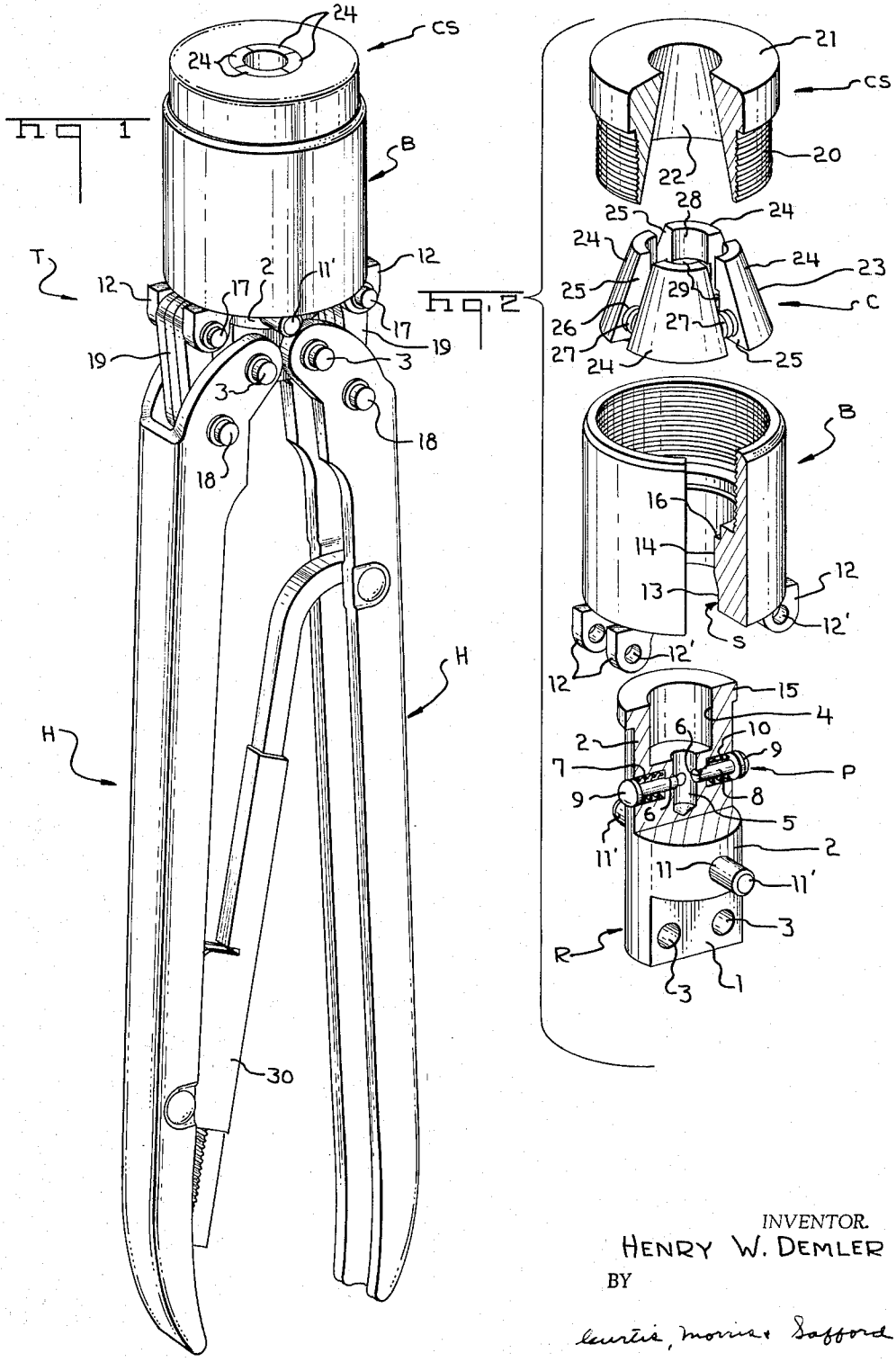
Nov. 16, 1965 H. W. DEMLER 3,217,519

COAXIAL CRIMPING TOOL

Filed Nov. 21, 1963 3 Sheets-Sheet 1



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Filed Nov. 21, 1963 3 Sheets-Sheet 2

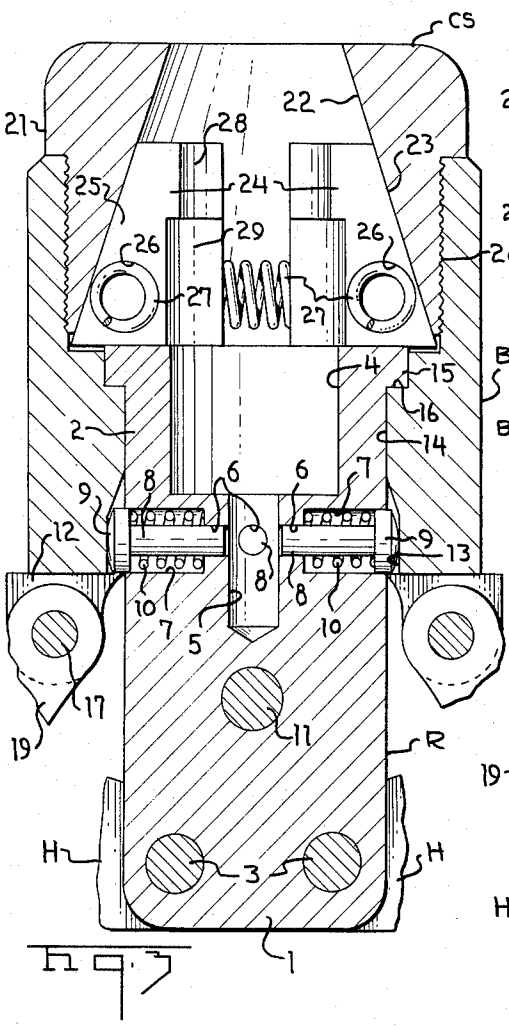

Fig. 3

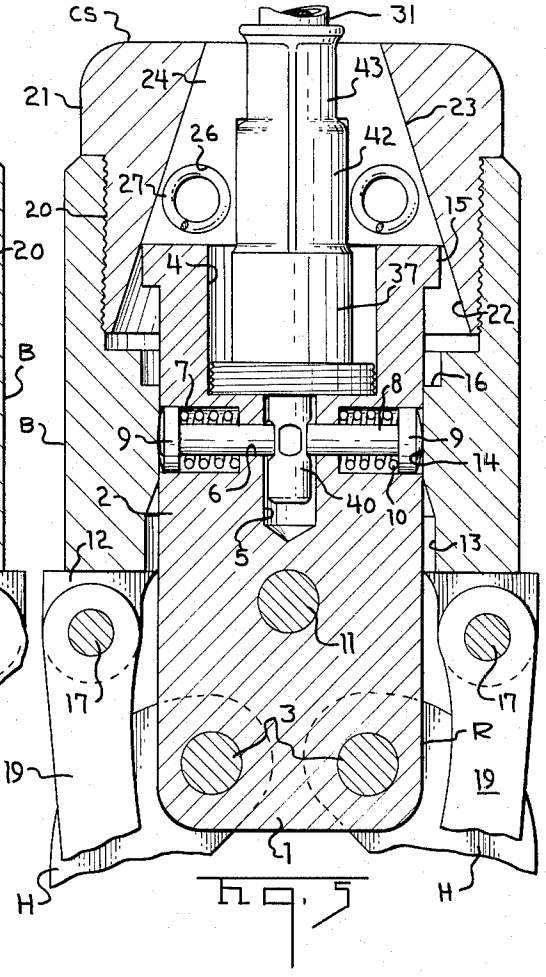

Fig. 5

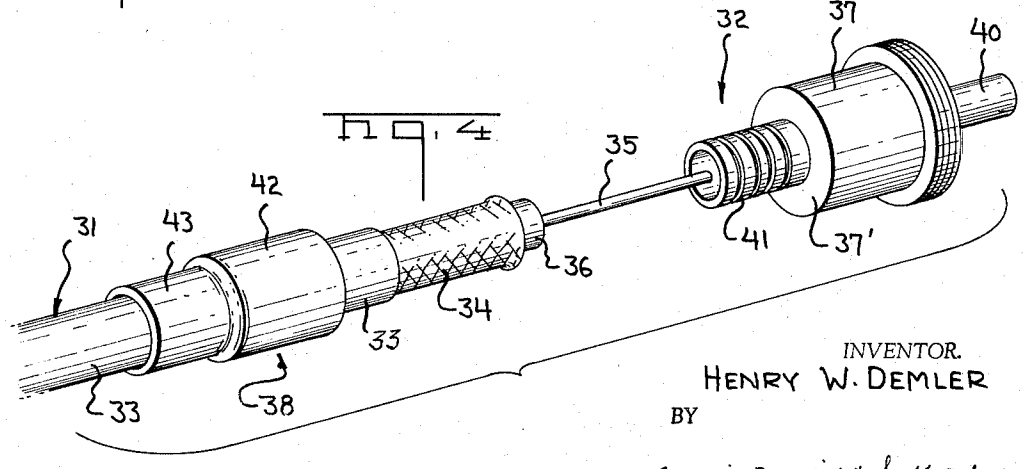

Fig. 4

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Filed Nov. 21, 1963 3 Sheets-Sheet 3

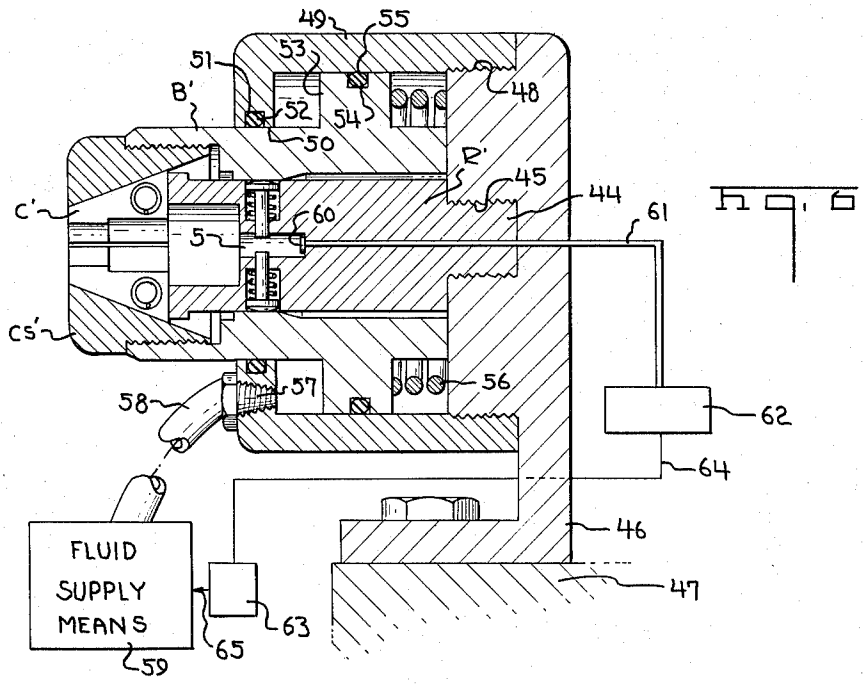

Fig. 6

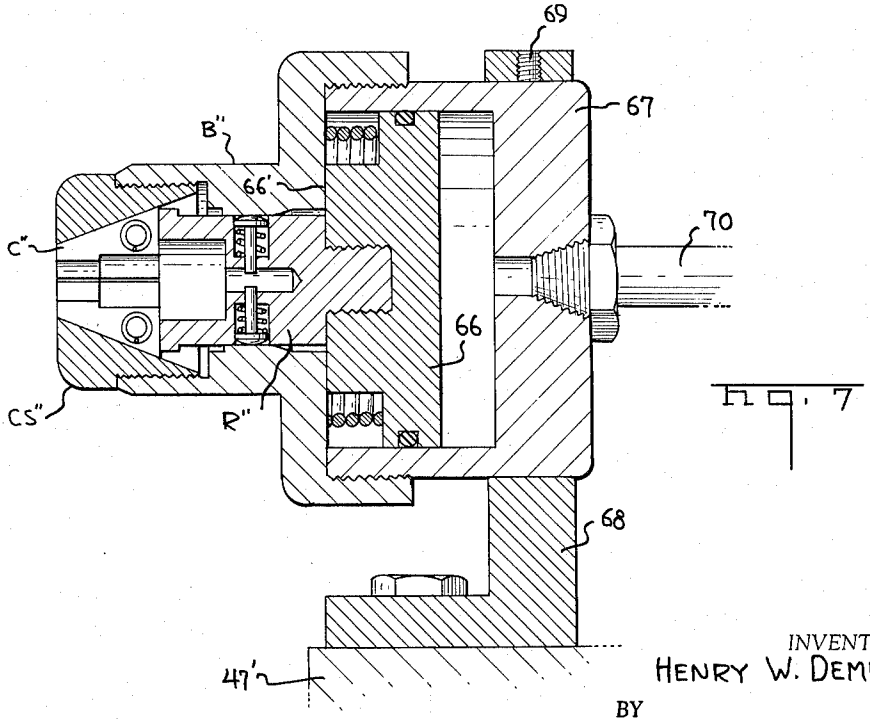

Fig. 7

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COAXIAL CRIMPING TOOL

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15 Claims. (Cl. 72—15)

This invention relates to a crimping tool for securing an electrical connector to an electrical conductor and more particularly a special tool for securing a coaxial electrical connector to a coaxial cable.

In the field of coaxial connectors, it is desirable to secure the conductors of a coaxial cable simultaneously to a coaxial connector as well as to secure the connector to the coaxial cable. Various types of coaxial connectors have been heretofore provided; however, one which is crimped onto the conductors of a coaxial cable has proven most effective since it can readily be secured on the conductors of a coaxial cable to provide an excellent mechanical and electrical connection as well as secured to the cable itself.

It is, therefore, a primary object of the present invention to provide a tool for securing a coaxial connector on the conductors of a coaxial cable.

Another object of the present invention is to provide a tool that simultaneously secures a coaxial connector on the conductors of a coaxial cable and the cable itself.

A further object of the present invention is the provision of a tool that will simultaneously crimp a workpiece at three locations in a radial direction; two at adjacent locations and the other spaced therefrom.

It is a further object of the present invention to provide a tool of the type that is compact and easily operated either by hand or in conjunction with a fluid operated means.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there is shown and described illustrative embodiments of the invention; it is to be understood, however, that these embodiments are not intended to be exhaustive nor limiting of the invention but are given for purposes of illustration in the invention and principles thereof and the manner of applying them in practical use so that they may modify them in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

FIGURE 1 is a perspective view of a tool embodying principles of the present invention;

FIGURE 2 is an exploded perspective-sectional view of the tool head of FIGURE 1;

FIGURE 3 is a longitudinal cross-sectional view of the tool in its open position;

FIGURE 4 is an exploded perspective view of the coaxial connector and coaxial cable onto which it is to be crimped;

FIGURE 5 is a view similar to FIGURE 3 but with the coaxial connector and cable therein and with the tool in its operated position; and

FIGURE 6 and 7 show alternative embodiments of the present invention.

In the drawings, and more particularly FIGURES 1–4, there is shown a hand tool T which comprises a ram member or supporting member R, a hollow body member B, a chuck device C, a chuck sleeve CS and handles H.

Ram member R includes a rectangular section 1 extending outwardly from one end of a circular section 2. Pivot pins 3 are disposed in openings in section 1 which are in a plane normal to the longitudinal axis of the tool

and each opening is equidistant therefrom. One end of each of handles H is pivotally mounted on pivot pins 3.

A cup-shaped recess 4 is disposed in the other end of circular section 2. At the bottom of recess 4, there is a cylindrical opening 5 in communication therewith and of smaller diameter. Recess 4 and opening 5 are coaxial with the longitudinal axis of the tool.

Extending outwardly from opening 5 are openings 6 which are normal to opening 5 and in communication therewith. Openings 6 are preferably four in number and are disposed around the longitudinal axis of the tool at 90° intervals. Each opening 6 merges into a larger opening 7 which extends to the outer surface of circular section 2.

A pin P is movably disposed in openings 6 and 7 and includes a shank portion 8 and a head portion 9. Shank portion 8 is slightly less in diameter than opening 6 and is disposed therein. Head portion 9 is slightly less in diameter than opening 7 and is disposed therein. A spring means 10, such as a helical spring, is disposed between head portion 9 and the bottom of opening 7, to normally bias pin P in a direction away from the longitudinal axis of the tool. The outer surface of head portion 9 is preferably rounded. A stop pin 11 is disposed in an opening between the end of opening 5 and rectangular section 1. Stop pin 11 has extensions 11′ extending beyond the outer surface of circular section 2.

Body member B is movably mounted on ram member R and has lugs 12 on the inner end which are provided with holes 12′. The internal surface of the outer end of body member B is threaded. Between lugs 12 and the internally threaded surface, there is provided an internal cam surface S which includes one section 13 having a larger diameter than the outer surface of circular section 2 so as to define a space therebetween. Section 13 merges into another section 14 which is just slightly larger than the diameter of the outer surface of circular section 2.

With the tool in its operative position, as shown in FIGURES 3 and 5, section 14 of cam surface S maintains pins P in their crimping position within opening 5; whereas when the tool is in its inoperative position, section 13 of cam surface S is opposite pins P and they are biased thereagainst by spring means 10.

A flange 15 is located on the innermost end of circular section 2, and this flange mates with an annular recess 16 adjacent section 14 in order to limit the forward movement of body member B on ram member R.

Openings 12′ in lugs 12 have pivot pins 17 therein, and handles H have just rearwardly of pivot pins 3 another set of pivot pins 18. Link members 19 have one end pivotally connected on pivot pins 17 while the other end is pivotally connected on pivot pins 18. Thus, link members 19 move body member B relative to ram member R when handles H are moved toward and away from each other via pivot pins 3.

Collet sleeve CS has a threaded section 20, which mates with the internal threads of body member B, and a flange section 21 which abuts against the threaded end of body member B to limit its inner movement. Collet sleeve CS also has an inner cam surface 22 in the form of a frustum of a cone which inclines away from the longitudinal axis of the tool from flange section 21 toward threaded section 20.

Chuck device C is disposed within collet sleeve CS and has an exterior surface 23 in the shape of a frustum of a cone, which mates with inner surface 22 of the collet sleeve, and a rear surface which engages the inner surface of ram member R adjacent flange 15. Chuck device C comprises four sections 24 each of which has two flat surfaces 25 at right angles to each other. Each flat surface

25 has an opening 26, and all the openings in all four sections are disposed in the same plane which is normal to the longitudinal axis of the tool.

A spring means 27 such as a coil spring is disposed in adjacent openings of sections 24 so that they are biased into normal engagement with inner surface 22 of the collet sleeve. Each section 24 has an outer arcuate part 28 which merges into an inner arcuate part 29 of larger radius. When sections 24 are disposed within collet sleeve CS parts 28 and 29 form adjacent crimping areas coaxial with the longitudinal axis of the tool which are moved toward and away therefrom upon the longitudinal movement of body member B and collet sleeve CS relative to ram member R.

While there has been disclosed a chuck device having four sections and the number of pins P have been disclosed as four, it is to be understood that two or more of these members can be utilized to perform the desired result.

A ratchet assembly 30 is pivotally connected to handles H and operates in such a manner that once the tool is operated to crimp a connector onto a conductor, the handles cannot again be opened until the crimping operation has been completed. This ratchet assembly is conventional and a description thereof can be found in U.S. Patent No. 2,618,993.

In FIGURE 4, there is illustrated a coaxial cable 31 and coaxial connector 32. Coaxial cable 31 has an outer sheath of insulation 33, an outer braided conductor 34 underneath insulation 33, a center conductor 35 and insulation 36 disposed between center conductor 35 and braided conductor 34. Coaxial connector 32, which is disclosed in U.S. patent application Ser. No. 325,222 filed November 21, 1963 in the names of O'Keefe and Stull, has a body part 37 and a ferrule part 38. Body part 37 has insulation (not shown) therein and a center connection part 40 both of which have a hole therethrough coaxial with the connector axis in which center conductor 35 is disposed. A hollow barrel part 41 extends outwardly from the rear of body part 37 and has serrations on the outer surface thereof. A stepped section 37' is disposed between body part 37 and barrel part 41. Barrel part 41 has an inside diameter slightly larger than the diameter of insulation 36 over which it is disposed while braided conductor 34 is disposed on the outer serrated surface thereof. Ferrule part 38 has a section 42, which is disposed over barrel part 41 and braided conductor 34 thereon, and section 43 which is disposed on outer insulation 33.

Operation

The operation of the present invention will now be described. Coaxial cable 31 is stripped so as to expose center conductor 35 and braided conductor 34. Ferrule part 38 is slipped on over outer insulation 33 and moved beyond the stripped part. Body part 37 is next disposed on the cable with center conductor 35 passing through barrel part 41, the hole in connector insulation and center connection part 40 in which it is disposed. Barrel part 41 is disposed over insulation 36, and braided conductor 34 is disposed on the outer serrated surface of barrel part 41 to stepped section 37'. Ferrule part 38 is then moved along the cable until section 42 engages stepped section 37' and this section overlies braided conductor and barrel part 41 while section 43 surrounds outer insulation 33.

The assembled cable and connector are now ready to be subjected to a crimping operation in tool T. Handles H are moved away from each other causing body member B and collet sleeve CS to move relative to ram member R via link members 19 and pivot pins 3, 17 and 18. This causes pins P and chuck device C to move outwardly from the longitudinal axis of the tool under the influence of spring means 10 and 27, respectively. Heads 9 of pins P are, therefore, at section 13 of cam surface S. Opening 5 and arcuate parts 28, 29 are now open to their fullest extent in order the receive the coaxial connector and cable assembly within the tool.

The coaxial connector and cable assembly is placed within the tool with center connection part 40 disposed in opening 5, body part 37 in recess 4, section 42 in arcuate part 29 and section 43 in arcuate part 28.

Handles H are now moved toward each other thereby moving body member B and collet sleeve CS relative to ram member R. Section 14 of cam surface engages pins P thereby moving them toward the longitudinal axis of the tool to crimp center connection part 40 onto center conductor 35 at four positions while at the same time cam surface 22 of collet sleeve CS engages exterior surface 23 of chuck device C thereby moving sections 24 toward the longitudinal axis of the tool so that arcuate parts 28 and 29 crimp sections 43 and 42 onto braided conductor 34 and outer insulation, respectively.

The handles are pressed toward each other until extensions 11' of stop pin 11 engage the end of body member B and ratchet assembly 30 is released thereby assuring proper crimping of the coaxial connector onto the coaxial cable to provide excellent mechanical and electrical interconnection and strain relief. After the crimping operation has been completed, the handles are moved outwardly from each other and the coaxial cable and coaxial connector secured thereto are removed from the tool.

FIGURES 6 and 7 show alternative embodiments of the present invention. In these figures, the ram member, body member, collet sleeve and chuck device are the same except as set forth hereafter. In FIGURE 6, ram member R' has a threaded portion 44 which is secured in a threaded hole 45 of a mounting member 46 which is mounted on a base member 47 such as a workbench. Mounting member 46 has a threaded section 48 concentric with hole 45 and on which a hollow cup-shaped member 49 is threadably mounted.

Member 49 has an opening 50 therethrough coaxial with the axis of ram member R' and in which body member B' is slidably mounted. Opening 50 has an annular groove 51 therein and an O-ring 52 is disposed therein to form a seal between opening 50 and body member B'.

Body member B' has a flange 53 extending outwardly therefrom and whose diameter is slightly less than the inside diameter of cup-shaped member 49 in which flange 53 can be moved. Flange 53 has an annular groove 54 therein in which an O-ring 55 is disposed to provide a seal between flange 53 and member 49. A spring means 56 such as a coil spring is disposed between flange 53 and mounting member 46 to normally maintain flange 53 against the end of cup-shaped member 49 in which opening 50 is disposed.

Another opening 57 is disposed in member 49 adjacent opening 50 and pipe means 58 is disposed in opening 57 and connected to a fluid supply means 59 in order to supply a suitable fluid within member 49 to operate the tool in a similar manner as that described in connection with FIGURES 1–3.

If desired, the tool of FIGURE 6 can be automatically actuated. This can be accomplished by disposing a sensing means 60 on the inner end of opening 5. Coaxial cable means 61 is connected to sensing means 60 through a hole disposed in ram member R' and mounting member 46. Cable means 61 is connected to a control circuit means 62 which in turn is connected to an actuating circuit means 63 via wire means 64. Actuating circuit means 63 is connected to fluid supply means 59 via conduit means 65.

Sensing means 60 and control circuit means 62 are disclosed in U.S. patent application Ser. No. 325,321 filed November 21, 1963 in the names of Grebe and Kreinberg and attention is directed thereto for a description thereof. Control circuit means 62 can be an oscillator circuit arrangement which oscillates at a predetermined frequency until the circuit is disrupted by engagement with sensing means 60. Actuating circuit means 63 can be a solenoid or relay controlled valve means to initiate operation of fluid supply means 59. Thus, when center con-

nector part 40 engages sensing means 60, control circuit means 62 is actuated to send a signal via wire means 64 to actuate actuating circuit means 63 which in turn causes fluid supply means 59 to move body member B' relative to ram member R' thereby automatically operating the tool to crimp the coaxial connector onto the coaxial cable. The tool in FIGURE 6 is shown in its operative position, and the inner end of body member B' is in engagement with mounting member 46 thereby limiting the inner movement of the body member in order to properly crimp the coaxial connector onto the coaxial cable.

Of course, the tool of FIGURE 6 can be operated by a foot-operated member (not shown) connected to fluid supply means 59 to initiate operation thereof instead of the automatic means described above.

The tool of FIGURE 7 is similar to FIGURE 6 except in this embodiment, ram member R'' is connected to a spring biased piston 66 movably disposed in a cylinder 67 threadably connected to body member B''. Cylinder 67 is secured in a mounting member 68 by a set screw 69 and a fluid supply is connected to cylinder 67 via pipe means 70. Piston 66 has a surface 66' which engages an inner surface of body member B'' defining one end of the cylinder. When these surfaces engage each other, this acts as a limiting means limiting the inner movement of ram member R'' within body member B''.

Thus, the operation of FIGURE 7 is the same as that of FIGURE 6 except that ram member R'' and chuck device C'' move relative to body member B'' and collet sleeve CS''. Either the automatic operating means or foot-operated means described in conjunction with FIGURE 6 can be utilized to operate the embodiment of FIGURE 7 which is shown in its operated position.

As can be discerned, there has been disclosed a tool to effectively crimp a coaxial connector onto a coaxial cable to provide excellent mechanical and electrical connection therebetween as well as strain relief.

It will, therefore, be appreciated that the aforementioned and other desirable objects have been achieved; however, it should be emphasized that the particular embodiments of the invention, which are shown and described herein, are intended as merely illustrative and and not as restrictive of the invention.

I claim:

1. A tool for crimping a coaxial connector member onto a coaxial cable comprising supporting means having an opening therein, pin means resiliently disposed in said supporting means and communicating with said opening, body means movably surrounding said supporting means and including camming surface means engaging said pin means to move same toward and away from the axis of said opening, resilient chuck means disposed in said body means and having at least one crimping area in alignment with said opening, said body means including an additional camming surface engaging said chuck means to move same toward and away from the axis of the opening, and operating means connected to said supporting means and body means to move same relative to each other to cause said camming surfaces to move said pin means and chuck means to crimp the coaxial connector member onto said coaxial cable.

2. A tool according to claim 1 wherein said chuck means has two crimping areas adjacent each other.

3. A tool according to claim 1 wherein said operating means comprises handle means pivotally connected to said supporting means, and linkage means pivotally connected between said body means and said handle means to move said body means relative to said supporting means upon movement of said handle means.

4. A tool according to claim 1 wherein said operating means comprises a flange disposed on said body means, said flange movably disposed within a cylinder and defining a piston member, and fluid supply means connected to said cylinder to supply fluid under pressure into said cylinder to move said body means relative to said supporting means.

5. A tool according to claim 1 wherein said operating means comprises a flange disposed on said supporting means, said flange movably disposed within a cylinder and defining a piston member, and fluid supply means connected to said cylinder to supply fluid under pressure into said cylinder to move said supporting means relative to said body means.

6. A tool according to claim 1 wherein said operating means comprises a flange disposed on one of said supporting means and body means, said flange movably disposed within a cylinder and defining a piston member, and fluid supply means connected to said cylinder to supply fluid under pressure into said cylinder to move one of said body means and supporting means relative to the other.

7. A tool according to claim 6 wherein sensing means is disposed in said opening, and control means are connected between said sensing means and fluid supply means, said sensing means upon being engaged by a part of said coaxial connector when placed in said opening actuating said control means which in turn actuates said fluid supply means.

8. A tool according to claim 1 wherein one of said supporting means and body means has stop means to limit the movement of one of these means relative to the other.

9. In a tool, supporting means having an opening therein defining a first operating area, means movably mounted in said supporting means and communicating with said opening, body means on said supporting means, said supporting means and body means movable relative to each other, means between said supporting means and said body means having a movable opening therein in communication with said opening in said supporting means, said movable opening defining a second operating area, said body means having camming surface means engaging said movable means and said means having said movable opening, and operating means connected to said supporting means and body means to move one thereof relative to the other to cause said camming surface means to move said movable means and said means having the movable opening toward and away from the axis of the tool.

10. In a tool according to claim 9 wherein said movable means comprise pin means angularly disposed around the axis of the tool, and spring means engaging said pin means to maintain same in normal engagement with said camming surface means.

11. In a tool according to claim 9 wherein said means having the movable opening comprising a chuck device including at least two sections, and spring means disposed between said sections to maintain same in normal engagement with said camming surface means.

12. In a tool according to claim 9 wherein said operating means comprise handle means pivotally connected to said supporting means and body means.

13. In a tool according to claim 9 wherein said operating means comprise a flange disposed on one of said supporting and body means, a cylinder in which said flange is movably disposed, and fluid supply means connected to said cylinder to supply fluid under pressure therein thereby causing one of said supporting and body means to move relative to the other.

14. In a tool according to claim 13 wherein sensing means is disposed in said opening of said supporting means, control means connected between said sensing means and said fluid supply means, said fluid supply means being actuated by said control means upon said sensing means being contacted by a member on which said tool is to perform work.

15. In a tool according to claim 9 wherein one of said supporting means and body means has stop means to limit the movement of one of these means relative to the other.

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