

[54] **WIRE CONNECTING DEVICE HAVING
IMPROVED WIRE TRIMMING MEANS**

[75] Inventors: **James Earl Fleischhacker**,
Clearwater; **Henry George
Wasserlein, Jr.**, North Seminole,
both of Fla.

[73] Assignee: **AMP Incorporated**, Harrisburg, Pa.

[22] Filed: **May 8, 1974**

[21] Appl. No.: **468,037**

[52] **U.S. Cl.**..... **339/99 R; 339/205**

[51] **Int. Cl.**..... **H01r 9/08**

[58] **Field of Search**..... **339/95, 97-99,
339/205**

[56] **References Cited**

UNITED STATES PATENTS

2,651,768 9/1953 Oortgijsen..... 339/97 R

FOREIGN PATENTS OR APPLICATIONS

1,963,313 6/1971 Germany..... 339/97 R

452,634 5/1968 Switzerland..... 339/97 R

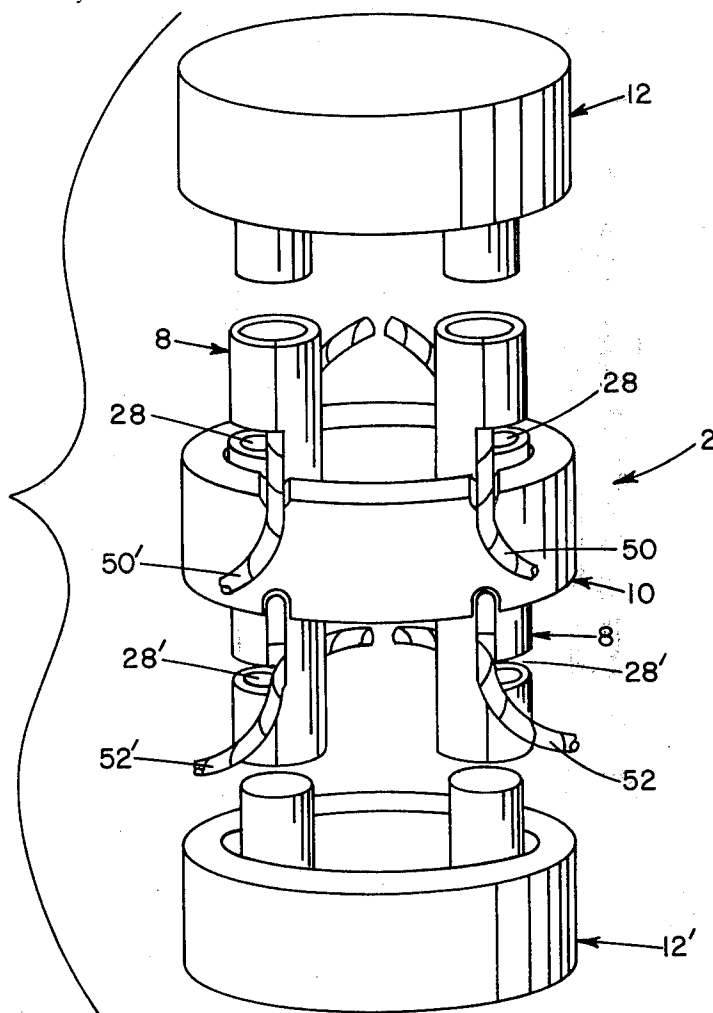
1,913,992 10/1970 Germany..... 339/97 R

Primary Examiner—Joseph H. McGlynn
Attorney, Agent, or Firm—Frederick W. Raring;
Robert W. Pitts; Jay L. Setichik

[57] **ABSTRACT**

Electrical connecting device comprises a tubular metallic terminal member having an open end and an axially extending seam. An axially extending wire receiving slot is provided which coincides with the seam. The end of this slot which is proximate to the open end of the terminal serves as the wire receiving end and a wire locating slot extends transversely from this wire receiving end partially circumferentially around the tubular terminal. An insulating cover which is movable over the open end has an integral stuffing and shearing member projecting therefrom which has a snug fit in the terminal. In use, the wire is positioned in the locating slot and cover member is moved over the terminal. The stuffer cooperates with edge portions of the wire locating slot to trim the wire which is thereafter forced into wire receiving slot.

6 Claims, 11 Drawing Figures



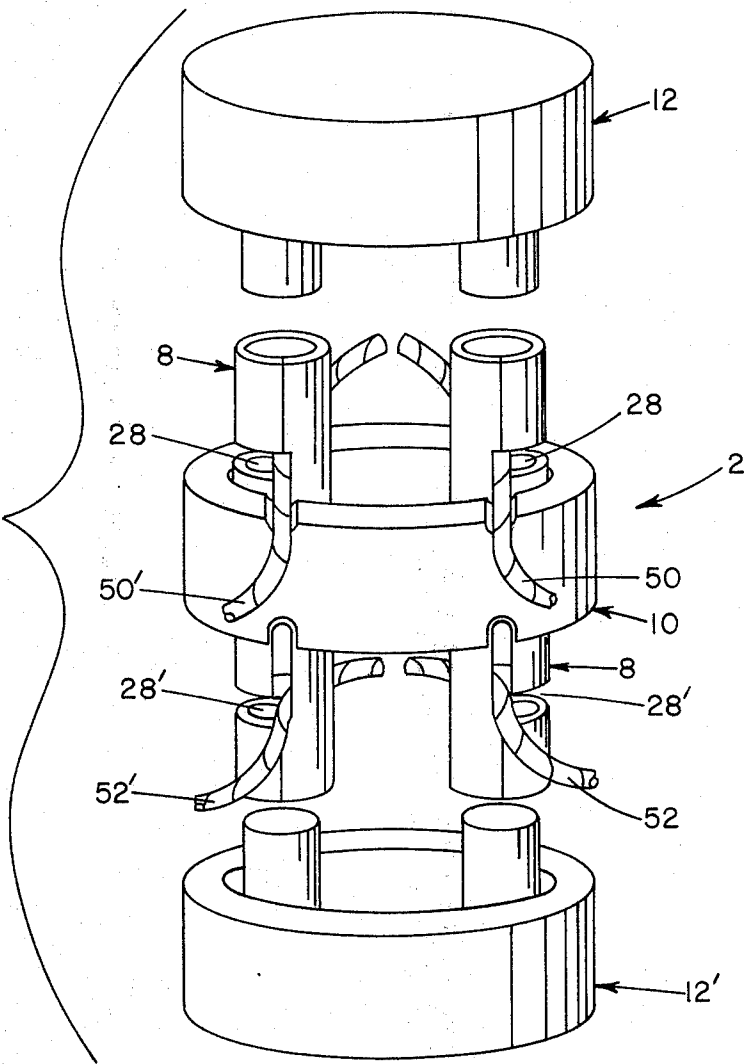


FIG. 1

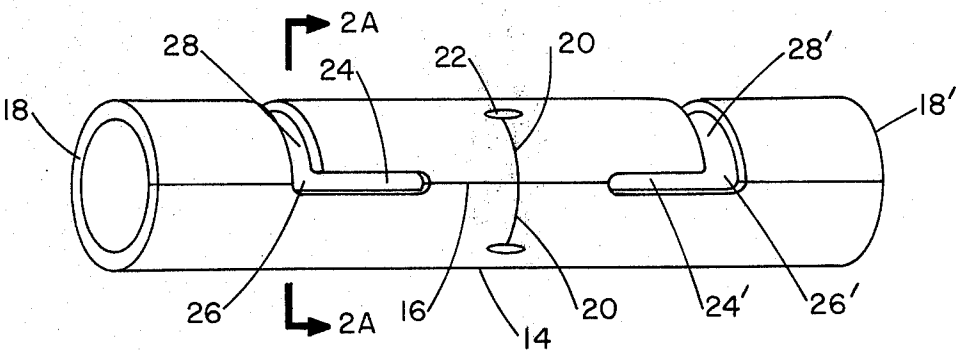


FIG. 2

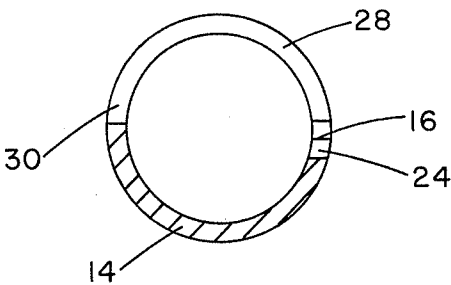


FIG. 2A

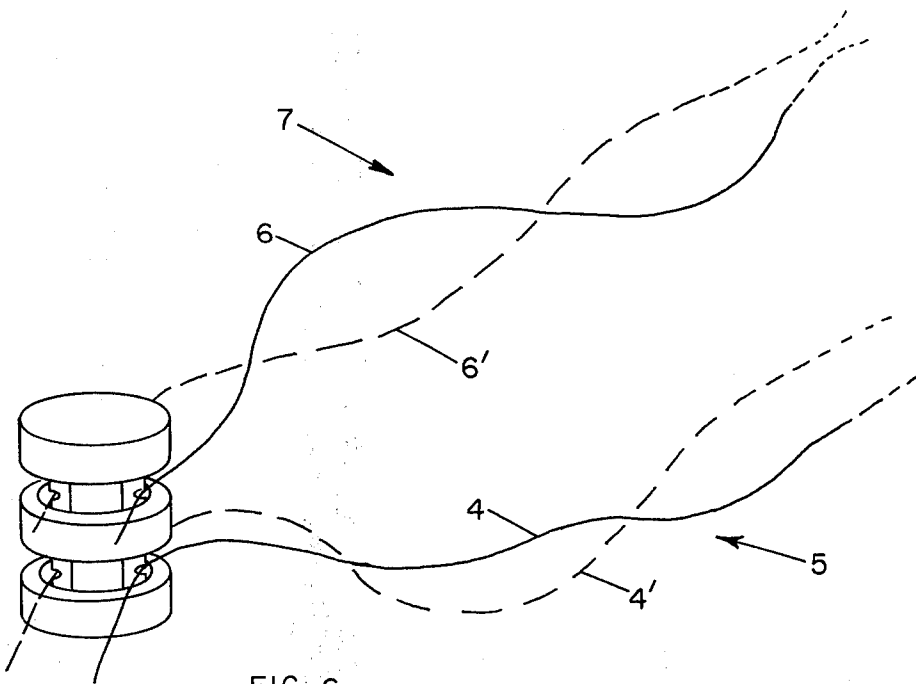


FIG. 6

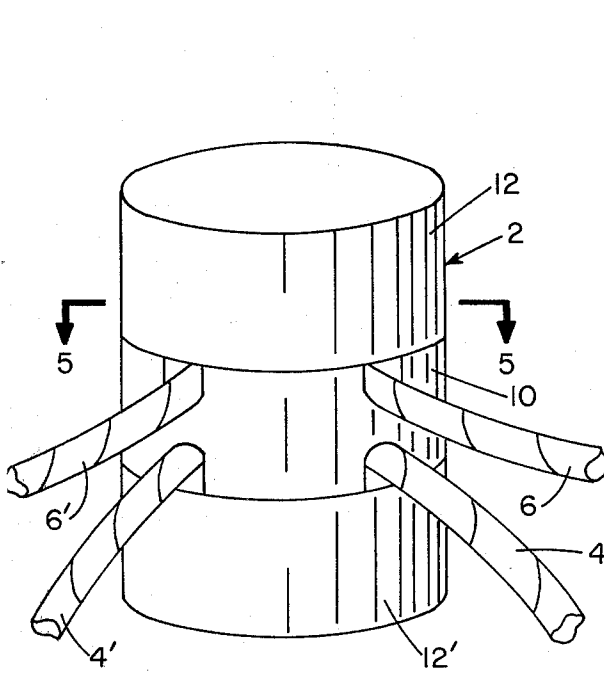


FIG. 4

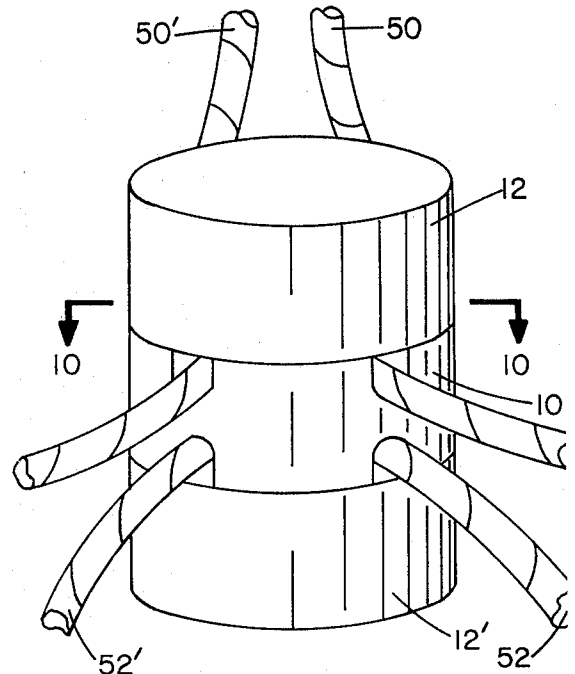


FIG. 9

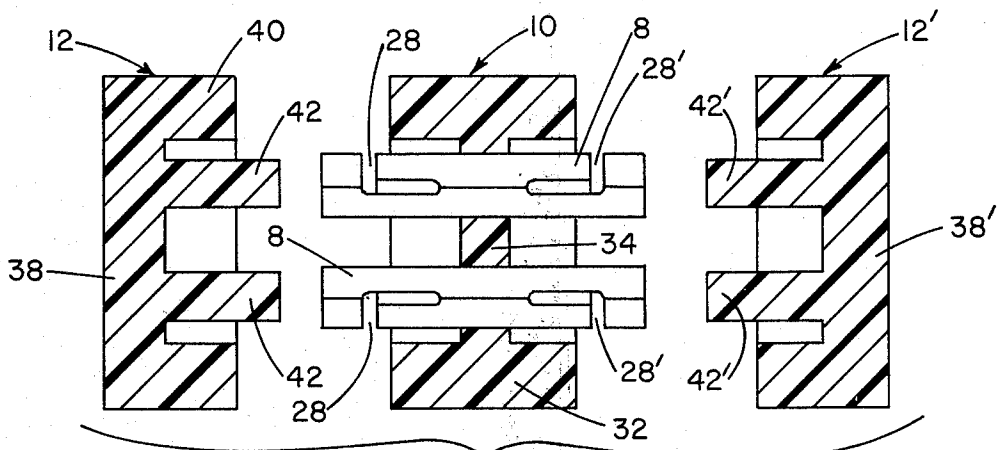


FIG. 3

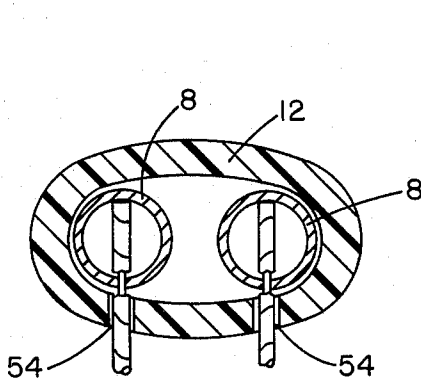


FIG. 5

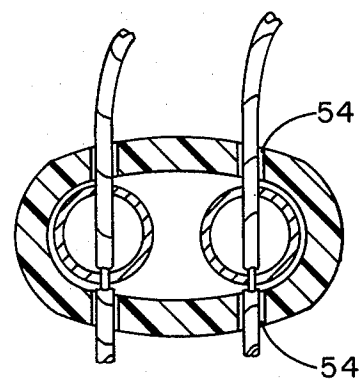


FIG. 10

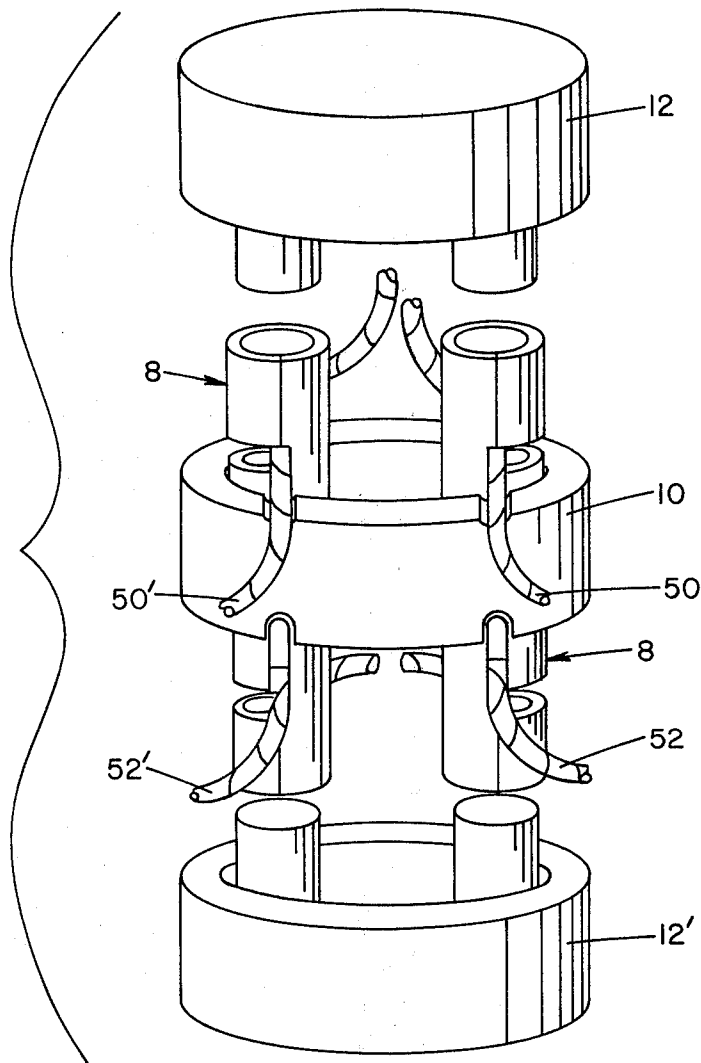


FIG. 8

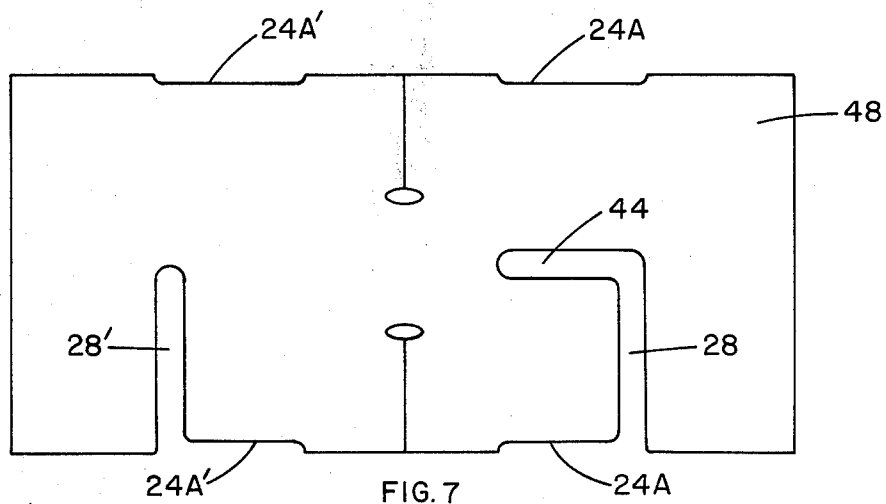


FIG. 7

WIRE CONNECTING DEVICE HAVING IMPROVED WIRE TRIMMING MEANS

BACKGROUND OF THE INVENTION

This invention relates to connecting devices for trimming the ends of wires and establishing an electrical connection with the trimmed wire. The invention is herein disclosed in an embodiment particularly intended for connecting the corresponding wires of two twisted pairs of wires to each other however, it will be apparent that the principles of the invention can be used in the manufacture of connecting devices for connecting any number of wires to each other.

It is now common practice in the electrical industry to form electrical connections with terminals having a wire-receiving slot, the width of the slot being less than the diameter of the metallic core of the wire so that as the wire is moved laterally of its axis and into the slot, the edges of the slot penetrate and displace the insulation of the wire and establish electrical contact with the core. It is advantageous to trim the end of a wire concomitantly with movement of the wire into the slot and this trimming operation is usually carried out by means of a wire inserting tool which has trimming and inserting means for trimming the wire and inserting it into the terminal in the connector as disclosed, for example, in U.S. Pat. No. 3,758,935.

It has been recognized that under many circumstances, it would be desirable to avoid the necessity of using a specialized trimming and inserting tool and provide a trimming means in the connector. Connecting devices of the wire-slot type which have a self-contained wire trimming means have been proposed, see, for example, the U.S. Pat. to Leach No. 3,202,957. It is difficult, however, to obtain clean and effective trimming of the wire in these types of connecting devices unless two metallic shearing edges are provided and the provision of a metallic shearing means in a connecting device, in addition to the terminals, complicates the design and thereby increases the expense and the bulk of the connecting device. It is proposed in the above-identified Leach patent that an edge which is part of the plastic be used in cooperation with a shearing edge which is part of the terminal. It is difficult, however, to obtain good shearing action with one plastic edge, at least with relatively large diameter wires.

The instant invention is specifically addressed to the problem of providing an improved connecting device having a self-contained shearing means of which one of the shearing edges is on the plastic housing of the connecting device.

The invention is further directed to the achievement of a compact and inexpensive connecting device for connecting two wires to each other and/or connecting corresponding wires of two pairs of wires to each other in separate electrical connections. This aspect of the invention is particularly directed to the achievement of a device having improved wire locating means which assists the technician making the connections in ensuring that the wires are properly located in the device prior to formation of the electrical connections.

It is accordingly an object of the invention to provide an improved connecting device. A further object is to provide an improved connecting device for wires having a self-contained wire shearing means which is com-

pact, inexpensive and relatively simple, and which has the capability of cleanly and effectively shearing the wires being connected at the time the connection is established. A further object is to provide an improved device for connecting the corresponding wires of the two pairs of wires to each other.

These and other objects of the invention are achieved in preferred embodiments which are briefly described in the foregoing abstract, which are described in detail below, and which are shown in the accompanying drawing in which:

FIG. 1 is an exploded view of a preferred form of connecting device in accordance with the invention.

FIG. 2 is a perspective view of one of the metallic terminal members which are contained in the connecting device of FIG. 1.

FIG. 2A is a view taken along the lines 2A—2A of FIG. 2.

FIG. 3 is a cross-sectional view of the connecting device of FIG. 1 with the end covers exploded from the central section thereof.

FIG. 4 is a perspective view of a connecting device in accordance with the invention applied to the ends of wires.

FIG. 5 is a view taken along the lines 5—5 of FIG. 4.

FIG. 6 is a perspective diagrammatic view which illustrates the manner of positioning the wires and of two twisted pairs of wires in the connecting device.

FIG. 7 is a plan view of a flat metal blank form which a terminal for a connecting device in accordance with an alternative embodiment of the invention is formed.

FIG. 8 is an exploded view of a connecting device in accordance with the alternative embodiment.

FIG. 9 is a perspective view of showing a connecting device in accordance with the alternative embodiment as applied to wires to form tap connections.

FIG. 10 is a view taken along the lines 10—10 of FIG. 9.

The embodiment of the invention shown in FIGS. 1—6 is particularly intended to connect the corresponding wires of two twisted pairs 5, 7 of wires to each other in separate electrical connections. The pair 5 thus comprises wires 4, 4' which must be connected to the wires 6, 6' of the pair 7. Electrical connections of this type must be made in large numbers, particularly in telephone cables.

The connecting device 2, comprises a pair of identical terminal members 8 which are contained in an insulating housing having a center section 10, and two end sections 12, 12' which are movable into assembled relationship with the center section as described below.

The terminal members 8, FIG. 2, are identical so that a description of one will suffice for both. Each terminal member is, moreover, symmetrical about its transverse central axis and the same reference numerals, differentiated by prime marks are used to demonstrate corresponding structural features on each side of this central axis. Each terminal thus comprises a sheet metal cylindrical member or body 14 having an axially extending seam 16 which is preferably not bonded. The ends 18, 18' are open as shown and transverse shears 20 extend from the seam midway between the ends partially circumferentially around the tubular body to punched holes 22. The shear lines 20 serve to divide the tubular body member into two separate spring systems, one for each wire, as will be described below and as described in detail in application Ser. No. 347,956.

Wire-receiving slots 24, 24' extend axially intermediate the ends 18, 18' on each side of the shear lines 20 and coincide with the seam 16. These slots have outer ends 26, 26' which are proximate to the ends 18, 18' of the tubular body and which serve as the wire receiving ends of the slots 24, 24'. Transversely extending wire locating slots 28, 28' extend partially circumferentially, from the wire receiving ends 26, 26', around the tubular body and the outer ends 30, of the slots 28, 28' have edge portions 30, 30' which serve as shearing edges as will be described below.

The terminals may be of any suitable conductive sheet metal such as a 70-30 brass of suitable temper and hardness. Tubular terminals are preferred for the practice of the invention for the reason that a right circular cylinder as shown is an extremely strong structure which, when loaded, reacts with the development of hoop stresses.

The central body section 10 comprises an outer rim portion 32 and a web 34 which is midway between the oppositely directed faces of this body section. As shown in FIG. 5, this body section 10 and the cover members or end sections 12, 12' are oval shaped in the interest of compactness although they can be circular if desired. The terminal members 8 are centrally mounted in the web 34 and oriented such that the wire locating slots 28, 28' of the two terminal members face in opposite directions for reasons which will be explained below.

Each cap section 12, 12' comprises an oval shaped base 38 having an integral flange 40 extending from its periphery and having two cylindrical shearing and stuffing members 42 projecting from its base. These shearing and stuffing members are of a diameter which is substantially equal to, and no less than, the inside diameter of the tubular members 14 so that while they can move into the tubular members through the open ends 18, 18' thereof, they will have an extremely snug fit. In fact, the diameter of the stuffing and shearing members 42 may be very slightly greater than the inside diameter of the tubular terminals 14 so that the seam 16 is opened very slightly when the cap members are assembled to the body.

The housing may be of any suitable plastic of sufficient hardness to effect the shearing operation. Thermosetting plastics such as diallylphthalate can be used and certain thermoplastic materials such as a nylon reinforced with glass fillers are entirely suitable. Glass reinforced nylons can be formulated such that they are extremely firm and hard, almost as hard as thermosetting materials.

In use, the technician separates the ends of the wires 4, 4' of the pair 5 as shown in FIG. 6, laces one wire laterally into the wire locating slot 28 of one of the terminal members and he laces the other wire into the wire locating slot 28' of the other terminal member so that the two wires pass on each side of the connector. He then repeats the process with the wires 6, 6' of the pair 7, placing these wires in the upper wire-receiving or locating slots 28, as viewed in FIG. 6. He then presses the end sections 12, 12' towards each other so that the shearing and stuffing plugs 42, 42' move into the open ends 18, 18' of the terminal members. During movement of the ends of the stuffing plugs 42, 42' past the edge portions 30 of the terminal members, the wires are sheared and the scrap ends fall away from the connector. During subsequent movement of the end hous-

ing sections 12, 12' towards the central housing section 10, the wires are moved into the wire receiving slots 24, 24'. The widths of the members and with slots is such that the edges of the slots penetrate and displace the insulation of the wires and establish electrical contact with the metallic cores thereof.

It has been found that very effective shearing of the wires can be obtained in accordance with the practice of the invention by virtue of the fact that the shearing and stuffing members 42 have an extremely close fit in the tubular terminal members 8. As mentioned previously, the diameter of these stuffing members should be no less than the inside diameter of the terminal members so that there is no clearance between the two parts. The very close proximity of the surface of each shearing and stuffing member to the internal wall of its associated terminal ensures clean and effective shearing of the wires notwithstanding the fact that one of the shearing edges is of a plastic material.

A further advantage of the embodiment described thus far is that when the technician positions the wires in the connecting device 2, he does so by lacing them as illustrated in FIG. 6 and the positions of the wires, prior to closure of the end housing sections onto the center section, are clearly evident from casual visual inspection. The technician can thus ensure that effective connections will be obtained before he closes the end sections onto the center section. This feature is to be contrasted with known connecting devices in which the wire is inserted into a blind hole in the connector housing; precise position of the end of the wire is never apparent with these known types of connecting devices and inferior connections or no electrical connection is achieved if the wire is not fully inserted.

FIGS. 7-10 show an embodiment of the invention which is adapted to form tap connections to through wires without cutting the through wires. This embodiment is in many respects similar to the previously described embodiment and differs therefrom as pointed out and described below.

The terminal members for this alternative embodiment are formed from a flat blank 48 (FIG. 7) which has punched slots 28, 28' and contoured edge portions 24A, 24A' so that when this blank is rolled into a cylindrical shape, the finished part will have the previously described wire-receiving slot 24. The blank also has a slot 44 which extends parallel to the edge portion 24A and which extends from the inner end of the wire locating slot 28. When the blank 48 is formed into a tube or cylinder then, the terminal device will have an additional wire receiving slot 44 in alignment with the wire-receiving slot 24. The housing section also has additional notches 54 which provides an exit passageway for the through wires as shown in FIG. 9.

In use, the through wires and tap wires 50, 50' 52, 52' are located in the connector as shown in FIG. 10 with the through wires 50 in the wire locating slots 28 and the tap wires in the wire locating slots 28'. The cover members are then assembled to the central housing section as previously described and the tap wires 52 are trimmed and inserted into the wire-receiving slots 24'. The through wires, however, are simply moved into the slots 24 of the two terminal members and into the slots 44 so that while electrical contact is established with the conducting cores of the through wires, they are not cut because of the presence of the slots 44.

The principles of the invention can be employed in the design of connecting devices intended for purposes other than forming pair to pair connections or tap connections as described above. For example, the principles of the invention can be used in the design of free standing terminals which are adapted to be mounted on or in a panel-like member such as a printed circuit board or a housing for an electrical device such as a switch. A double ended terminal as shown in either of FIGS. 2 or 7 can be mounted in the panel-like member or housing wall so that the two wire locating slots are on opposite sides of the panel member or wall. Alternatively, the principles of the invention can be used in the design of a single ended free standing terminal which is adapted to receive only one wire at its open end and which is adapted to have its other or fixed end connected to a further conductor or to have a disengageable terminal on its other end as disclosed in application Ser. No. 347,956.

Under some circumstances, a connecting device 2 in accordance with the invention may have more than two terminals therein to form permanent electrical connections between a large number of wires such as the wires in multiconductor cable.

Connecting devices in accordance with the invention can readily be adapted so that they have a water proofing feature. A waterproof connector in accordance with the invention can be made by simply filling, or partially filling, the central portion of each terminal member 8, 8' with a viscous waterproof grease such as petrolatum or a suitable silicone grease. When the wires are positioned in the terminals and the cover members 12, 12' are assembled to the central portion of the connecting devices, the wire stuffing and shearing projections 42, 42' function as pistons; when they enter the tubular terminals, they tend to compress the grease so that it flows into completely surrounding relationship with the wires and thereby seals the electrical interfaces between the wires and the terminals.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only.

What is claimed is:

1. A device for trimming the end of a wire and establishing an electrical connection with the trimmed wire, said device comprising:

a tubular metallic terminal member having an open end and an axially extending seam,
an axially extending wire-receiving slot in said terminal member extending for at least partially the length of said terminal member, said slot coinciding with said seam, said slot having a wire-receiving end which is proximate to said open end,

locating means on said terminal member for locating a wire with its axis extending transversely of the axis of said terminal member, transversely of, and in alignment with, said wire-receiving end of said slot, and across shearing edge portions of said terminal member which are on the side of said terminal member which is opposite to the side on which said wire-receiving end of said slot is located, and insulating cover means, said cover means having flange means which is movable over, and into surrounding relationship with, said terminal member,

said insulating cover means having an integral stuffing and shearing member projecting therefrom in the same direction as said flange means and beyond said flange means, said stuffing and shearing member being dimensioned to fit snugly within said terminal member whereby,

upon locating said wire on said terminal member and moving said cover member onto said terminal member, said stuffing and shearing member moves past said wire and said wire is sheared by the cooperative action of said stuffing and shearing member and said shearing edge portions of said terminal member, and said wire is thereafter moved into said wire-receiving slot.

2. A device as set forth in claim 1, said stuffing and shearing member being dimensioned to have a force fit in said terminal member.

3. A device as set forth in claim 1, said terminal member having a second open end and a second wire-receiving slot which is proximate to said second open end and in alignment with said wire-receiving slot, a second wire locating slot extending from the wire-receiving end of said second wire-receiving slot, a third wire-receiving slot which is on the opposite side of said terminal from the side of said second wire-receiving slot, said third wire-receiving slot having a wire-receiving end which communicates with said second wire locating slot, said second and third wire-receiving slots being transversely aligned with respect to the axis of said terminal member, and a second insulating cover means having a second integral stuffer member whereby, a through wire can be connected to a tap wire by locating said tap wire on said terminal member in alignment with said wire receiving slot, locating said through wire in alignment with said second and third wire-receiving slots, and moving said cover members over and onto the ends of said terminal member, and said tap wire will be trimmed and said through wire will be moved into said second and third wire-receiving slot without trimming.

4. A device as set forth in claim 1, said wire-receiving slot extending intermediate the ends of said terminal member, said locating means comprising a wire locating slot extending partially circumferentially around said terminal member from said wire-receiving end of said slot to said shearing edge portions of said terminal member.

5. A device as set forth in claim 4, said terminal member having a second open end and a second wire-receiving slot which is proximate to said second open end, a second wire locating slot extending from the wire-receiving end of said second wire-receiving slot, and a second cover member having a second stuffer and shearing member projecting therefrom whereby, two wires can be electrically connected to each other by placing one wire in each of said wire locating slots and moving said cover members over said ends of said terminal member.

6. An electrical connecting device for electrically connecting corresponding wires of two pairs of wires to each, said device comprising:

first and second electrical terminal members, said members each comprising a tubular body having an axially extending seam, each terminal member having first and second wire-receiving slots adjacent to each of its ends, said slots coinciding with said seam, each of said slots having a wire-receiving end

7

which is proximate to one end of said terminal member,
 wire locating means on each of said terminal members for each of said wire-receiving slots, said locating means for each slot being effective to locate a
 5 wire with its axis extending transversely of the axis of said terminal member, transversely of, and in alignment with, said wire receiving end of said slot, and across shearing edge portions of said terminal which are on the side of said terminal member 10 which is opposite to the side on which said wire-receiving end of said slot is located, and
 an insulating cover means for each end of said connecting device, each of said cover means being 15 movable over the ends of said terminal members, each cover means having a depending flange for

8

surrounding both of said terminal members and having integral stuffer and shearing members projecting therefrom, said stuffer members extending in the same direction as said flange, and beyond said flange, said stuffer members being dimensioned to fit snugly within said terminal members whereby,

upon locating corresponding wires of said two pairs in the wire-locating means of a common terminal member and thereafter moving said cover members towards each other and over the ends of said terminal members, said wires are moved into said wire-receiving slots whereby said corresponding wires are electrically connected to each other.

* * * * *

20

25

30

35

40

45

50

55

60

65