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(11) **EP 1 202 391 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication: **02.05.2002 Bulletin 2002/18** (51) Int Cl.7: **H01R 4/44, H01R 4/24**

(21) Application number: **01870225.8**

(22) Date of filing: **24.10.2001**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**
Designated Extension States:
AL LT LV MK RO SI

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(30) Priority: **27.10.2000 JP 2000328158**

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(54) **Connector for an insulated cable**

(57) **[Problems]** To enable the connection work of branching an insulated cable off from another insulated cable at an intermediary position to be readily performed singlehandedly.

[Solution] The invention offers a connector 1 comprising at least one connector member 5 composed of a conductor material and having a first and second puncturing tooth 17, 18 capable of piercing through the insulator coverings of two insulated cables and achieving electrical contact with conductors inside; a sealing member 6 composed of a resilient material, provided with a contact surface 6b for contacting outer surfaces

of the insulator coverings of said insulated cables 7, 8, and a through hole 6c opening onto said contact surface 6b for passage of the first and second puncturing teeth 17, 18 of said connector member 5, for applying pressure to said puncturing teeth 17, 18 to make them project from said opening; a pair of jaw members 2, 3 for grasping said insulator cables 7, 8 via said connector member 5 and said sealing member 6; and a bolt 13 for coupling these jaw members 2, 3 to bring said jaw members 2, 3 closer together by clamping; wherein a handle 20 projecting to the outside is provided in at least one of said jaw members 2, 3.

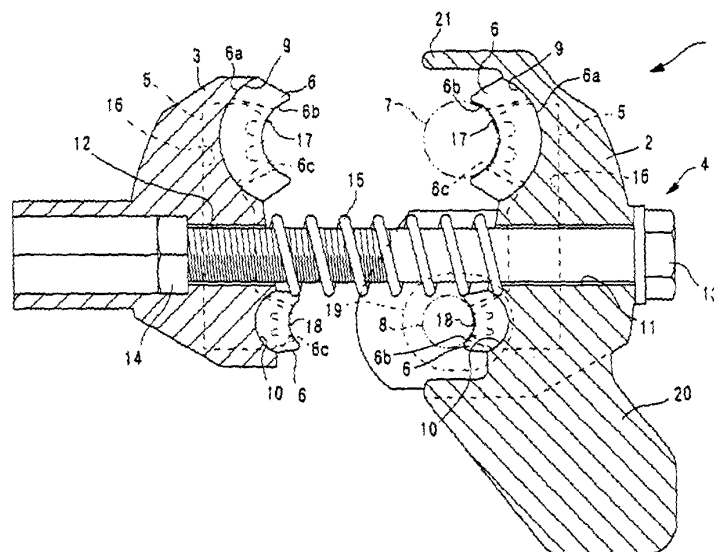


FIG. 1

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Description

[0001] The present invention relates to a connector for an insulated cable, particularly to a connector for connecting two insulated cables in such a way as to branch an insulated cable off an insulated cable such as an elevated line at an intermediary position.

[0002] This type of connector used for branching a cable off from an intermediary position on an elevated line is, for example, disclosed in US Patent No. 5,015,198.

[0003] The connector described in this publication comprises a pair of opposing jaw members composed of an insulator material, a bolt for coupling these jaw members, a connector member composed of a conductive material having puncturing teeth projecting from both end portions each accommodated inside each jaw member, and a sealing member composed of a resilient material having a through hole for passage of the puncturing teeth of said connector member.

[0004] The sealing member is provided with two cable holes for passing two insulated cables, one cable hole being open at a portion in the circumferential direction for insertion of a cable from a radial direction, and the other cable hole being closed around its entire circumference. The above-described through hole opens up at a side surface of each cable hole.

[0005] When connecting an insulated cable by means of a connector having this type of structure, a branched cable is inserted into the cable hole closed in the circumferential direction, and the branching cable is inserted from the radial direction at an intermediary position of the insulated cable. Then, by tightening the bolt, the pair of jaw members are moved toward each other.

[0006] As a result, the sealing member composed of a resilient material is compressed between the jaw members, the puncturing teeth of the connector member accommodated inside the through holes of said sealing member are made to protrude from the openings of said through hole into the cable hole, and pierce through the insulator coverings of the insulated cables positioned inside the cable hole. Then, the puncturing teeth respectively reach the conductors of the two insulated cables, thereby electrically connecting the insulated cables.

[0007] However, due to the need to generate enough clamping force to make the puncturing teeth pierce through the hard insulator covering of the insulated cable, a certain level of strength is required in the jaw members, connector member and bolt, the attainment of which necessitates that the overall weight of the connector and its size be rather large. Additionally, since the connector as a whole becomes a box-shaped lump, the shape offers nowhere to hold, so that when performing connection work, one worker must support it using both hands to encircle it while the other worker tightens the bolt. Since this type of connector connection work tends to be performed at elevated locations, it is often difficult to perform cooperative work with more than one

person. Additionally, when performed while wearing thick rubber gloves to ensure insulation, the efficiency of such connection work can become even worse.

[0008] Furthermore, when connecting high-voltage cables in a live-wire situation, the connector must be held using a tool at the tip of a long pole composed of an insulator material provided with grasping means which can be remotely controlled with the hands. However, in the case of the above-described connector, the grasping means for holding the entire connector must be very large and heavy, so that when attached to the end of a long pole, it is difficult to handle at the base of the pole, particularly with only a single hand.

[0009] Additionally, during connection work of high-voltage cables in a live-wire situation, a connector cover and sleeve-shaped connector must be handled, and various general tools for grasping these exist, so that it is preferable to be able to perform the connection work using pre-existing general-purpose tools without the need to design and manufacture new specialized tools.

[0010] The present invention has been made in view of the above-described considerations, and has the purpose of offering a connector enabling a single person to perform connection work to branch an insulated cable at an intermediary position from an insulated cable such as an elevated line, and enabling this to be performed using existing general tools.

[0011] In order to achieve the above purpose, the present invention offers a connector characterized by comprising at least one connector member composed of a conductor material and having first and second puncturing teeth capable of piercing through the insulator coverings of two insulated cables and achieving electrical contact with conductors inside; a sealing member composed of a resilient material, provided with a contact surface for contacting outer surfaces of the insulator coverings of said insulated cables, and a through hole opening onto said contact surface for passage of the first and second puncturing teeth of said connector member, for applying pressure to said puncturing teeth to make them project from said opening; a pair of jaw members for grasping said insulator cables via said connector member and said sealing member; and a bolt for coupling these jaw members to bring said jaw members closer together by clamping; wherein a handle projecting to the outside is provided in at least one of said jaw members.

[0012] In the above-described connector, the connector member and the sealing member may be positioned opposite each other in such a way as to clamp the insulated cables from both sides.

Additionally, at least one of the jaw members can be provided with a cap for covering the end portion of one of the insulated cables.

[0013] Furthermore, it is effective to attach the handle on the jaw member in a removable manner.

Additionally, the jaw member may have a liquid-tight structure, with the sealing member sealing the area

around the connector member in a liquid-tight state.

[0014] According to the present invention, by grasping an insulated cable between a pair of jaw members by way of a connector member and a sealing member, then tightening the bolt to bring the jaw members closer together, it is possible to make the puncturing teeth of the connector member pierce through the insulator covering to bring the two insulated cables into electrical contact. In this case, since the connector of the present invention has a handle on at least one jaw portion, the worker can support the connector by holding this handle either directly by one hand or by using a pre-existing general tool, while performing bolt tightening work with the other hand. That is, since the connector connection work can be performed alone, the productivity improves and the connection work can be easily performed even at elevated locations.

[0015] Additionally, since the handle is provided in a state of protrusion from the outer surface of the jaw member, it can be readily grasped using general tools. Therefore, even in the case where a high-voltage cable is being connected in a live-wire situation, the operation can be performed with a general tool having comparatively lightweight grasping means at the tip, thereby enabling the productivity of the connection work to be improved.

[0016] Furthermore, by providing a cap for covering the end portion of one of the insulated cables on at least one of the jaw members, it is possible to protect the end portion of the branching cable by means of a cap.

Additionally, by providing a detachable handle on the jaw member, the handle can be used during the connection work to ensure improved productivity and maintenance of safety, then after the work is completed, the handle can be removed to make the connector more compact.

[0017] Furthermore, by giving the jaw member a liquid-tight structure and sealing the area around the connector member in a liquid-tight state by means of a sealing member, it is possible to reliably prevent the intrusion of rainwater into the joint portion between the insulated cable and the connector member, thus preventing the occurrence of such problems as misconnections and electrical leaks.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] **[Fig. 1]** Vertical section view showing a connector according to an embodiment of the present invention.

[0019] **[Fig. 2]** Plan view showing the connector of Fig. 1.

[0020] Herebelow, an embodiment of the connector according to the present invention shall be described with reference to Figs. 1 and 2.

[0021] The connector 1 according to the present embodiment comprises, for example, a pair of jaw members 2, 3 composed of an insulator material such as

plastic, clamping means 4 for coupling these jaw members 2, 3, a connector member 5 composed of a conductive material such as brass attached to the jaw members 2, 3, and a sealing member 6 attached to the jaw members 2, 3.

[0022] The above-described jaw members 2, 3 are composed of a first jaw member 2 and a second jaw member 3 provided in mutual opposition, and each jaw member 2, 3 is provided with two recesses 9, 10 for holding and positioning parallel cables 7, 8 between the jaw members 2, 3. Of these recesses 9, 10, one recess 9 is, for example, a recess 9 for accommodating an elevated line 7 which is already in place, while the other recess 10 is a recess 9 for positioning another cable 8 connected such as to branch off from the elevated line 7.

[0023] The clamping means 4 is composed of a bolt 13 inserted into through holes 11, 12 passing through opposing positions of the pair of jaw members 2, 3, and a nut 14 screwed onto the bolt 13, such that by tightening the nut 14 with respect to the bolt 13, it is possible to make the jaw members 2, 3 approach each other.

[0024] Additionally, around the bolt 13 provided between the jaw members 2, 3 is provided a compressed spring 15 sandwiched between these jaw members 2, 3. As a result, the jaw members 2, 3 are continually biased in the direction of separation, so that the jaw members 2, 3 can be separated simply by loosening the bolt 13 with respect to the nut 14.

[0025] The connector member 5 is a plate-shaped piece positioned so as to fit inside the groove 16 formed inside the jaw members 2, 3, having sawtooth-shaped puncturing teeth 17, 18 projecting into the recesses 9, 10 for holding the cables 17, 18.

The sealing member 6 comprises, for example, a groove sealing surface 6a composed of a resilient material such as rubber for sealing off the groove 16 for inserting the connector member 5, and a contact surface 6b for sealing the outer surface of the insulation covering of the cable 7, 8 in a liquid-tight state when the cables 7, 8 are gripped between the jaw members 2, 3, a through hole 6c allowing passage of the puncturing teeth 17, 18 so as to enable the puncturing teeth 17, 18 of the connector member 5 to project from the contact surface 6b.

[0026] A cap 19 for covering an end portion of the branching cable 8 is provided in one of the jaw members 2, 3. Additionally, a handle 20 protruding from the outer surface of the jaw member 2 is provided on one jaw member 2 of the jaw members 2, 3. This handle 20, for example, is formed into a plate shape with a thickness that is sufficiently smaller than the jaw member 2, and for example is formed with an incline of a uniform angle with respect to the orientation of the two recesses 9, 10 for positioning the two cables 7, 8. While Fig. 1 shows the handle 20 composed unitarily with the same material as the portion forming the jaw members 2, 3, it may be attached separably with respect to the portions forming the jaw members 2, 3.

[0027] In Fig. 1, the jaw member 2 provided with the handle 20 is provided with a planar projection portion 21 extending toward the other jaw member 3 on the surface opposite the surface from which the handle protrudes. When the pair of jaw members 2, 3 are adequately separated, this projection portion 21 can form a gap large enough to pass the cable 7 between the projection portion 21 and the opposing jaw member 3; on the other hand, with the pair of jaw members 2, 3 sufficiently close together due to the action of the clamping means 4, it functions as a barrier to prevent the cable 7 from coming loose from between the jaw members 2, 3.

In Fig. 2, the reference number 22 denotes engaging means for preventing rotation of the jaw members 2, 3 around the bolt 13 with respect to each other, while also preventing the pair of jaw members 2, 3 from coming loose from each other when the clamping means 4 is loosened.

[0028] The functions of the connector 1 according to the present embodiment composed in this way shall be explained below.

In order to use the connector 1 according to the present embodiment to connect a first insulated cable 7 such as an elevated line or the like with a second insulated cable 8 such as a branching cable, the clamping means 4 composed of the bolt 13 and nut 14 is loosened and the space between the pair of jaw members 2, 3 is widened by the biasing force of the compressed spring 15.

[0029] Next, the first and second insulated cables 7, 8 are positioned between the pair of jaw members 2, 3 spaced in this way, and the pair of jaw members 2, 3 are brought closer together against the biasing force of the compressed spring 15 by tightening the bolt 13, thereby holding the insulated cables 7, 8 in the two recesses 9, 10 provided in each jaw member 2, 3. Since a sealing member 6 is provided in each recess 9, 10, the outer insulation covering of the insulated cables 7, 8 is brought into tight contact with the contact surface 6b of the sealing member, so as to seal off both in a liquid-tight state.

[0030] Furthermore, by further tightening the bolt 13, the sealing member 6 contacting the insulated cables 7, 8 is pressed by the insulated cables 7, 8, as a result of which the tightness of the seal between the insulated cables 7, 8 and the contact surface 6a of the sealing member 6 is raised, while the puncturing teeth 17, 18 of the connector member 5 project from inside the through hole 6c formed in the sealing member 6 toward the insulated cables 7, 8 and are made to pierce through the insulation coverings of the insulated cables 7, 8.

[0031] Since puncturing teeth 17, 18 are provided with respect to each of the two insulated cables 7, 8, the conductors of the two insulated cables 7, 8 are electrically connected by the connector member 5 due to the puncturing teeth 17, 18 being thrust through the insulation coverings of the insulated cables 7, 8 until reaching the conductors. Then, since the sealing member 6 is in tight contact with the outer surfaces of the insulated cables

7, 8 in the area around the puncturing teeth 17, 18, the portion of connection of the conductors of the insulated cables 7, 8 with the puncturing teeth 17, 18 is protected from intrusion by ambient air or rainwater.

[0032] Since a handle 20 is provided on one of the jaw members 2 in the connector 1 according to the present embodiment, the connection work can be performed by grasping the handle 20. That is, for example, with the second insulated cable 8 provided between the pair of jaw members 2, 3, the connector 1 can be handled by grabbing the handle 20 with the left hand to bring it close to the first insulated cable 7.

[0033] Then, for example, the projection portion 21 provided in the jaw member 2 is made to catch the insulated cable 7, and the bolt is tightened using a tool with the right hand with the first insulated cable 7 inserted between the pair of jaw members 2, 3. As a result, the pair of jaw members 2, 3 is brought closer together, the two insulated cables 7, 8 are gripped between these, and the insulation coverings are pierced by the connector member 5 to attach the insulated cables 7, 8 in an electrically connected state.

[0034] With the connector 1 according to the present embodiment structured in this way, as opposed to the connectors of the past which were lump-like and without anyplace to grab, the handle 20 provided on the jaw member 2 can be used to hold the connector directly with one hand or with the aid of a tool having a grasping tool attached to the end of a rod composed of an insulating material, so as to allow the bolt 13 to be tightened using the other remaining hand. That is, whereas conventional connectors require a plurality of people to cooperate in order to perform connection work when connecting a branching cable 8 to an elevated line 7, this connector enables connection work to be performed alone, thereby improving the productivity and eliminating the need for more workers and time.

[0035] In particular, since the handle 20 is formed in the shape of a plate having a thickness which is sufficiently smaller than the width of the jaw member 2, this handle 20 can be held using existing general-purpose tools which have been used conventionally to hold connector covers, sleeve-shaped connectors and the like. Since a special tool which grasps the entire connector 1 can be considered to require a large size and weight, work with such a tool attached to the tip of a long insulated rod can be expected to have extremely poor productivity and be difficult in actual practice to handle singlehandedly. Thus, according to the connector 1 of the present embodiment, connection work can be performed very efficiently.

[0036] Additionally, due to the handle 20 provided in a state of projection from the jaw member 2 the connector can be handled singlehandedly, making it unnecessary to perform any work that requires the connector 1 to be held with both hands from around the insulated cables 7, 8.

Furthermore, since the handle 20 of the present

embodiment projects from the jaw members 2, 3 at an incline with respect to the orientation of the two insulated cables 7, 8, the connection work can be performed without depending on the position of the worker with respect to the insulated cables 7, 8. That is, no matter what the position of the worker with respect to the insulated cables 7, 8, the connector 1 can easily be made to approach the insulated cable 7 and positioned by holding the handle 20, and the work of tightening the clamping means 4 can be easily performed with the handle 20 held in a single hand in a stable posture.

[0037] Additionally, with the connector 1 according to the present embodiment, a cap 19 is provided for covering an end of the insulated cable 8, thereby enabling the end portion of the insulated cable 8 to be protected by the cap 19.

Furthermore, since the connector member 5 and sealing member 6 are positioned in opposition such as to grasp the insulated cables 7, 8 from both sides, when the clamping means 4 is tightened, the puncturing teeth 17, 18 of the connector member 5 can be made to pierce through the insulator covering from both sides of the insulated cables 7, 8, thereby achieving a more reliable electrical connection and reliably protecting the connection portions by means of the sealing member 6.

[0038] While the handle 20 provided in the jaw member 2 in the present embodiment was formed unitarily with the same material as the jaw member 2, it is possible to have a structure wherein the handle 20 is composed of a material different from the jaw member 2, and to attach the handle 20 to the jaw member 2 in detachable fashion. By doing so, the handle 20 can be removed from the jaw member 2 after completion of the connection work, without forming any extraneous projections on the connector which would be left even after attachment to the elevated line or the like.

[0039] As described in detail above, according to the connector of the present invention, a handle is provided in the jaw member, thereby making it possible to use the handle to hold the connector with one hand during connection work, consequently improving the productivity and safety of the connection work, and since the work can be performed alone and the connection work can be performed using existing general-purpose tools which are easy to handle, the number of work steps can be largely reduced.

[0040] Additionally, according the connector of the present invention, the connector member and sealing member are opposed so as to grasp the insulated cables from both sides, thereby to more reliably achieve an electrical connection between the insulated cables by means of the connector member, while ensuring that the connection portion between the insulated cables and the connector member is sealed off and protected by means of the sealing member.

[0041] Furthermore, by providing a cap covering the end portion of one of the insulated cables, the end portion of the branching cable and the like can be kept from

being exposed and thereby protected.

Additionally, by attaching a handle to the jaw member in a detachable manner, the handle can be removed from the jaw member in a state of connection to the insulated cable, so that the connector which may be installed outdoors is not left with any extraneous protrusions.

[0042] Furthermore, by giving the jaw member a liquid-tight structure and sealing off the area around the connector member in a liquid-tight state by means of the sealing member, the portion of connection between the connector member and the conductor of the insulated cable, in the connector which may be installed outdoors, is reliably protected from the elements such as rain and air, thereby maintaining a good state of connection.

[Description of Reference Numbers]

[0043]

1	connector
2, 3	jaw member
5	connector member
6	sealing member
6b	contact surface
6c	through hole
7, 8	insulated cable
13	bolt
17, 18	puncturing teeth
19	cap

Claims

1. A connector (1) for an insulated cable **characterized by** comprising:

at least one connector member (5) composed of a conductor material and having first and second puncturing teeth (17, 18) capable of piercing through the insulator coverings of two insulated cables (7, 8) and achieving electrical contact with conductors inside;

a sealing member (6) composed of a resilient material, provided with a contact surface (6b) for contacting outer surfaces of the insulator coverings of said insulated cables (7, 8), and a through hole opening (6c) onto said contact surface (6b) for passage of the first and second puncturing teeth (17, 18) of said connector member (5), for applying pressure to said puncturing teeth to make them project from said opening;

a pair of jaw members (2, 3) for grasping said insulator cables (7, 8) via said connector member (5) and said sealing member (6); and a bolt (13) for coupling these jaw members (2, 3) to bring said jaw members (2, 3) closer to-

gether by clamping;

wherein a handle (20) projecting to the outside is provided in at least one of said jaw members (2, 3).

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2. A connector as recited in claim 1, **characterized in that** said connector member (5) and said sealing member (6) are positioned in mutual opposition such as to grasp said insulated cables (7, 8) from both sides. 10
3. A connector as recited in claim 1 or 2, **characterized in that** at least one of said jaw members (2, 3) is provided with a cap (19) for covering an end portion of one of said insulated cables (8). 15
4. A connector as recited in any one of claims 1-3, **characterized in that** said handle (20) is removably attached to said jaw member (2). 20
5. A connector as recited in any one of claims 1-4, **characterized in that** said jaw member (2, 3) has a liquid-tight structure, and said sealing member (6) seals off the area around said connector member (5) in a liquid-tight manner. 25

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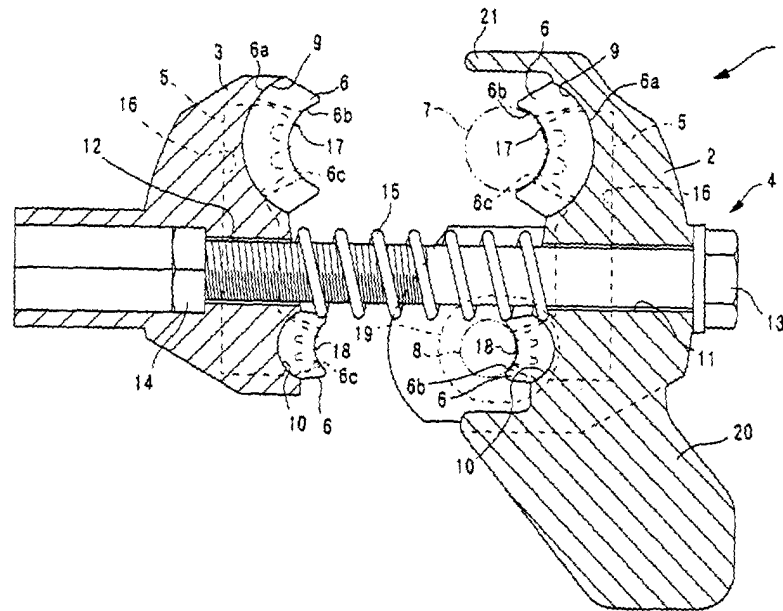


FIG. 1

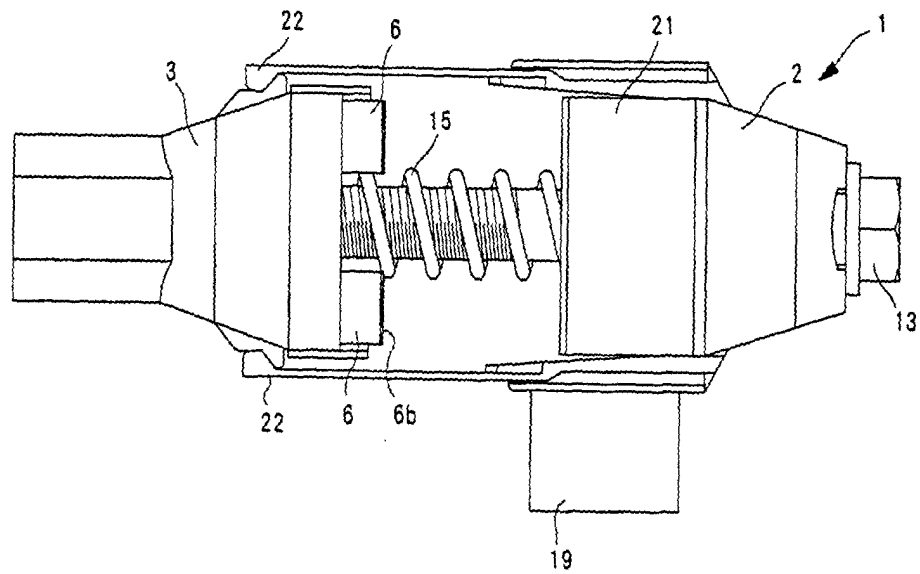


FIG. 2



European Patent
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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 4 February 2002	Examiner Tappeiner, R
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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