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(54) **CLAMPING ELEMENT**

(57) The invention refers to a pre-mounted clamping element that is mounted inside of a mouth or hole placed crosswise in a connector, and especially designed to clamping elements onto one or more electrical wires that are entered lengthwise into the connector.

The clamping element of the invention is configured so that once it is mounted in the connector it makes an optimal electrical contact with the electrical wire and also an optimal waterproof closing of the clamping element in the connector.

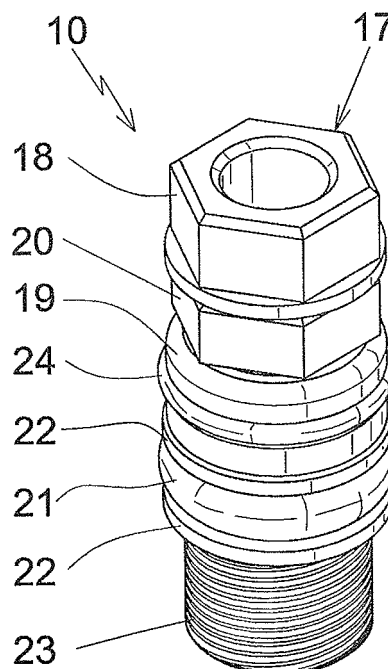


Fig. 6

Description

Field of the invention:

[0001] More specifically, the invention refers to a pre-mounted clamping elements of the kind that are placed inside a mouth or hole placed crosswise in a connector, said connector consisting of a connecting element especially designed for clamping element one or more electrical wires that are entered lengthwise into it by way of one or more tightening elements.

State of the art:

[0002] Connectors that allow splices, shunts, or terminations, preferably of metal, with a body that is tubular, generally cylindrical, are well-known. Usually they have one or more holes or bores that cross through the wall of said body in order to hold one or more electrical wires of the same or different diameters running lengthwise inside the connector still in the interior of the connector by way of their respective tightening elements.

[0003] On the market there are a wide variety of mechanical screwing connectors that have a wide variety of types of screws to clamping element onto the wiring, entered into one or both ends of the electrical connector, among these, for example, Spanish patents 200502821, 200600568, 200600954, and 200602698, held by the same owner.

[0004] In general, the clamping elements are intended to maintain a certain torque on the exterior part of the electrical wire in order to make an electrical connection with said wire. In order to achieve the function of electrically connecting the clamping elements with the wire, the clamping elements are designed so that when the foreseen torque is surpassed, they end up breaking, as there is a choking area, which is preferably ring-shaped, inside them that determines the torque force to be applied to the wire in the interior of the connector, where part of the element breaks.

[0005] There are also some clamping elements configured with the additional function of ensuring a degree of waterproofing that is suitable for keeping fluids, such as water, from getting into the connector. This double function of the clamping elements currently presents technical difficulties, as known clamping elements are made up of a waterproof tightening screw held into the element like an O-ring, so that when the tightening screw is screwed into the mouth of a connector to make an electrical contact with the electrical wire, the waterproofing rubs against the inner walls of the mouth and this rubbing force means that when one tries to maximise the waterproofing, the axial pressure on the electrical wiring decreases, so that the electrical contact with said wire is made under conditions of less-than-normal torque transmission.

[0006] Therefore, the aforementioned double function of the clamping elements can't be achieved under optimal

conditions with the clamping elements known to date.

Aim of the invention:

[0007] The main aim of the present invention is to design a clamping element adapted to be mounted inside a mouth or hole placed crosswise in a connector, within which one or more electrical wires are placed, which on one hand makes optimal electrical contact between the clamping element and the electrical wire, and on the other hand, allows optimal waterproof tightening of the clamping element in the connector.

[0008] Another aim of the present invention is to design a clamping element that can easily be mass produced with low manufacturing costs, so that later the system can be pre-mounted in a connector.

[0009] Another aim of the present invention is to design a pre-mounted clamping element that can easily be assembled by a factory worker inside the mouth of a connector.

Description of the invention:

[0010] The present invention consists of a pre-mounted clamping element of the kind placed inside of a mouth placed crosswise in a connector, inside of which one or more electrical wire(s) are placed, this mouth having a threaded part at the bottom for the threading to hold the clamping elements still.

[0011] The pre-mounted clamping element of the invention is made up of a set that comprises:

A means of tightening that is set up in such a way that when you act on it, it exercises a torque that is transmitted axially, and when this set comes up against the electrical wiring at its lower end, the torque applied, "P1," achieves an optimal electrical contact with said electrical wire; and

Other tightening means that are arranged in such a way that, once this optimal electrical contact is made, when they are acted upon, a torque is transmitted in a radial direction against the lower walls of the mouth, and said "P2" torque is suitable for achieving optimal waterproofing of the clamping elements in said mouth of the connector.

[0012] This particular configuration of the tightening element means that once it is pre-mounted, it can be placed in the mouth of a connector by way of two simple, consecutive actions, so that two different functions are fulfilled at the same time: on one hand there is an optimal electrical contact with the electrical wire, and on the other hand, there is optimal waterproof closing of the clamping elements in the mouth.

[0013] Preferably the transmission of the radial torque of the set is made by way of a waterproof joint.

[0014] According to a preferred practical version of the present invention, the pre-mounted tightening set com-

prises:

- a clamping element made up of a tightening screw with a head adapted to be screwed into the interior of the mouth until its lower end goes all the way against the electrical wire that runs through the interior of the connector and manages to exercise a certain axial torque, "P1," to make optimal electrical contact with the wire, and said tightening screw has a tightening nut; and
- other means of tightening made up of a tightening nut with a head adapted to be screwed onto a waterproof joint until this waterproof joint generates a radial pressure, "p2" that is suitable for making a waterproof closure against the inside walls of the upper part of the mouth.

[0015] The axial pressure, "p1" of the tightening screw against the electrical wire is achieved by applying a "P1" torque on the head of the tightening screw in a first screwing operation.

[0016] The "p2" radial pressure of the waterproofing joint against the inner walls of the mouth is achieved by applying a "P2" torque on the head of the tightening nut in a second screwing operation that is transmitted to the waterproofing joint, the lower part of which rests on the connector, so that said torque contracts the waterproof joint axially and thus generates a radial force "P2" against the inner walls of the mouth, making a waterproof seal.

[0017] The means of holding the tightening nut on the tightening screw can be a threaded part foreseen on the exterior surface of the tightening screw and the corresponding coaxial threaded part of the interior surface of the nut.

[0018] Both the tightening screw and the tightening nut include a means of weakening between their respective bodies and heads, so that when the aforementioned heads are screwed all the way in, they break by way of said weakening mechanism.

[0019] Optionally, the pre-mounted set can include two tightening washers placed above and below the waterproofing joint, made to press on the joint above and below said joint, respectively.

[0020] The lower part of the pre-mounted set may optionally include a toe attached to the tightening screw and adapted to make an electrical contact with the wire, this piece being adapted to the material and/or type of each conductor so as to make an optimal electrical contact of metal against metal, due to the great variety of materials (for example, aluminium or copper) and types of wires (solid, flexible, etc.).

[0021] The pre-mounted set may optionally include an O-ring in the tightening nut, in order to improve the waterproofing of the tightening set.

[0022] Other details and features will be shown in the course of the description provided, referring to the drawings that accompany this report, which show the invention, although it is not limited to them, keeping in mind

that the versions of the invention can be made in any material, in reference to the composition, as well as the non-critical outside configuration.

5 **Description of the figures:**

[0023] Below is a list of the different parts of the invention which are found on the diagrams and which can be located using the following numbers; (10, 10', 10'') clamping element, (11) connector, (12) mouth of the connector, (13) electrical wire, (14) known clamping element, (15) threaded part of the mouth, (16) inner walls of the mouth, (17) tightening screw, (18) head of the tightening screw, (19) tightening nut, (20) head of the tightening nut, (21) waterproofing joint, (22) tightening washers, (23) toe, (24) O-ring, (25) upper, outer threaded part of the tightening screw, (26) inner threaded part of the nut, (27) lower, outer threaded part of the tightening screw, (28) inner threaded part of the toe, (29) outer threaded part of the toe, (30) through-hole of the tightening nut, (31) through-hole of the washer, (32) through-hole of the waterproofing joint, (33) blind hole of the toe, (35) lower base of the toe, (36) butting surface of the mouth, (37) lower base of the lower washer, (38) O-ring, (39) inner walls of the mouth, (39) narrowing in the tightening screw, (40) narrowing in the tightening nut.

[0024] In the figures:

Figure no. 1 shows a frontal view of a conventional clamping element mounted crosswise in a connector, specifically screwed into one of its mouths to make an electrical contact with an electrical wire.

Figure no. 2 shows a side view of the tightening element (10) of the invention.

Figure no. 3 shows a sectioned side view of A-A' of the clamping elements (10) of the invention.

Figure no. 4 shows a view of the clamping element (10) of the invention as seen from above.

Figure no. 5 shows a view of the tightening element (10) of the invention from below.

Figure no. 6 shows a frontal view of the clamping element (10) of the invention.

Figure no. 7 shows the same side view of the clamping element (10) of the invention as figure no. 2, but with the parts separated.

Figure no. 8 shows the same sectioned side view of the clamping element (10) of the invention as figure no. 3, but with the parts separated.

Figure no. 9 shows the same frontal view of the clamping element (10) of the invention as figure no. 6, but with the parts separated.

Figure no. 10 shows a side view of the two clamping elements (10) which are starting to be mounted crosswise in the respective mouths (12) of a connector (11).

Figure no. 11 shows a sectioned frontal view of C-C' of the two clamping elements (10) of figure no. 10.

Figure no. 12 shows a frontal view of the two clamp-

ing elements (10) of figure no. 10.

Figures no. 13 to 15 show sectioned raised frontal views of the various consecutive positions of the assembly of a clamping element (10, 10', 10'') in the mouth (12) of a connector (11).

Description of a preferred form of the invention:

[0025] Figure no. 1 shows a known clamping element with an O-ring (38) mounted on the outer surface, so that when the clamping element is screwed into the mouth (12) of a connector (11) to make an electrical contact with one or more electrical wires (13), this O-ring (38) rubs against the inner walls (16) of said mouth (12), thus making the electrical contact with said wire (13) faulty.

[0026] In one of the preferred versions of the invention, and as can be seen in the attached figures no. 2 to 9, the clamping element (10) is made up of a pre-mounted set comprising a tightening screw (17) mounted inside a tightening nut (19), a waterproofing joint (21) mounted in the lower part of the tightening nut (19), and two washers (22) mounted above and below the aforementioned waterproofing joint (21).

[0027] The tightening screw (17) has a head (18) for the screwing of the same inside the mouth by the threaded part (15) until its lower base (35) butts up against an electrical wire (13), having a narrowing (39) between the body and the head (18) as a weakening surface (see figures no. 3 and 8), so that when this head (18) is screwed all the way in, it breaks at this point, as can be seen in figure no. 14. On the other hand, the tightening screw (17) has a screwing part (25) on the outer surface of its body intended to be screwed into the corresponding threaded part (26) of the inside surface of the tightening nut (19), thus joining the tightening nut (19) to the tightening screw (17).

[0028] On its part, the tightening nut (19) has a head (20) to screw it against the waterproofing joint (21) placed under the lower base of the nut (19). The waterproofing joint (21), along with both washers (22), mounted above and underneath said waterproofing joint (21), all have an upper diameter that is greater than the diameter of the lower part of the tightening screw (17), so that in the second operation of tightening of the head (20) of the tightening nut (19), the lower washer (20) has its lower base (37) resting on a butting surface (36) of the mouth (12) of the connector (11). Therefore, the torque "P2" applied to the head (20) deforms the waterproofing joint (21) (making its height decrease from "e1" to "e2") when it butts against said surface (36), and it necessarily contracts axially and consequently generates a radial force "p2" against the inner walls of the mouth, thus achieving a waterproof seal against the outside surface of the body of the tightening screw (17), see figure no. 15.

[0029] It can optionally have a toe (23) attached below to the tightening screw (17) by way of a threaded portion (27) on the lower part of the tightening screw (17) that screws into a corresponding interior threaded portion of

the toe (23), the toe (23) having the function of making an electrical contact with the wire (13), see figures no. 2 to 9. The toe (23) has outside threading (29) for screwing in (15).

[0030] There can also be an O-ring (24) in the tightening nut (19) to improve the waterproofing of the clamping element (10), see figures no. 2 to 9.

[0031] In order to allow the body of the tightening screw (17) to pass through, the tightening nut (19), the waterproofing joint (21), the washers (22) and the toe (23) have their respective through-holes (30, 31, 32, 33) in an axial direction, (30, 31, 32), except hole (33), which is blind, see figure no. 9.

[0032] Figures no. 10 to 12 show a possible version of a connector (11) with two mouths (12) in which the respective clamping elements (10) are starting to be mounted.

[0033] Figure no. 13 shows the position of the introduction of the clamping element (10) into a mouth (12) of a connector (11) in the first assembly operation, figure no. 14 shows the maximum screwing-in position of the clamping element (10) inside the mouth (12) of the connector (11) at the end of the first assembly operation in which an optimal axial force is applied downwards, "p1" causing the breaking of the head (18) of the tightening screw, and, lastly, figure no. 15 shows the maximum screwing-in position of the tightening nut (19) on the waterproofing joint (21) in the second assembly operation, causing the breaking of the head (20) of the tightening nut (19) and the generation of an optimal radial force, "p2" in the two directions that makes the closure totally waterproof.

[0034] Having described the present invention in correspondence to the attached figures, it is easy to understand that any changes can be made in the details that are considered convenient, as long as they don't change the essence of the invention, which is summarised in the following claims.

Claims

1. **"Clamping element"** of the kind that are mounted inside of a mouth placed crosswise in a connector inside of which there is at least one electrical wire, the mouth having a threaded inside part for screwing in the clamping element, **characterised in that** it is made up of a set that comprises:

A clamping element that is configured such that when acted upon, a torque is exercised that transmits axially and when the bottom end of the set goes all the way in against the electrical wire, the applied torque, "P1" achieves optimal electrical contact with said electrical wire; and Another clamping element that is configured so that once said optimal electrical contact is made, when it is acted upon, a torque is exercised that

is transmitted in a radial direction against the inner walls of the mouth, and said torque, "P2," is suitable for achieving an optimal waterproof closing of the clamping element in said mouth of the connector.

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2. **"Clamping element"** according to the first claim, **characterised in that** the transmission of the radial torque of the set is achieved through a waterproofing joint.

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3. **"Clamping element"** according to the first and second claims, **characterised in that** the set comprises:

A means of tightening made up of a tightening screw with a head adapted to be screwed inside the mouth until the lower end butts up against the electrical wire that runs through the inside of the connector and it manages to exercise a certain axial torque, "P1" to make an optimal electrical contact with aforementioned wire, and this tightening screw has a way to hold a tightening nut; and

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Another clamping elements made up of the tightening nut with a head adapted to be screwed onto a waterproofing joint until it generates a radial pressure, "P2" that is suitable for making a waterproof seal against the inner walls of the upper part of the mouth.

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4. **"Clamping element"** according to any of the previous claims, **characterised in that** it has a toe in the lower part held to the tightening screw and adapted to make an electrical contact with the electrical wire.

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5. **"Clamping element"** according to the third claim, **characterised in that** the means that the tightening screw has of holding the nut is a threaded part on the outer surface of the tightening screw and the corresponding threaded part on the inside surface of the nut.

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6. **"Clamping element"** according to any of the previous claims, **characterised in that** the tightening screw has a means of weakening between its body and its head, so that when the aforementioned head is screwed all the way in, it breaks due to this weakening system.

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7. **"Clamping element"** according to any of the previous claims, **characterised in that** the tightening nut comprises a means of weakening between its body and its head, so that when the aforementioned head is screwed all the way in, it breaks due to this weakening system.

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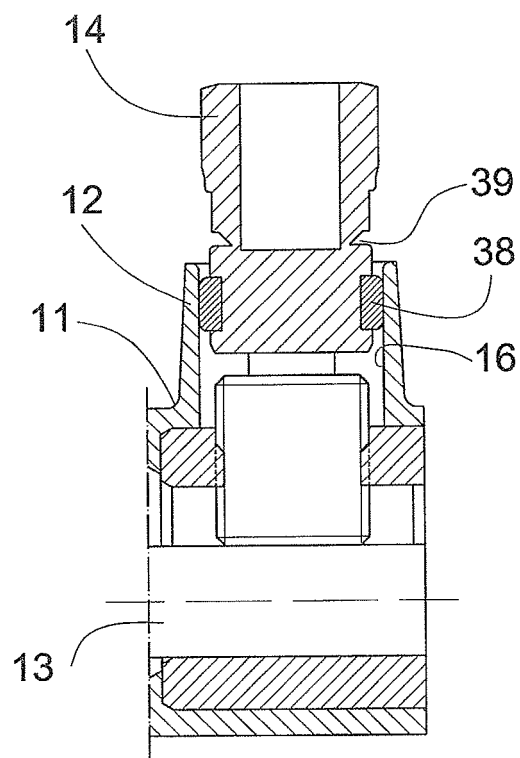


Fig. 1

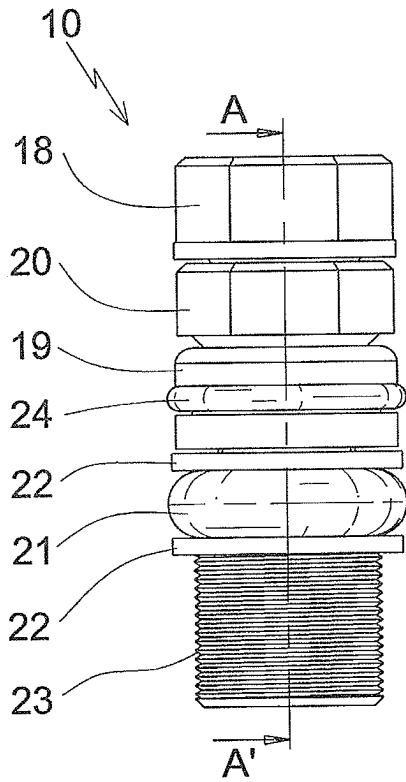
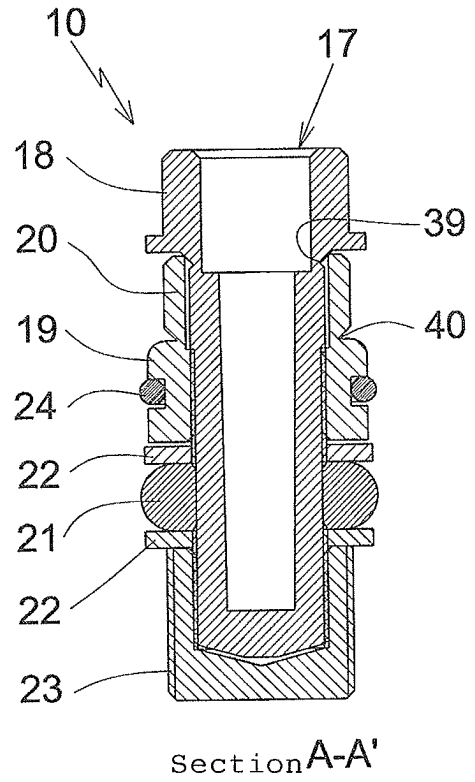


Fig. 2



Section A-A'

Fig. 3

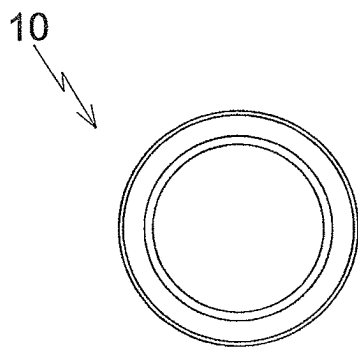


Fig. 4

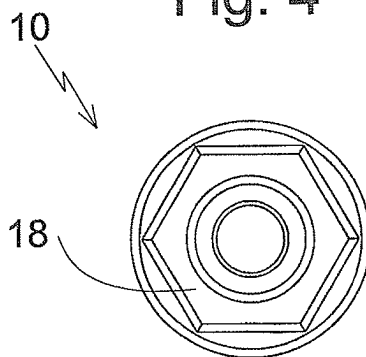


Fig. 5

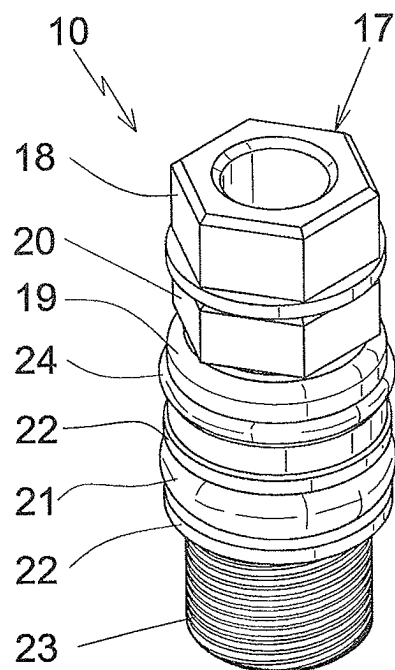


Fig. 6

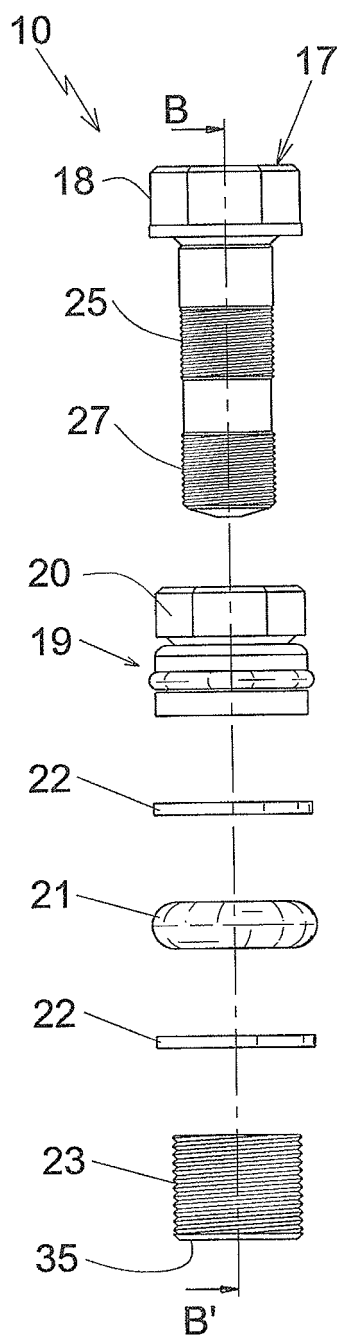
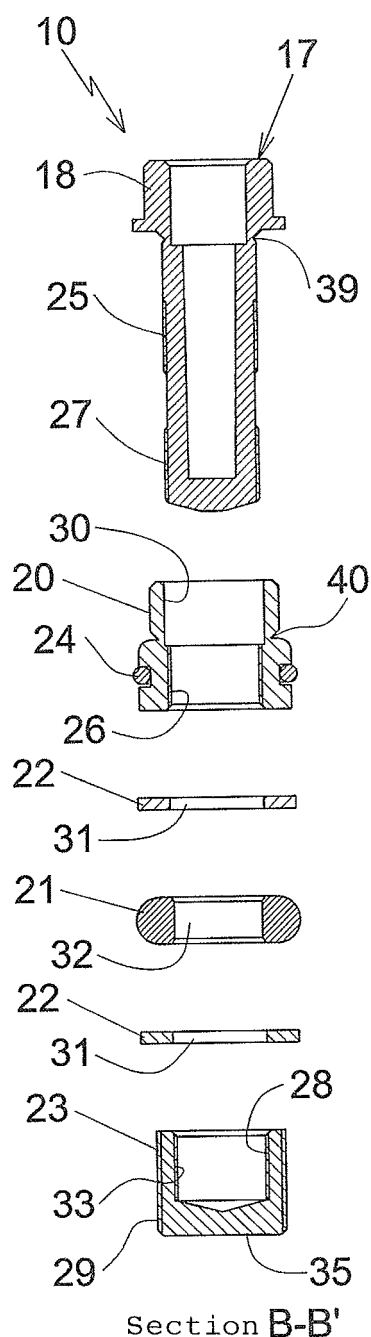


Fig. 7



Section B-B'

Fig. 8

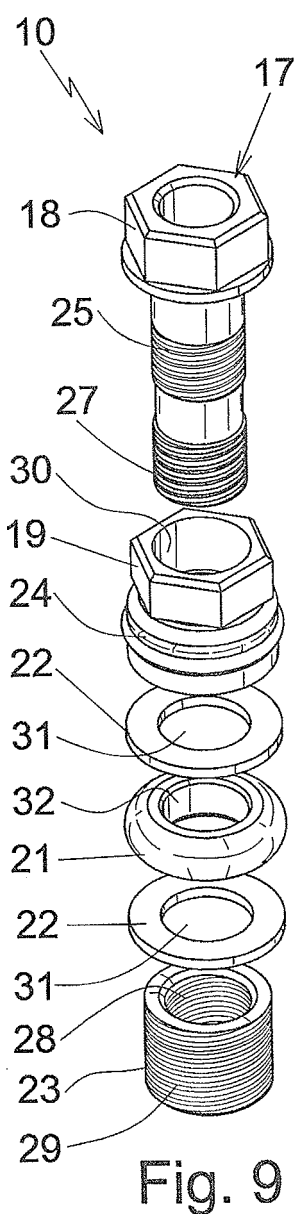


Fig. 9

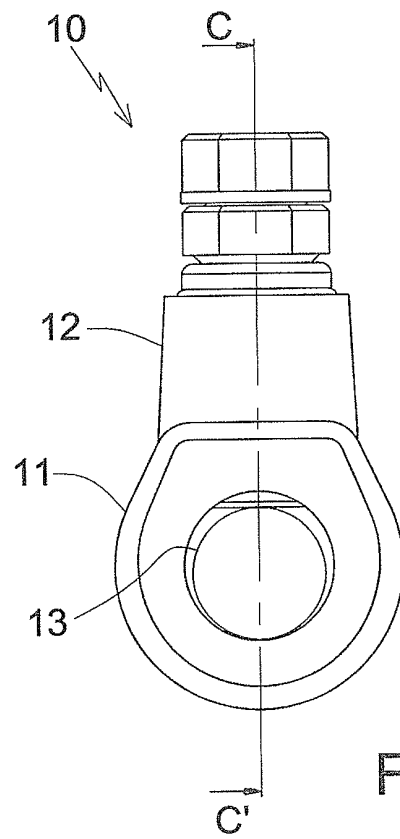
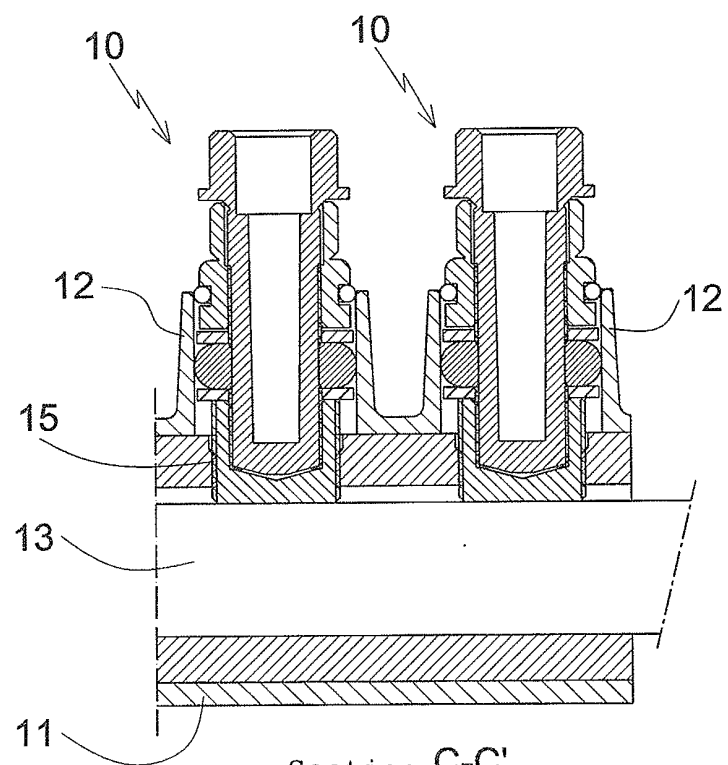


Fig. 10



Section C-C'

Fig. 11

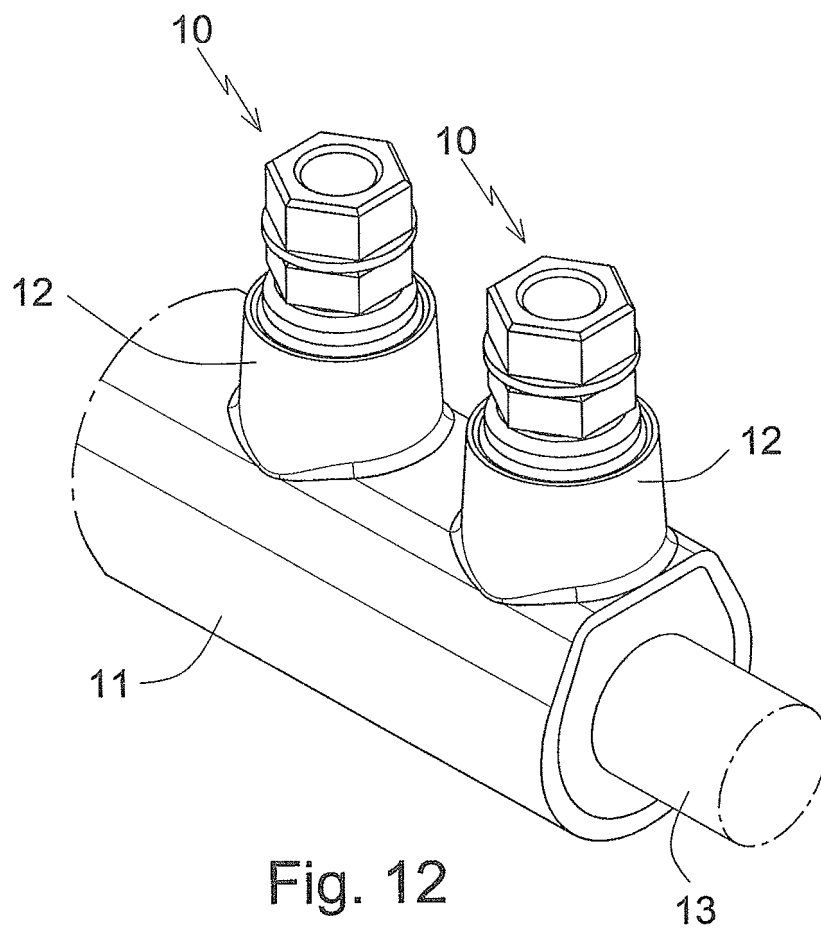


Fig. 12

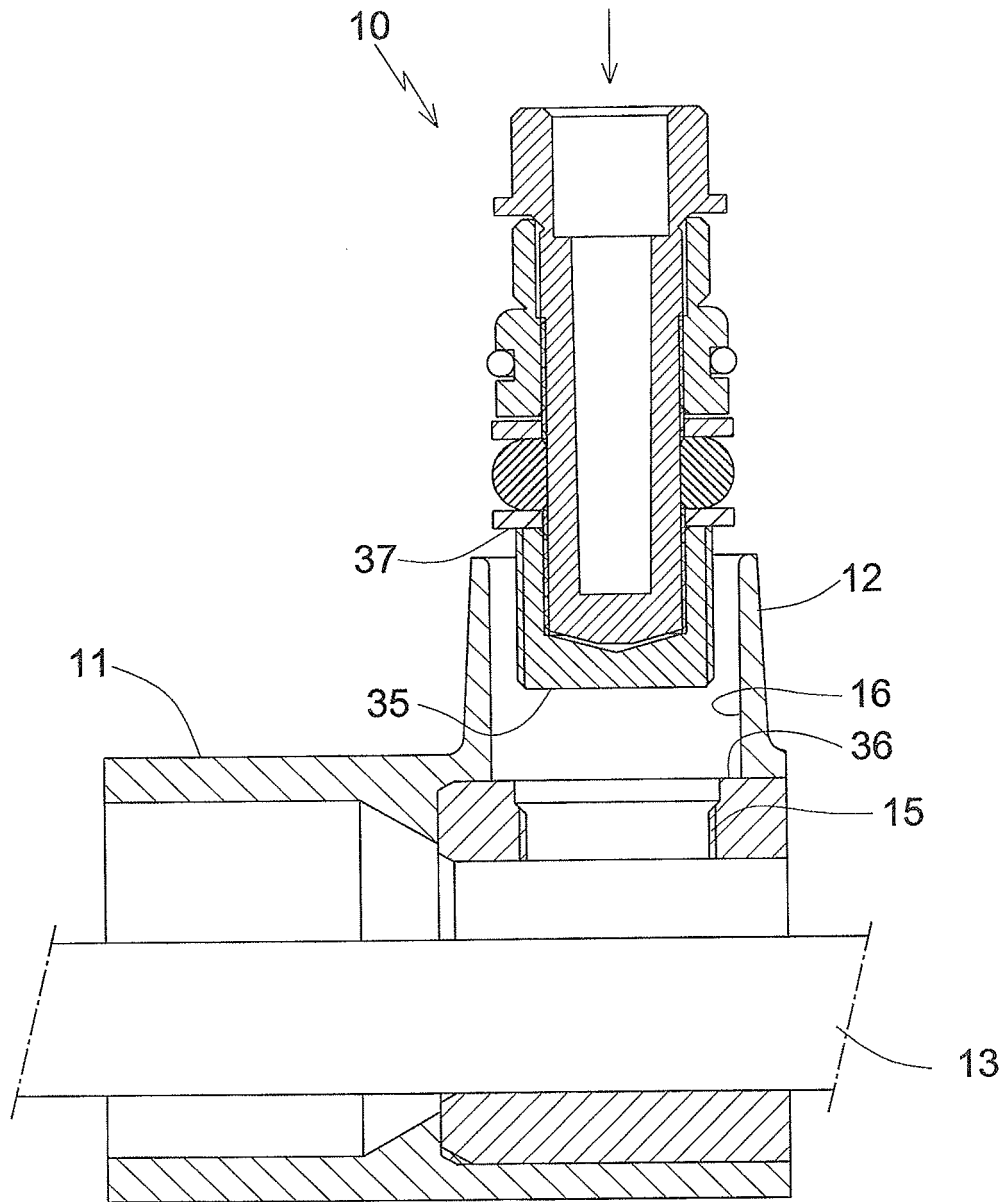


Fig. 13

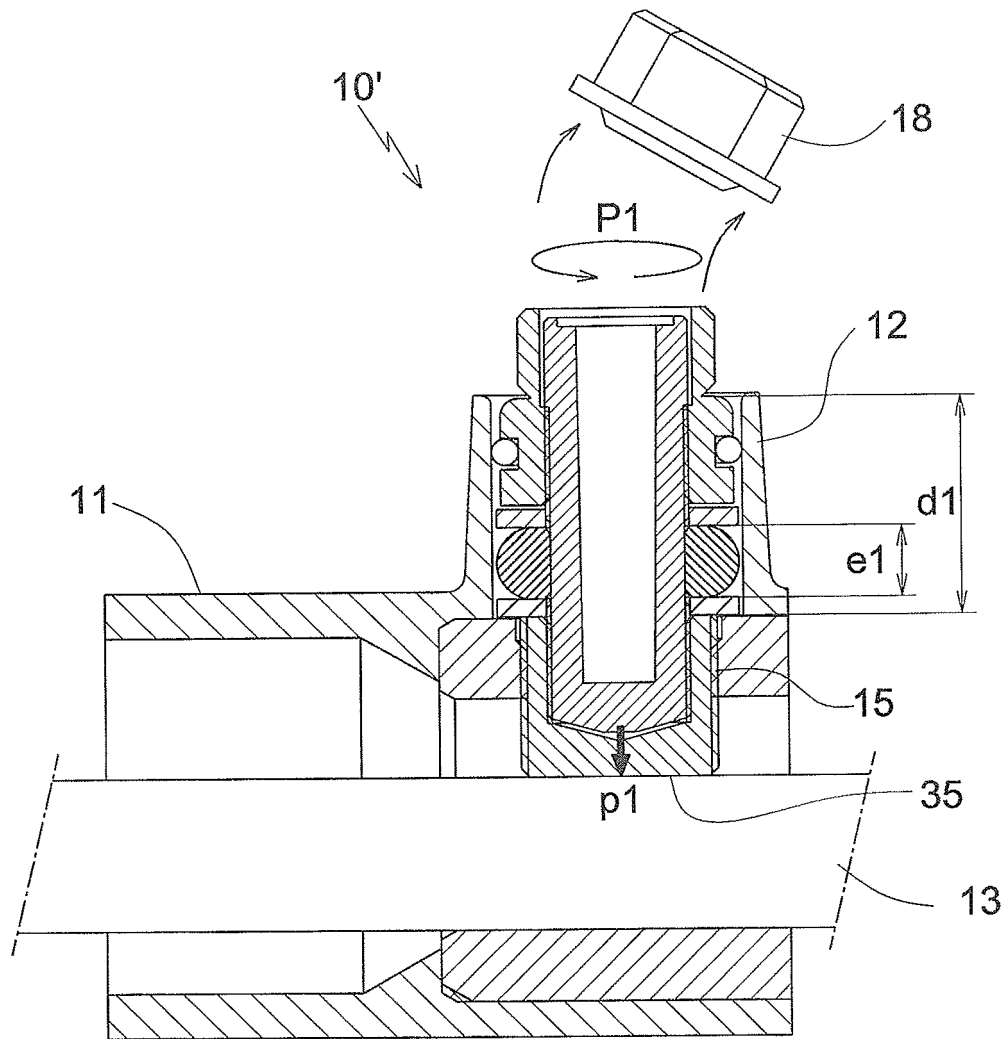


Fig. 14

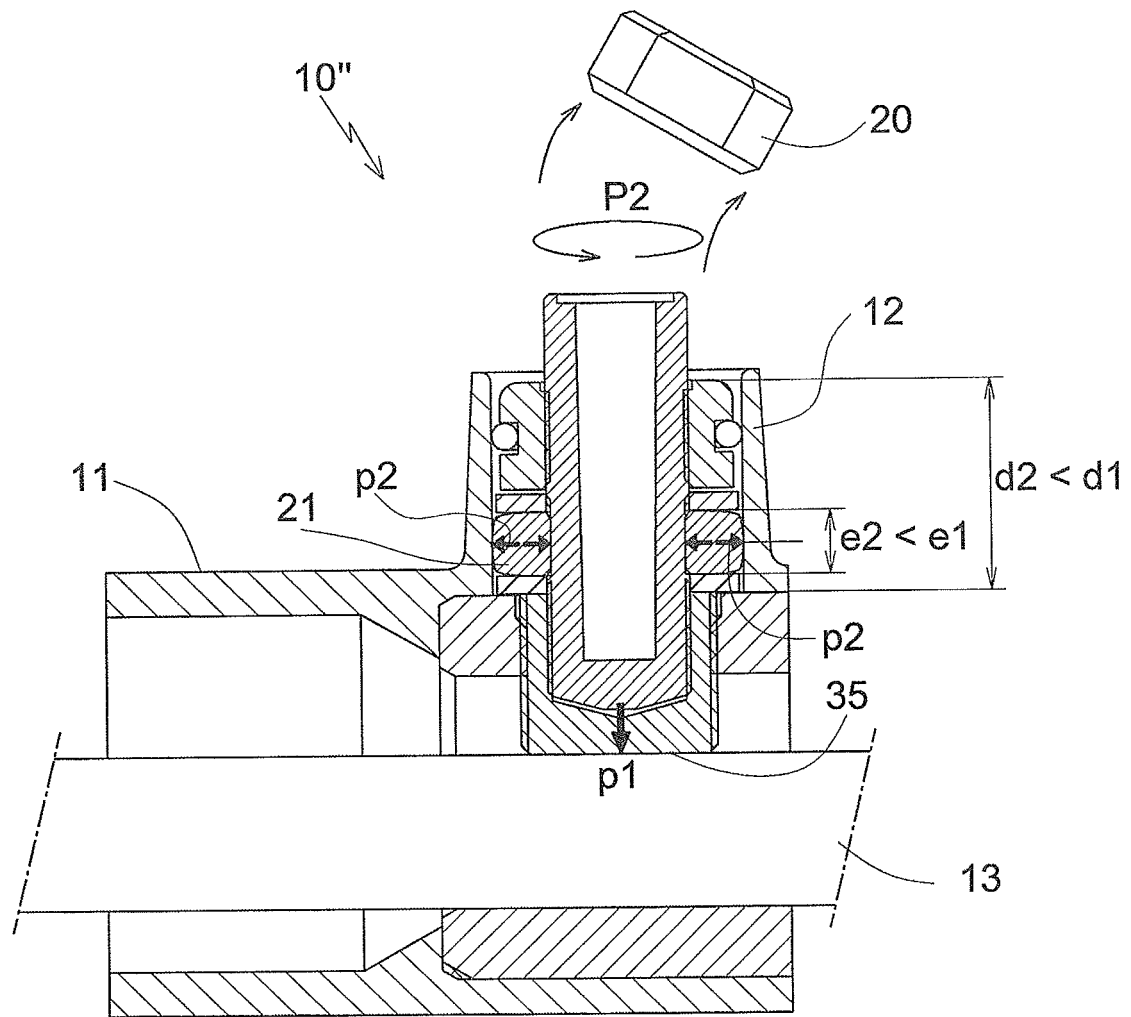


Fig. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2013/070843

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01R, F16B, F16J, F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AU 2009200994 A1 (DULMISON PTY LTD) 12/11/2009, description; figures.	1-4
A		5-7
X	WO 2008047119 A1 (TYCO ELECTRONICS TJK LTD ET AL.) 24/04/2008, description; figures.	1-4
A		5-7
X	CA 2532289 A1 (THOMAS & BETTS INT) 06/07/2007, description; figures.	1-4
A		5-7
X	EP 2375502 A1 (SORECA) 12/10/2011, description; figures.	1-4
A		5-7

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search
28/08/2014

Date of mailing of the international search report
(29.08.2014)

Name and mailing address of the ISA/

Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2013/070843

C (continuation).	DOCUMENTS CONSIDERED TO BE RELEVANT	
Category *	Citation of documents, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2498338 A1 (NEXANS) 12/09/2012, description; figures.	1-4
A		5-7
X	EP 2381535 A1 (NEXANS) 26/10/2011, description; figures.	1-4
A		5-7
A	CN 102163777 A (SUZHOU HUAZHAN SPACE APPLIANCE CO LTD) 24/08/2011, figures & abstract of WPI DataBase (Retrieved from EPOQUE; AN 2011-L78801).	1-5
A	EP 1099892 A1 (WITZENMANN METALLSCHLAUCHFAB ET AL.) 16/05/2001, description; figures.	1-5
A	US 4170163 A (PAYNE WILLIAM J) 09/10/1979, description; figures.	1-5

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

Information on patent family members

PCT/ES2013/070843

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
AU2009200994 A1	12.11.2009	NZ576562 A	26.11.2010
-----	-----	-----	-----
WO2008047119 A1	24.04.2008	JP2010507879 A	11.03.2010
		EP2084782 A1	05.08.2009
		CN101529658 A	09.09.2009
		AU2007311673 A1	24.04.2008
		AU2007311673B B2	31.05.2012
		GB2443001 A	23.04.2008
-----	-----	-----	-----
CA2532289 A1	06.07.2007	NONE	
-----	-----	-----	-----
EP2375502 A1	12.10.2011	AU2011201558 A1	20.10.2011
		FR2958459 A1	07.10.2011
		FR2958459 B1	12.10.2012
-----	-----	-----	-----
EP2498338 A1	12.09.2012	RU2012104230 A	10.09.2013
		RU2495519 C1	10.10.2013
		BR102012002802	23.07.2013
		A2	15.08.2012
		CN102637966 A	23.08.2012
		AU2012200645 A1	
-----	-----	-----	-----
EP2381535 A1	26.10.2011	NONE	
-----	-----	-----	-----
CN102163777 A	24.08.2011	NONE	
-----	-----	-----	-----
EP1099892 A1	16.05.2001		12.06.2001
		BR0005308 A	29.06.2001
		JP2001173855 A	22.03.2001
		DE20006803U U1	
-----	-----	-----	-----
US4170163 A	09.10.1979	NONE	
-----	-----	-----	-----

Form PCT/ISA/210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2013/070843

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CLASSIFICATION OF SUBJECT MATTER

H01R4/36 (2006.01)
F16B31/02 (2006.01)
F16J15/24 (2006.01)
F16L21/04 (2006.01)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- ES 200502821 [0003]
- ES 200600568 [0003]
- ES 200600954 [0003]
- ES 200602698 [0003]