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(54) **CABLE CONNECTION SYSTEM WITH CABLE FIXATION SHELL**

(57) The present invention relates to a cable connection system. The cable connection system thereby comprises a cable having an insulation sleeve, a shell encompassing the cable and having inner protrusions for fixing the shell to the insulation sleeve of the cable, and

a housing attached to the shell. The application further relates to a method of assembling such a cable connection system, the use of such a cable connection system, as well as a shell for attaching a housing to a cable.

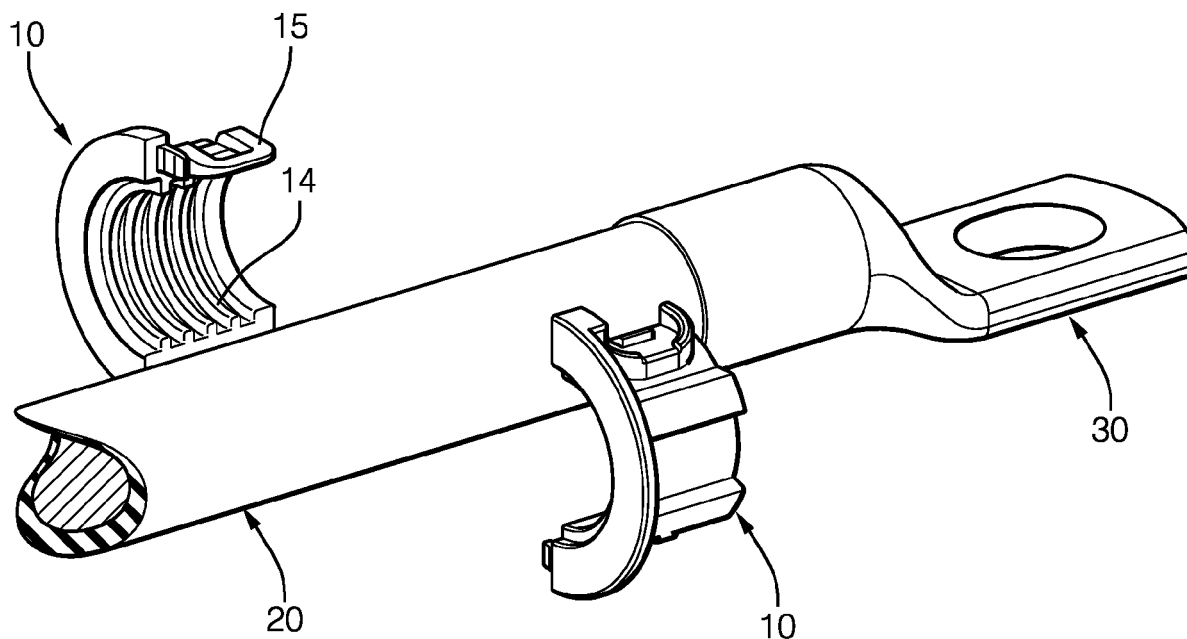


FIG. 3

Description

1. Background of the invention

[0001] The present invention relates to a cable connection system, a method of assembling such a cable connection system, the use of such a cable connection system, and a shell for attaching a housing to a cable.

2. Technical background

[0002] Cable are typically used to transfer energy and/or information, for example between different components provided in a car. In order to interconnect these components, electrical connectors are typically applied. A male-ended connector and a female-ended connector may thereby be connected, whereby the connection may be temporary or permanently. Connectors with electrical crimps are one type of such electrical connections. Crimp connectors are typically used to terminate stranded wires. Thereby, the wire may be inserted into a terminal, and the terminal may then be cold-welded onto the wire. The terminal may be connected to a respective counter-connector.

[0003] A connector may comprise a housing, which may house one or more wires, and may be adapted to be secured to a housing of the respective counter-connector, or to a supporting structure, for example. For mounting the housing to the cable, crimp metal ferrules are typically used. Thereby, a metal ferrule may be crimped on a cable braid, using a suitable crimping tool. Afterwards, for mounting the housing, the housing may be arranged over the crimped metal ferrule, or the metal ferrule with the cable may be inserted into the housing.

[0004] Figure 1 shows a cable connection system according to a prior art design. Terminals 30' are provided on cables 20', and crimp metal ferrules 10' are crimped on the cables 20'. Furthermore, a housing 40' is provided over the crimp metal ferrules 20', and a seal retainer 50' is further attached to the housing 40'. The prior art design has several drawbacks: As can be depicted from figure 1, the terminals 30' have different orientations, as the prior art design does not provide for a fixed orientation of the terminals 30'. Further, the terminals 30' (and cables 20') can be pulled out of the housing, as the crimp metal ferrules 20' are not fastened to the housing 40'.

[0005] For unshielded cables, i.e. cables without a braid, different ferrules must be used for different cable diameters. This increases the overall costs and also comes along with the necessity of advanced crimping equipment for crimping diverse ferrules. Furthermore, the terminal and cable are typically not provided in an orientation-fixed manner, so that a terminal may be provided relative to the housing in an incorrect orientation. In addition, when using the common metal ferrules, a proper fixation to the housing is typically only ensured in one direction, to withstand cable pulling. However, when cable pushing occurs, the fixation to the housing is typi-

cally of less strength.

[0006] It is thus an objective of the present invention to provide a cable connection system which at least partially overcomes the above disadvantages. It is thereby a particular object of the present invention to provide a cable connection system of reduced cost, which allows for a proper orientation of a terminal with regard to a housing upon assembly, and/or which allows for a proper cable fixation inside the housing.

[0007] These and other objects, which become apparent to the person skilled in the art upon reading the following description, are solved by the subject matter according to the independent claims.

3. Summary of the invention

[0008] The present invention relates to a cable connection system. The cable connection system may thereby comprise an electrical connector, which may be adapted to be connected to a respective counter-connector. The counter-connector may thereby also be part of the cable connection system. The cable connection system may thereby allow for a temporary or permanent electrical connection between the connectors.

[0009] The cable connection system thereby comprises a cable having an insulation sleeve. The person skilled in the art understands that the cable may be an electrical cable, having a wire insulated from its surroundings by means of the insulation sleeve. The insulation sleeve may be made of or comprise cloth, rubber, paper and/or plastic components. The person skilled in the art understands that the cable may further comprise a dielectric insulator, and/or a metallic shield, for example.

[0010] The cable connection system further comprises a closable plastic shell encompassing the cable. The shell may thus essentially be formed of a plastic material, wherein the plastic material of the shell may be harder and feature a higher tensile strength with regard to a plastic component of the insulation sleeve.

[0011] The plastic shell is thereby closable, such that it may be closed around the cable. Upon closing the shell around the cable, the shell is fixed thereon. For example, the plastic shell may be provided in form of an interrupted ring, wherein a gap in the ring can be widened to place the cable inside the plastic shell, and wherein the gap can then be closed so that the shell essentially encompasses the cable. The open ends of the ring can then be interconnected, for example by a clip system, to prevent an unwanted removal of the cable from the shell. Further for example, the plastic shell may be provided as a multi-part shell, wherein the shell may comprise two or more parts, which are interconnectable to be closed around the cable, and to thereby encompass the cable.

[0012] The shell comprises inner protrusions for fixing the shell to the insulation sleeve of the cable. Thus, the shell features protrusions on the inner side of the shell, i.e. on the side facing the cable. The protrusions may extend towards the center of the cable. The protrusions

can be of any suitable form, and can be, for example, ribs or (elongated) nubs. These inner protrusions of the shell thereby allow for fixing the shell to the insulation sleeve of the cable in a secure manner. For example, the protrusions may fix the shell to the insulation sleeve by means of traction. When the shell is closed around the cable, the inner protrusions may act on the insulation sleeve of the cable, preventing displacement of the shell.

[0013] Furthermore, the cable connection system comprises a housing attached to the shell. Thus, the housing may encompass the shell and the cable. The shell, the cable and the housing may be provided as individual parts. As the housing is attached to the shell, and the shell is fixed to the cable, the housing is essentially attached to the cable. The plastic shell thus ensures for a proper attachment of the housing to the cable. For attaching the housing to the shell, the shell may comprise attaching means, and the housing may comprise respective counter attaching means. For example, the attachment may be in a form-fitting manner, preventing a relative orientation of the housing to the shell.

[0014] As the shell is made of a plastic material, costs are reduced with regard to solutions where metal crimp ferrules are used. When closing the shell around the cable, to encompass the cable, the inner protrusions of the shell provide for a secure fixation to the cable. Hence, the shell can be fixed to the cable in an easy, safe, reliable and resistant manner. Thus, it is eventually possible to attach the housing to the cable in such an easy, safe, reliable and resistant manner.

[0015] The cable connection system is preferably an unshielded connector system. The cable may thereby be free of a cable braid. Thus, for such unshielded cables, the use of the plastic shell is of particular advantage, as the plastic shell it can be provided at different sizes at low cost. No advanced crimping equipment is required, as a plastic shell at any size can be easily provided at and fixed to the cable.

[0016] In a preferred embodiment, the shell comprises at least two shell-parts. Thus, the shell may be provided as multi-part shell. Each shell-part may thereby partially encompass the cable. The shell-parts may be interconnected in order to close the shell-parts around the cable. Preferably, the shell comprises two half-shells, which each cover one half of the cable. The shell-parts (or half-shells) may thereby be assembled together by means of a clip system. Thus, the shell-parts may be provided around the cable, and then assembled together in an easy manner. The clip system may comprise a hook and corresponding loop, wherein the hook can be inserted into the loop to interconnect the shell-parts. Thereby, the shell can be assembled around the cable, and if desired, also be un-assembled in an easy manner.

[0017] Particularly preferred, the shell-parts or half-shells are equal in their structure. Thus, preferably, two structurally identical half-shells may be provided and assembled together around the cable. This additionally reduces the manufacturing costs, as only one injection

mold is required for producing the multi-part plastic shell.

[0018] Preferably, an inner diameter of the shell is smaller than an outer diameter of the cable at an area free of the shell. Thus, at an area not covered by the shell, the cable may have an outer diameter which is larger than an outer diameter of the cable at an area covered by the shell. This allows for properly fixing the shell to the cable.

[0019] Preferably, the shell at least partially squeezes the insulation sleeve of the cable. Thus, by closing the shell around the cable, the inner protrusions of the shell may squeeze the insulation sleeve of the cable in order to fix the shell to the cable in a safe manner, preventing a displacement of the shell along the cable. The person skilled in the art understands to choose a proper material for the plastic shell, or at least for the inner protrusions, in order to allow for squeezing the insulation sleeve of the cable.

[0020] Preferably, the inner protrusions of the shell are inner ribs, which encompass the cable. The inner ribs may thereby form rings around the cable, when the shell is fixed to the cable. This structure provides for a particular strong fixation of the shell to the cable, effectively preventing a displacement of the shell along the cable.

[0021] In a preferred embodiment, the shell has outer protrusions, preferably outer ribs, which at least partially engage the housing. When provided as outer ribs, the outer protrusions may extend along a main direction of the cable, i.e. along the cable itself. This provides for a particular strong attachment of the housing to the shell in a rotation-secure manner, as the interplay of the elongated ribs with the housing prevents a rotation of the housing around the cable.

[0022] Further preferred, the housing has recesses, which at least partially receive the outer protrusions of the shell. Due to the interplay of the outer protrusions of the shell with the recesses of the housing, a proper orientation of the cable with respect to the housing can be ensured. A rotation of the cable relative to the housing is thereby efficiently prevented.

[0023] Further preferred, the recesses of the housing and the outer protrusions of the shell are aligned at least partially in a form-fitting manner. Thus, the form-fit may prevent a rotation of the housing around the shell. The recesses of the housing and the outer protrusions of the shell may thereby be keyed. This interplay of the housing and shell may prevent attachment of the housing to the shell except when the shell and the housing are provided in a desired orientation relative to each other. Thus, a misalignment of the cable with regard to the housing upon assembly is prevented. Preferably, the recesses of the housing and the outer protrusions of the shell are keyed such that the shell can be arranged inside the housing in four or less orientations, further preferred in three or less orientations, further preferred in two or less orientations and most preferred in only a single orientation. Thereby, a proper orientation of the cable with regard to the housing is ensured.

[0024] In a further preferred embodiment, the shell has a collar extending from the shell, and the housing has one or more blocking ribs, which engage the collar of the shell. The blocking ribs may thereby engage the collar of the shell along the main direction of the cable. Thus, a force applied to the cable along the main direction of the cable can be transferred via the shell to the housing, as will be appreciated by the person skilled in the art. Thereby, a proper fixation of the cable inside the housing is ensured, and the durability of the cable connection system is increased. It will be appreciated that the blocking ribs of the housing may be provided on both sides of the collar of the shell, thus efficiently transferring cable pulling and cable pushing forces.

[0025] Preferably, the system further comprises a seal retainer engaging the collar of the shell. The seal retainer may thereby be attached to the housing and/or to the cable, and the seal retainer may engage the collar of the shell on a side opposite to the side which is engaged by the blocking ribs of the housing. The seal retainer may be provided together with a seal, which is held in position by the seal retained. The seal may be provided to protect the shell. The seal retainer may engage the collar of the shell to come into blocking contact therewith if pushing and/or pulling forces are applied to the cable. Hence, the provision of the seal retainer provides for an easy assembly of the cable connection system while allowing for efficiently transferring both cable pulling and cable pushing forces to the housing.

[0026] Preferably, the system further comprises a terminal attached to the cable. The terminal may thereby be crimped to the cable, for example to an end of the wire, in proximity to the shell fixed on the cable. The person skilled in the art understands that several cables, each provided with a shell, may be provided in the housing.

[0027] The invention further relates to a method of assembling a cable connection system according to the above. The method thereby comprises the steps of: Providing the cable with the insulation sleeve; fixing the plastic shell to the insulation sleeve, for example by interconnecting two plastic half-shells around the cable by closing a clip system; and attaching the housing to the shell. Thereby, the housing can eventually be attached to the cable via the shell in an easy, low-cost, and secure manner.

[0028] Furthermore, the present invention relates to the use of a cable connection system according to the above, in order to transfer energy and/or information. The cable connection system can, for example, be provided in an automotive vehicle, for transferring energy and/or information.

[0029] Furthermore, the invention relates to a shell for attaching a housing to a cable. The shell is thereby formed of a plastic material, and is closable, as described above. In particular, the shell is closeable to essentially encompass the cable, as described above. Furthermore, the shell comprises inner protrusions for fixing the shell

to a cable, and attaching means for attaching a housing to the shell. The person skilled in the art understands that the above details with regard to the shell described in context of the cable connection system also apply here with regard to the single shell.

4. Description of preferred embodiments

[0030] In the following, the present invention will be described in more detail with reference to the figures. Therein, similar elements are provided with same reference numbers. It shows:

Figure 1: a cable connection system according to the prior art;

Figure 2: a part of a cable connection system according to an embodiment of the invention;

Figures 3 and 4: parts of a cable connection system according to an embodiment of the invention;

Figure 5: a cable connection system according to an embodiment of the invention;

Figure 6: a cross-sectional view of parts of a cable connection system according to an embodiment of the invention;

Figure 7: a cross-sectional view of a cable connection system according to an embodiment of the invention; and

Figure 8: a cross-sectional view of a cable connection system according to an embodiment of the invention.

[0031] Figure 2 presents a part of a shell of a cable connection system according to an embodiment of the present invention. In particular, a half-shell 10 is shown, which is of a plastic material, and is preferably free of metals. The half-shell 10 may thereby be produced by injection molding, as will be appreciated by the person skilled in the art. The half-shell 10 comprises outer ribs 11, which are provided in an elongated form and parallel to a main central axis of the half-shell 10. Furthermore, the half-shell 10 features a collar 12, which extends from one end of the shell, away from the main central axis of the half-shell 10. Furthermore, the half-shell 10 comprises a hook 13, which is part of a clip system for interconnecting several such half-shells 10, as will be further described below.

[0032] Figure 3 illustrates two half-shells 10, which can be interconnected to form a shell of a cable connection system according to an embodiment of the present invention. Each one of the half-shells 10 may correspond to the half-shell 10 presented in figure 2. Further, the half-shells 10 in figure 3 are identical to each other. Each half-shell 10 is provided with a lash 15, which is located at a side opposite to the hook 13 described with regard to figure 2. The two half-shells 10 can be arranged around a cable 20, and can then be interconnected and closed by means of the lash 15 and hook 13. By interconnecting the half-shells 10, the shell formed of the half-shells 10

can be closed around the cable 20. The design of identical half-shells 10 provided with the clip system allows for an easy assembly of the shell to the cable 20. As only one type of half-shells 10 is required, production and storage costs can be reduced.

[0033] The half-shells 10 further feature inner ribs 14 facing the cable 20. When the half-shells 10 are interconnected, the inner ribs 14 form rings around the cable 20. The provision of the inner ribs 14 allows for fixing the interconnected half-shells 10 to the cable 20, as the inner ribs 14 partially squeeze the cable 20 when the half-shells 10 are closed around the cable 20.

[0034] As can further be seen in figure 3, a terminal 30 is provided at one end of the cable 20, adapted to be connected to a respective counter-terminal.

[0035] Figure 4 illustrates the two half-shells 10 of figure 3 in the interconnected or closed state. In this state, the half-shells 10 of the closed shell encompass the cable 20. The shell thereby encompasses the cable 20, and is fixed to the cable 20 by means of the inner ribs 14. For fixing the shell to the cable 20, the inner ribs 14 partially squeeze an insulation sleeve of the cable 20, as will be described in more detail below.

[0036] Figure 5 illustrates a housing 40 attached to the shell described with reference to figure 4. The housing 40 encompasses the shell 10, and thus also the cable 20. The housing 40 comprises a housing collar 42, which extends from the housing 40. Furthermore, locking means in form of a sliding ramp or hook 41 for locking a seal retainer to the housing 40 are provided.

[0037] Figure 6 presents a cross-sectional view along the length of the cable with interconnected half-shells 10 attached thereto, according to the embodiment of figure 4. The cable 20 comprises an electrical cable 21, and an insulation sleeve 22 which surrounds the electrical cable 21. The rings formed of the inner ribs 14 of the half-shells 10 extending around the cable 20 have an inner diameter which is smaller than the outer diameter of the cable 20 at a location free of the shell. Thus, as can be seen in figure 6, the ribs 14 of the half-shells 10 squeeze the insulation sleeve 21 at the squeezing portions 23. As the material of the plastic half-shells 10 is harder and has a higher tensile strength than the material of the insulation sleeve 22, the insulation sleeve 22 is partially compressed, and thus the shell eventually fixed to the cable 20 by traction. The shell is thereby protected against an undesired displacement along the length the cable 20. Cable movement relative to the shell, and thus relative to a housing 40 attached to the shell, is thereby blocked.

[0038] Figure 7 presents a cross-sectional view through a cable connection system, according to the embodiment of figure 5. The electrical cable 21 is encompassed by the insulation sleeve 22, which is in turn encompassed by the shell comprising the two interconnected half-shells 10, which shell is in turn encompassed by the housing 40. As described with reference to figure 6, the shell is fixed to the cable 20 by means of the inner ribs 14 of the half-shells 10. The half-shells 10 are inter-

connected via the lashes 15 and hooks 13, which were described above with reference to figures 2 and 3.

[0039] As can further be seen in figure 7, the shell comprises outer ribs 11, as also described with reference to figure 2. The housing 40 in turn comprises recesses 43, which receive the outer ribs 11 of the half-shells 10. The outer ribs 11 of the half-shells 10 and the recesses 43 of the housing 40 are thereby aligned in a form-fitting manner, preventing an undesired rotation of the housing 40 relative to the shell. The recesses 43 of the housing 40 and the outer ribs 11 of the half-shells 10 are keyed. Thus, according to the embodiment illustrated in figure 7, the housing 40 can be provided on the shell only in one particular orientation, due to the keying. Other orientations are prevented, due to the outer ribs 11 of the half-shells 10 coming into blocking contact with parts of the housing 40 upon rotation of the housing 40 relative to the shell, or upon inserting the shell in an incorrect orientation into the housing 40. Thus, a misalignment of the cable 20 and thus of the terminal 30 relative to the housing 40 is efficiently prevented.

[0040] Figure 8 illustrates a cross-sectional view along a cable connection system according to a further embodiment of the present invention, which to a large extent corresponds to the cable connection system described with reference to figures 5 and 7. Again, a shell 10 is provided on a cable 20, and fixed thereon by the inner ribs partially squeezing the insulation sleeve 21 of the cable 20, as also described above with regard to figure 6. Furthermore, a housing 40 is attached to the shell. The housing 40 comprises a blocking rib 44, which engages the collar 12 of the half-shells 10. When pulling the cable 20 to the right, according to figure 8, the collar 12 of the half-shells 10 comes into blocking contact with the blocking rib 44 of the housing 40. As the housing 40 may be secured to a further device, the pulling forces can be efficiently transferred to the housing 40 and the further device. Hence, an undesired relative movement of the cable 20 can be prevented.

[0041] As can further be seen from figure 8, a seal 60 is provided, which is secured by a seal retainer 50 to the housing 40. The seal retainer 50 is locked to the housing 40 by engaging the hook 41 provided on the housing 40. The seal retainer 50 comprises a tip 51, which engages in the collar 12 of the half-shells 10. The tip 51 of the seal retainer 50 thereby engages the collar 12 on a side opposed to the side engaged by the blocking rib 44 of the housing 40. Thus, when pushing the cable 20 to the left, according to figure 8, the collar 12 of the half-shells 10 comes into blocking contact with the tip 51 of the seal retainer 50. As the seal retainer 50 is connected to the housing 40 via the hook 41 of the housing 40, and as the housing 40 may be secured to a further device, such pushing forces can be efficiently transferred to the housing 40 and the further device. Hence, pulling and pushing forces acting on the cable 20 are efficiently transferred to the housing 40. Hence, the shell is blocked by the blocking rib 44 of the housing 40 on the one side, and by

the tip 51 of the seal retainer 50 on the other side. Hence, the terminal 30 is eventually fixed in a proper position.

[0042] The low-cost shell thus provides for properly fixing the cable 20 in the housing 40, thereby ensuring correct retention forces. Further, an undesired cable rotation inside the housing 40 is blocked, thereby ensuring a correct orientation of the terminal 30.

Reference signs

[0043]

10	half-shell
11	outer rib of half-shell
12	collar of half-shell
13	hook of half-shell
14	inner rib of half-shell
15	lash of half-shell
20	cable
21	electrical cable
22	insulation sleeve
23	squeezed portion of cable
30	terminal
40	housing
41	hook of housing
42	collar of housing
43	recess of housing
44	blocking rib of housing
50	seal retainer
51	tip of seal retainer
60	seal

Claims

1. Cable connection system, comprising:

a cable (20) having an insulation sleeve (21);
a closable plastic shell encompassing the cable (20) and having inner protrusions (14) for fixing the shell to the insulation sleeve (21) of the cable (20);
a housing (40) attached to the shell.

2. The system of claim 1, wherein the system is an unshielded connector system and the cable (20) is free of a cable braid.

3. The system of claim 1 or 2, wherein the shell comprises two shell-parts (10), which are preferably two half-shells (10) equal in their structure, wherein the shell-parts (10) are assembled together by means of a clip system.

4. The system of any of the preceding claims, wherein an inner diameter of the shell is smaller than an outer diameter of the cable (20) at an area free of the shell.

5. The system of any of the preceding claims, wherein the shell at least partially squeezes the insulation sleeve (21) of the cable (20).

6. The system of any of the preceding claims, wherein the inner protrusions (14) of the shell are inner ribs (14) encompassing the cable (20).

7. The system of any of the preceding claims, wherein the shell has outer protrusions (11), preferably outer ribs (11), which at least partially engage the housing (40).

8. The system of claim 7, wherein the housing (40) has recesses (43), which at least partially receive the outer protrusions (11) of the shell.

9. The system of claim 8, wherein the recesses (43) of the housing (40) and the outer protrusions (11) of the shell are aligned at least partially in a form-fitting manner.

10. The system of any of the preceding claims, wherein the shell has a collar (12) extending from the shell, and wherein the housing (40) has one or more blocking ribs (44), engaging the collar (12) of the shell.

11. The system of claim 10, further comprising a seal retainer (50), engaging the collar (12) of the shell.

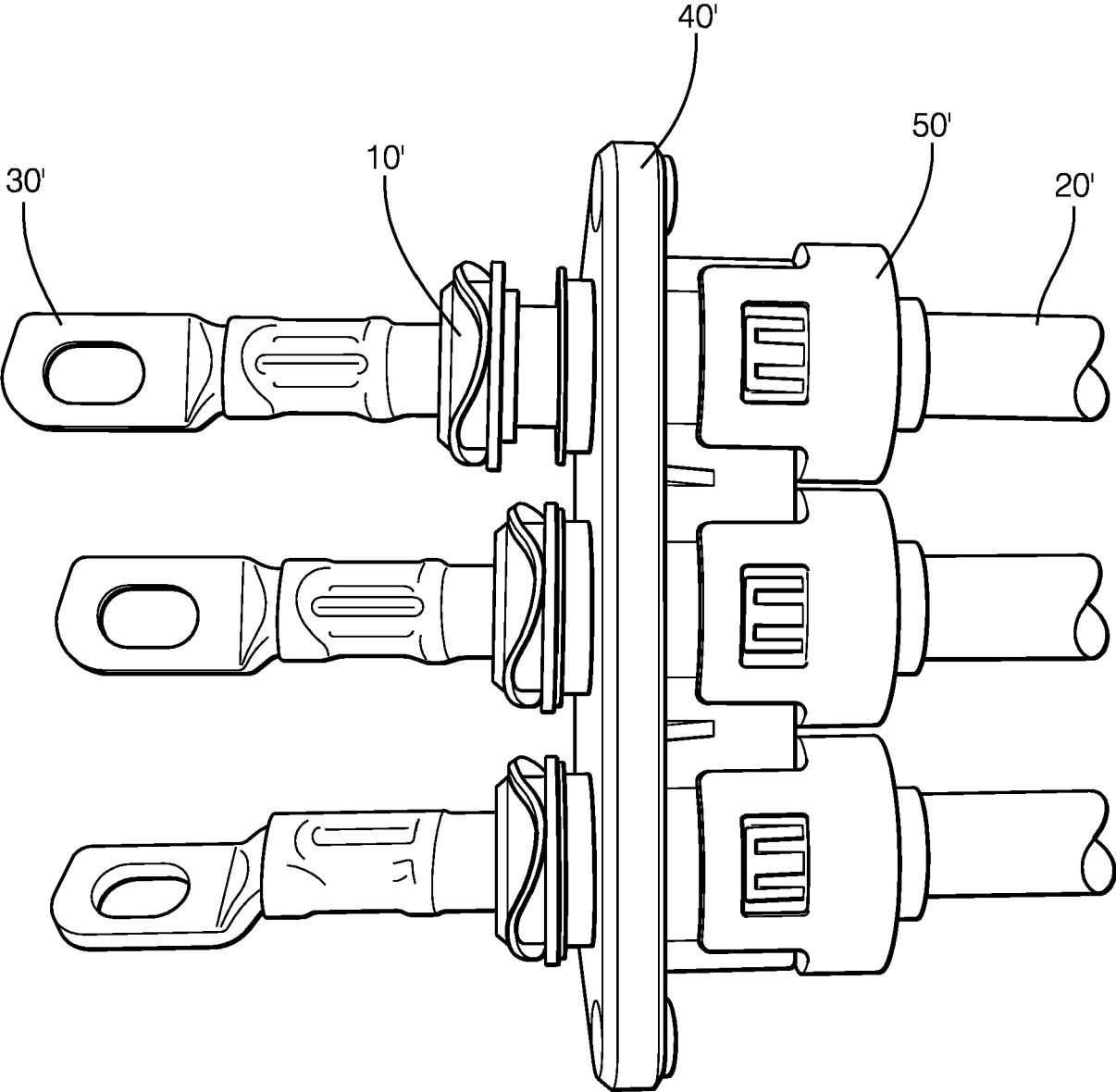
12. The system of any of the preceding claims, further comprising a terminal (30) attached to the cable (20).

13. Method of assembling a cable connection system according to any of the preceding claims, the method comprising:

Providing the cable (20) with the insulation sleeve (21);
fixing the plastic shell to the insulation sleeve (21);
attaching the housing (40) to the shell.

14. Use of the cable connection system according to any of the claims 1 to 12 to transfer energy and/or information.

15. Shell for attaching a housing (40) to a cable (20), wherein the shell is closable and formed of a plastic material, the shell comprising inner protrusions (14) for fixing the shell to the cable (20), and attaching means for attaching the housing (40) to the shell.



PRIOR ART
FIG. 1

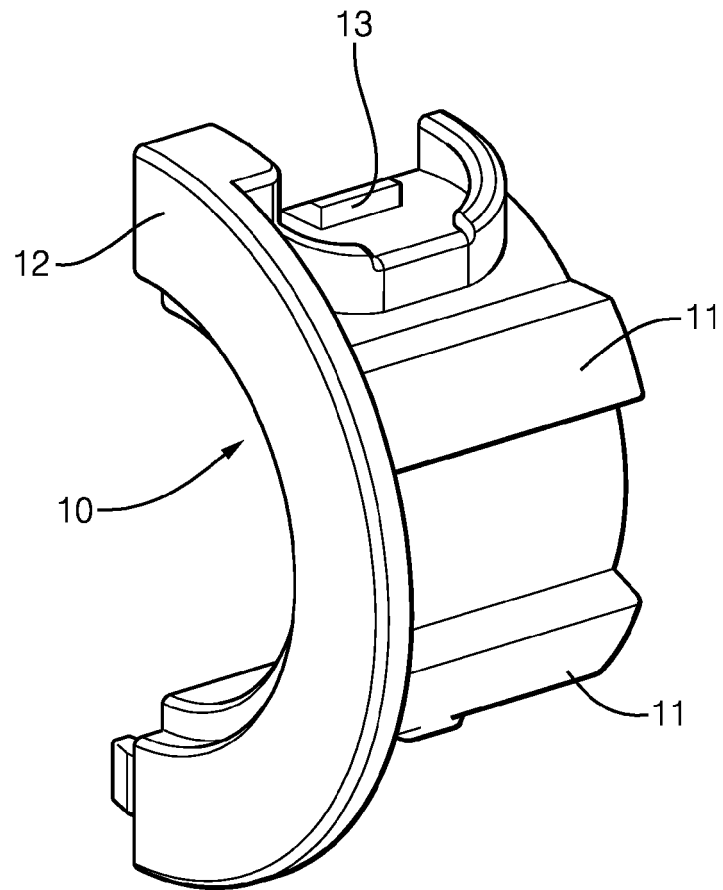


FIG. 2

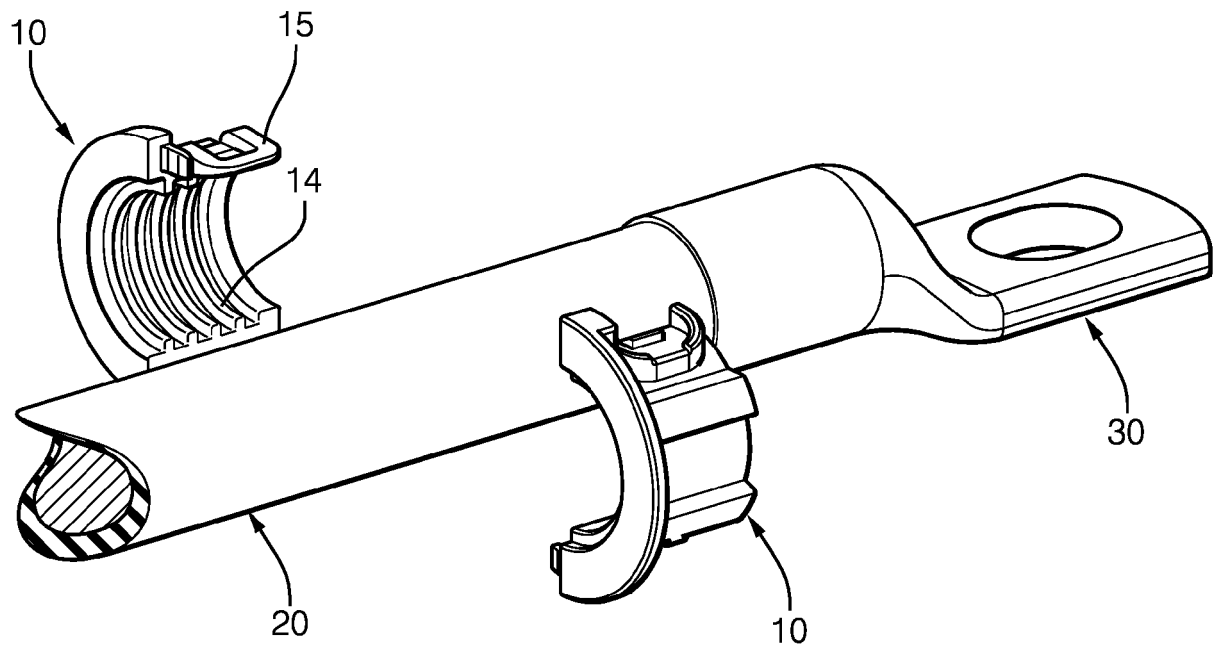


FIG. 3

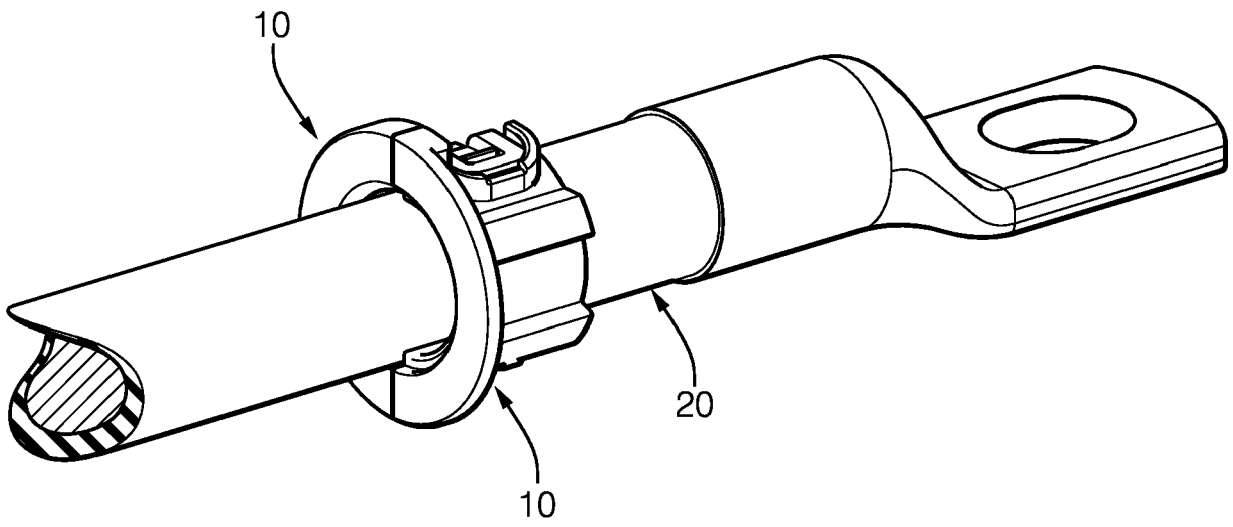


FIG. 4

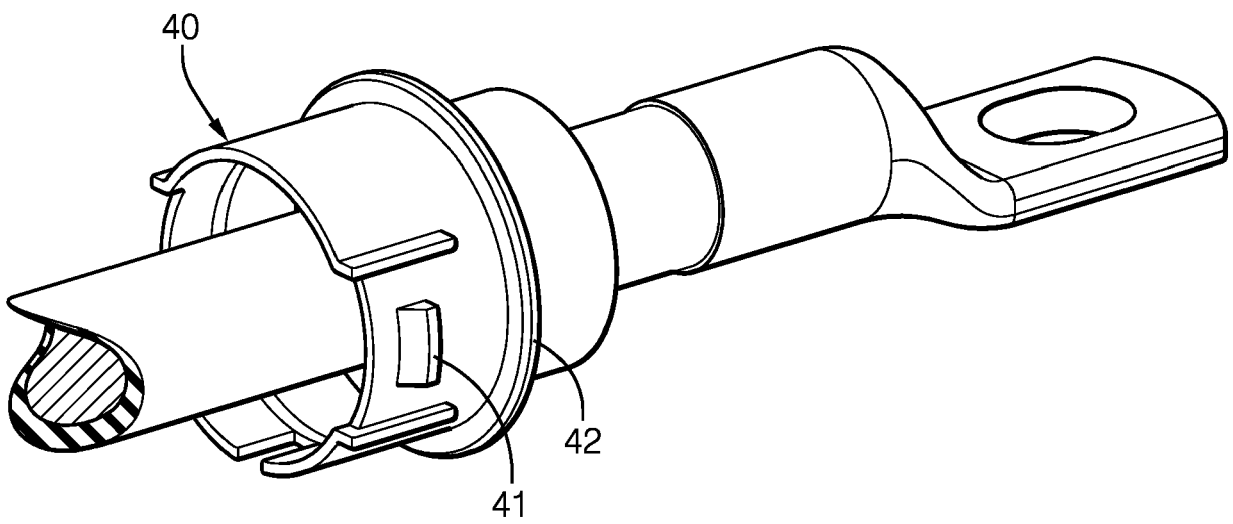


FIG. 5

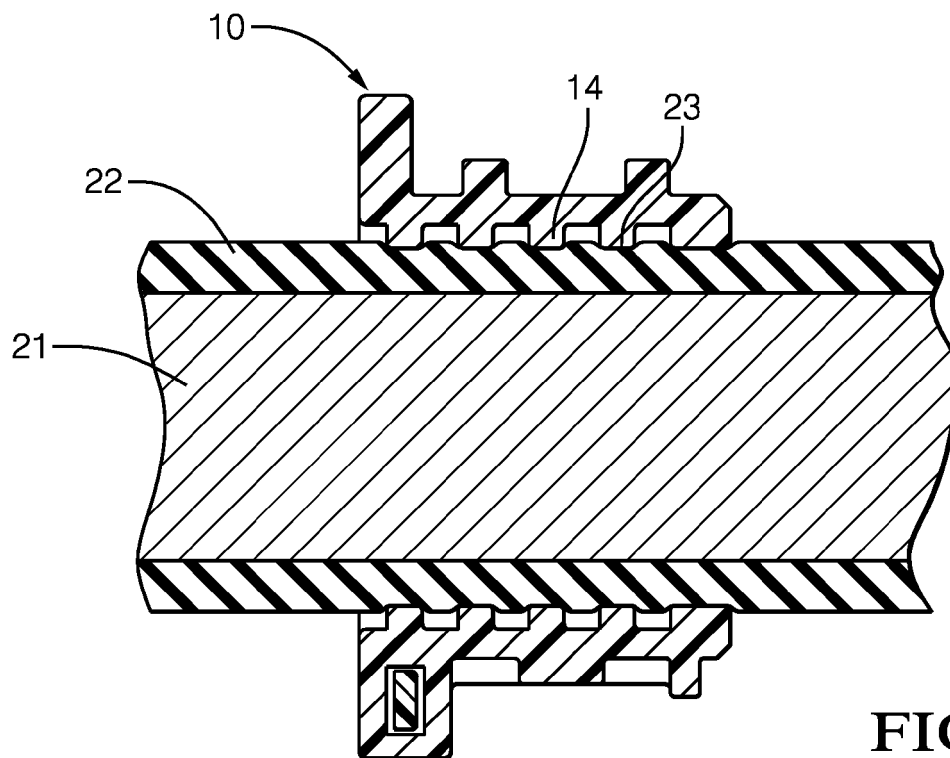


FIG. 6

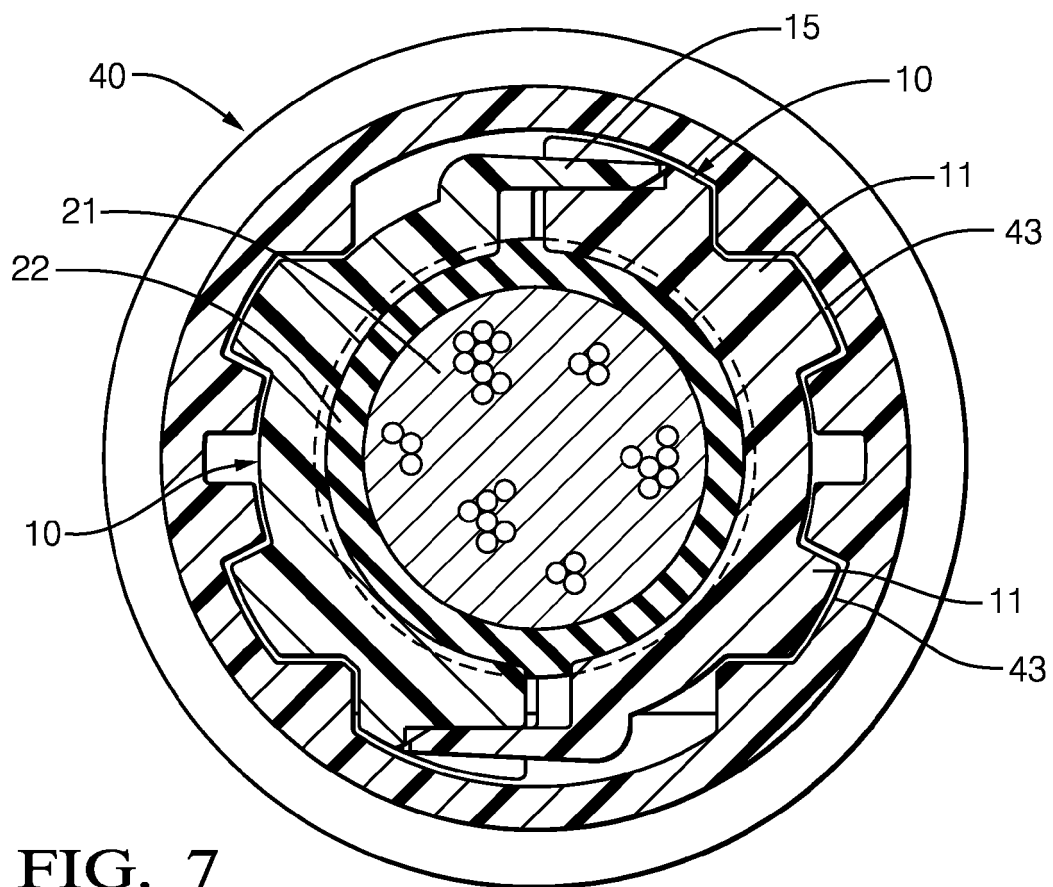


FIG. 7

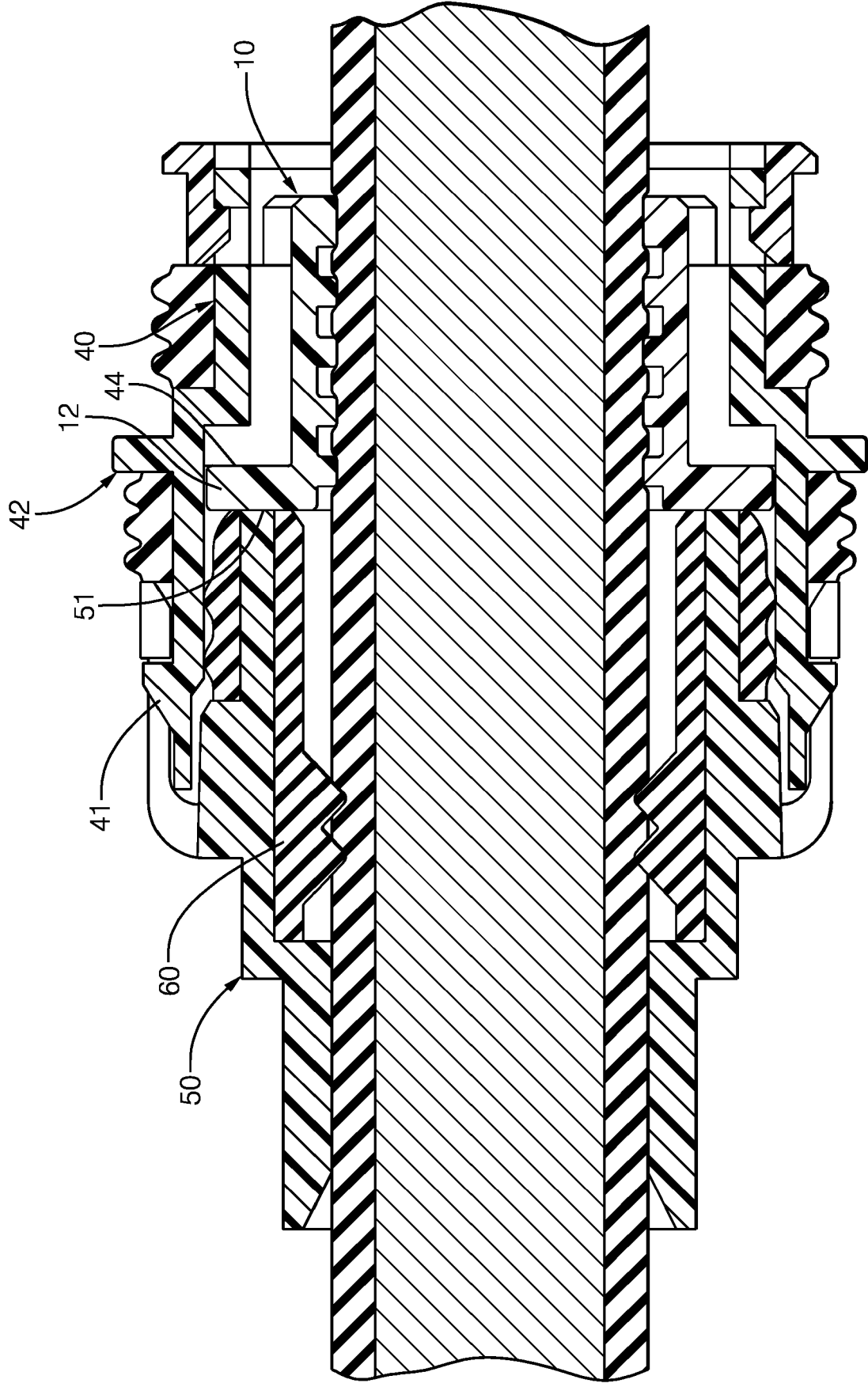


FIG. 8



EUROPEAN SEARCH REPORT

 Application Number
 EP 18 17 2626

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	* figures 1,2,5 * * page 4, line 7 - page 4, line 18 *	11	ADD. H01R13/506
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A		1-10, 12-15	
			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 9 October 2018	Examiner Skaloumpakas, K
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EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 17 2626

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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