

- [54] EXTRUSION TOOL
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- [73] Assignee: Thomas & Betts Corporation, Elizabeth, N.J.
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- [58] Field of Search 72/270, 253, 261, 268; 425/467, 517, 506, 515, 392; 29/282, 519, 520, 517, 518, 516, 515, 525

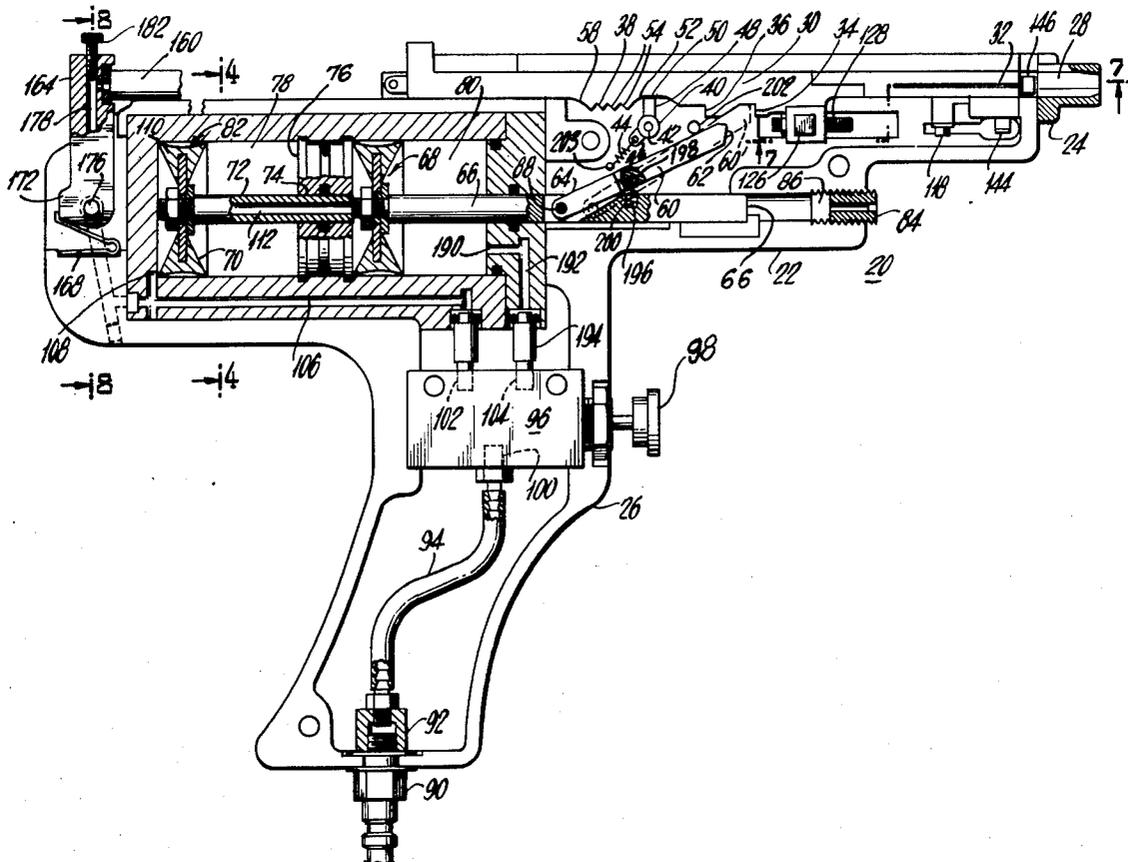
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- UNITED STATES PATENTS
- 2,406,392 8/1946 Minarik 29/282
- 3,680,202 8/1972 Siebol 29/520

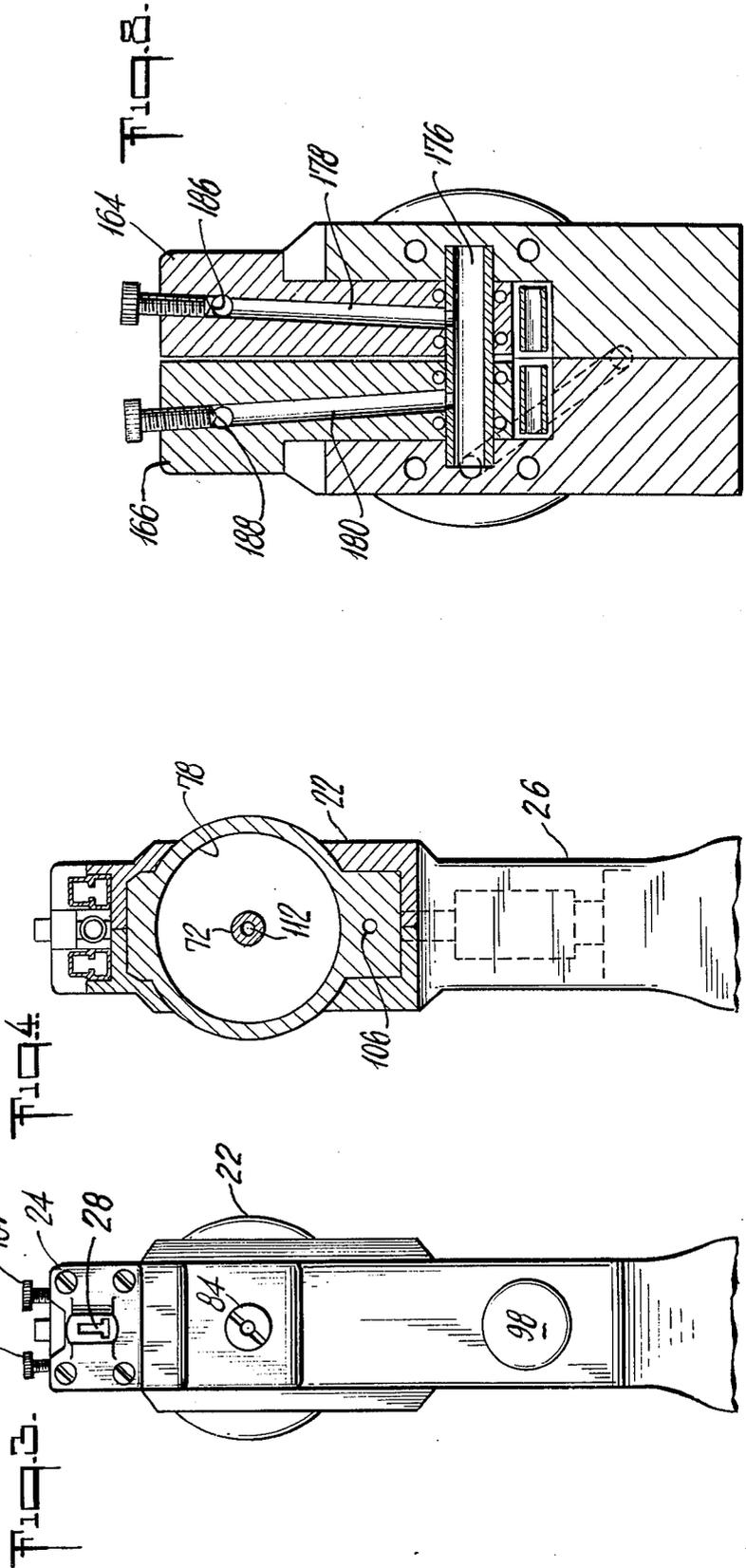
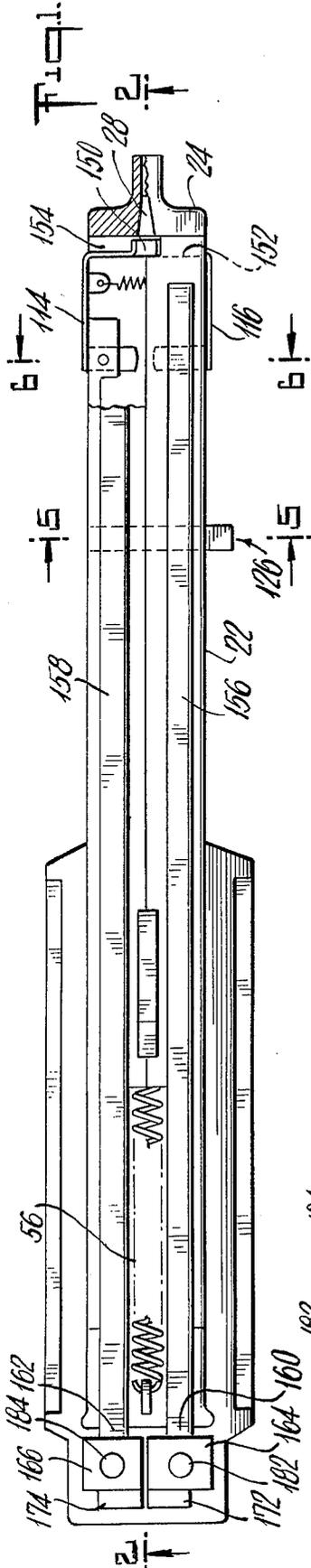
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[57] **ABSTRACT**
 A tool body having preferably a pistol-like configuration comprises a preferably pneumatically powered

drive means which may comprise a tandem piston arrangement and articulated assembly in which the shank portion of the forward piston has attached thereto a cam member preferably in the form of a link the other end of which is arranged to engage selectively spaced cam engaging portions on a plunger reciprocatingly movable in the tool body to provide stepped advancement of the plunger in response to axial movement of the piston. The front end of the plunger is arranged to advance a selectively apertured extrudable workpiece into and through a tapered orifice extending through the nose portion of the tool in discrete steps for controlled sequential extrusion of the workpiece about one or more elements inserted therewithin. A full stroke compelling mechanism comprising a spring biased pawl member attached to the tool body and engageable with a plurality of teeth located on the plunger means insures that the plunger will undergo a complete forward stroke before returning to its retracted position. Dispensing means which may include selectively movable opposingly disposed arm portions located adjacent the nose portion orifice and cooperative with the tool plunger for coordinated movement therewith is arranged to selectively transfer workpieces fed from feed tubes located on the tool body into proper position within the extrusion zone of the tool.

24 Claims, 8 Drawing Figures





EXTRUSION TOOL

CROSS REFERENCE TO RELATED APPLICATIONS:

In a copending application entitled Pneumatic System Including Auxiliary Output, Ser. No. 490,289 filed July 22, 1974 in the name of Daniel Eppler and assigned to the assignee of the instant invention, there is described a pneumatic drive system having a tandem piston arrangement which may be employed for energizing an extrusion tool wherein the plunger of the extrusion tool is coupled directly to the shank portion of the forward piston. Accordingly, reference is made herein to said application for a description of a pneumatic circuit including valve means for selectively directing the incoming pneumatic pressure to provide controlled operation of the tool. Reference is also made herein to a copending application entitled Selective Dispensing Mechanism, Ser. No. 480,478, filed June 18, 1974 in the name of Daniel Eppler and similarly assigned to the assignee of the instant invention, for a description of a dispensing mechanism adaptable for use in an extrusion tool and incorporating a pair of oppositely disposed movable arms located generally adjacent the nose portion of the tool and arranged to selectively transfer workpieces from a feed chamber to a position generally adjacent a tapered orifice extending through the nose portion for controlled extrusion therethrough. Such applications are, accordingly, incorporated by reference herein as disclosing and describing the aforesaid mechanisms for use in an extrusion tool.

BACKGROUND OF THE INVENTION:

1. Field of the Invention:

The invention is directed to the field of extrusion devices and principally to a convenient, compact, pneumatically powered extrusion tool for use with extrudable connectors.

2. Description of the Prior Art:

In U.S. Pat. No. 3,614,885 entitled Extrusion Tool and issued Oct. 26, 1971 to Daniel Eppler and assigned to the assignee of the instant invention and U.S. Pat. No. 3,674,392 entitled Extrusion Tool and issued July 4, 1972 to Daniel Eppler and assigned similarly to the assignee of the instant invention, there are described two forms of extrusion tools employing plunger means slidably mounted in a tool housing for axial movement towards a tapered orifice in the nose portion of the tool to advance an extrudable workpiece such as an electrical connector through the nose portion orifice for achieving an electrical connection. In one case there is provided a single plunger having a deformable end arranged to conform closely with the tapered orifice in the nose portion of the tool, while the other case includes a tool having a pair of plungers arranged in telescoping relationship wherein the inner plunger is arranged to advance beyond the outer plunger to provide greater control of the extrusion operation. In either case, however, the extrusion operation is completed in a single, uninterrupted stroke advantageous only in those applications in which two or more elements are readily available for simultaneous connection within the extrudable connector. There are, however, many applications in which it is desired to accomplish a connection in a series of steps spaced in time to permit repositioning of an initial splice connection before the subsequent or final connection is completed, an opera-

tion incapable of performance with such prior art devices. These devices are also generally designed to accept only a given sized connector thereby seriously limiting the versatility thereof where it is desired, for example, to establish a splice connection between conductors of varying sizes. A further drawback of the above-described prior art tools is the absence of any storage means associated therewith for storing and feeding a plurality of extrudable connectors into the extrusion zone to avoid the necessity for continually manually reloading the tool after each operation.

SUMMARY OF THE INVENTION:

The invention overcomes the problems and limitations noted above with respect to prior art devices by providing a pneumatically powered extrusion tool for extrudable connectors or the like which is more efficient, versatile, and more convenient than such prior art tools. A cam means which may comprise an elongate link having one end preferably pivotably coupled to the shank portion of a piston slidably disposed within a cylinder and driven by a source of pneumatic pressure is selectively formed to provide a free end engageable with a reciprocatingly movable plunger mounted in the tool body for corresponding movement therewith during the forward stroke of the piston. The plunger may be normally biased in a rearwardly position so that, upon disengagement by the cam means, the plunger is returned to its initial retracted position upon completion of the extrusion cycle. A full stroke compelling mechanism which may comprise a movable pawl pivotally mounted to the tool body and having a free end engageable with a toothed portion located generally intermediate the ends of the tool plunger serves to insure that the plunger complete its forward stroke before returning to its retracted position under the influence of the biasing means. Workpieces, which may comprise extrudable connectors, may be selectively positioned adjacent the front end of the plunger by coordinating operation of a dispensing means which may include a pair of opposing arm portions pivotably coupled to the tool body adjacent the nose portion thereof and suitably deflected by an actuating means located on the plunger and movable therewith to provide controlled transfer of the workpieces from a feed chamber during each stroke of the plunger to the extrusion zone. The workpieces may be stored in a feed means comprising selectively pressurized tubular members each having an exit end communicating with associated feed chambers providing a passageway between the feed means and the extrusion orifice. In a preferred embodiment, the plunger means is provided with a pair of spaced cam engaging portions so that a full forward stroke of the plunger means requires two full strokes of the drive means wherein the first stroke the workpiece is joined to a first element and in the second stroke the workpiece including the first element is joined to a second element to provide a completed connection therebetween. The workpiece may comprise a powder metal part suitably apertured to provide, for example, a combination of conductor and terminal receiving cavities independent of one another and individually deformable upon the selective advancement of the workpiece through the nose portion orifice, the workpiece thereby establishing electrical continuity between the enclosed elements. It is therefore an object of this invention to provide an improved extrusion tool.

It is a further object of this invention to provide a compact, pneumatically driven, sequentially operable extrusion tool.

It is still another object of this invention to provide means for selectively sequentially advancing the plunger of an extrusion tool.

It is still another object of this invention to provide means for selectively sequentially advancing the plunger of an extrusion tool in cooperation with the reciprocating movement of a pneumatically driven piston means.

It is yet a further object of this invention to provide a dual-stroke pneumatically powered extrusion tool including a dispensing mechanism and storage means for selectively storing and feeding workpieces into the extrusion zone.

It is still a further object of this invention to provide a pneumatically powered extrusion tool in which a workpiece is advanced in discrete steps through an extrusion orifice in controlled relationship with the advancing stroke of a tandem piston assembly.

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 mode contemplated for carrying it out.

BRIEF DESCRIPTION OF THE DRAWINGS:

In the Drawings:

FIG. 1 is a top plan view, partly cut away and partly in section, of an improved extrusion tool constructed in accordance with the concepts of the invention.

FIG. 2 is a side elevational view, in section, taken along the line 2—2 of FIG. 1.

FIG. 3 is a front elevational view of the device of FIG. 1.

FIG. 4 is a rear elevational view, partly in section, taken along the line 4—4 of FIG. 2.

FIG. 5 is a fragmentary sectional view taken along the line 5—5 of FIG. 1.

FIG. 6 is a sectional view taken along the line 6—6 of FIG. 1.

FIG. 7 is a fragmentary sectional view taken along the line 7—7 of FIG. 2.

FIG. 8 is a sectional view taken along the line 8—8 of FIG. 2.

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

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

Turning now to FIGS. 1 through 8 there is shown an extrusion tool 20 constructed in accordance with the concepts of the invention. The extrusion tool 20 comprises a tool body 22 having a nose portion 24 and a grip portion 26. An orifice 28 having a tapered entrance portion, as shown in greater detail in FIG. 7, extends generally longitudinally through the nose portion 24 for extruding a workpiece therethrough as shown and described in greater detail in my copending application entitled, Selective Dispensing Mechanism, referred to hereinabove. Reciprocatingly movable in the tool body 22 is a plunger means 30 having a first end 32 movable towards and away from the nose portion 24 and in coaxial alignment with the nose portion orifice 28. The plunger means 30 is provided with a first stepped portion 34 and a second stepped portion 36

disposed in selectively spaced relationship with respect to each other and located generally intermediate the length of the plunger means 30. Each of the stepped portions 34 and 36 provide cam engaging means as will be described in greater detail hereafter. Disposed just rearwardly of the stepped portions 34 and 36 is a toothed portion 38 which, upon advancement of the plunger means 30, is engagable with a pawl means 40 rotatable about a pivot 42 attached to the tool body 22 and biased to an upright position, as viewed in FIG. 2, by means of a spring 44 extending between an extension 46 on the pawl means 40 and the tool body 22. The toothed portion 38 of the plunger means 30, in cooperation with the movable pawl 40, provides a ratchet mechanism for insuring that the plunger means 30 undergoes a complete forward stroke before returning to its retracted position, and comprises what may be referred to as a full stroke compelling mechanism. As is clearly shown in FIG. 2, the pawl means 40 comprises a leg portion 48 terminating in an end surface 50. A recess 52 located just forwardly of the toothed portion 38 of the plunger means 30 provides clearance for the pawl means leg portion 48 when the plunger means 30 is in its retracted position. As further shown in FIG. 2, each of the teeth of the toothed portion 38 is provided with a first surface 54 inclined in such manner with respect to the longitudinal axis of the plunger means 30 as to present an abutting surface for the surface 50 of the pawl means leg portion 48. As the plunger means 30 is advanced forwardly during the operating stroke of the tool, the leg portion 48 of the pawl means 40 is contacted by the rear portion of the recess 52 of the plunger means 30 and rotated in a clockwise direction sufficiently to clear the recess and snap into engagement in the V-shaped notch between the respective teeth of the plunger means toothed portion 38 under the influence of the biasing spring 44. The length of the leg portion 48 is arranged to insure that the pawl means 40 is held at a position in which the leg portion 48 is axially oriented at an angle somewhat less than 90° to the longitudinal axis of the plunger means 30, whereby the rearward force exerted on the plunger means 30 by a biasing spring 56 attached thereto to bias the plunger means 30 in a rearward position causes the plunger means 30 to be locked against the movable pawl 40. Accordingly, the plunger means 30 must be advanced forwardly sufficiently for the leg portion 48 of the pawl means 40 to traverse the entire stepped portion 38 of the plunger means 30 in order to return to its initial upright position upon encountering a second plunger means recess 58 located just beyond the toothed portion 38. At this point, the plunger means 30 is retracted to its initial rearward position under the influence of its biasing spring 56, while the pawl means 40 is intermittently deflected in a counterclockwise direction as each tooth of the toothed portion 38 of plunger means 30 is drawn thereover. Upon completion of the return stroke of the plunger means 30, the pawl means 49 is again aligned in an upright position beneath the plunger means recess 52 and out of engagement with the plunger means toothed portion 38.

The plunger means 30 is operatively advanced by cam means such as an elongate link 60 having a first end 62 selectively engagable with the stepped portions 34 and 36 of the plunger means 30 when positioned as shown by the dotted outline 60'. The link 60 is pivotally attached at its other end 64 to the shank portion 66 of

a piston member 68 which is illustrated in FIG. 2 as the forward piston member of a pair of tandemly mounted piston means including a rear piston member 70 provided with a shank portion 72 the terminating end of which extends within an annular aperture 74 in a divider 76 interposed between a rear cylinder portion 78 and a front cylinder portion 80 of a cylinder means 82 located within the tool body 22. The front and rear piston members 68 and 70, respectively, are reciprocatingly slidable within their respective cylinder portions 80 and 78. The length of stroke of the forward piston member 68 is controlled by an adjustable stop such as a threaded member 84 located within the tool body 22 just forwardly of the terminating end of the shank portion 66 of the piston member 68 and in coaxial alignment therewith. Thus, as the forward piston member 68 advances forwardly under the influence of pneumatic pressure introduced within the cylinder means 82, as will be described in greater detail hereafter, the front surface of its shank portion 66 is caused to abut the adjacent surface 86 of the threaded member 84 which prevents further travel of the piston member 68. In this manner, the stepped advancement of the plunger means 30 is similarly controlled since the forward movement of the link 60, which is pivotally coupled to the piston member shank portion 66 by a pin 88 and operatively engages the plunger means 30, is directly related to the extent of forward movement of the piston member 68. The piston means 68 and 70 are both energized from an external source of pneumatic pressure, such as compressed air or the like, which is coupled to the tool 20 by a pressure fitting 90 disposed adjacent an inlet 92 located in the grip portion 26 of the tool 20. A conduit 94 conducts the pressurized fluid into a valve means 96 which may comprise a conventional four-way valve controlled by a trigger 98 arranged for manual manipulation by the operator. The valve means 96 comprises an inlet port 100, a first exit port 102, and a second exit port 104. The first exit port 102 communicates with a passageway 106 extending generally lengthwise in the tool body 22 and communicating with the rear chamber portion 78 as at 108. Accordingly, pressurized fluid entering the rear chamber portion 78 is caused to impinge upon the head portion 110 of the rear piston means 70 while a portion thereof is conducted into the front chamber portion 80 through a bore 112 extending longitudinally through the head portion 110 and the shank portion 72 of the rear piston member 70, to pressurize the front chamber portion 80. Disposed adjacent the nose portion 24 of the tool 20 is dispensing means comprising a pair of opposing arm portions 114 and 116 (FIG. 7) pivotally attached to the tool body 22 by respective pin members 118 and 120 extending through respective apertured inturred finger portions 122 and 124 located at the rear of the arm portions 114 and 116 and selectively engageable by actuating means, such as member 126 coupled to the plunger means 30 and comprising a threaded member 128 threadably movable within a bore 130 in a support 132 attached to a transverse member 134 movable to either one of two positions offset from the central axis of the plunger means 30. The threaded member 128 comprises a forward end 136 which is selectively engageable with either one of the leg portions 122 and 124 of the arm portions 114 and 116, respectively, according to the position of the transverse member 134. For example, when the transverse member 134 is positioned

to the left of the central longitudinal axis of the plunger means 30 as shown, for example, in FIG. 7 when viewed from the front of the tool 20, the forward end 136 of the threaded member 128 is aligned with and will engage the finger portion 124 of the arm portion 116 as the plunger means 30 is driven forward during the extrusion cycle so that the arm portion 116 is rotated about its pivot 120 to a position essentially as shown by the dotted outline 138 in FIG. 7. As the plunger means 30 returns to its retracted position at the completion of the cycle, the actuating means 126 is similarly moved rearwardly whereby the threaded member 128 is disengaged from the finger portion 124 of the arm portion 116 permitting the arm portion 116 to return to its initial position under the influence of a biasing spring 140 attached between a spring support 142 located on the arm portion 116 and a spring support 144 located on the arm portion 114 for normally biasing the arm portions 114 and 116 towards one another and against the sides of the tool body 22. Each of the arm portions 114 and 116 further comprise an offset end 146 and 148, respectively, arranged to straddle the nose portion orifice 28 prior to deflection by the member 126. The space between the offset portions 146 and 148 is arranged to closely approximate the width of a workpiece such as 150, (FIG. 1) which is fed thereto from either one of a pair of feed chambers 152, 154 located adjacent the nose portion orifice 28. The feed chambers 152 and 154 communicate with the respective exit ends of a pair of feed tubes 156 and 158 which are located along the top surface of the tool body 22. Each of the feed tubes 156 and 158 are arranged to receive and store a given supply of selectively apertured workpieces having an external configuration conforming generally with the internal configuration of each of the feed tubes 156 and 158 for slidable movement therewithin. It will, of course, be readily apparent that the workpieces 150 loaded into one of the feed tubes 156 and 158 may be selectively apertured to accept a range of conductor and/or terminal sizes different from that receivable within the workpieces loaded into the other of the feed tubes 156 and 158, thus permitting the operator to conveniently select workpieces from one or the other of the feed tubes 156 and 158 merely by repositioning the transverse member 134 of the actuating means 126 prior to initiation of the operating cycle. Each of the feed tubes 156 and 158 comprise a respective entrance end 160 and 162 (FIG. 1) enclosed by a mating cover member 164, 166, respectively, which is held tightly against a respective entrance end 160 and 162 of the feed tubes 156 and 158 by a respective spring member 168, 170 having one end supported by the tool body 22 and the other end engaging a leg portion 172, 174 of each of the cover members 164 and 166, each of which is pivotally coupled to the tool body 22 by a pivot pin 176 extending through transverse bores (FIG. 8) in each of the cover members 164 and 166. As more clearly illustrated in FIG. 8, each of the cover members 164 and 166 is provided with a passageway 178, 180, respectively, which serves as a path for pressurized fluid from the conduit 106 into each of the feed tubes 156 and 158. The feed tubes 156 and 158 may thus be selectively pressurized to insure proper alignment of the workpieces 150 within each of the respective feed tubes and proper advancement of the workpieces towards the exit end of each of the feed tubes for displacement by the opposing dispensing

means arm portions 114 and 116 into the extrusion zone. Each of the cover members 164 and 166 further includes a respective adjusting screw 182, 184 terminating in an end 186, 188 respectively, arranged to communicate with a respective one of the bores 178 and 180, as shown more clearly in FIG. 8, to control the flow of pressurized fluid therethrough. Accordingly, the threaded screws 182 and 184 provide a means for controlling the amount of pressure exerted against each column of workpieces contained in the feed tubes 156 and 158. This may be found extremely advantageous where, for example, the workpieces in one of the feed tubes 156 and 158 are substantially heavier than the workpieces contained in the other of the feed tubes in which case the feed tube containing the heavier workpieces may be pressurized to a greater extent than the feed tube containing the lighter workpieces to assist in maintaining proper orientation and advancement of the workpieces. As further illustrated in detail in FIG. 2, the forward chamber portion 80 of the pneumatic drive means comprises an outlet port 190 which is coupled back to the valve means 96 through a transverse bore 192 communicating with a fitting 194 joining the cylinder housing with the valve means 96.

The dual stroke operation of the tool 20 is accomplished in the following manner. As the forward cylinder portion 80 is energized from the source of pressurized fluid flowing through the longitudinally extending bore 112 in the shank portion 74 of the rear piston member 72, the forward piston member 68 is caused to move forwardly in the forward cylinder portion 80. The link 60 which is biased upwardly by a spring 196 having one end seated within a spring receiving chamber 198 in the link 60 and the other end seated within a spring receiving chamber 200 in the shank portion 66 of the forward piston means 68, normally abuts a pin 202 coupled to the tool body 22 to maintain the link convenient, out of engagement with the plunger means 30 and in generally oblique angular relationship with respect to the shank portion 66 of the forward piston member 68, substantially as shown in FIG. 2. Upon movement of the forward piston member 68 in a forwardly direction, the link 60 is caused to traverse a path generally indicated by the dotted outline 60' so that its forward surface 62 is brought into engagement with the plunger means stepped portion 34 thereby driving the plunger means 30 forwardly in response to the movement of the piston member 68 for a distance approximately equal to the stroke of the piston member 68. The cycle is initiated by depression of the trigger 98 which causes the source of pressurized fluid to flow into both the rear cylinder portion 78 and the front cylinder portion 80, as described heretofore. Upon release of the trigger 98 the source of pressurized fluid is diverted into the front cylinder portion 80 through a path including the fitting 194, the transverse bore 192, and port 190, thereby returning the front piston member 68 to its retracted position as shown in FIG. 2. Since the front end of the shank portion 72 of the rear piston member 70 abuts the head portion of the front piston member 68, the rear piston member is thereby also driven rearwardly by the rearward movement of the front piston member 68. Consequently, at the end of the first cycle, both piston members 68 and 70 have been returned to their retracted positions essentially as shown in FIG. 2. However, the plunger means 30 is prevented from returning to its retracted position during

this portion of the cycle as a result of the locking engagement established between its stepped portion 38 and the pawl 40, as described heretofore. Accordingly, the plunger means 30 has been caused to undergo the first part of a dual stroke operation wherein its front end 32 has engaged a workpiece 150 previously positioned in the extrusion zone, thereby forcibly advancing the workpiece 150 a given distance into the nose portion tapered orifice 28 to effect a partial extrusion of the workpiece, and its consequent connection to a conductor end (not shown) inserted within a pre-designated aperture in the workpiece which is contracted sufficiently to securely engage the conductor end therewithin. When the trigger 98 is depressed a second time, the front end 62 of the link 60 is caused to engage the second stepped portion 36 of the plunger means 30 to further advance the plunger means 30 in response to the movement of the piston member 68, causing the workpiece 150 to be advanced further through the tapered orifice 28 of the nose portion 24 so as to be extrudably compressed about a second conductor or terminal (not shown) inserted within a second pre-designated workpiece aperture underformed during the first stroke. The second stroke of the plunger means 30 is arranged to advance the workpiece 150 completely through the nose portion 24 of the tool 20 to insure separation of the workpiece and the elements connected therewithin from the tool 20 upon release of the trigger 98 and the return of the plunger means 30 to its retracted position. Upon completion of the second stroke of the plunger means 30, the leg portion 48 of the movable pawl 40 will have traversed the plunger means stepped portion 38 and will be located adjacent the plunger means recess 58 thereby unlocking the plunger means 30 which is now returned rapidly to its retracted position under the influence of spring 56 as the trigger 98 is released. It will also be noted that the link 60 having been retracted to its initial position, as shown in FIG. 2, by the return of the forward piston member 68, is disengaged from the stepped portions 34 and 36 of the plunger means 30 during the rearward travel of the plunger means 30. As further illustrated in FIG. 2, the extension 46 protruding outwardly from the outer surface of the movable pawl 40 is so located with respect to a spring support 203 to which the other end of the spring 44 is engaged as to maintain the pawl means 40 in an upright position when disengaged from the toothed portion 38 of the plunger means 30.

It will of course be clear to those skilled in the art that the pneumatic drive means illustrated and described hereinabove may be readily replaced by either a manual or hydraulic drive system suitably coupled to the link 60 to advance the plunger means 30 in substantially the same manner as heretofore described without departing from the spirit of the invention and within the concepts herein disclosed.

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

1. An extrusion tool comprising: a tool body having a nose portion and a grip portion; plunger means reciprocatingly movable in said tool body and having a first end movable towards and away from said nose portion; pneumatic drive means located within said tool body for selectively moving said plunger means towards said nose portion; cam means selectively coupling said drive means to said plunger means in one direction to pro-

vide stepped movement of said plunger means towards said nose portion; an inlet located in said grip portion for coupling a source of pneumatic pressure thereto; and valve means located in said grip portion for selectively directing a source of pneumatic pressure from said inlet to said drive means to control the direction of movement of said drive means; said nose portion having a tapered orifice extending therethrough, said orifice being arranged to receive said plunger means first end therein for extruding a workpiece there-through.

2. An extrusion tool as defined in claim 1 further comprising feed means cooperative with said tool body for selectively feeding a workpiece into said tool body.

3. An extrusion tool as defined in Claim 2 wherein said feed means comprises a tubular member mounted on said tool body and having an exit end selectively disposed adjacent said tool body nose portion.

4. An extrusion tool as defined in Claim 2 wherein said feed means is selectively pneumatically coupled to said drive means to provide controlled pressurization of said feed means.

5. An extrusion tool as defined in claim 1 wherein said drive means comprises piston means slidable within a respective cylinder means and having a shank portion, said cam means comprising an elongate link having one end pivotally coupled to said piston means shank portion for corresponding movement therewith.

6. An extrusion tool as defined in claim 5 wherein said plunger means is normally biased in a rearwardly position and further comprises a cam engaging portion arranged for cooperative engagement with said cam means for movement in a forward direction.

7. An extrusion tool comprising: a tool body having a nose portion and a grip portion; plunger means reciprocatingly movable in said tool body and having a first end movable towards and away from said nose portion; pneumatic drive means located within said tool body for selectively moving said plunger means towards said nose portion; cam means selectively coupling said drive means to said plunger means in one direction to provide stepped movement of said plunger means towards said nose portion; an inlet located in said grip portion for coupling a source of pneumatic pressure thereto; valve means located in said grip portion for selectively directing a source of pneumatic pressure from said inlet to said drive means; feed means cooperative with said tool body for feeding a workpiece into said tool body; said nose portion having a tapered orifice extending there-through, said orifice being arranged to receive said plunger means first end therein for extruding a workpiece there-through; and dispensing means located adjacent said tool body nose portion and comprising opposing arm portions selectively cooperative with said plunger means for movement towards and away from said nose portion orifice for selectively positioning a workpiece adjacent said orifice.

8. An extrusion tool as defined in claim 7 wherein said feed means comprises a pair of tubular members mounted on said tool body, each of said tubular members terminating in an exit end communicating with a respective one of said dispensing means arm portions.

9. An extrusion tool as defined in Claim 7 wherein said arm portions are pivotally coupled to said tool body generally adjacent said nose portion orifice.

10. An extrusion tool as defined in Claim 7 further comprising actuating means coupled to said plunger

means for selective engagement with said dispensing means arm portions upon movement of said plunger means.

11. An extrusion tool as defined in Claim 10 wherein said actuating means is selectively positionable between a first position and a second position for predetermined engagement with a respective one of said dispensing means arm portions.

12. An extrusion tool as defined in Claim 7 wherein said drive means comprises piston means slidable within a respective cylinder means and having a shank portion, said cam means comprising an elongate link having one end pivotally coupled to said piston means shank portion for corresponding movement therewith.

13. An extrusion tool as defined in Claim 12 further comprising spring means cooperative with said dispensing means arm portions for normally biasing said arm portions towards one another.

14. An extrusion tool as defined in claim 13 wherein said actuating means includes a threaded member for controlling the engagement between said actuating means and said dispensing means arm portions.

15. An extrusion tool comprising: a tool body having a nose portion and a grip portion; plunger means reciprocatingly movable in said tool body and having a first end movable towards and away from said nose portion; pneumatic drive means located within said tool body for selectively moving said plunger means towards said nose portion; cam means selectively coupling said drive means to said plunger means in one direction to provide stepped movement of said plunger means towards said nose portion; an inlet located in said grip portion for coupling a source of pneumatic pressure thereto; and valve means located in said grip portion for selectively directing a source of pneumatic pressure from said inlet to said drive means to control the direction of movement of said drive means; said plunger means having a first cam engaging portion and a second cam engaging portion, said plunger means first and second cam engaging portions being arranged in selectively spaced disposition generally intermediate the length of said plunger means for selective stepped movement of said plunger means in a forward direction in response to the movement of said cam means.

16. An extrusion tool as defined in claim 15 wherein said cam means comprises an elongate link having one end pivotally connected to said drive means, the opposite end of said link being arranged for selective engagement with said plunger means first and second cam engaging portions.

17. An extrusion tool as defined in claim 16 further comprising biasing means normally biasing said plunger means in a rearwardly position, said plunger means further comprising a toothed portion, said tool further comprising ratchet means coupled to said tool body and including a movable pawl for selective engagement with said plunger means toothed portion during the forward stroke of said plunger means to resist the return of said plunger means before completion of its forward stroke.

18. An extrusion tool as defined in claim 16 wherein said drive means comprises piston means slidable within a respective cylinder means and having a shank portion, said link being pivotally coupled to said piston means shank portion for corresponding movement therewith.

19. An extrusion tool as defined in claim 15 wherein said drive means comprises piston means including a forward piston member and a rear piston member, said cylinder means including a forward cylinder portion and a rear cylinder portion, said forward and said rear piston members each being independently slidable in a respective one of said forward and rear cylinder portions.

20. An extrusion tool as defined in claim 19, said forward and said rear piston members being arranged for tandem operation, said rear piston member having a shank portion, and said forward piston member having a head portion, said forward piston member head portion being arranged for abutting relationship with said rear piston member shank portion to permit said forward and said rear piston members to assist one another during each stroke thereof.

21. An extrusion tool comprising: a tool body having a nose portion and a grip portion; plunger means reciprocatingly movable in said tool body and having a first end movable towards and away from said nose portion; pneumatic drive means located within said tool body for selectively moving said plunger means towards said nose portion; cam means selectively coupling said drive means to said plunger means in one direction to provide stepped movement of said plunger means towards said nose portion; an inlet located in said grip portion for coupling a source of pneumatic pressure thereto; valve means located in said grip portion for selectively directing a source of pneumatic pressure from said inlet to said drive means to control the direction of movement of said drive means; said nose portion having a tapered orifice extending therethrough, said orifice being arranged to receive said plunger means first end therein for extruding a workpiece therethrough; said plunger means having a first cam engaging portion and a second cam engaging portion; said plunger means first and second cam engaging portions being arranged in selectively spaced disposition generally intermediate the length of said plunger means for selective stepped

movement of said plunger means in a forward direction in response to the movement of said cam means; dispensing means located adjacent said tool body nose portion and comprising opposing arm portions selectively cooperative with said plunger means for movement towards and away from said nose portion orifice for selectively positioning a workpiece adjacent said orifice; actuating means coupled to said plunger means for selective engagement with said dispensing means arm portions upon movement of said plunger means; said plunger means further including a toothed portion located generally intermediate its length; and ratchet means including a movable pawl selectively pivotable on said tool body for selective engagement with said plunger means toothed portion in one direction to insure completion of the forward stroke of said plunger means.

22. An extrusion tool as defined in claim 21 further comprising spring means coupling said plunger means to said tool body for normally biasing said plunger means in a retracted position.

23. An extrusion tool as defined in claim 21 wherein said drive means comprises piston means slidable within a respective cylinder means and having a shank portion, said cam means comprising an elongate link having one end pivotally coupled to said piston means shank portion for corresponding movement therewith.

24. An extrusion tool as defined in claim 21 wherein said drive means comprises a forward piston member, a rear piston member, and cylinder means including a forward cylinder portion and a rear cylinder portion, said forward and said rear piston members each being independently slidable in a respective one of said forward and rear cylinder portions, said forward piston member having a shank portion, said cam means comprising an elongate link pivotally coupled to said forward piston means shank portion for corresponding movement therewith.

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,889,517
DATED : June 17, 1975
INVENTOR(S) : Daniel Eppler

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

Column 4, line 58, "49" should be -- 40 --

Column 8, line 23, "durring" should be -- during --

Column 10, line 4, "ad" should be -- as --

Column 10, line 26, "now" should be -- nose --

Column 10, line 40, "secod" should be -- second --

Column 10, line 43, "steped" should be -- stepped --

Signed and Sealed this

fourteenth Day of October 1975

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks