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(51) INT CL[5]
H01R 4/28

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(56) Documents cited
GB 0944544 A GB 0531947 A EP 0245917 A2
EP 0116760 A2 US 5024606 A US 4339166 A

(58) Field of search
UK CL (Edition L) H2E ECBB EEGA EEGE EEH
INT CL[5] H01R

(54) Electrical conductor terminating arrangement

(57) An electrical terminal 31, 33, 34 for clamping onto a cable (not shown) is driven into clamping engagement with a cable by axial displacement of a driver (eg ring 35). Once in clamping position, axial pressure need not be applied to the driver 35 to maintain clamping engagement of the terminal 31, 33, 34 and the cable. The terminal may be attached to the central pin 32 of a co-axial connector, and clamp the core conductor of a co-axial cable.

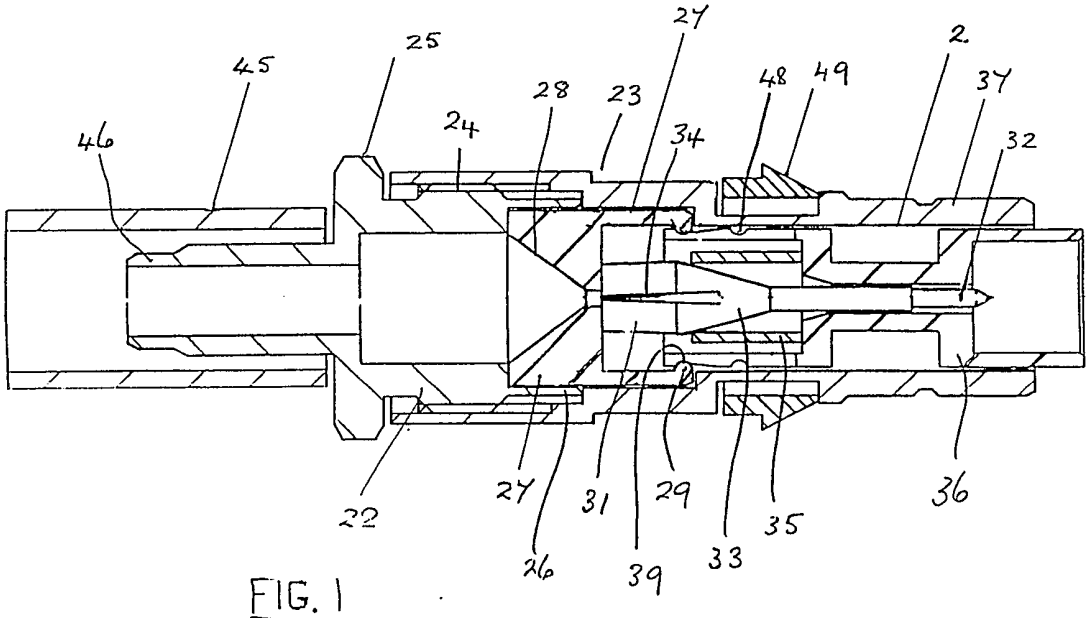

FIG. 1

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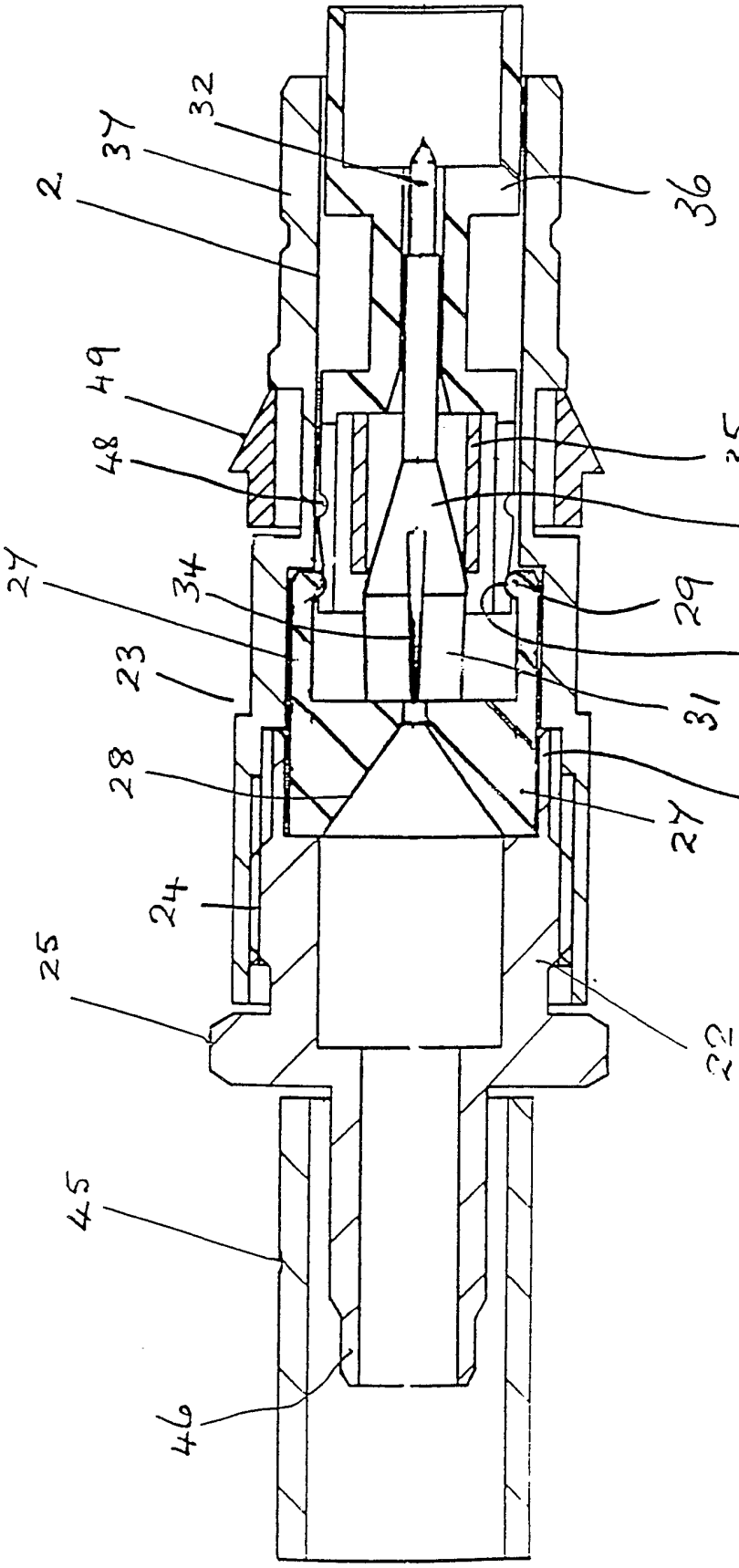

FIG. 1

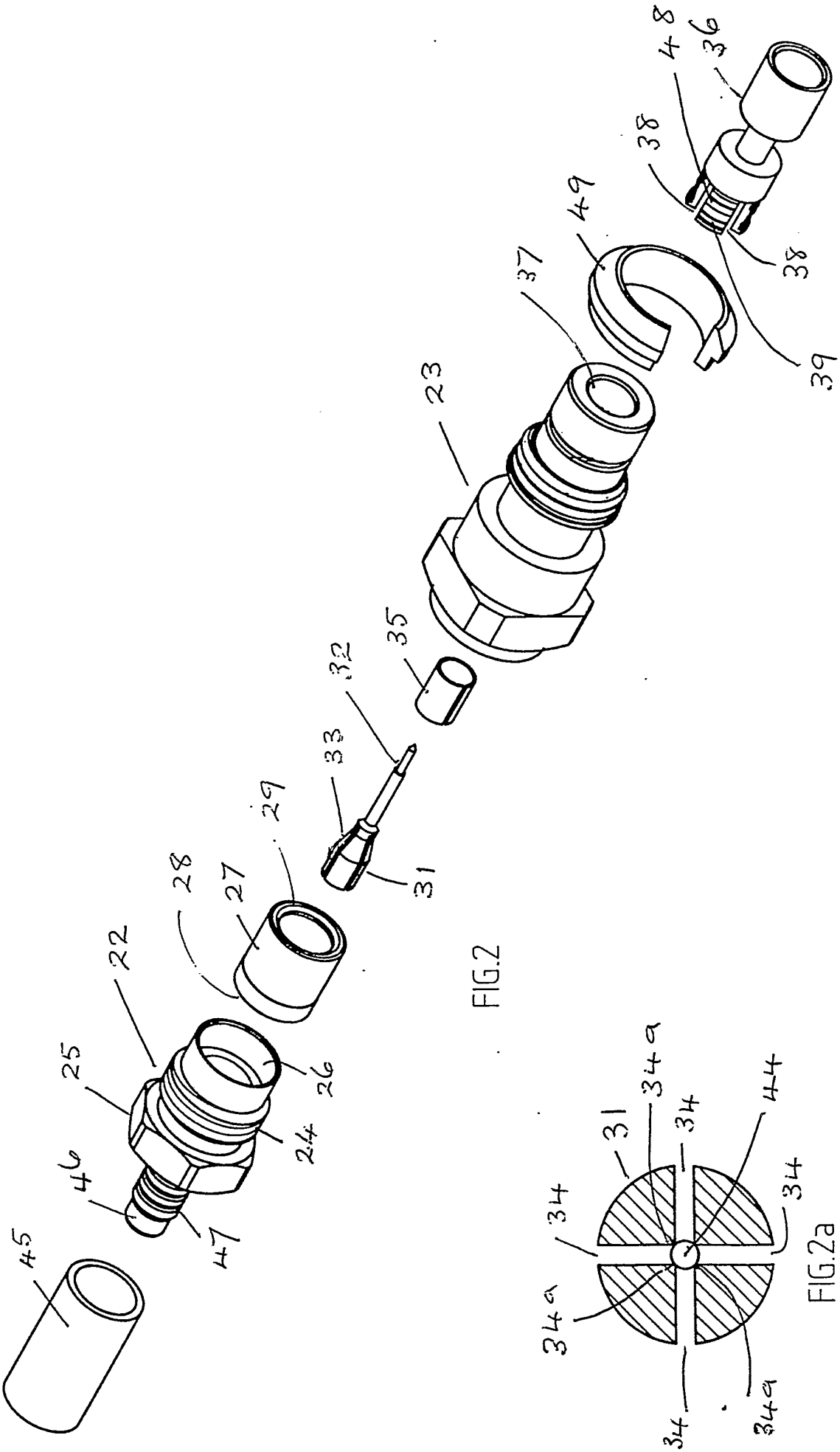
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FIG.2

31
34a
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34a

FIG.2a

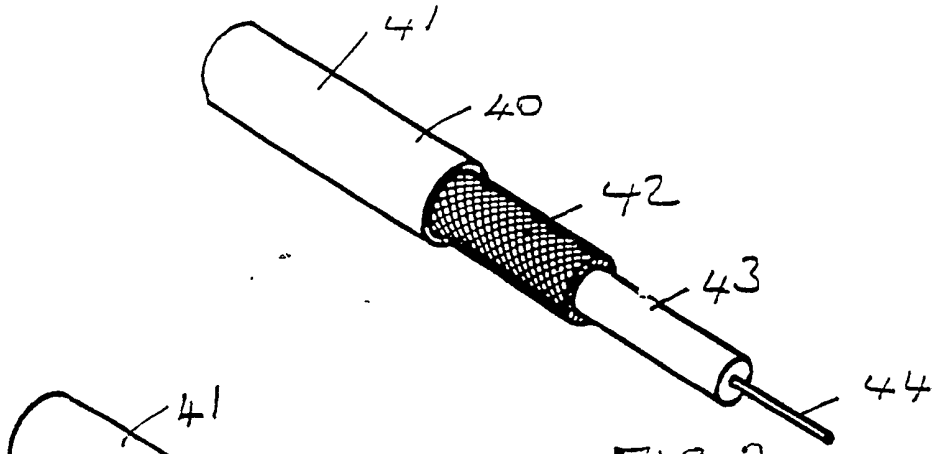

FIG. 3a

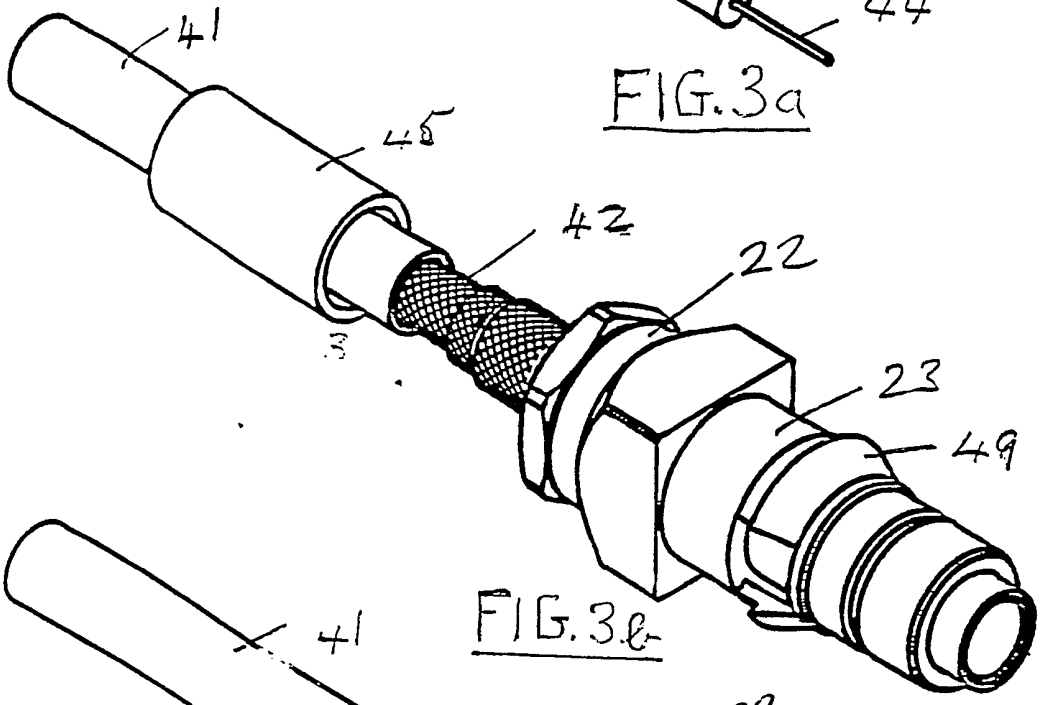

FIG. 3b

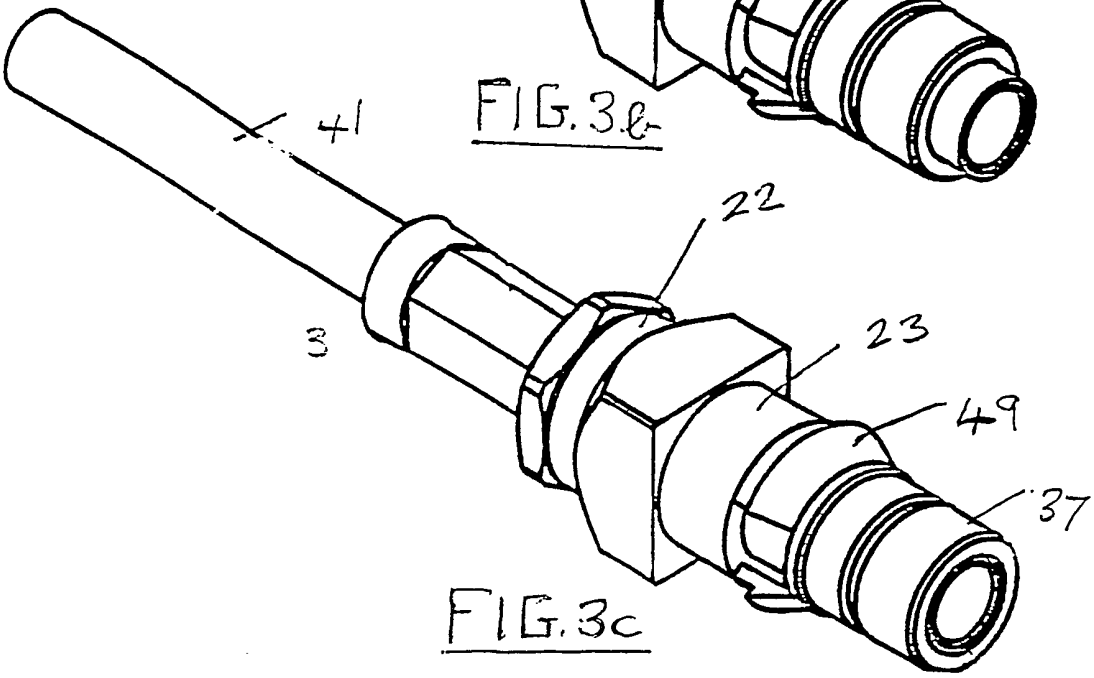

FIG. 3c

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IMPROVEMENTS RELATING TO ELECTRICAL CONDUCTOR TERMINATING ARRANGEMENTS

This invention relates to electrical conductor terminating arrangements which are especially, but not exclusively, applicable to the termination of electrical conductors in electrical connectors of the coaxial type.

The invention is especially directed to an improved conductor terminating arrangement in a coaxial connector of the kind facilitating the ready and effective connection of the usual central conductor of an incoming coaxial cable to contact means (e.g. pin contact) of the connector without the need for crimping and/or other tools.

According to the present invention as broadly conceived an electrical conductor terminating arrangement comprises contact-making means which makes good electrical contact with an electrical conductor in response to axial pressure displacement over the contact-making means of displaceable means to exert a radial force on the contact-making means and to co-operate therewith for providing ongoing pressure engagement between the contact-making means and the electrical conductor without the need for the continuance of axial pressure on the displaceable means after a predetermined axial displacement of the displaceable means.

In carrying out the present invention the displaceable means may comprise a resilient or non-resilient sleeve member which when displaced axially exerts an inward radial force on the contact-making means located within the sleeve

member and which co-operates with the contact-making means positioned over the electrical conductor to provide the aforesaid ongoing pressure engagement with the conductor. A resilient sleeve member may be provided by a split metal ring or a continuous ring of resilient plastics material whereas a continuous metal ring may comprise a non-resilient sleeve member.

The contact-making means of the conductor terminating arrangement may comprise a compressible clamping element adapted to fit over the electrical conductor.

The compressible clamping element may comprise a split tubular metal part into one end of which the conductor extends and which is adapted to be radially compressed by the contact-making means to make good electrical contact with the conductor. The split tubular metal part may be formed integrally with contact means (e.g. pin contact) of the terminating arrangement provided at the end thereof remote from the end at which the conductor enters the tubular compressible clamping element.

To positively ensure good electrical contact between the compressible clamping element and the electrical conductor, the actual conductor clamping region of the element may be screw-threaded or otherwise configured to bite into the outer surface of the electrical conductor as clamping takes place.

The split tubular clamping element may, for example, be provided with radial slots which have a width less than the diameter of the conductor and which present at the periphery of a central passage in the element for slidingly receiving the conductor, sharp edges to bite into the outer surface of the conductor to make good electrical contact therewith when the clamping element is compressed. Four such radial slots may be provided to afford a passageway of cruciform configuration but other multi-slot constructions are also contemplated.

To accommodate conductors of different sizes the tubular clamping element may be stepped on its inner surface.

The split tubular clamping element may be of relatively large diameter and connected with the contact means of the terminating arrangement by a split frusto-conical section which facilitates smooth and easy transitional displacement of an associated resilient sleeve member from the conical surface thereof to the outer periphery of the clamping element in order to compress the tubular element radially inwards as the resilient sleeve member is displaced over the split tubular element.

In accordance with one especially contemplated application of the present invention a conductor terminating arrangement of the foregoing construction is provided in a coaxial connector comprising a tubular body structure having an axially extending bore therein for receiving an incoming coaxial cable and for accommodating the electrically conductive contact-making means of the terminating arrangement located adjacent a part of the cable within the tubular body structure and electrically coupled with connector contact means (e.g. pin contact), the displaceable means of the arrangement, in response to the predetermined axial displacement thereof exerting a radial force on the contact-making means with which it co-operates to provide ongoing pressure engagement between the contact-making means and the central conductor of the coaxial cable to ensure good electrical contact therebetween without the need for the continuance of any axially applied force to the displaceable means.

The resilient or non-resilient sleeve member may form part of the axially displaceable means which also comprises a tubular insulating member at least partly accommodated within the axially extending bore of the tubular body structure of the connector at the contact means end of the connector, the sleeve member being engaged by or being attached to or formed integrally with the tubular insulating member.

Displacement of the tubular insulating member may be arrested by the abutment of an end portion of the member

with shoulder means of a cup-shaped insulating stop member located within the bore of the tubular member and having a tapered opening therethrough for the passage of the central conductor of the coaxial cable.

The tubular insulating member received by the axially extending bore of the tubular body structure of the connector may be adapted to make a first snap engagement with another connector part whereby the connector conductor clamping or contacting-making component part is held in a pre-conductor clamping or connecting state. The Displaceable means may also be adapted to be moved further to a second snap engagement with a connector part when the clamping or contact-making part makes good electrical contact with the central conductor.

The provision of a pre-conductor clamping/contacting assembled state of the connector in which connector component parts are contained in situ enables the connector to be handled/transported and/or delivered without the risk of parts becoming detached or lost and in this connection reference is made to our co-pending Patent Application No. (I.Gray 5).

For the purpose of gripping the incoming coaxial cable at the end of the connector where the coaxial cable enters, a suitable strain-relief arrangement may be provided.

The strain relief facility may be provided by sliding the end of the connector remote from the contact between the metal braiding of the cable and the underlying cable insulation and then crimping a metal ferrule down on to the braiding.

By way of example various embodiments of the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 shows a longitudinal cross-sectional view of a coaxial cable connector comprising a conductor terminating arrangement in accordance with the present invention;

Figure 2 shows an exploded view of the coaxial cable connector of Figure 1 with small modifications.

Figure 2a shows an enlarged detail of Figure 2; and,

Figures 3a, 3b and 3c show different steps in the connection of an incoming cable to the connector of Figure 1.

Referring now to Figures 1 and 2 of the drawings, the embodiment depicted therein constitutes a preferred construction which provides inter alia a pre-conductor clamping assembled state of the connector.

The tubular body structure of the coaxial connector comprises two generally cylindrical metal parts 22 and 23, the body part 22 having an externally-threaded portion 24 which, as facilitated by the integral nut head 25, can be screwed into an internally-threaded portion of the body part 23. The body part 22 includes a cylindrical cavity 26 which slidingly receives a hollow cylindrical latching member 27 of electrically insulating material. The end of the latching member 27 which engages the base of the cavity 26 is provided with a conical recess 28 against the surface of which the end of the dielectric layer of an incoming coaxial cable to the connector will abut, as will later be apparent. The right-hand end of the latching member 27 is provided with a radially inwardly extending lip or projection 29.

The latching member 27 is adapted to receive the end of a split radially compressible metal clamping collet 31 of the conductor terminating arrangement which, in the present embodiment is formed integrally with a contact 32 (e.g. pin contact) of the connector connected to the collet 31 by a split conical section 33. The internal periphery of the clamping collet may be threaded or provided with serrations or surface irregularities or otherwise configured in order to bite into the outer surface of the single or stranded central conductor of the coaxial cable during the conductor clamping operation. In the present embodiment the metal clamping collet 31 of the terminating arrangement, as can best be seen from Figure 2a of the drawings, is split axially by means of four radial slots 34 which define a

cruciform passageway extending axially through the collet and providing four axially extending sharp corners or edges 34a towards the centre of the passageway where clamping of a central conductor 44 of the coaxial cable takes place. The width of the radial slots 34 will be less than the diameter of the central conductor but the central passage or region of the cruciform passageway will be sufficiently large to slidingly receive the central conductor 44 before radial compression of the collet 31 takes place to effect clamping of the conductor and termination of the latter in the connector. During such conductor clamping the axially extending sharp edges 34a of the collet 31 will bite into the conductor 44 in order to ensure good electrical contact therewith. As will readily be apparent, other multi-slot collet constructions could alternatively be provided to achieve a similar result. A six slot collet construction is also especially contemplated.

A resilient split metal ring 35 forming part of axially displaceable means and corresponding to the ring 13 in Figure 1 is provided for co-operating with the collet 31 to effect radial compression thereof. To achieve such compression, a tubular axially-displaceable member 36 of insulating material also forming part of the displaceable means is provided. The displaceable member 36 is slidably received in a through bore 37 of the body part 23 and when the two body parts 22 and 23 are secured together with the collet 31 and the co-operating split clamping ring 35 located within the internal cylindrical cavity of the body structure, the member 36 can readily be displaced axially simply by exerting finger pressure on the right-hand end thereof, as viewed in the drawing, so that the radially flexible slotted end of the member 36 defined by slots 38 first makes snap engagement with the tubular latching member 27 by the engagement of the lip or projection 29 on the member 27 with an external circumferential groove 29 in the slotted end of the displaceable member 36. It will be appreciated that with the latching member 27 could be

possibly be slotted, in which case the slots 38 in the member 36 could be dispensed with. As will readily be appreciated from Figure 1 of the drawings which shows the connector in an assembled state prior to clamping of the central cable conductor, component parts of the connector are securely held in situ by the initial latching arrangement provided between the members 27 and 36 with the lip 29 of member 27 engaging groove 39 in the member 36. Such an arrangement importantly enables connectors to be handled and/or transported/delivered in readiness for cable connection and conductor clamping without the risk of connector parts becoming detached or lost.

In order to connect the connector to an incoming coaxial cable, as shown at 40 in Figure 3a of the drawings, the usual outer insulation sleeve 41 will be cut back, as shown, to expose a suitable length of an underlying metal braided screen 42. The metal braid will then be stripped back, as shown, over a requisite length to leave a length of extruded dielectric insulation 43 exposed. This dielectric will then be cut back to leave a length of bared central conductor 44. The cable end will then be inserted through a metal crimping ferrule, shown at 45 in Figures 2 and 3b, and then into the cable receiving end of the body part 22 which is already screwed to the body part 23 in the pre-conductor clamping assembled state of the connector shown in Figure 1. The body part 22 has a tubular extension 46 which may have circumferential ridges 47 so that as the cable moves into the interior of the connector the ridged extension 46 will be urged between the dielectric layer 43 and the metal braiding sleeve 42 of the cable, as shown in Figure 3b, whilst the bared end 44 of the central conductor will move into and along the central passage of the clamping collet 31 as indicated in Figure 2a of the drawings, until the forward end of the exposed dielectric material 43 abuts against the conical surface of the recess 28 provided in the latching member 27.

To effect clamping of the collet 21 to the central

conductor 44 of the incoming cable 40 and thereby effect termination of the conductor 44 in the connector, the axially displaceable member 36 is simply pressed from its initial pre-clamping latched position further into the bore 37, as a result of which the split clamping ring 35 of the terminating arrangement will be forced by the displacement member 36 over the cylindrical surface of the split collet 31 which is accordingly compressed radially inwards so that the inner axially extending sharp edges 34a, as shown in Figure 2a, bite into the outer surface of the single or stranded central conductor in order to make good electrical contact therewith. When sufficient clamping force has been exerted on the collet 31 by movement of the clamping ring 35, the displaceable member 36 makes a second and final snap engagement with the latching member 27 by the engagement of a second circumferential groove 48 in the member 36 with the inturned lip or projection 29 on the latching member 27. In this position of the displaceable member 36 the components of the connector are in the conductor clamped assembled state with the resilient split clamping ring 35 co-operating with the split collet 31 to provide ongoing pressure engagement between the collet and the central conductor. No continuing axial pressure needs to be applied to the displaceable member. In this clamped conductor state of the connector the cable may be pulled to carry out a tensile test for ensuring that effective clamping of the central conductor has been achieved.

Although in the embodiment described with reference to Figures 1 to 3 the sleeve member 35 comprises a resilient split metal ring which co-operates with the clamping element 31 to provide ongoing pressure engagement with the central conductor 44, it will be appreciated that the resilient sleeve member 35 could be replaced by a non-resilient sleeve member which co-operates with resilient contact-making means over which the sleeve member fits to provide the ongoing pressure engagement between the contact-making means and the central conductor of the co-axial cable.

It is contemplated that the members 27 and 36 could be composed of a transparent insulating material which would enable a conductor clamp connection to be viewed after unscrewing the two body parts.

In order to complete the strain relief connection between the incoming cable 40 and the connector, the metal ferrule 45 may be positioned over the metal braiding overlying the tubular ridged extension 46, as can be seen in Figure 3b of the drawings, and then crimped down on to the braiding, as shown in Figure 3c.

To enable the connector to be panel mounted, a radially collapsible ring 49 may be fitted in a groove of the body part 23. The configuration of the ring allows the contact end of the connector to be inserted into a panel aperture after which the ring restores to hold the connector in position.

CLAIMS:

1. An electrical conductor terminating arrangement comprising contact-making means which makes good electrical contact with an electrical conductor in response to axial pressure displacement over the contact-making means of an axially displaceable means which exerts a radial force on the contact-making means and co-operates therewith to provide ongoing pressure engagement between the contact-making means and the electrical conductor without the need for the continuance of axial pressure on the axially displaceable means.

2. An electrical conductor terminating arrangement as claimed in claim 1, in which the axially displaceable means comprises a resilient or non-resilient sleeve member which exerts an inward radial force on a contact-making element located within it and which co-operates with the element to provide the ongoing pressure engagement of the element with the conductor.

3. An electrical conductor terminating arrangement as claimed in claim 2, in which the resilient sleeve member is provided by split metal ring or a continuous plastics ring.

4. An electrical conductor terminating arrangement as claimed in claim 2, in which the non-resilient sleeve comprises a continuous metal ring.

5. An electrical conductor terminating arrangement as claimed in any preceding claim, in which the contact-making means comprises a compressible clamping element adapted to fit over the conductor and subjected to a radial compressive force exerted on it by the axially displaceable means in order to cause the element to clamp down on the conductor.

6. An electrical conductor terminating arrangement as claimed in claim 5, in which the compressible clamping element comprises a split tubular metal part into one end of which the conductor extends and which is adapted to be radially inwardly compressed to make good electrical contact with the conductor.

7. An electrical conductor terminating arrangement as

claimed in claim 5 or claim 6, in which the split tubular metal part is formed integrally with contact means (e.g. pin contact) of the terminating arrangement provided at the end thereof remote from the conductive compressible clamping element.

8. An electrical conductor terminating arrangement as claimed in claim 5, 6 or 7, in which the actual conductor clamping region of the clamping element is screw-threaded or otherwise configured to bite into the outer surface of the conductor as clamping takes place.

9. An electrical conductor terminating arrangement as claimed in claim 8, in which the clamping element is provided with radial slots which have a width less than the diameter of the conductor and which present at the periphery of a central passage in the element for slidingly receiving the conductor, sharp edges to bite into the outer surface of the conductor to make good contact therewith when the clamping element is compressed.

10. An electrical conductor terminating arrangement as claimed in claim 9, in which four or six radial slots are provided in the clamping element.

11. An electrical conductor terminating arrangement as claimed in claim 7 in which the clamping element comprises a relatively large diameter element coupled to the contact means of the arrangement by a split frusto-conical section which facilitates smooth and easy transitional displacement of the sleeve member from the cone surface of the section on to the outer periphery of the clamping element in order to compress the element radially inwards when the front end of the sleeve member is displaced axially.

12. In a coaxial connector comprising a tubular body structure having an axially extending bore therein for receiving an incoming coaxial cable, a conductor terminating arrangement as claimed in any preceding claim, in which the contact-making means of the arrangement is located within the tubular body structure and electrically coupled to connector contact means (e.g. pin contact), the axially

displaceable means of the arrangement exerting a radial force on the contact-making means to provide ongoing pressure engagement between the contact-making means and the central conductor of a coaxial cable extending into the tubular body structure.

13. A conductor terminating arrangement as claimed in claim 12, in which a resilient or non-resilient sleeve member forms part of the axially displaceable means of the arrangement, which means also comprises a tubular insulating member at least partly accommodated within the axially extending bore of the tubular body structure at the contact means end of the connector, and in which the sleeve member is engaged by or attached to the tubular insulating member.

14. A conductor terminating arrangement as claimed in claim 13, in which axial movement of the tubular insulating member during clamping is arrested by the engagement thereof with a cup-shaped stop member accommodated in the bore of the tubular body structure and into which the split tubular metal part fits during conductor clamping.

15. A conductor terminating arrangement as claimed in claim 13 or 14, in which the tubular insulating member and the bore of the tubular body structure are provided with grooves and/or projections which co-operate to lock the tubular insulating member in position within the bore of the body structure as conductor clamping takes place.

16. A conductor terminating arrangement as claimed in claim 12 or 13, in which the tubular insulating member and another component part of the connector are provided with projections and/or grooves which co-operate to provide a first positive hold position of the tubular insulating member relative to the tubular body structure to retain component parts within the tubular body structure prior to clamping of the contact-making means down on to the central conductor.

17. A conductor terminating arrangement as claimed in claim 16, in which the tubular insulating member and another component part of the connector are provided with

projections and/or grooves which co-operate to provide a second positive hold position of the tubular insulating member relative to the tubular body structure when clamping of the central conductor has been effected.

18. A conductor terminating arrangement as claimed in claim 17 in which a projection is provided by an inturned lip at one end of a tubular latching member accommodated within the axially extending bore of the tubular body structure and in which the projection makes sequential snap engagement with axially spaced grooves provided in the periphery of the tubular insulating member.

19. A conductor terminating arrangement as claimed in any preceding claim, in which the contact-making clamping element is stepped to accommodate conductors of different diameters.

20. A co-axial connector comprising a conductor terminating arrangement as claimed in claim 12, in which the tubular body structure comprises two parts which are threadingly connected together.

21. A coaxial connector as claimed in claim 20, in which one or more parts of the connector are composed of transparent insulating material to allow the conductor clamped or terminated condition of the connector to be inspected following separation of the body structure parts.

22. A conductor terminating arrangement substantially as hereinbefore described with reference to the accompanying drawings.

23. A coaxial connector substantially as hereinbefore described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under section 17 (The Search Report)

Application number

GB 9223825.2

Relevant Technical fields

(i) UK Cl (Edition L) H2E (EEGA EEGE EEH ECBB)

(ii) Int Cl (Edition 5) H01R

Search Examiner

F J FEE

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

25 FEBRUARY 1993

Documents considered relevant following a search in respect of claims 1 TO 23

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
X	GB 0944544	(AMP) particularly Figure 6	1, 2, 4
X	GB 0531947	(CARR)	1
X	EP 0245917 A2	(EVERETT/CHARLES)	1, 2, 3
X	EP 0116760 A2	(OMNI-SPECTRA)	1, 2, 5, 8, 12
X	US 5024606	(MING-HWA)	1, 2, 5, 12
X	US 4339166	(DAYTON)	1, 2, 5, 12, 13

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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