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# (54) ELECTRICAL CONNECTOR AND METHOD OF ASSEMBLING AN ELECTRICAL CONNECTOR TO A CABLE

(57) Electrical connector comprising:
a retainer 2 with a bore 6, said retainer 2 being adapted to be mounted onto an outer insulating jacket 7 of an electric cable 1,
a cavity block 3 having a plurality of cavities 13, 13' adapted to accommodate electrical terminals 10, 10' connected to electrical conductors 18 of wires 9, 9' of the cable 1,
a tubular shield element 4 made of an electrically conductive material and accommodating said retainer 2 and said cavity block 3, wherein said retainer 2 has a threaded bore 6 adapted to be screwed onto the outer insulating jacket 7 of the electric cable 1.

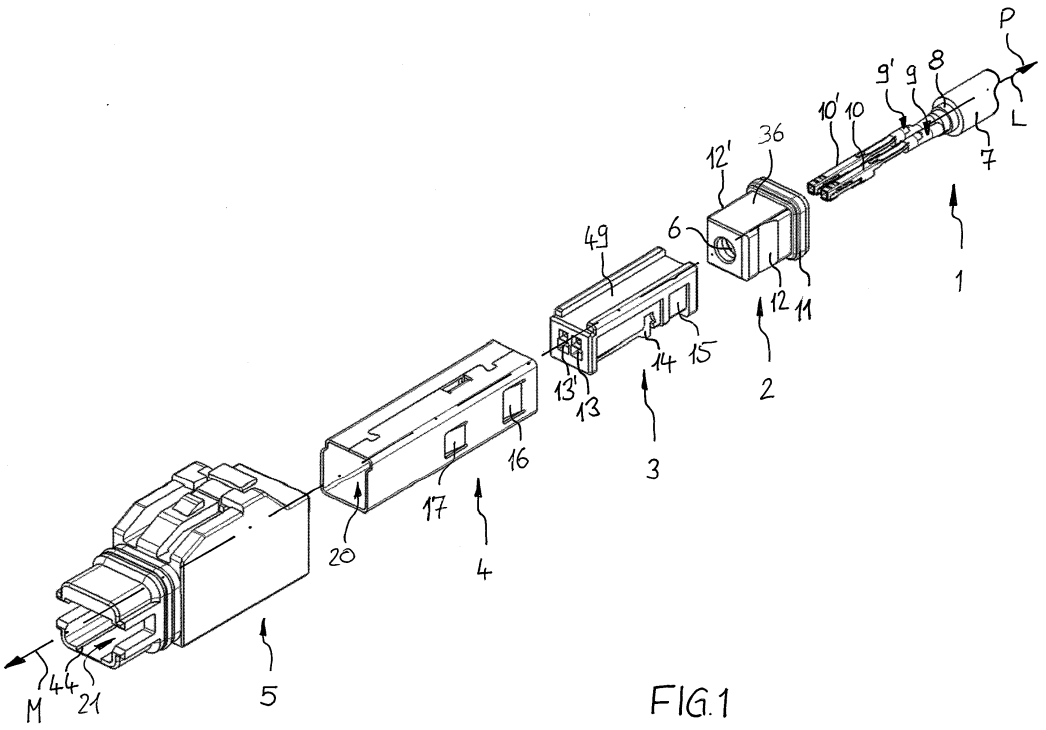


FIG.1

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## Description

**[0001]** The invention relates to an electrical connector comprising a retainer adapted to be mounted onto an outer insulating jacket of an electric cable. The electric connector further comprises a cavity block having a plurality of cavities adapted to accommodate electrical terminals connected to electrical conductors of wires of the cable. A tubular shield element is provided made of an electrically conductive material and accommodating said retainer and said cavity block.

**[0002]** Such electric connectors are typically used for shielded connectors on shielded cables as, exemplary, disclosed in US 4 634 208 A. The plug connector disclosed in US 4 634 208 A is made for a shielded cable and has a one-piece metal shell member as shield element in which a housing member, serving as a cavity block, is inserted and secured. Conductors of wires of the cable are connected to electrical terminals which are inserted into cavities of the housing member. A shielding of the cable is placed around a rear shell section of the shell member and a crimping retainer is crimped there around. A rear section of the retainer is crimped to the outer insulating jacket of the cable. Hence, an electrical connection between the shielding of the cable and the shell member is constituted.

**[0003]** US 6 231 392 B1 discloses a cable connector comparable to the aforementioned plug connector. The difference is that both the shield element and the cavity block have a box-shape.

**[0004]** Another electrical contact of this type is disclosed in US 7 390 221 B2, wherein the retainer is only crimped onto the shielding of the cable and not onto the outer insulating jacket of the cable.

**[0005]** The object of the invention is to provide an electrical connector as described at the beginning, providing for an easy assembly of the electrical connector to a cable.

**[0006]** The object is solved by an electrical connector comprising a retainer with a bore, wherein said retainer is adapted to be mounted onto an outer insulating jacket of an electric cable. The connector further has a cavity block with a plurality of cavities adapted to accommodate electrical terminals connected to electrical conductors of wires of the cable. A tubular shield element is made of an electrically conductive material and accommodates said retainer and said cavity block. The retainer has a threaded bore adapted to be screwed onto the outer insulating jacket of the electric cable.

**[0007]** Due to the threaded bore of the retainer the retainer can simply be screwed onto the outer insulating jacket of the electric cable without the need to crimp a crimp section of the retainer onto the outer jacket. The assembly of the retainer is, therefore, much easier without the need to provide crimping tools. Further, when screwing the retainer onto the outer insulating jacket of the electric cable, the thread of the threaded bore cuts into the outer insulating jacket providing a secure fit of the retainer on the cable. Further, cutting the thread into the outer insulating jacket provides a sealed connection between the retainer and the cable.

**[0008]** The retainer can be made of an electrically conductive material wherein the bore has a contact section adapted to be in contact to a shielding of the cable. Hence, the retainer is adapted for an electrical connection between the retainer and the shielding of the cable.

**[0009]** However, alternatively, the retainer can also be made of an insulating material such as synthetic resin. The retainer design, thus, can be used for unshielded connectors or an unshielded cable. Even a retainer made of an electrically conductive material, such as metal, could also be used for an unshielded connector, when screwed onto an unshielded cable.

**[0010]** In an embodiment the contact section has a cylindrical inner contact face adapted to be brought into radial contact to the shielding of the cable. The contact face can have an inner diameter which is slightly smaller than the outer diameter of the shielding of the cable so that a pressfit between the contact face and the shielding is provided.

**[0011]** In an embodiment the bore has a threaded section along a part of its longitudinal extension. The unthreaded sections of the bore can be used for other purposes.

**[0012]** The contact section can have an inner diameter which is smaller than the minimum inner diameter of the threaded section. The threaded section may also have an inner diameter which is bigger than the outer diameter of the shielding of the cable. Thereby it is ensured that the thread of the threaded section does not cut too deep into the outer insulating jacket and does not cut into the insulation of the cable, while the contact section has a diameter which is adapted to the outer diameter of the shielding of the shielded cable in order to provide a safe and reliable electrical connection between the contact section and the insulation of the cable.

**[0013]** An embodiment of the electrical connector has a retainer with a bore having an insertion section wherein the insertion section is cone shaped opening in a direction away from the threaded section. The cone facilitates the assembly of the retainer onto the cable. By the cone it is easier to insert a connection end of the cable into the bore of the retainer.

**[0014]** The threaded section can be arranged between the contact section and the insertion section. This means, that the contact section is arranged farther towards the end of the cable than the insertion section for contacting the shielding of the cable.

**[0015]** In order to provide a safe and simple electrical connection between the retainer and the shield element, the retainer can have an outer contact face being in electrical contact to the shield element wherein both, the retainer as well as the shield element, are made of an electrically conductive material.

**[0016]** For fixation of the retainer within the shield element the shield element can have at least one resilient

retainer engagement tongue engaging an engagement recess in an outer face of the retainer, securing the retainer against pull-out forces in a pull-out direction which is parallel to a longitudinal axis of the shield element. Any other well-known fixation means can be used. The resilient retainer engagement tongue, however, is a simple way to hold the retainer within the shield element. The resilient retainer engagement tongue can be cut out of the material of the shield element, in particular, if the shield element is made of sheet metal. The retainer engagement tongue can be bent inwardly towards the retainer in such a manner, that the tongue is pushed outwardly during the axial insertion of the retainer into the shield element until the tongue snaps into the engagement recess of the retainer behind a support face of the engagement recess. In this position, when pulling back or pulling out the retainer in a direction out of the shield element, the retainer engagement tongue is axially supported against the support face of the engagement recess, wherein the tongue cannot be bent outwardly by the retainer itself.

**[0017]** In order to secure the cavity block within the shield element the shield element can have at least one resilient cavity block engagement tongue engaging an engagement recess in an outer face of the cavity block, securing the cavity block against pull-out forces in a pull-out direction which is parallel to a longitudinal axis of the shield element. Any other well-known fixation means can be used. The resilient cavity block engagement tongue, however, is a simple way to hold the cavity block within the shield element. The resilient cavity block engagement tongue can be cut out of the material of the shield element, in particular, if the shield element is made of sheet metal. The cavity block engagement tongue can be bent inwardly towards the cavity block comparable to the retainer engagement tongue in such a manner, that the tongue is pushed outwardly during the axial insertion of the cavity block into the shield element until the cavity blocks engagement tongues snaps into the engagement recess of the cavity block behind a support face of the engagement recess of the cavity block. In this position, when pulling back or pulling out the cavity block in a direction out of the shield element, the cavity block engagement tongue is axially supported against the support face of the engagement recess of the cavity block, wherein the tongue cannot be bent outwardly.

**[0018]** The electric connector comprises, in an embodiment, a connector housing accommodating the shield element with inserted retainer and inserted cavity block.

**[0019]** In order to securely hold the shield element within the connector housing, the shield element can have at least one resilient housing engagement tongue engaging an engagement recess in the connector housing securing the shield element against pull-out forces in a pull-out direction which is parallel to a longitudinal axis of the shield element. The housing engagement tongue is comparable to the at least one retainer engagement tongue and the at least one cavity block engagement tongue. Accordingly, the housing engagement tongue can be cut out of the material of the shield element. The housing engagement tongue can be bent outwardly towards the housing in such a manner, that the housing engagement tongue is pushed inwardly during the axial insertion of the shield element into the connector housing until the housing engagement tongue snaps into an engagement recess of the connector housing behind a support face of the connector housing. In this position, when pulling back or pulling out the shield element in a direction out of the connector housing, the housing engagement tongue is axially supported against the support face of the connector housing.

**[0020]** The cavity block can have at least one terminal position assurance (TPA) element locking the terminals within the cavities. Preferably, the at least one terminal position assurance (TPA) element is moveable between a pre-set position and a set position, wherein the terminal position assurance (TPA) element projects beyond an outer face of the cavity block in its pre-set positon. In the pre-set position the terminals are not secured by the terminal position assurance (TPA) element. As long as the terminal position assurance (TPA) element projects beyond an outer face of the cavity block the terminal position assurance (TPA) element would collide with an outside edge of the shield element when the cavity block would be inserted into the shield element. As a result, it would be impossible to insert the cavity block into the shield element. The cavity block can only be inserted into the shield element when the terminal position assurance (TPA) element is moved into its set position, which can only be reached when the terminals are inserted properly into the cavities of the cavity block. If the terminals are not fully inserted into the cavities, the terminal position assurance (TPA) element collides with the terminals before the terminal position assurance (TPA) element reaches its set position and projects beyond the outer face of the cavity block.

**[0021]** In addition, when the terminal position assurance (TPA) element is moved into its set position, it is flush with the outer face of the cavity block and the terminal position assurance (TPA) element is held and secured in its set position by the shield element in an inserted condition of the cavity block in the shield element. This secures the terminal position assurance (TPA) element and avoids that the terminal position assurance (TPA) element can be moved from its set position into its pre-set position and thereby unlocking the terminals as long as the cavity block is held within the shield element.

**[0022]** The object is further solved by a method of assembling an electrical connector according to an electrical connector as described above, comprising the steps of:

providing an electric cable having at least one wire with an electrical conductor and an insulating jacket, a shielding surrounding the at least one wire and an outer insulating jacket surrounding the shielding,

stripping off the outer insulating jacket of a connection end of the electric cable exposing the shielding and the at least one wire,
stripping off the insulating jacket of a connection end of the at least one wire exposing the electrical conductor,
guiding the wires through the bore of the retainer,
threading the retainer onto the outer insulating jacket of the cable,
crimping an electric terminal onto the electric conductor of the connection end of the at least one wire,
inserting the terminal on the at least one wire into a cavity of the cavity block, inserting the cavity block and the retainer into the shield element in an insertion direction opposite to a pull-out direction parallel the a longitudinal axis of the shield element, and
inserting the shield element into a connector housing in the insertion direction.

**[0023]** A preferred embodiment is described in more detail with reference to the attached drawings.

Figure1 is an exploded perspective view of an electrical connector assembled to a cable,

Figure 2 is a sectional view of a retainer according to Figure 1 mounted onto a cable,

Figure 3 is a sectional view of the retainer according to Figure 2,

Figure 4 is a sectional view of the electrical connector according to Figure 1, mounted in a connector housing, and

Figure 5 is another sectional view of the electrical connector according to Figure 4.

**[0024]** Figure 1 shows the elements of the electrical connector mounted to a cable which are a cable 1, a retainer 2, a cavity block 3, a shield element 4 and a connector housing 5. These elements are depicted in Figure 1 in an exploded view along a longitudinal axis L and are assembled in a mounting direction M. The cable 1 is guided through a threaded bore 6 of the retainer 2, wherein the retainer 2 is finally mounted onto an outer insulating jacket 7 of the cable 1. The cable 1 further has a shielding 8 surrounded by the outer insulating jacket 7 and surrounding two electric wires 9, 9'. The shielding 8 can be made of a braid wire. As can be seen from Figure 2 each wire 9 has a central conductor 18 covered by an insulating jacket 19. The conductor 18 of each of the wires 9, 9' is electrically connected to an electrical terminal 10, 10'. The terminals 10, 10' are connected to the conductors 18 in a well-known manner, i.e. by crimping, welding, etc.

**[0025]** The retainer 2 is threaded onto the outer insulating jacket 7 of cable 1 in order to establish a firm connection between the retainer 2 and the cable 1. The thread of the threaded bore 6 cuts into the outer insulating jacket 7 so that the cable 1 is secured against forces in a pull-out direction P parallel to the longitudinal axis L. The thread, that cuts into the outer insulating jacket 7, also provides for a sealing effect between the retainer 2 and the cable 1.

**[0026]** A seal 11 in form of a sealing ring is mounted onto the retainer in order to seal the retainer against the connector housing 5. Further, the retainer has two engagement recesses 12, 12' for fixation of the retainer 2 within the shield element 4.

**[0027]** The terminals 10, 10' are pushed in the mounting direction M into cavities 13, 13' of the cavity block 3. The cavities 13, 13' extend in a longitudinal direction parallel to the longitudinal axis L. The cavity block 3 has a flap like terminal position assurance (TPA) element 14 which locks the terminals 10, 10' within the cavities 13, 13'.

**[0028]** On the outside the cavity block 3 has engagement recesses 15 for securing the cavity block 3 within the shield element 4.

**[0029]** The shield element 4 is made of sheet metal and has a tubular form with an accommodation chamber 20, extending through the shield element 4 in a longitudinal direction parallel to the longitudinal axis L. The cavity block 3, the retainer 2 together with the cable 1 are inserted into the accommodation chamber 20 of the shield element 4 in the mounting direction M. The shield element 4 comprises retainer engagement tongues 16 and cavity block engagement tongues 17, which are cut out of the sheet metal material of the shield element 4. The retainer engagement tongue 16 and the cavity block engagement tongue 17 are bent inwardly towards the longitudinal axis L angled to the longitudinal axis L and directed in the mounting direction M. This configuration ensures that during the insertion of the cavity block 3 and the retainer 2 into the shield element 4 the retainer engagement tongues 16 and the cavity block engagement tongues 17 are pushed outwardly in a direction away from the longitudinal axis L until the engagement recess 16 of the cavity block 3 reaches the cavity block engagement tongue 17 and the engagement recesses 12, 12' reach the retainer engagement tongues 16. In this position the cavity block engagement tongues 17 snap into the engagement recesses 15 of the cavity block 3 and the retainer engagement tongues 16 snap into the engagement recesses 12, 12' of the retainer 2. Thereby, the cavity block 3 and the retainer 2 are secured against pull-out forces in a pull-out direction P.

**[0030]** The retainer 2 has an outer face 36 which is the outer circumferential face of the retainer 2 around the longitudinal axis L. The outer face 36 servers as a contact face being held in electrical contact to the shield element 4.

**[0031]** The shield element 4 is inserted in the mounting direction M into an accommodation chamber 21 of the connector housing 5 and secured therein.

**[0032]** Figures 2 and 3 disclose the retainer 2 in more detail and how it is assembled to the cable 1 and described together. In the disclosed embodiment the retainer 2 is made of an electrical conductive material such as metal, because the retainer 2 is electrically connected to the shielding 8 of the cable 1 as described hereinafter. Alternatively, it is also possible that the retainer 2 is made of an electrically insulating material in case that the retainer 2 is used for an unshielded connector.

**[0033]** The threaded bore 6 is a through-bore through the retainer 2 in longitudinal direction, terminating in mounting direction M in a front face 22 of the retainer 2 and opposite to that in a rear face 23 of the retainer 2. The threaded bore 6 has, starting from the front face 22, a connection section 24 merging into a threaded section 25 which merges into an insertion section 26 terminating into the rear face 23. The retainer 2 is mounted onto a connection end 27 of the cable 1. The outer insulating jacket 7 of the connection end 27 has been stripped off, exposing the shielding 8. The shielding 8 is stripped from a filler 28, which is surrounded by the shielding 8, exposing the filler 28. The filler 28 is stripped from the wires 9, 9' exposing the wires 9, 9'. The insulating jacket 19 of the wires 9, 9' have also been stripped off exposing the conductors 18 of the wires 9, 9'.

**[0034]** For assembling the retainer 2 onto the cable 1 the connection end 27 of the cable 1 is guided through the threaded bore 6 of the retainer 2. In order to simplify to guide the connection end 27 into the threaded bore 6 the insertion section 26 has a first cylindrical portion 29, starting from the rear face 23, wherein the cylindrical portion 29 has an inner diameter which is bigger than the outer diameter of the outer insulating jacket 7 of cable 1. The cylindrical portion 29 merges into a cone shaped portion 30 having a cone angle which opens towards the cylindrical portion 29. The cone shaped portion 30 merges into the threaded section 25 of bore 6. The cone shaped portion 30 guides the wires 9, 9' and the connection end 27 into the threaded section 25 during mounting the retainer 2 onto the cable 1.

**[0035]** The threaded section 25 has a thread 31. The thread 31 has an inner diameter which is smaller than the outer diameter of the outer insulating jacket 7. Therefore, when threading the retainer 2 onto the outer insulating jacket 7 the thread 31 cuts into the outer insulating jacket 7, establishing a secure mechanical connection between the retainer 2 and the cable 1 as well as a sealed connection therebetween.

**[0036]** The inner diameter of the thread 31 is bigger than the outer diameter of the shielding 8 of the cable 1, so that it is avoided that the thread 31 cuts into and damages the shielding 8.

**[0037]** The threaded section 25 merges into the contact section 24. The contact section 24 is stepped, having a contact portion 32 and a holding portion 33. The contact portion 32 is arranged adjacent to the threaded section 25 and the holding portion 33 is arranged adjacent to the front face 22. The contact portion 32 has a cylindrical contact face 34 which is in electrical contact to the shielding 8. The inner diameter of the contact face 34 is adapted to the outer diameter of the shielding 8 in such a manner, that a secure electrical contact is provided. The contact face 34 can be press fit onto the shielding 8 by having a slightly smaller inner diameter than the outer diameter of the shielding 8 providing for a secure electrical contact between the retainer and the shielding. Together with the electrical contact between the outer face 36 of the retainer and the shield element 4 an electric connection between the shielding 8 of the cable 1 and the shield element 4 is achieved. The shielding 8 may also be compressed in axial direction by the retainer so that the shielding 8 is widened in radial direction which increases the press-fit condition.

**[0038]** The holding portion 33 sits on the filler 28, wherein the inner diameter of the holding portion 33 is substantially equal to the outer diameter of the filler 28.

**[0039]** In order to provide a sealing between the retainer 2 and the connector housing 5 the seal 11 is arranged onto the retainer 2. The retainer 2 has a flange portion 35 at the end of the retainer 2 which is on the side of the rear face 23. The seal 11, which is formed as a sealing ring, is axially supported in pull-out direction P against the flange portion 35 and sits on the outer face 36 of the retainer 2.

**[0040]** Figure 4 depicts a longitudinal sectional view of the electrical connector in a completely assembled condition. The retainer 2 and the cavity block 3 are inserted into the accommodation chamber 20 of the shield element 4. The shield element 4 is inserted into the accommodation chamber 21 of the connector housing 5. The accommodation chamber 21 reaches through the connector housing 5 from a front face 37 to a rear face 38.

**[0041]** For securing the cavity block 3 within the shield element 4 the cavity block engagement tongues 17, 17' engage into the respective engagement recesses 15, 15' and are axially supported against support faces 39, 39' of the engagement recesses 15, 15'. The cavity block engagement tongues 17, 17' are supported against the support faces 39, 39' in such a way that the cavity block 3 is secured against forces in pull-out direction P.

**[0042]** For securing the retainer 2 within the shield element 4 the retainer engagement tongues 16, 16' engage into the engagement recesses 12, 12' of the retainer 2. The retainer engagement tongues 16, 16' are axially supported against support faces 40, 40' of the engagement recesses 12, 12' in such a manner that the retainer 2 is secured within the shield element 4 against pull-out forces in the pull-out direction P.

**[0043]** The seal 11 is in sealing contact to the connector housing 5 so that the retainer 2 is sealed against the connector housing 5 by the seal 11. Further, the retainer 2 is sealed against the cable 1 by the threaded connection between the threaded bore 6 and the outer insulating jacket 7 of the cable 1.

**[0044]** Figure 5 depicts another longitudinal sectional view of the electrical connector. In a forward direction in

mounting direction M, i.e. at the front face, the connector housing 5 has a wall portion 41 which projects radially inwardly in the accommodation chamber 21, wherein the shield element 4 and the cavity block 3 are axially supported against the wall portion 41 in mounting direction M. The wall portion 41 serves as a stop so that the shield element 4 cannot be pushed into the connector housing 5 too far.

**[0045]** For a secure fixation of the shield element 4 within the accommodation chamber 21 of the connector housing 5 the connector housing 5 is provided with an engagement recess 44. The shield element 4 has a housing engagement tongue 45, cut out of a sheet metal material and bent radial outwardly relative to the longitudinal axis L when the housing engagement tongue 45 is directed in pull-out direction. The housing engagement tongue 45 is axially supported against a support face 46 of the engagement recess 44, so that the shield element 4 is secured against pull-out forces in pull-out direction P.

**[0046]** Further, it can be seen that a cavity block 3 has a flap like terminal position assurance (TPA) element 14 which is hinge like connected to a front side of the cavity block 3 and can be moved radial outwardly and radial inwardly. In Figure 5 the terminal position assurance (TPA) element 14 is shown in a radial inward set position in which a blocking portion 42 of the terminal position assurance (TPA) element 14 reaches through an opening 43 in the cavity block 3. The opening 43 leads from the outside of the cavity block 3 to the cavities 13, 13'. In the set position the terminal position assurance (TPA) element 14 engages into a recess 48 of each terminal 10, 10', wherein each terminal 10, 10' is supported with a support face 47 against the blocking portion 42 in pull-out direction P (Figure 2).

**[0047]** In the set position the terminal position assurance (TPA) element 14 is substantially flush with an outer face 49 of the cavity block 3 and is supported against the shield element 4 and cannot be moved radial outwardly. The terminal position assurance (TPA) element 14 can only be moved into a radial outward pre-set position, in which the blocking portion 42 does not reach into the opening 43 and into the cavities 13, 13', when the cavity block 3 is pulled out of the shield element 4.

**[0048]** In said pre-set position (not shown) the terminal position assurance (TPA) element 14 projects beyond the outer face 49 of the cavity block 3. In case that the terminals 10, 10' are not fully inserted into the cavities, the terminal position assurance (TPA) element 14 collides with the terminals 10, 10' so that the terminal position assurance (TPA) element 14 cannot be moved into the set position. Hence, the cavity block 3 cannot be inserted into the shield element 4 avoiding a wrong assembly of the connector.

Reference Numerals

**[0049]**

| | |
|---|---|
| 1 | cable |
| 2 | retainer |
| 3 | cavity block |
| 4 | shield element |
| 5 | connector housing |
| 6 | threaded bore |
| 7 | outer insulating jacket |
| 8 | shielding |
| 9, 9' | wire |
| 10, 10' | terminal |
| 11 | seal |
| 12, 12' | engagement recess of retainer |
| 13, 13' | cavity |
| 14 | terminal position assurance (TPA) element |
| 15 | engagement recess of cavity block |
| 16 | retainer engagement tongue |
| 17 | cavity block engagement tongue |
| 18 | conductor |
| 19 | insulating jacket |
| 20 | accommodation chamber of the shield element |
| 21 | accommodation chamber of the connector housing |
| 22 | front face of retainer |
| 23 | rear face of retainer |
| 24 | contact section |
| 25 | threaded section |
| 26 | insertion section |
| 27 | connection end |
| 28 | filler |
| 29 | cylindrical portion |
| 30 | cone shaped portion |
| 31 | thread |
| 32 | contact portion |
| 33 | holding portion |
| 34 | contact face |
| 35 | flange portion |
| 36 | outer face of retainer |
| 37 | front face of connector housing |
| 38 | rear face of connector housing |
| 39, 39' | support face |
| 40, 40' | support face |
| 41 | wall portion |
| 42 | blocking portion |
| 43 | opening |
| 44 | engagement recess of connector housing |
| 45 | housing engagement tongue |
| 46 | support face |
| 47 | support face |
| 48 | recess |
| 49 | outer face of cavity block |

| | |
|---|---|
| L | longitudinal axis |
| M | mounting direction |
| P | pull-out direction |

## Claims

1. Electrical connector comprising:

   a retainer (2) with a bore (6), said retainer (2) being adapted to be mounted onto an outer insulating jacket (7) of an electric cable (1),
   a cavity block (3) having a plurality of cavities (13, 13') adapted to accommodate electrical terminals (10, 10') connected to electrical conductors (18) of wires (9, 9') of the cable (1),
   a tubular shield element (4) made of an electrically conductive material and
   accommodating said retainer (2) and said cavity block (3),
   **characterized in**
   **that** said retainer (2) has a threaded bore (6) adapted to be screwed onto the outer insulating jacket (7) of the electric cable (1).

2. Electrical connector according to claim 1,
   **characterized in**
   **that** the retainer (2) is made of an electrically conductive material, and
   **that** the bore (6) has a contact section (24) adapted to be in contact to a shielding (8) of the cable (1).

3. Electrical connector according to claim 2,
   **characterized in**
   **that** the contact section (24) has a cylindrical inner contact face (34).

4. Electrical connector according to any one of claims 2 or 3,
   **characterized in**
   **that** the bore (6) has a threaded section (25) separate from the contact section (24).

5. Electrical connector according to claim 4,
   **characterized in**
   **that** the contact section (24) has an inner diameter which is smaller than the inner diameter of the threaded section (25).

6. Electrical connector according to any one of claims 4 or 5,
   **characterized in**
   **that** the bore (6) has an insertion section (26) and
   **that** the insertion section (26) is cone shaped in a direction away from the threaded section (25).

7. Electrical connector according to any one of the preceding claims,
   **characterized in**
   **that** the retainer (2) has an outer face (36) being in electrical contact to the shield element (4).

8. Electrical connector according to any one of the preceding claims,
   **characterized in**
   **that** the shield element (4) has at least one resilient retainer engagement tongue (16, 16') engaging an engagement recess (12, 12') in an outer face (36) of the retainer (2) securing the retainer (2) against pull-out forces in a pull-out direction (P) parallel to a longitudinal axis (L) of the electrical connector.

9. Electrical connector according to any one of the preceding claims,
   **characterized in**
   **that** the shield element (4) has at least one resilient cavity block engagement tongue (17, 17') engaging an engagement recess (15, 15') in an outer face (49) of the cavity block (3) securing the cavity block (3) against pull-out forces in a pull-out direction (P) parallel to a longitudinal axis (L) of the electrical connector.

10. Electrical connector according to any one of the preceding claims,
    **characterized in**
    **that** the electrical connector further comprises a connector housing (5) accommodating the shield element (4) with inserted retainer (2) and inserted cavity block (3).

11. Electrical connector according to claim 10,
    **characterized in**
    **that** the shield element (4) has at least one resilient housing engagement tongue (45) engaging an engagement recess (44) in the connector housing (5) securing the shield element (4) against pull-out forces in a pull-out direction (P) parallel to a longitudinal axis (L) of the electrical connector.

12. Electrical connector according to any one of the preceding claims,
    **characterized in**
    **that** the cavity block (3) has at least one terminal position assurance (TPA) element (14) locking the terminals (10, 10') within the cavities (13, 13').

13. Electrical connector according to claim 12,
    **characterized in**
    **that** the at least one terminal position assurance (TPA) element (14) is movable between a pre-set position and a set position wherein the terminal position assurance (TPA) element (14) projects beyond an outer face (49) of the cavity block (3) in its pre-set position.

14. Electrical connector according to claim 13,
    **characterized in**
    **that** the terminal position assurance (TPA) element (14) is secured in its set position by the shield element (4) when accommodated within the shield el-

ement (4).

**15.** Method of assembling an electrical connector according to any one of the preceding claims to a cable comprising the steps of:

providing an electric cable (1) having at least one wire (9, 9') with an electrical conductor (18) and an insulating jacket (19), a shielding (8) surrounding the at least one wire (9, 9') and an outer insulating jacket (7) surrounding the shielding (8),
stripping off the outer insulating jacket (7) of a connection end (27) of the electric cable (1) exposing the shielding (8) and the at least one wire (9, 9'),
stripping off the insulating jacket (7) of a connection end (27) of the at least one wire (9, 9') exposing the electrical conductor (18),
guiding the wires (9, 9') through the bore (6) of the retainer (2),
threading the retainer (2) onto the outer insulating jacket (7) of the cable (1),
crimping an electric terminal (10, 10') onto the electric conductor (18) of the connection end (27) of the at least one wire (9, 9'),
inserting the terminal (10, 10') on the at least one wire (9, 9') into a cavity (13, 13') of the cavity block (3),
inserting the cavity block (3) and the retainer (2) into the shield element (4) in a mounting direction (M) opposite to a pull-out direction (P) parallel the a longitudinal axis (L) of the electrical connector, and
inserting the shield element (4) into a connector housing (5) in the mounting direction (M).

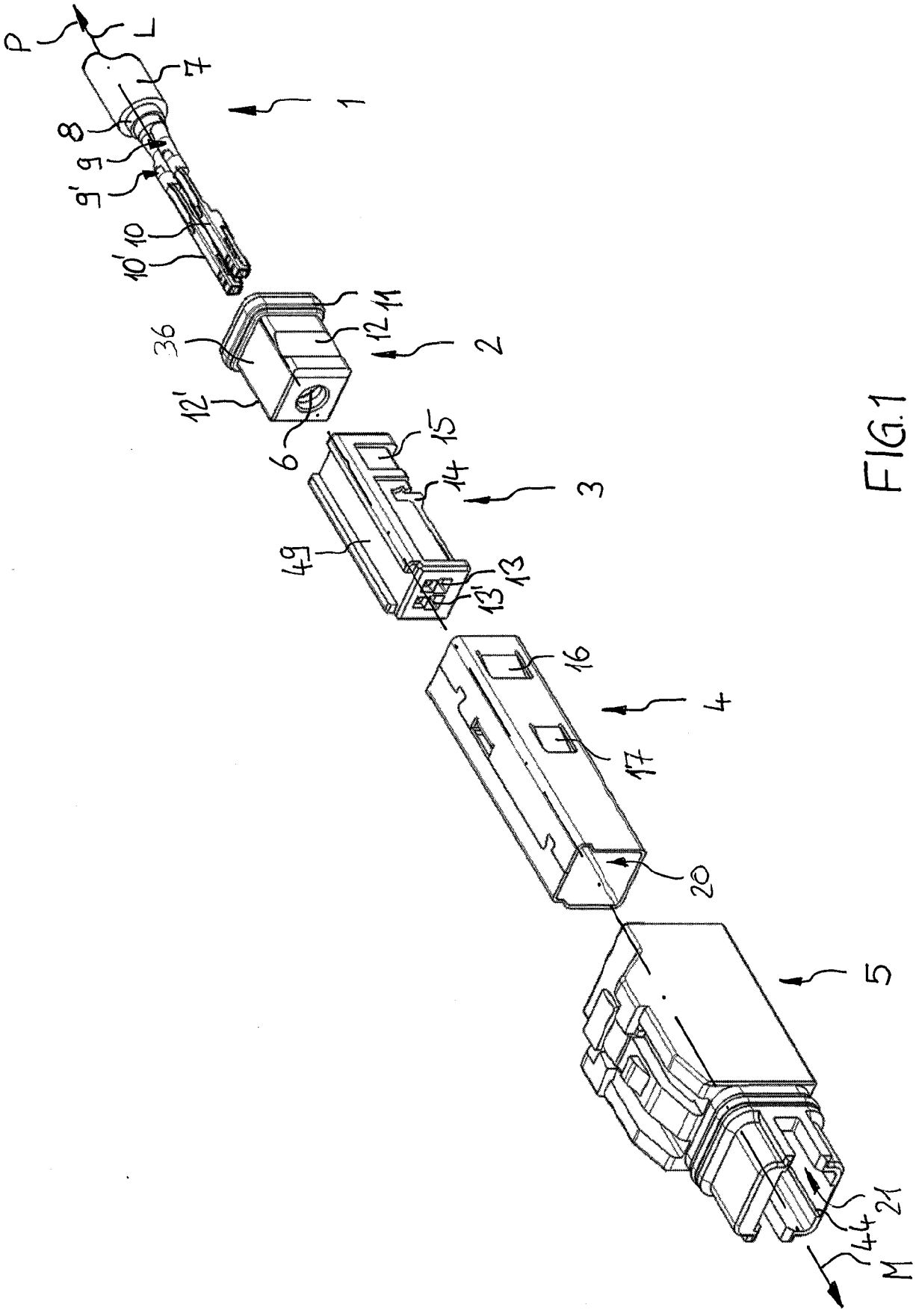


FIG.1

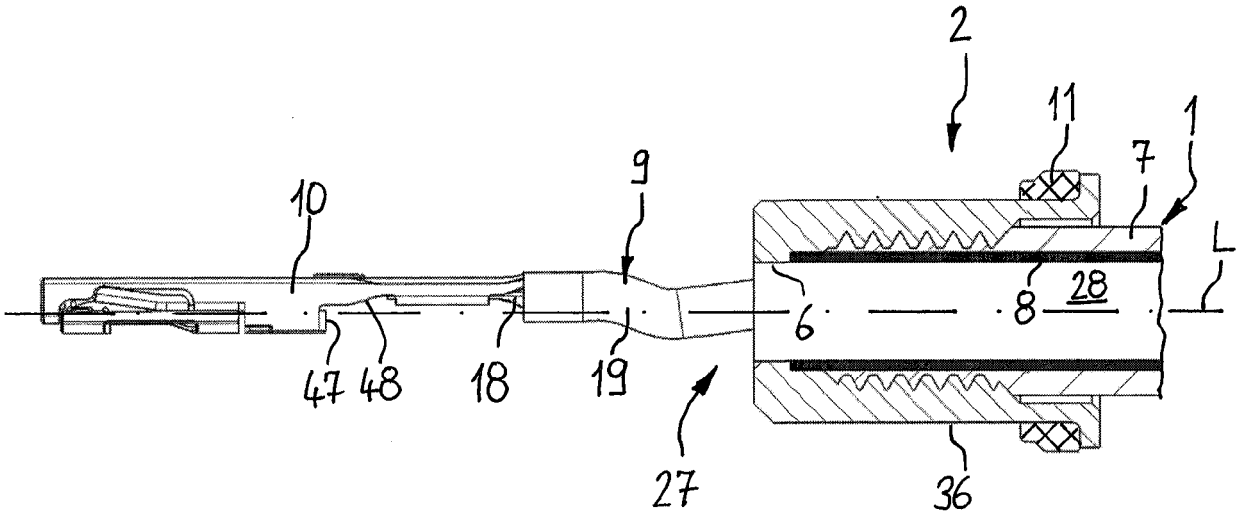
2
11
1
7
9
10
L
28
6
8
47
48
18
19
27
36

FIG.2

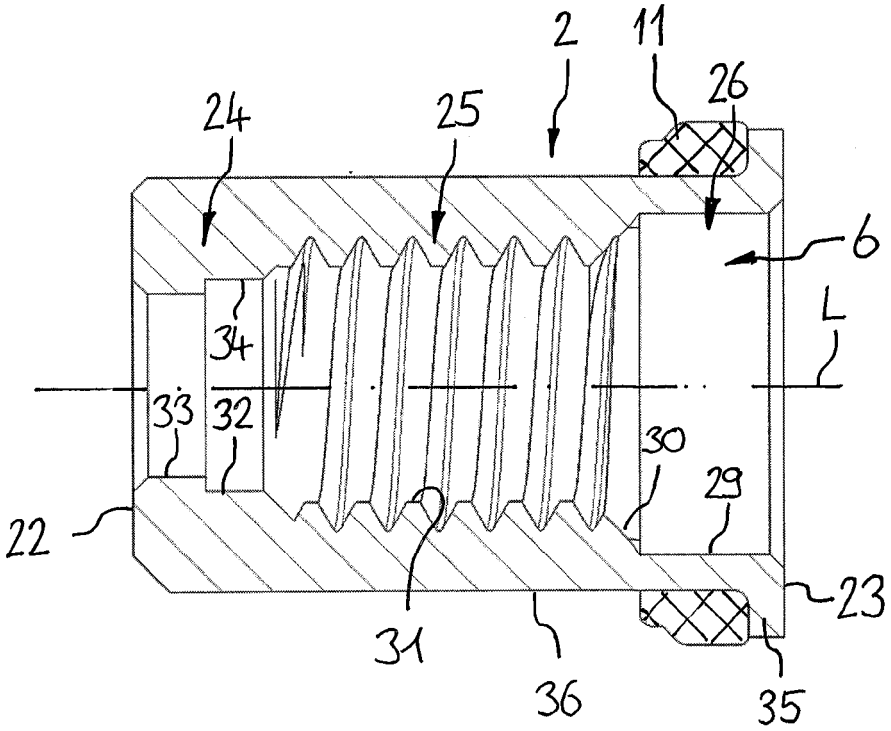
2
11
26
24
25
6
L
34
33
32
30
29
22
23
31
36
35

FIG.3

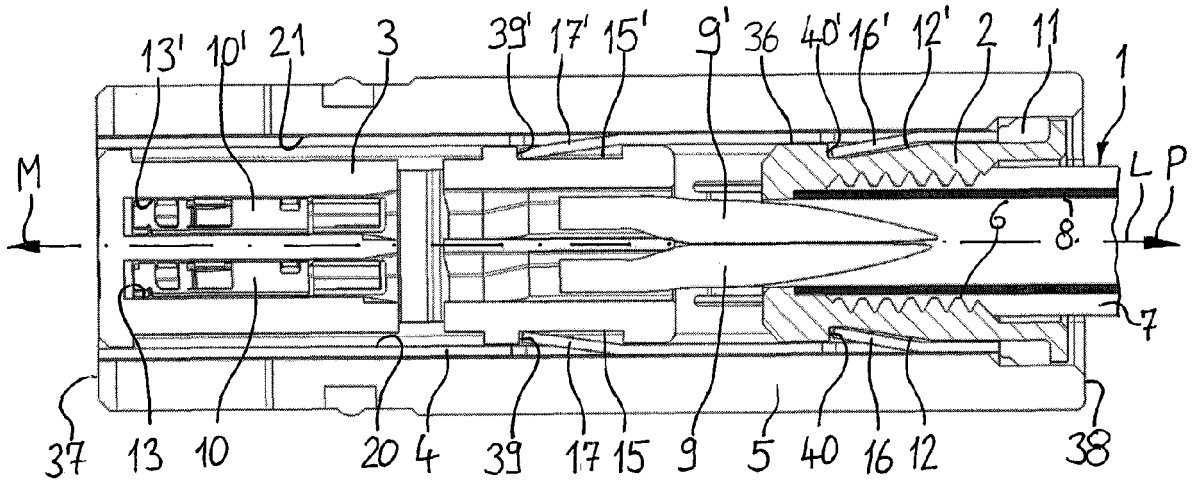
13'
10'
21
3
39'
17'
15'
9'
36
40'
16'
12'
2
11
1
M
L
P
6
8
7
37
13
10
20
4
39
17
15
9
5
40
16
12
38

FIG.4

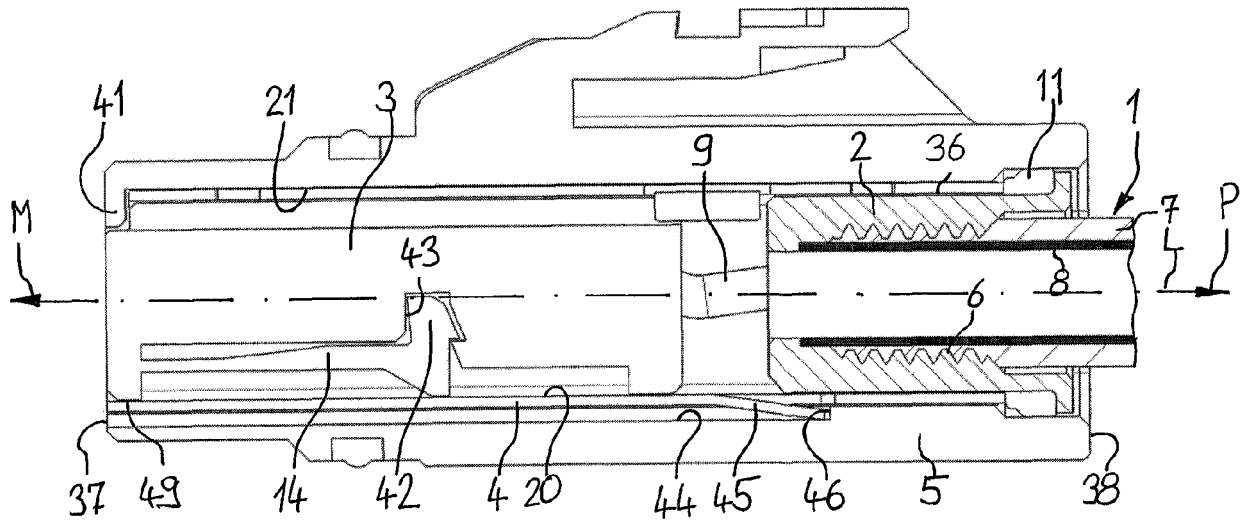
41
21
3
11
1
9
2
36
M
7
P
L
43
8
6
37
49
14
42
4
20
44
45
46
5
38

FIG.5

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# EUROPEAN SEARCH REPORT

Application Number
EP 16 20 4507

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| The Hague | 30 January 2017 | Skaloumpakas, K |

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