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(71) Applicant: **Cable Accessories (Australia) PTY., Ltd.**
Seven Hills NSW 2147 (AU)

(72) Inventor: **Ogden, Bruce James**
Menai, New South Wales 2234 (AU)

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(74) Representative: **Intès, Didier Gérard André et al**
Cabinet Beau de Loménie
158, rue de l'Université
75340 Paris Cedex 07 (FR)

(54) **Cable connection system**

(57) A cable connection system comprises a connector body (10), a fastener (20) and an installation tool (30). The connector body (10) is formed of an electrically conductive material and has a tunnel (11) for receipt of a cable to be connected and a threaded aperture (12) communicating with the tunnel (11) and opening onto an external surface (13) of the connector body (10). The fastener (20) is formed of an electrically conductive material. The fastener (20) has a hollow fastener body defined by a substantially cylindrical frangible fastener wall (23) having a slot (24) formed therein and extending from the fastener trailing end (22) towards the fastener leading face (21). The fastener wall (23) is externally threaded

for engagement with the threaded aperture (12). The installation tool (30) is adapted to rotatably drive the fastener (20) through the threaded aperture (12). The tool (30) has a drive tab (31) adapted to be slidingly received in the slot (24) and to transmit torque from the tool (30) to the fastener wall (23) at the slot (24). The tool (30) further has a detent surface (32) adapted to engage the external surface (13) of the connector body (10) adjacent the aperture (12), thereby limiting travel of the tab (31) along the slot (24), in use, such that upon application of a predetermined torque to the tool (30), the fastener wall (23) fails at the tab (31) at a predetermined location relative to the external surface (13) of the connector body (10).

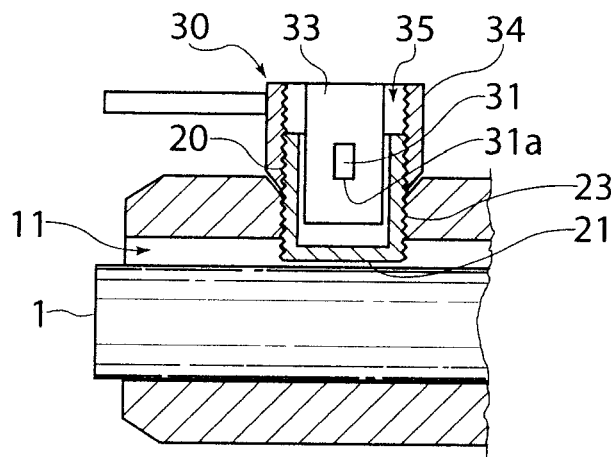


FIG. 7

Description

[0001] The present invention relates to the field of electrical cable connections.

Background of the Invention

[0002] One known form of mechanical connector for connecting electrical cables comprises an electrically conductive connector body having one or more tunnels for receipt of cables to be connected. Threaded fasteners extend through threaded apertures formed in the body and communicate with each tunnel. The threaded fasteners are threadingly advanced through the threaded apertures such that the leading face of the fastener engages the conductor of the cable located in the tunnel, thereby forming an electrical connection between the cable and the body.

[0003] In recent times, shear head fasteners have been utilised in such connection devices, configured such that the head of the fastener breaks from the body of the fastener after application of a predetermined torque which governs the compressive load applied to the cable by the leading end of the fastener. The remaining body of the fastener typically protrudes from the connector body and may present sharp edges or voids. The exposed portion of fastener typically needs to be filed back level with the connector body for aesthetical considerations and to minimise or eliminate any "corona effect" for medium voltage applications. The degree to which the fastener body protrudes from the connector body will generally vary dependent upon the size of cable being joined, given that most mechanical connectors accept a range of cable diameters.

[0004] Forms of shear head fasteners have previously been proposed that adopt multiple weak points along the fastener body, allowing for failure at various locations along the length of the fastener, however such multiple weak point fasteners do not always reliably fail at the intended location and are still limited to a discrete number of locations for failure of the fastener. Thus, there are still times where there is a need to file and dress an exposed remaining portion of a fastener in such applications. This additional step of needing to file and dress the exposed section of fastener after forming the connection is tedious and labour intensive.

Object of the Invention

[0005] It is an object of the present invention to substantially overcome or at least ameliorate the above disadvantage.

Summary of the Invention

[0006] In a first aspect, the present invention provides a cable connection system comprising:

a connector body formed of an electrically conductive material, said connector body having a tunnel for receipt of a cable to be connected and a threaded aperture communicating with said tunnel and opening onto an external surface of said connector body; a fastener formed of an electrically conductive material and extending between a fastener leading face and a fastener trailing end, said fastener having a hollow fastener body defined by a substantially cylindrical frangible fastener wall having a slot formed therein and extending from said fastener trailing end towards said fastener leading face, said fastener wall being externally threaded for engagement with said threaded aperture; and

an installation tool adapted to rotatably drive said fastener through said threaded aperture, said tool having a drive tab adapted to be slidably received in said slot and to transmit torque from said tool to said fastener wall at said slot, said tool further having a detent surface adapted to engage said external surface of said connector body adjacent said aperture, thereby limiting travel of said tab along said slot, in use, such that upon application of a predetermined torque to said tool, said fastener wall fails at said tab at a predetermined location relative to said external surface of said connector body.

[0007] Typically, said fastener comprises two said slots and said installation tool comprises two said tabs, each adapted to be received in one of said slots.

[0008] Typically said slots are substantially diametrically opposed.

[0009] In a preferred form, said tool comprises a tool body adapted to be received in a cavity defined by said fastener wall and an outer tube arranged about said tool body, said tab extending between said tool body and said outer tube and said detent surface being defined by a leading end of said outer tube.

[0010] In a preferred form, said tool further comprises a handle extending from said outer tube.

[0011] In one form, said external surface of said connector body is provided with a frustoconical region extending about said threaded aperture, said detent surface having a matching taper for engaging said frustoconical region.

[0012] In one form, said system further comprises a plug adapted to be received in said aperture following installation of said fastener so as to cover a remaining portion of said fastener.

[0013] Typically, said plug has a head configured to be substantially flush with said external surface of said connector body when received in said aperture.

[0014] In a preferred form, said fastener is formed of brass and said tool is formed of steel.

[0015] In a second aspect, the present invention provides a cable connector comprising:

a connector body formed of an electrically conduc-

tive material, said connector body having a tunnel for receipt of a cable to be connected and a threaded aperture communicating with said tunnel and opening onto an external surface of said connector body; a fastener formed of an electrically conductive material and extending between a fastener leading face and a fastener trailing end, said fastener having a hollow fastener body defined by a substantially cylindrical frangible fastener wall having a slot formed therein and extending from said fastener trailing end towards said fastener leading face, said fastener wall being externally threaded for engagement with said threaded aperture;

wherein said slot is configured to slidably receive the drive tab of an installation tool for transmitting torque from the tool to said fastener wall at said slot, said external surface of said connector body being configured, adjacent said aperture, to engage a detent surface of the installation tool, thereby limiting travel of the tab along said slot, in use, such that upon application of a predetermined torque to the tool, said fastener wall fails at the tab at a predetermined location relative to said external surface of said connector body.

[0016] Typically, said fastener comprises two said slots, each adapted to receive a tab of the installation tool.

[0017] Typically, said slots are substantially diametrically opposed.

[0018] In one form, said external surface of said connector body is provided with a frustoconical region extending about said threaded aperture, for engaging the detent surface of the installation tool having a matching taper.

Brief Description of the Drawings

[0019] A preferred embodiment of the present invention will now be described, by way of an example only, with reference to the accompanying drawings wherein:

Figure 1 is a perspective view of a connector body of a cable connection system according to a preferred embodiment;

Figure 2 is a perspective view of a fastener of the cable connection device of the preferred embodiment;

Figure 3 is a first perspective view of an installation tool of the cable connection system of the preferred embodiment;

Figure 4 is a second perspective view of the cable connection system of the preferred embodiment;

Figure 5 is a perspective view of a plug of the cable connection system of the preferred embodiment;

Figure 6 is a partially cross-sectioned view of the cable connection system of the preferred embodiment prior to driving of the fastener;

Figure 7 is a partially cross-sectioned view of the cable connection system of the preferred embodi-

ment during driving of the fastener;

Figure 8 is a partially cross-sectioned view of the cable connection system of the preferred embodiment following failure of the fastener;

Detailed Description of the Preferred Embodiments

[0020] Referring to the accompanying drawings, a cable connection system according to a preferred embodiment comprises a cable connector comprising a connector body 10, and a fastener 20, in combination with an installation tool 30 and, optionally, a plug 40.

[0021] Referring specifically to Figure 1, the connector body 10 is formed of an electrically conductive material, such as brass or aluminium, and is provided with a tunnel 11 for receipt of a cable to be connected. The connector body 10 is also provided with a threaded aperture 12 that communicates with the tunnel 11 and opens onto an external surface 13 of the connector body 10. The connector body 10 may be of any of various forms, including a cable terminal lug, link, or any of other various known forms of mechanical electrical connector. The connector body 10 may be provided with two or more tunnels 11 and associated threaded apertures 12 for separate receipt of multiple electrical cables. Alternatively, it is envisaged that the connector body 10 may be provided with other means for connecting additional cables to the connector body 10 by any of various other known means. It is also envisaged that two or more cables might be received within a single tunnel 11. It is also envisaged that the connector body 10 may be provided with two or more threaded apertures 12 communicating with the same tunnel 11, so as to provide two (or more) connection points as may be dictated by the requirements of local authorities. In the particular embodiment depicted, the external surface 13 is provided with an annular or tapered or frustoconical region 14 that extends about the threaded aperture 12, as better depicted in Figure 6.

[0022] Referring now to Figure 2, the fastener 20 is formed of an electrically conductive material, typically a relatively weak material such as brass. The fastener 20 extends between a fastener leading face 21 and a fastener trailing end 22. The fastener 20 has a hollow fastener body defined by a substantially cylindrical frangible fastener wall 23 so as to provide a rearwardly facing cavity 25 in the fastener 20. The fastener wall 23 has at least one, and here two, slots 24 formed therein and extending from the fastener trailing end 22 towards the fastener leading face 21. In the arrangement depicted, the two slots 24 are diametrically opposed. The fastener wall 23 is externally threaded for engagement with the threaded aperture 12 of the connector body 10. The thickness of the fastener wall 23 is selected so as to fail at a predetermined shear stress resulting from application of a predetermined torque to the fastener 20, as will be discussed further below. The leading face 21 of the fastener 20 is typically continuous, with the leading region of the fastener 20 between the end of the slot 24 and the leading

face 21 being solid. For applications where insulation is stripped from the conductor of a cable prior to receipt within the tunnel 11, or where the cable is in the form of an uninsulated conductor, the leading face 21 will typically be flat. In other applications, however, where it is intended to receive the insulated end of a cable in the tunnel 11, the leading face 21 may be configured with an insulation piercing feature or features, or might alternately co-operate with an insulating piercing device located between the leading face 21 and cable.

[0023] Referring now to Figures 3 and 4, the installation tool 30 is adapted to rotatably drive the fastener 20 through the threaded aperture 12 of the connector body 10. The tool specifically has a pair of drive tabs 31 that are adapted to be slidably received in the slots 24 of the fastener 20. For configurations where the fastener 20 is only provided with a single slot 24, only a single drive tab 31 would be provided. Similarly, where more than two slots 24 are provided in the fastener 20, an equal number of drive tabs 31 would be provided in locations corresponding to the slots 24. The installation tool 30 also has a detent surface 32 that is adapted to engage the external surface 13 of the connector body 10 adjacent the threaded aperture 12. In particular, the detent surface 32 has a taper matching the frustoconical region 14 that extends about the threaded aperture 12 such that the tapered detent surface 32 engages the frustoconical region 14, as will be further discussed below. The specific installation tool 30 depicted is configured in the form of a tool body 33 that is here of generally cylindrical form and sized to be received in a cavity defined by the fastener wall 23. The installation tool 30 further has an outer tube 34 concentrically arranged around the tool body 33 with the drive tabs 31 extending between, and welded to, the tool body 33 and outer tube 34. The detent surface 32 is defined by the leading end of the outer tube 34. An annular passage 35 is defined between the tool body 33 and outer tube 34. The annular passage 35 is sized to snugly receive the fastener wall 23. A handle 36 radially extends from the outer tube 34 for a user to apply torque to the installation tool 30. In the arrangement depicted, the leading end 31a of each of the drive tabs 31 is flush with the leading edge of the tapered detent surface 32 defined at the leading end of the outer tube 34.

[0024] Next referring to Figure 5, the plug 40, which may be formed of plastic or any other suitable material, has a substantially cylindrical plug body 41 that is sized to be neatly received within the cavity 25 of the fastener 20 following installation, as will be discussed below. The plug body 41 may be provided with one or more slots 42 and sized to provide an interference fit with the fastener wall 23 so as to assist in retaining the plug 40 following installation. The plug 40 further has a head 42 with a tapered side wall 43 matching the frustoconical region 14 of the external surface 13 of the connector body 10 such that, when installed, the plug head 42 is substantially flush with the external surface 13.

[0025] Use of the cable connection device will now be

described with particular reference to Figures 6 through 8. A cable 1 is inserted into the tunnel 11 of the connector 10 such that it passes beyond the threaded aperture 12. At this stage, as depicted in Figure 6, the fastener 20 will typically already be threadingly received in the threaded aperture 12 with the leading face 21 located adjacent to a wall of the tunnel 11.

[0026] Referring to Figure 7, the installation tool 30 is then applied to the fastener 20, aligning the drive tabs 31 with the slots 24. The installation tool 30 is pushed into the fastener 20 until the detent surface 32 of the installation tool 30 engages the frustoconical region 14 of the external surface 13 of the connector body 10. This fixes the longitudinal location of the drive tabs 31 relative to the external surface 13 of the connector body 10. Particularly, in the configuration depicted, the leading end 31a of the drive tabs 31 are generally aligned with the intersection between the frustoconical region 14 and the threaded aperture 12. Torque is then applied to the installation tool 30 manually via the handle 36, thereby driving the fastener 20 into the threaded aperture 12, advancing the leading face 21 into the tunnel 11 towards the cable 1. As the fastener 20 advances, the installation tool 30 remains in the same position as a result of engagement of the detent surface 32 with the frustoconical region 14. Accordingly, the slots 24 advance over the drive tabs 31.

[0027] Once the leading face 21 of the fastener 20 engages the cable 1, the torque applied to the fastener walls 23 at the edge of the slots 24 by way of the drive tabs 31 increases. The torque applied results in a maximum shear load in the fastener wall 23 where it engages the leading end 31a of each drive tab 31. Once this maximum shear load exceeds the ultimate shear stress of the material forming the fastener wall 23, the fastener wall 23 will fail at this location, which is fixed relative to the external surface of the connector body. Accordingly, the fastener 30 will reliably fail at a location generally corresponding to the intersection between the frustoconical region 14 and the threaded aperture 12, irrespective of the size of cable 1. The trailing failed region of the fastener is then allowed to fall from the connector body 10 and the plug 40 is applied to the connector body 10 to cover the remaining portion of the fastener 20 and the threaded aperture 12. The plug body 41 is received within the cavity 25 of the fastener 20 and the tapered side wall 43 of the head 42 of the plug 40 engages the frustoconical region 14 of the external surface 13 of the connector body 10. The head 42 remains flush with the external surface 13, providing a neat aesthetic appearance and inhibiting any "corona" effect.

[0028] A person of ordinary skill in the art will appreciate that the described principles of the cable connection system may be applied to any of various forms of cable connectors.

Claims

1. A cable connection system comprising:

a connector body (10) formed of an electrically conductive material, said connector body having a tunnel (11) for receipt of a cable to be connected and a threaded aperture (12) communicating with said tunnel (11) and opening onto an external surface (13) of said connector body (10); said cable connection system being **characterized** by further comprising:

a fastener (20) formed of an electrically conductive material and extending between a fastener leading face (21) and a fastener trailing end (22), said fastener (20) having a hollow fastener body defined by a substantially cylindrical frangible fastener wall (23) having a slot (24) formed therein and extending from said fastener trailing end (22) towards said fastener leading face (21), said fastener wall (23) being externally threaded for engagement with said threaded aperture (12); and
an installation tool (30) adapted to rotatably drive said fastener (20) through said threaded aperture (12), said tool (30) having a drive tab (31) adapted to be slidingly received in said slot (24) and to transmit torque from said tool (30) to said fastener wall (23) at said slot (24), said tool (30) further having a detent surface (32) adapted to engage said external surface (13) of said connector body (10) adjacent said aperture (12), thereby limiting travel of said tab (31) along said slot (24), in use, such that upon application of a predetermined torque to said tool (30), said fastener wall (23) fails at said tab (31) at a predetermined location relative to said external surface (13) of said connector body (10).

2. The system of claim 1, wherein said fastener (20) comprises two said slots (24) and said installation tool (30) comprises two said tabs (31), each adapted to be received in one of said slots (24).

3. The system of claim 2, wherein said slots (24) are substantially diametrically opposed.

4. The system of any one of claims 1 to 3, wherein said tool (30) comprises a tool body (33) adapted to be received in a cavity (25) defined by said fastener wall (23) and an outer tube (34) arranged about said tool body (33), said tab extending between said tool body (33) and said outer tube (34) and said detent surface (32) being defined by a leading end of said outer

tube (34).

5. The system of claim 4, wherein said tool further comprises a handle (36) extending from said outer tube (34).

6. The system of any one of claims 1 to 5, wherein said external surface (13) of said connector body (10) is provided with a frustoconical region (14) extending about said threaded aperture (12), said detent surface (32) having a matching taper for engaging said frustoconical region (14).

7. The system of any one of claims 1 to 6, wherein said system further comprises a plug (40) adapted to be received in said aperture (12) following installation of said fastener (20) so as to cover a remaining portion of said fastener (20).

8. The system of claim 7, wherein said plug (40) has a head (42) configured to be substantially flush with said external surface (13) of said connector body (10) when received in said aperture (12).

9. The system of any one of claims 1 to 8, wherein said fastener (20) is formed of brass and said tool (30) is formed of steel.

10. A cable connector comprising:

a connector body (10) formed of an electrically conductive material, said connector body having a tunnel (11) for receipt of a cable to be connected and a threaded aperture (12) communicating with said tunnel (11) and opening onto an external surface (13) of said connector body (10); said cable connector being **characterized by** further comprising

a fastener (20) formed of an electrically conductive material and extending between a fastener leading face (21) and a fastener trailing end (22), said fastener (20) having a hollow fastener body defined by a substantially cylindrical frangible fastener wall (23) having a slot (24) formed therein and extending from said fastener trailing end (22) towards said fastener leading face (21), said fastener wall (23) being externally threaded for engagement with said threaded aperture (12);

wherein said slot (24) is configured to slidingly receive the drive tab (31) of an installation tool (30) for transmitting torque from the tool (30) to said fastener wall (23) at said slot (24), said external surface (13) of said connector body (10) being configured, adjacent said aperture (12), to engage a detent surface (32) of the installation tool (30), thereby limiting travel of the tab (31) along said slot (24), in use, such that

upon application of a predetermined torque to the tool (30), said fastener wall (23) fails at the tab (31) at a predetermined location relative to said external surface (13) of said connector body (10).

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- 11.** The connector of claim 10, wherein said fastener (20) comprises two said slots (24), each adapted to receive a tab (31) of the installation tool (30).

- 12.** The connector of claim 11, wherein said slots (24) are substantially diametrically opposed.

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- 13.** The connector of any one of claims 10 to 12, wherein said external surface (13) of said connector body (10) is provided with a frustoconical region (14) extending about said threaded aperture (12), for engaging the detent surface (32) of the installation tool (30) having a matching taper.

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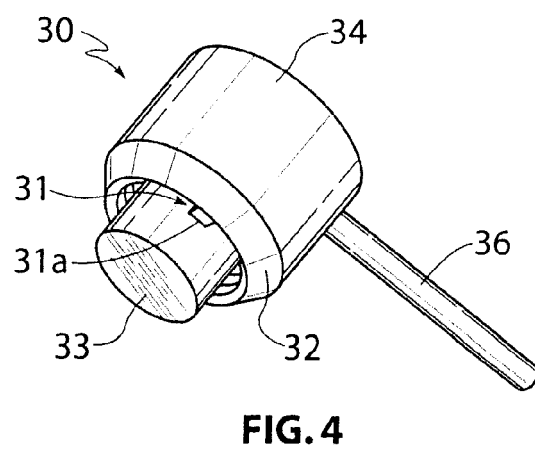
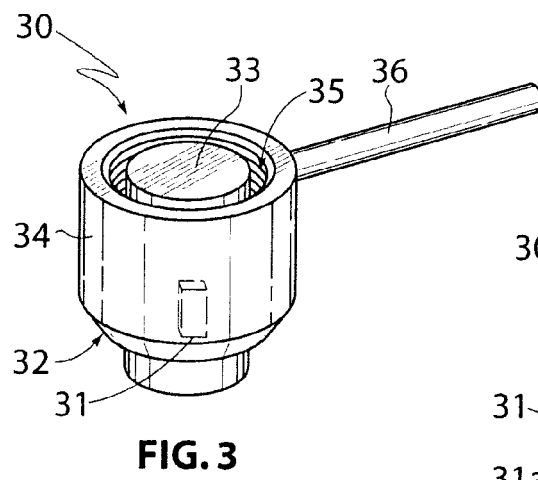
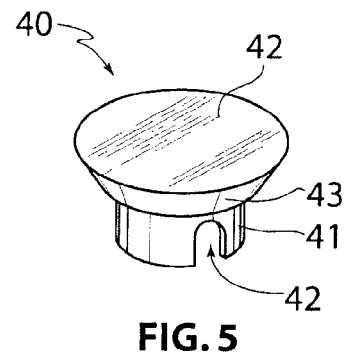
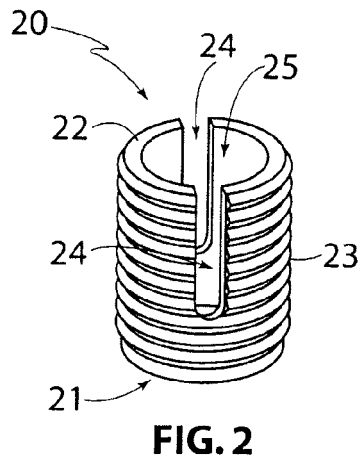
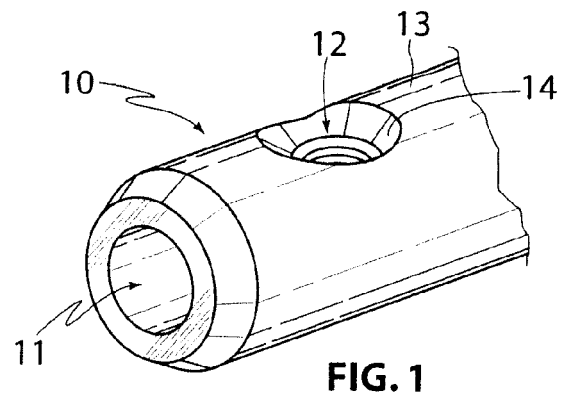
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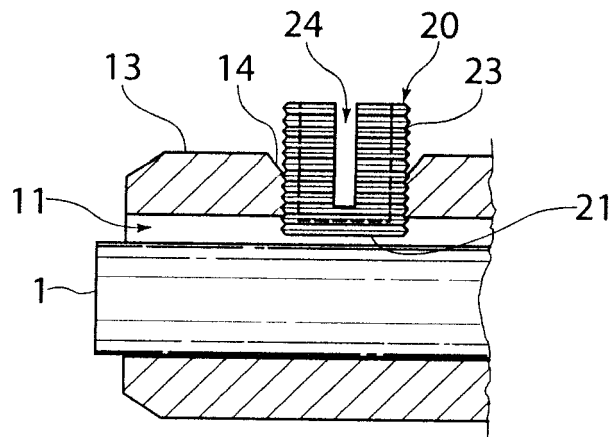


FIG. 6

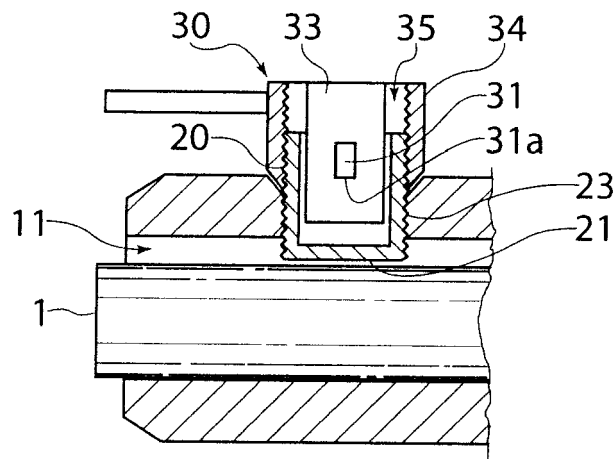


FIG. 7

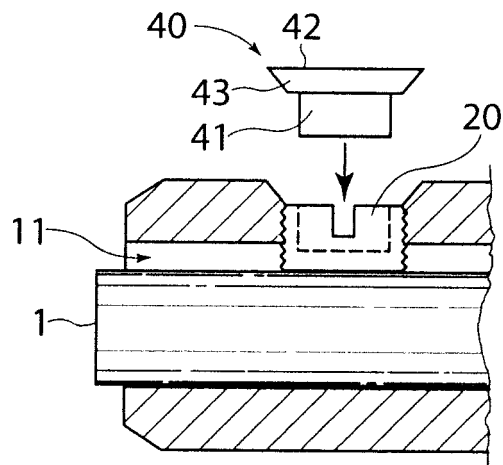


FIG. 8