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H01R 4/28

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H2E EEGA

(56) Documents cited
GB 2232016 A EP 0186339 A1 EP 0002984 A1
US 5024608 A US 5011432 A US 4923412 A
US 4795370 A US 4676577 A

(58) Field of search
UK CL (Edition K) H2E ECBB EDLJ EEGA
INT CL[5] H01R

(54) Connecting the core of a coaxial cable to a contact of a connector

(57) The bared core (9) of a coaxial cable (4) is connected to the centre contact (11) of a connector (1) by radially inwardly compressible clamps (10). The clamps may take the form of split fingers with roughened surfaces. An insulator (14) may move axially to urge a split spring ring (13) over the clamps (10) thereby urging their roughened surfaces into the core (9). The connector also embodies a cable sheath clamp as claimed in GB Application 9203233.3.

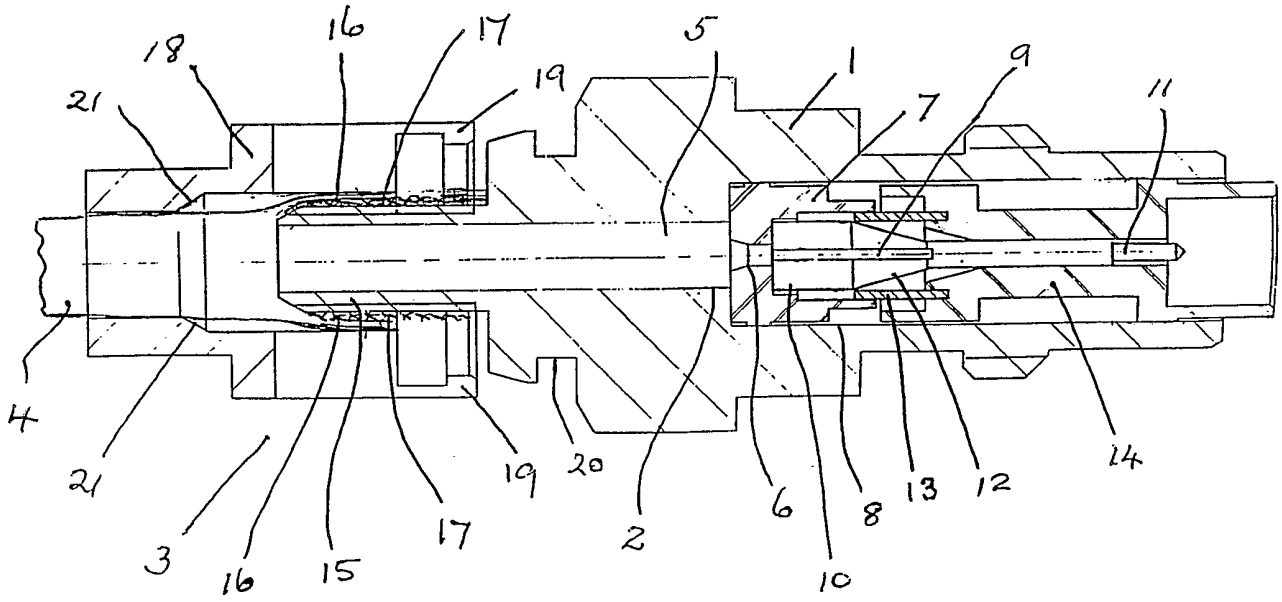

FIG. 1

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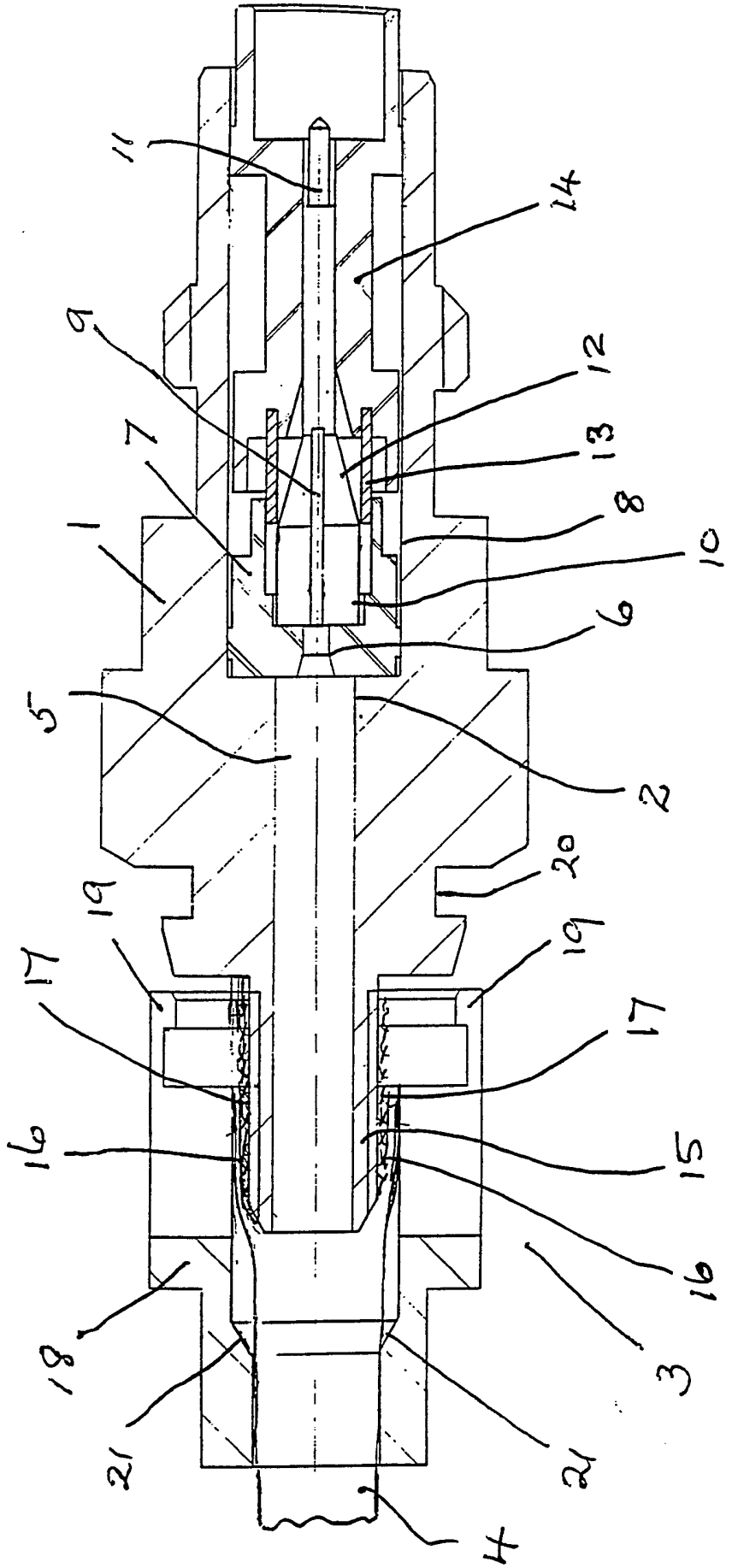

FIG. 1

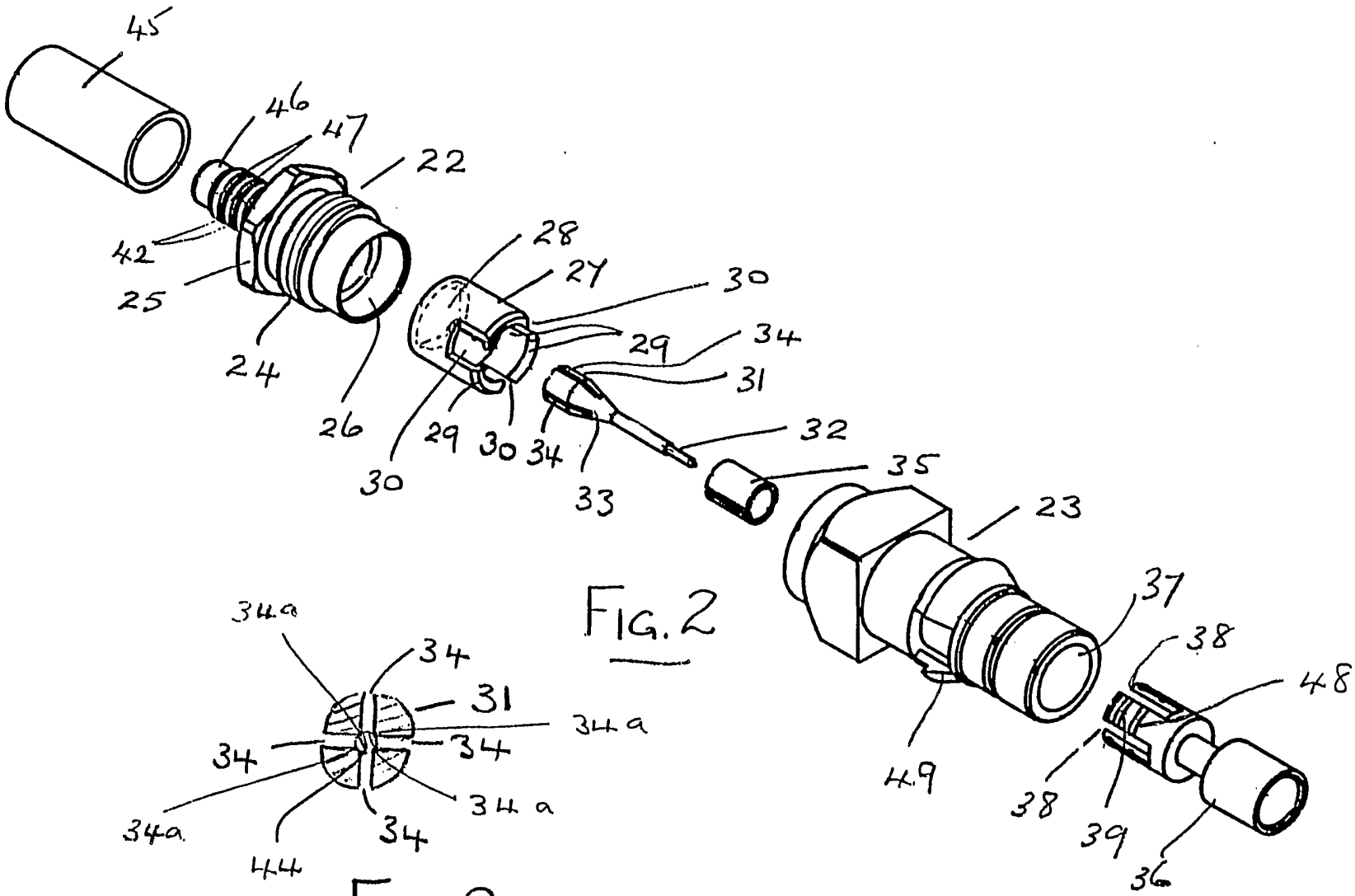
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FIG. 2

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FIG. 2a

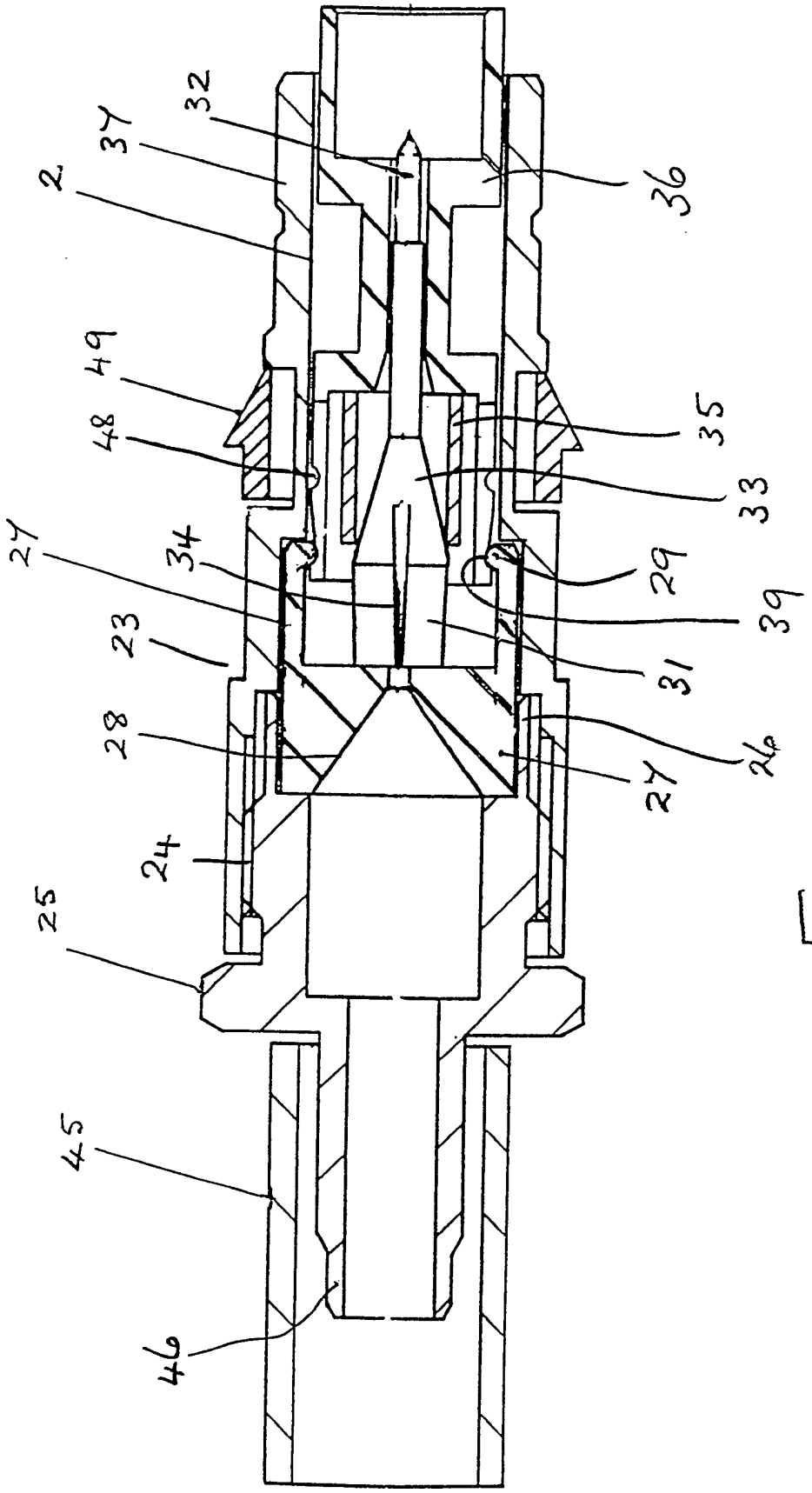

FIG. 3

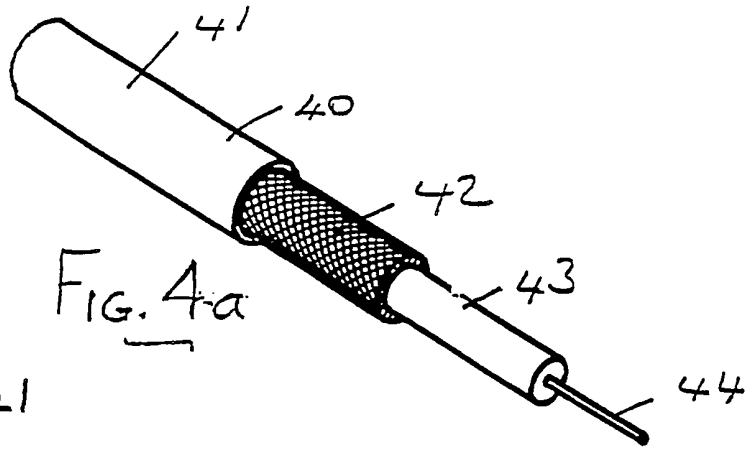

FIG. 4-a

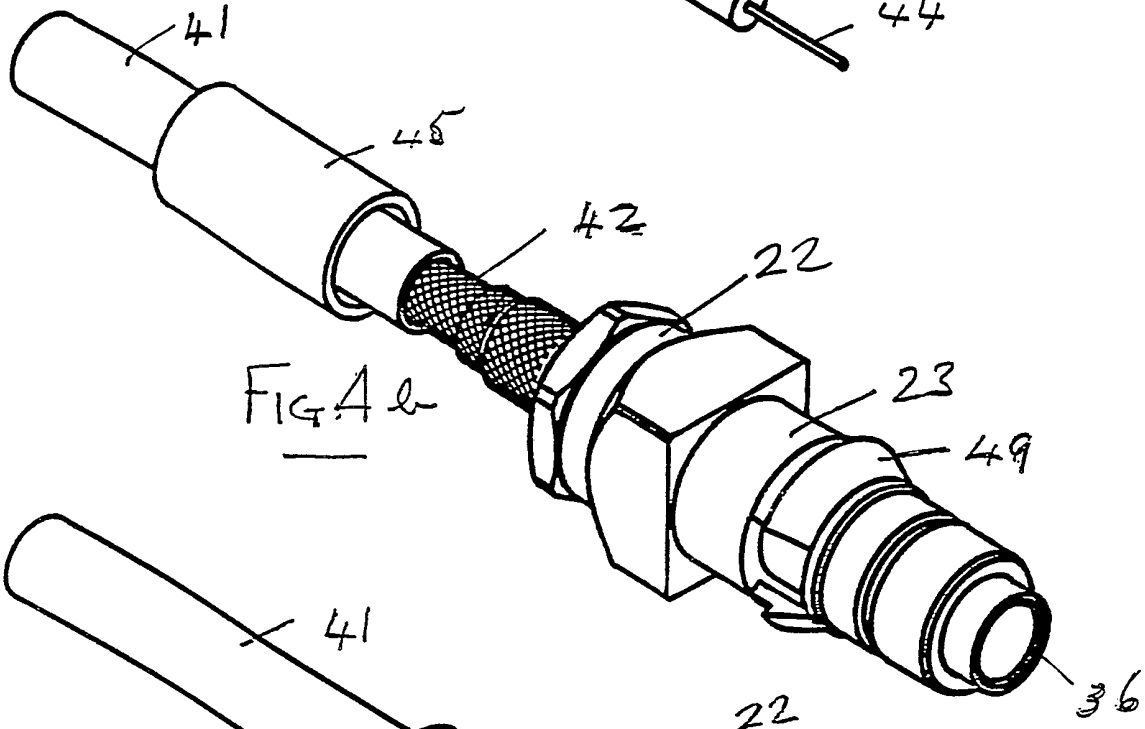

FIG. 4-b

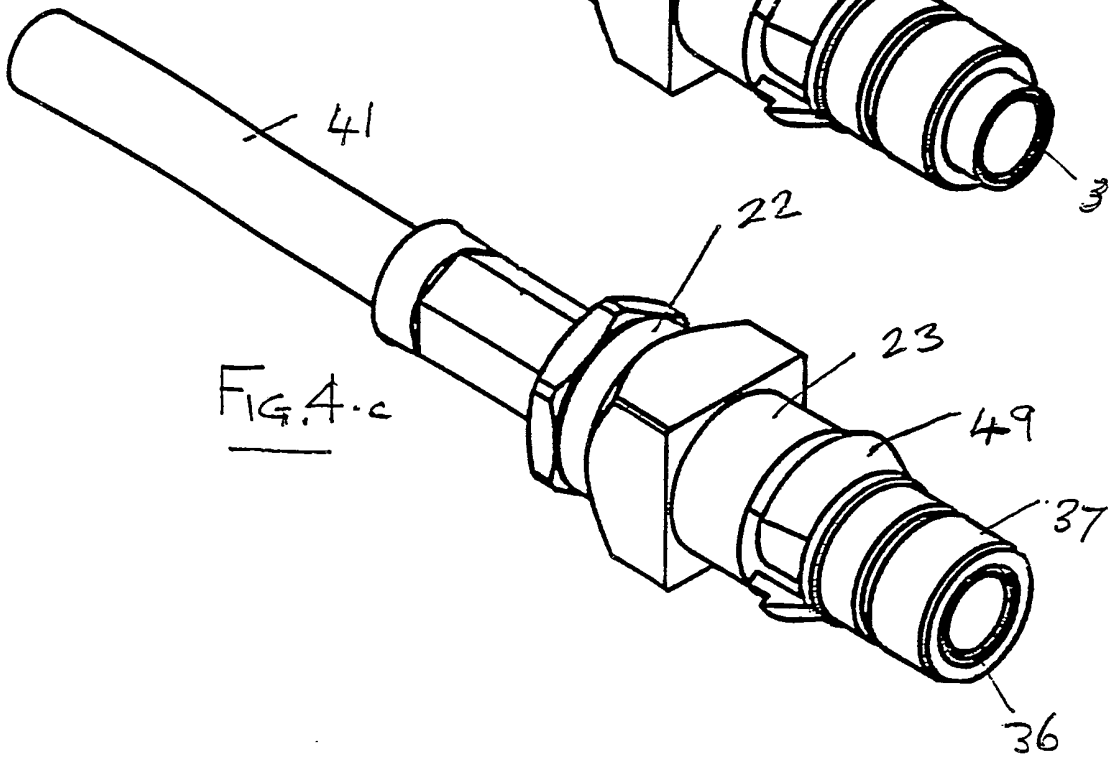

FIG. 4-c

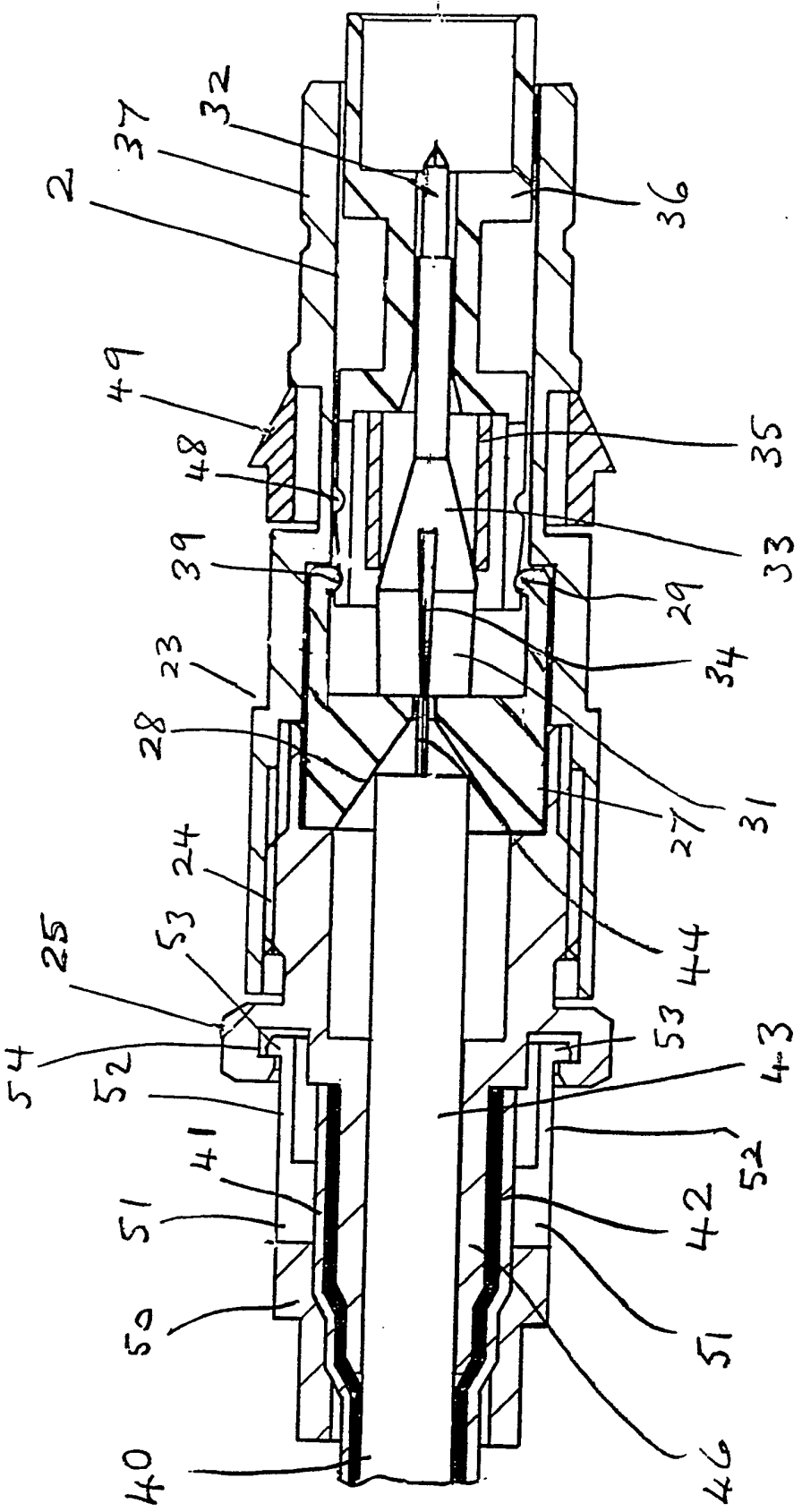
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FIG. 5

IMPROVEMENTS RELATING TO ELECTRICAL CONNECTORS

This invention relates to electrical connectors and relates more specifically to such connectors of the coaxial type.

The invention is directed to an improved construction of coaxial connector which facilitates inter alia 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. The invention also conveniently provides for greater security against loss or detachment of connector parts during handling, transport and/or delivery of such connectors.

In accordance with one aspect of the present invention a coaxial connector comprises a tubular body structure having an axially extending bore therein for receiving an incoming coaxial cable and for accommodating an electrically conductive contact-making element located adjacent a part of the cable within the tubular body structure and electrically coupled with contact means (e.g. pin contact) of the connector, the connector comprising readily displaceable means for exerting a radial force on the contact-making element to cause it to make good electrical contact with the central conductor of the coaxial cable.

In accordance with another aspect of the present invention a coaxial connector comprises a tubular body structure having an axially extending bore therein for

receiving an incoming coaxial cable and for accommodating an electrically conductive compressible clamping element adapted to fit over a bared part of the central conductor within the tubular body structure and electrically coupled with contact means (e.g. pin contact) of the connector, the connector being provided with readily displaceable means for exerting a radial compressive force on the clamping element to cause it to clamp down on to the central conductor so as to make good electrical contact therewith in response to a predetermined displacement of the displaceable means.

In carrying out the second aspect of the present invention the compressible clamping element may comprise a split tubular metal part into one end of which the bared part of the central conductor extends and which is adapted to be radially compressed to make good electrical contact with the central conductor.

The split tubular metal part may be formed integrally with the contact means (e.g. pin contact) of the connector provided at the end thereof remote from the conductive compressible clamping element.

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

The coaxial connector may, for example, be provided with radial slots which have a width less than the diameter of the central conductor and which present at the periphery of a central passage in the element for slidingly receiving the central conductor, sharp edges to bite into the outer surface of the central conductor to make good contact therewith when the clamping element is compressed. Four such radial slots may be provided to afford a passageway of cruciform configuration. A six slot construction is also especially contemplated.

The readily displaceable means for exerting the

radial compressive force on the clamping element may comprise a resilient sleeve member which progressively envelops the split clamping element to compress it radially inwards in response to displacement of the displaceable means in the axial direction of the connector. The resilient sleeve member may be provided by a split metal ring or by forming the sleeve of inherently resilient material (e.g. plastics material). The resilient sleeve may be engaged by, or attached to or formed integrally with a tubular insulating member which is slidably mounted in the bore of the tubular body structure at the contact end of the connector and which is mounted over the contact means end of the member incorporating the clamping element. The contact means may be coupled to a relatively large diameter clamping element by a split frusto-conical section which facilitates smooth and easy transition of the resilient sleeve member from the cone surface on to the outer periphery of the clamping element in order to compress the element radially inwards when the front end of the tubular insulating member is displaced axially towards the rear end of the connector. Displacement of the tubular insulating member may be arrested by the abutment of the rear 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.

In carrying out the invention the displaceable means which preferably comprises a tubular insulating member received by the axially extending bore of the tubular body structure may be adapted to make a first snap engagement with another connector part whereby the connector conductor clamping or contacting parts are held in a pre-conductor clamping or connecting state. The displaceable means is also adapted to be moved further to make a second snap engagement with a connector part when the clamping or contact making element makes good electrical contact with the central conductor.

The provision of a pre-conductor clamping/contacting assembled state of the connector in which the connector parts are contained in situ enables the connector to be handled/transported and/or delivered without the risk of parts becoming detached or lost.

In carrying out the present invention the compressible clamping element may be stepped on its inner surface in order to accommodate central conductors of different diameters.

For the purpose of gripping the incoming coaxial cable at the end of the connector where the coaxial cable enters, a strain-relief arrangement may be provided. This strain-relief arrangement may be constructed in accordance with our co-pending Patent Application No.9203233.3.

Accordingly, the arrangement may comprise an externally-threaded extension of the tubular body structure of the connector which is adapted to penetrate between the outer surface of the insulating layer extruded over the central conductor and the adjacent surrounding metal braided screen over which the outer insulating sleeve of the cable is applied. Such penetration of the threaded extension is achieved by relative rotation between the tubular body structure of the connector and the incoming cable. A radially-slotted locking bush or gland through which the incoming cable extends is axially moveable over the threaded extension of the tubular body structure of the connector having the outer cable sheathing and metal braiding forced thereover and, as mentioned above, may be provided, preferably integrally, with means (e.g. latches) for lockingly engaging with the tubular body structure of the connector when the locking bush or gland has been moved to a position at which the outwardly splayed layer of metal braiding and outer insulation at the end of the threaded extension becomes clamped between the extension and an inner, preferably tapered, shoulder of the locking bush. This locking bush not only provides cable strain relief in the axial direction but it also positively prevents relative

rotation between the cable and the connector.

Alternatively, 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 one coaxial cable connector constructed in accordance with the present invention;

Figure 2 shows an exploded view of another coaxial cable connector according to the present invention;

Figure 2a shows an enlarged detail of Figure 2;

Figure 3 shows a longitudinal cross-sectional view of an assembled coaxial cable connector substantially as shown in exploded form in Figure 2;

Figures 4a, 4b and 4c show different steps in the connection of an incoming cable to the connector of Figure 2; and,

Figure 5 shows a longitudinal cross-sectional view of another coaxial cable connector similar to that of Figure 3 but having a different cable strain relief arrangement.

Referring to Figure 1 of the drawings, the coaxial cable connector illustrated comprises a hollow cylindrical metal body structure 1 having a central stepped bore 2 extending therethrough for receiving at the rear end 3 of the connector an incoming coaxial cable 4. After baring an end portion of the single or stranded central conductor of the cable to be connected and inserting the cable 4 into the connector and separating the outer insulation sheath of the cable and the metal braiding (i.e. screen) from the inner part of the cable, as will hereinafter be described, the cable will be located in the position indicated at which the front end of the inner layer 5 of insulation extruded over the central conductor will be accommodated in a tapered

bore 6 of an insulating cup-shaped stop member 7 slidably located in a relatively large diameter section 8 of the through bore 2. The bared end portion 9 of the central conductor projects forward from the cup-shaped stop member 7 into a metallic axially-split tubular clamping element or collet 10 which fits within the cup-shaped stop member 7. The clamping collet 10 may be formed integrally with a pin contact 11 connected to the collet by an axially-split hollow conical section 12.

As can be seen from the drawing, the internal cylindrical surface of the cup-shaped stop member 7 is stepped to facilitate the forced insertion between the outer cylindrical surface of the clamping collet 10 and the larger diameter inner cylindrical surface of the stop member 7 of a metallic split ring 13 secured to the inner end of a tubular insulating member 14 which is slidably mounted in the enlarged section 8 of the through bore 2 and which has the pin contact 11 extending therethrough.

In the illustrated state of the connector the tubular insulating member 14 projects from the front end of the connector and the single or stranded central conductor 9 is unclamped. In order to effect clamping, the tubular insulating member 14 will simply be displaced by hand in the rearward direction of the connector so that the split ring 13 rides over the transitional region between the split cone-shaped section 12 and the split clamping element 10. The sleeve 13 being restrained at its outer periphery by the cup-shaped stop member 7 compresses the split clamping collet 10 which accordingly clamps down on to the central conductor 9. The inner periphery of the split clamping collet 10 in the present embodiment is threaded but it could alternatively be provided with serrations or surface irregularities or otherwise configured to bite into the outer surface of the central conductor 9 during the clamping action whereby to ensure good electrical contact with the central conductor. The conductor clamping region of the collet may be stepped to accommodate central conductors of

different diameters.

The rearward movement of the split ring 13 and the tubular member 14 will be limited by the engagement of abutting radial surfaces of the members 14 and 7 and/or by the interengagement of co-operating projections/grooves on the outer cylindrical surface of the tubular member 14 and the cylindrical surface of the enlarged bore section 8 of the tubular structure 1, which will also serve to lock the tubular member 14 in position within the insulating body structure 1 once the member is in place.

As will readily be appreciated, the clamping of the central conductor 9 of the cable to the pin contact 11 of the connector is achieved in accordance with the present invention without the use of any crimping or other tools.

As previously mentioned, prior to the effective clamping of the central conductor 9 of the cable to the pin contact 11 a length of outer insulating sheath of the cable and metal braiding will be stripped from the inner insulating sleeve extruded over the central conductor.

This stripping of the outer insulating sheath and metal braiding from the inner part of the incoming cable constitutes an initial step in providing cable strain relief in accordance with our co-pending Patent Application No. 9203233.3 and for this purpose the metal tubular body structure 1 of the present embodiment is provided with a rearwardly extending externally-threaded tubular extension 15 through which the coaxial cable 4 stripped of its metal braiding and outer insulating sheath will extend. The threaded extension 15 is screwed between the inner insulation and the metal braiding, preferably by rotation of the metal tubular body structure 1 relative to the incoming cable 4. The separated sheath 16 and metal braiding 17 pass over the threaded extension 15, as shown, to the requisite extent at which point a radially slotted locking gland or bush 18 (e.g. plastics) through which the incoming cable extends and located over the threaded extension 15 is moved towards the front end of the connector so that latches 19

provided on the bush 18 snap into engagement with a circumferential groove 20, or individual slots, in the tubular body structure 1 and at the same time a tapered shoulder 21 on the inside of the locking gland or bush 15 will bear against and clamp the separated outer sheath 16 and metal braiding 17 extending over the threaded extension. The locking gland or bush 18 accordingly provides strain relief additional to that provided by the screwing of the extension 15 into the cable and rotation of the cable relative to the connector is positively prevented.

Referring now to Figure 2 of the drawings, the embodiment depicted therein in exploded form comprises a preferred construction by virtue of a pre-conductor clamping assembled state of the connector and the easy dismantling of the connector without tools to allow of internal inspection and/or re-use of the connector.

In Figure 2 the tubular body structure of the 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 (not shown) 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. However, it may here be mentioned that the latching member 27 corresponds very generally to the member 7 in the Figure 1 connector construction. The right-hand end of the latching member 27 is provided with a radially inwardly extending lip or projection 29 and, although in the present embodiment the latching member 27 is rendered radially resilient by the provision of slots 30, it should be understood that this may not be necessary, as will hereinafter become apparent.

The latching member 27 is adapted to receive the end of a split radially compressible metal clamping collet 31 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. As previously mentioned in connection with Figure 1, 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, 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 central conductor 44 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. 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 split metal ring 35 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 and corresponding generally to the insulating member 14 in Figure 1 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 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 slotted, as shown, the slots 38 in the member 36 could be dispensed with. As will readily be appreciated from Figure 3 of the drawings which shows a connector very similar to the exploded connector of Figure 2 but 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. 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 assembled connector to a coaxial cable, as shown at 40 in Figure 4a 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. This preparatory pre-clamping procedure is similar to that described with reference to Figure 1. The cable end will then be inserted through a metal crimping ferrule, shown at 45 in Figures 2 and 4b, 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. 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 4b, 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, 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 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. In this 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.

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 4c.

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.

Referring finally to Figure 5 of the drawings this shows a coaxial cable connector which is identical to that shown in Figure 3 apart from the cable strain relief arrangement.

After suitable stripping back of the outer insulation sleeve 41 and braiding 42 of the cable 40, as shown the stepped tubular extension 46 will be forced between and effect separation of the inner dielectric layer 43 from the braiding 42 so that the separated outer layers of the cable extend over the extension 46. A stepped clamping bush 50 which has radial slots 51 defining resilient arms 52 is then pressed over the extension 46 so that latches 53 at the ends of the arms 52 make snap engagement with an internal groove 54 provided in the nut 25. In this position of the clamping bush 50, the incoming cable is firmly clamped relative to the connector body structure to prevent straining of the central conductor 44 which is clamped to the clamping element/contact 32,33.

As will be appreciated the cable strain relief arrangements described and illustrated in the drawings may be interchanged.

CLAIMS:

1. A coaxial connector comprising a tubular body structure having an axially extending bore therein for receiving an incoming coaxial cable and for accommodating an electrically conductive contact-making element arranged to be located adjacent a part of the cable within the tubular body structure and electrically coupled with contact means (e.g. pin contact) of the connector, the connector comprising readily displaceable means for exerting a radial force on the contact-making element to cause it to make good electrical contact with the central conductor of the coaxial cable.

2. A coaxial connector comprising a tubular body structure having an axially extending bore therein for receiving an incoming coaxial cable and for accommodating an electrically conductive compressible clamping element adapted to fit over a bared part of the central conductor within the tubular body structure and electrically coupled with contact means (e.g. pin contact) of the connector, the connector being provided with readily displaceable means for exerting a radial compressive force on the clamping element to cause it to clamp down on to the central conductor so as to make good electrical contact therewith in response to a predetermined displacement of the displaceable means.

3. A coaxial connector as claimed in claim 2, in which the compressible clamping element comprises a split tubular metal part into one end of which the bared part of the central conductor extends and which is adapted to be radially compressed to make good electrical contact with the central conductor.

4. A coaxial connector as claimed in claim 3, in which the split tubular metal part is formed integrally with the contact means of the connector.

5. A coaxial connector as claimed in any one of claims 2 to 4, in which the conductor clamping region of the clamping element is screw threaded or provided with serrations or surface irregularities or otherwise configured

to bite into the outer surface of the central conductor to ensure good electrical contact therewith as clamping takes place.

6. A coaxial connector as claimed in claim 5, in which the clamping element is provided with radial slots which have a width less than the diameter of the central conductor and which present at the periphery of a central passage in the element for slidingly receiving the central conductor, sharp edges to bite into the outer surface of the central conductor to make good electrical contact therewith when the clamping element is compressed.

7. A coaxial connector as claimed in claim 6, in which the clamping element has four radial slots defining an axial passage through the element of cruciform configuration.

8. A coaxial connector as claimed in any one of claims 2 to 7, in which the readily displaceable means comprises or co-operates with a resilient sleeve member which progressively envelops the split tubular metal clamping element to compress it radially inwards in response to displacement of the displaceable means in the axial direction of the connector.

9. A coaxial connector as claimed in claim 8, in which the resilient sleeve is provided by a split metal ring.

10. A coaxial connector as claimed in claim 8, in which the resilient sleeve is provided by a sleeve of inherently resilient material.

11. A coaxial connector as claimed in claim 8, 9 or 10, in which the resilient sleeve is attached to, or formed integrally with, a tubular insulating member which is slidably mounted in the bore of the tubular body structure and which has the contact means extending therethrough.

12. A coaxial connector as claimed in claim 8, 9 or 10, in which the resilient sleeve member is arranged to be engaged by the readily displaceable means to urge the sleeve member over the split tubular metal clamping element to

compress it.

13. A coaxial connector as claimed in any of claims 8 to 12, in which the contact means of the connector is coupled to a relatively large diameter tubular clamping element by a frusto-conical section which facilitates smooth and easy transition of the resilient sleeve member from the conical surface on to the outer periphery of the clamping element in order to compress the clamping element radially inwards.

14. A coaxial connector as claimed in claim 11, in which 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 is a force fit during clamping.

15. A coaxial connector as claimed in claim 11 or claim 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 clamping takes place.

16. A coaxial connector as claimed in any preceding claim, in which the displaceable means is adapted to be moved to make a first snap engagement with another connector part whereby the connector conductor clamping or connecting parts are held in a pre-conductor clamping or connected assembled state and in which the displaceable means is adapted to be moved further to make a second snap engagement with a connector part when the displaceable means is moved to a position at which the clamping or contact-making element makes good electrical contact with the central conductor.

17. A coaxial connector as claimed in claim 16, in which the displaceable means comprises a tubular insulating member received by the axially extending bore of the tubular body structure.

18. A coaxial connector as claimed in claim 17, in

which the snap engagements between the connector parts is provided by co-operating projections and grooves in the respective parts.

19. A coaxial connector as claimed in claim 18, in which the tubular insulating member is provided with axially spaced circumferential grooves which are engaged sequentially by a projection or projections on the other connector part in order to provide the first and second snap engagements as the tubular insulating member is displaced axially within the axially extending bore of the tubular body structure.

20. A coaxial connector as claimed in claim 19, in which the projection or projections are provided by an inturned lip at one end of a tubular insulating insert which is accommodated in the axially extended bore of the body structure and which receives the clamping element.

21. A coaxial connector as claimed in any preceding claim, in which the tubular body structure comprises two parts which are threadingly connected together.

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

23. A coaxial connector as claimed in any preceding claim, in which the tubular body structure is provided at the end thereof remote from the contact end with a tubular extension for providing a cable strain relief connection thereto.

24. A coaxial connector as claimed in claim 23, in which the tubular extension is ridged for receiving the metal braiding of an incoming conductor cable over which a metal ferrule may be crimped.

25. A coaxial connector as claimed in any of claims 2 to 24, in which the clamping element has a stepped configuration in the clamping region thereof to accommodate central conductors of different diameters.

26. A co-axial connector as claimed in any of claims 1 to 23, in which the rearward end of the connector is provided with a cable strain-relief arrangement forming the subject of our co-pending Patent Application No. 9203233.3.

27. A co-axial 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 9210375.3

Relevant Technical fields

(i) UK Cl (Edition K) H2E (EEGA, ECBB, EDLJ)

(ii) Int Cl (Edition 5) H01R

Search Examiner

F J FEE

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

20.8.92

Documents considered relevant following a search in respect of claims 1 TO 27

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
Y	GB 2232016 A (MARPLES)	22
X,Y	EP 0186339 A1 (RAYCHEM)	X, 1 to 5 21 Y, 22
Y	EP 0002984 A1 (SOCAPEX)	22
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Category	Identity of document and relevant passages	Relevant to claim(s)

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