the first end 36 of the first plunger portion 34 (FIG. 5). The first ends 36 and 48, respectively, of the first plunger portion 34 and the second plunger portion 46 each terminate in a generally planar end surface adapted to provide a generally uniform pressure against a connector such as 68 (See FIG. 2) positioned adjacent thereto for extrusion through a tapered orifice 70 extending axially through the nose portion 30 of the tool 20. It will of course be clear that the generally rectangular configuration of both the first and second plunger portions 34 and 46, respectively, may be modified, for example, by providing convex or concave side walls (not shown) slidable along complementarily formed surfaces defining the inner walls of the housing 28 of tool 20, where necessary or desirable. The side walls of each of the first and second plunger portions 34 and 46 adjacent their first ends 36 and 48 may be suitably tapered as shown at 72 and 74 in FIG. 6 to more closely follow the tapered contour of the adjacent sidewalls of the extrusion orifice 70. Operation of the plunger means 22 when employed with a connector 68 having a transverse dimension "d" slightly less than the opening between the surface 56 of the second plunger portion 46 and the lower edge of the first plunger portion 34, as viewed in FIG. 2, may be more fully appreciated by reference specifically to FIGS. 2 and 3. As illustrated in FIG. 2, the connector 68 is positioned adjacent the nose portion orifice 70 by insertion, for example, through an opening 78 in the tool housing 28. The mechanics of such a feed arrangement have been disclosed in U.S. Pat. No. 3,674,392 referred to hereinabove and, accordingly, will not be repeated here. As further illustrated in FIG. 2, the plunger means 22 is shown in its normally retracted position, which, incidentally, provides an unobstructed passageway from the opening 78 into the interior of the tool 20 adjacent the first and second plunger portions 34 and 46. The plunger 22 is now advanced by movement of the handle 26 towards the housing 28 of the tool 20, causing a forward displacement of the plunger means 22 to a position essentially as shown in FIG. 3. As illustrated therein, the forwardly extending section of the second plunger portion 46 overlies the top surface 76 of the connector 68 during the forward motion of the plunger means 22. Accordingly, as the second plunger portion 46, the first plunger portion 34, and the connector 68 are advanced into the orifice 70, the second plunger portion 46 is maintained in its extended position by the compression spring 44 and continues to overlie the connector 68 throughout the forward motion of the plunger means 22. As the plunger means 22 is further advanced, the connector 68 is subjected to opposing forces exerted by the selectively tapered sidewalls of the orifice 70 one of which is indicated at 78. The surface 78 tends to urge the connector 68 towards the adjacent surface 56 of the second plunger portion 46 which prevents further transverse movement of the connector 68 so that as the first plunger portion 34 continues to advance the connector 68 through the orifice 70, the connector 68 is extruded through the exit end of the orifice 70 essentially as illustrated in FIG. 3. The second plunger portion surface 56 thus serves to provide an auxiliary support surface for the connector 68 to insure that the connector is confined within the space available between the surface 56 of the second plunger portion 46 and the tapered sidewall 78 of the

extruding orifice 70. Thus, although the orifice 70 has a substantially larger transverse dimension than the connector 68, the second plunger portion 46 operates to selectively reduce the available opening to insure proper extrusion of the connector 68 therethrough. As further illustrated in FIG. 3, a pair of conductors 80 and 82 each having a bared end 84, 86, respectively, may be connected to one another by the insertion of the bared ends 84 and 86 into a suitable conductor receiving orifice in the connector 68 prior to the extrusion of the connector 68 through the orifice 70. As the connector 68 is advanced through the orifice 70, its convergently tapered surfaces tend to selectively close each of the conductor receiving openings about the conductors 80 and 82 to provide a secure connection therebetween. It will be further noted that the bifurcated structure of the first plunger portion 34 permits it to advance freely into the orifice 70 to insure that the connector 68 is fully extruded through the exit end of the orifice 70. In FIGS. 4 and 5, operation of the plunger means 22 for extruding a connector 82 through the extruding orifice 70 is illustrated in greater detail. In this case, the connector 82 has a transverse dimension d generally equal to the corresponding combined transverse dimensions of both the first plunger portion 34 and the second plunger portion 46. Accordingly, as the plunger means 22 is advanced forwardly, the front end 48 of the second plunger portion 46 is caused to abut the adjacent surface of the connector 82 indicated generally at 83, whereby the second plunger portion 46 is longitudinally displaced rearwardly, compressing the biasing spring 44, and assuming a position relative to the front end 36 of the first plunger portion 34 essentially as shown in FIG. 5. The first end 48 of the second plunger portion 46 and the first end 36 of the first plunger portion 34 thus present a generally contiguous surface bearing against the connector 82 during the extrusion operation. The upstanding surface 40 disposed at the terminating end of the recessed portion 38 of the first plunger portion 34 is arranged to provide an abutment to restrict further rearward movement of the second plunger portion 46 during the extrusion operation. The end surfaces of each of the first and second plunger portions 34 and 46, respectively, although shown and described hereinabove as generally planar may be suitably configured in a variety of other shapes which may include convex and concave portions arranged to cooperate with suitably formed complementary surfaces on connectors selectively designed for use in connection therewith. Additionally, various indicia may be provided as raised or recessed elements at the front surfaces of the first and second plunger portions to code or mark the connectors as they are urged through the restrictive nose orifice 70. Although not illustrated, it will be readily apparent to those skilled in the art that the second plunger portion 46 may be bifurcated in a manner similar to that illustrated with respect to the first plunger portion 34 to permit an increased taper to be employed in the nose portion orifice 70, where necessary or desirable.

Referring now to FIG. 9 there is shown a further embodiment of a plunger means 84 constructed in accordance with the concepts of the invention. As illustrated therein, the plunger means 84 comprises a first plunger portion 86 flanked by a pair of second plunger portions 88 and 90 respectively, each essentially duplicative of element 46 illustrated and described in detail herein-

above, and slidable along recessed portions 91 and 93 disposed on opposite sides of the first plunger portion 86. Each of the second plunger portions 88 and 90 is resiliently coupled to the main body of the plunger means 84 by biasing means comprising compression springs 92 and 94 similar to the compression spring 44 of the embodiment illustrated in FIG. 2. This arrangement provides additional versatility in that three differently sized connectors may be extruded through the same extruding orifice of the extrusion tool in a manner essentially similar to that described above with respect to the embodiment illustrated in FIGS. 2 through 7. By way of example, the solid outline indicated by the reference numeral 96 defines the contour of the smallest of the three differently sized connectors which may be extruded through the nose portion orifice indicated as 98 in FIG. 9. In such case, each of the second plunger portions 88 and 90 operate to reduce the transverse dimension of the orifice 98 while the first plunger portion 86 operates to extrude the connector 96 between the second plunger portions 88 and 90 and the tapered inner surfaces 110 and 112 of the orifice 98. A second connector having a contour including the solid outline indicated by numeral 96 but further including a portion 100 indicated by the dotted outline adjacent the second plunger portion 88 may be extruded through the orifice 98 in a manner similar to that described with respect to the connector 82 shown in FIGS. 4 and 5. In this case, the second plunger portion 90 provides the additional closure necessary to contain the connector including portions 96 and 100 properly within the orifice 98 for extrusion therethrough. When used in conjunction with a connector having a contour defined generally by the solid outline 96 together with the dotted outlines 100 and 102, the embodiment illustrated in FIG. 9 functions in a manner similar to that described above with respect to the arrangement shown in FIGS. 4 and 5, except that both second plunger portions 88 and 90 are displaced longitudinally rearwardly to provide a generally contiguous surface comprising the front surfaces of both second plunger portions 88 and 90, and the first plunger portion 86. Accordingly, as the plunger means 84 is advanced forwardly towards the nose portion orifice 98, the front end surfaces of all three elements function cooperatively to urge the connector through the orifice 98. It will also be clear to those skilled in the art that each of the second plunger portions 88 and 90 may be cooperatively guided along the adjacent surfaces of the first plunger portion 86 by the employment of complementary ribs and slots such as the elements 62 and 64 illustrated in FIG. 8. A slot 108 bifurcates the first plunger portion 86 to permit a variation in the transverse dimension thereof in a manner similar to that described above with respect to the element 34, whereby the second plunger portions 88 and 90 may more closely follow the inner tapered surfaces of the orifice 98, which are indicated generally at 110 and 112 in FIG. 9.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Plunger means for use in connection with an extrusion tool or the like comprising: a generally elongate first plunger portion having a first end and a recessed portion extending rearwardly from said plunger portion first end; a second plunger portion slidable generally longitudinally on said first plunger portion recessed

portion and having a first end and a second end; and biasing means cooperative with said first plunger portion and said second plunger portion for biasing said second plunger portion first end selectively forward of said first plunger portion first end.

2. Plunger means as defined in claim 1 wherein said biasing means comprises spring means.

3. Plunger means as defined in claim 2 wherein said spring means comprises a compression spring and said second plunger portion has a longitudinally extending orifice, said compression spring being selectively engageable within said second plunger portion orifice.

4. Plunger means as defined in claim 1, said second plunger portion being selectively movable to a second position wherein said first end thereof is generally coincident with said first plunger portion first end.

5. Plunger means as defined in claim 1 further comprising means for guiding said second plunger portion along said first plunger portion recessed portion.

6. Plunger means as defined in claim 5 wherein said first plunger portion comprises rib means extending longitudinally along said recessed portion, and said second plunger portion comprises slot means engaging said rib means to guide said second plunger portion along said first plunger portion recessed portion.

7. Plunger means as defined in claim 1 wherein said biasing means comprises a compression spring, and said first plunger portion has a longitudinally extending orifice communicating with said recessed portion, said compression spring being selectively engageable within said first plunger portion orifice.

8. Plunger means as defined in claim 1 wherein said first and said second plunger portions are of substan-

tially equal width.

9. Plunger means as defined in claim 1 wherein said first and second plunger portions have correspondingly selectively tapered sides generally adjacent said first ends thereof.

10. Plunger means as defined in claim 1 wherein said first plunger portion recessed portion comprises an up-standing surface remote from said first plunger portion first end for limiting the rearward travel of said second plunger portion.

11. Plunger means as defined in claim 10 wherein said first plunger portion recessed portion comprises a generally planar surface, said second plunger portion being slidable along said recessed portion planar surface.

12. Plunger means as defined in claim 11 wherein said second plunger portion comprises a generally planar surface, said second plunger portion planar surface being slidable along said recessed portion planar surface.

13. Plunger means as defined in claim 1 wherein said first plunger portion and said second plunger portion each have a substantially rectangular configuration in cross section.

14. Plunger means as defined in claim 1 wherein said first plunger portion first end terminates in a first generally planar surface, and said second plunger portion first end terminates in a second generally planar surface, said second plunger portion being movable rearwardly so that said second planar surface is generally coincident with said first planar surface to provide a generally contiguous surface thereat.

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