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(54) Title: CABLE CONNECTOR

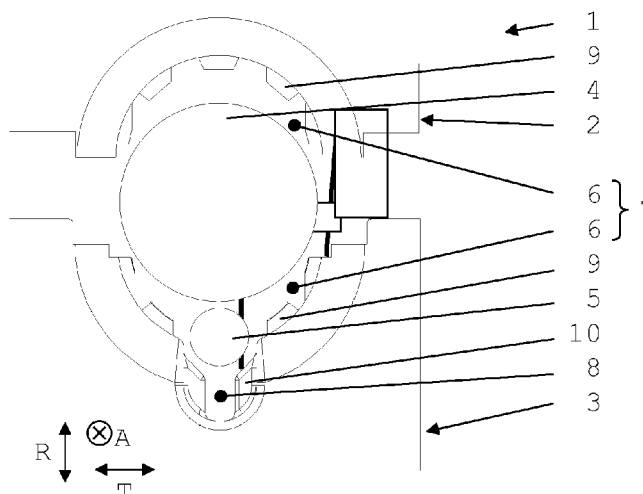


Fig. 1

(57) Abstract: A cable connector (1) comprises a first portion (2) and a second portion (3) couplable to the first portion, a first channel (7) with a first dimension configured to receive a first cable (4) and a second channel (8) with a second dimension configured to receive a second cable (5). The first channel is defined by the first portion and the second portion. The second channel is defined within the second portion. The second channel is in communication with the first channel to receive the second cable.

Cable connector

TECHNICAL FIELD

5 The present disclosure relates to the field of cable connectors, in particular to a cable connector comprising a plurality of cables, more in particular to a cable connector comprising cables of different sizes, e.g. different diameters.

10

BACKGROUND

 In a cable connector, in particular an electrical cable connector, it should generally be prevented that mechanical forces on the cable attached to the connector, such as stress and strain from pulling and/or bending, are transmitted to the interior parts and connections of the connector to protect them from damage. It is therefore known to provide a cable connector with a cable clamping structure for anchoring the cable to the connector (housing) limiting such transmission of forces from a freely movable portion of the cable further towards more delicate parts such as soldered connections.

 On the one hand, a cable clamping arrangement should provide sufficient clamping force for holding the cable against the various forces, favouring a tight clamping. In a cable connector comprising a plurality of cables clamping of each cable may be desired. On the other hand, the cable clamp should be mountable to the cable relatively easily and without damaging the cable. Further, interference of different cables should be kept to a minimum so as to provide as easy as possible cable handling and/or assembling.

In addition, there are continuing desires for size reductions and reductions of manufacturing costs.

SUMMARY

5 To address one or more of the above sketched demands, in a first aspect of the present disclosure a cable connector according to claim 1 is provided.

For assembling such connector with a first and second cable, the second cable is arranged in the second channel
10 via the first channel. Next the first cable is arranged in the first channel, this assists maintaining the second cable in the second channel. The first cable is maintained in the first channel when the first and second portions are connected together. Since the first cable assists
15 maintaining the second cable in the second channel, pinching off or otherwise damaging the second cable while coupling the first and second portions is prevented. Further, when the first cable has a larger dimension than the second cable, this arrangement provides a shielding
20 effect to the second cable against possible pinching and/or damaging. Thus, an operator need substantially only manipulate and/or concentrate on either the first cable or the second cable when assembling the connector and the first and second cables.

25 The presently provided connector may be smaller (in terms of volume) than a cable connector in which both first and second channels would be arranged side by side and would be defined by the first portion and the second portion. Further, in such connector care against damage and
30 pinching of the cables should be taken for both cables at the same time when coupling the first and second portions.

Thus, with the presently provided connector assembly of the connector and cables is facilitated and product

reliability is increased. This holds in particular when the difference between the first size and the second size is large, possibly with related difference in flexibility or rather rigidity of the first and/or second cables. E.g. the first cable may be a power cable with a first diameter in the range of centimetres and the second cable may be a signal wire with a second diameter in the range of a few millimetres. Manufacturing of a device comprising the presently provided cable connector and first and second cables is facilitated.

The connectors according to claims 3 and/or 4 allow attaching the first and/or second cable to the connector, for limiting transmission of forces exerted on the first and/or second cables to interior portions of the connector. The clamping of the second cable within the second channel in the connector of claim 3 may be due to the shape of the second channel and/or due to the combined effect of (the shape of) the second channel and the first cable.

The connector of claim 5 provides reliable fixing of the first and/or second cable to the connector.

The connector of claim 6 provides retention to first and second cables having different mechanical characteristics, e.g. to account for different cable properties such as robustness or flexibility in a direction of extension, e.g. bending flexibility, and/or diametric deformability, e.g. whether the cable may be dented or whether a cable comprising a plurality of leads may allow redistribution of the leads. Different types of cables may also be accounted for, e.g. the first cable being an electrical power cable and the second cable being an electrical or optical signal cable in which signal transmission may be significantly affected by pressure and/or bending stress.

In the connector of claim 7 the first cable is substantially held against pulling forces in substantially all directions having a component in a direction perpendicular to the first direction of extension.

5 It has been found that a substantially equal retention force in all radial directions is provided by a cable clamping arrangement extending along a circumference of a cable for about 270 degrees or more in tangential direction (or angular direction), i.e. providing an
10 interruption along the circumference of about 90 degrees or less which corresponds to an interruption of (less than) about one half of the diameter of a substantially round cable. Such arrangement accommodates a second cable having a size of less than about half that of the first cable.

15 In the connector of claim 8, the second cable is maintained in the second portion and excessive force or pinching off of the second cable between the first cable and the second portion is prevented since the second cable may be displaced "to make way" for the first cable.

20 In the connector of claim 9, the second cable is substantially fixed in position with respect to the first cable. Excessive force on the second cable by the first cable or pinching off of the second cable by the first cable against the second portion is substantially prevented
25 in case of a force on the first cable substantially directly in a direction towards the second cable, e.g. in case the first cable is bent.

 The first and second portions may be comprised in, e.g. be part of, a cable clamp comprised in the connector
30 or be comprised in the connector as portions of a connector housing and/or a connector cover. A separate cable clamp comprised in the connector provides the benefit that it may comprise a different material than a connector housing

and/or a connector cover, e.g. improving a holding force and/or flexibility against large forces.

In another aspect, the cable connector of claim 12 is provided. The connector facilitates assembling of a cable
5 connector with first and second cables, in which the first cable is clamped and in which the second cable is protected from damage, in particular by pinching off, during assembly and use.

In a further aspect the cable connector of claim 13
10 is provided, which facilitates assembling of a cable connector with first and second cables. The first and second cables are fixed to the connector and damage of the second cable in particular is avoided or prevented.

These and other aspects and benefits will hereafter
15 be more fully explained with reference to the drawings by way of non-limiting example.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings like elements are indicated with like
20 reference signs.

Fig. 1 is a partial schematic explosion front view of a cable connector with two cables;

Fig. 2 is a partial perspective view of a cable connector cover;

25 Figs. 3 and 4 schematically show further embodiments.

DETAILED DESCRIPTION OF EMBODIMENTS

It should be noted that elements and aspects discussed for or in relation with a particular embodiment
30 may be suitably combined with elements and aspects of other embodiments, unless explicitly stated otherwise.

Figs. 1 shows a cable connector 1 comprising a first cover 2 and a second cover 3, and being provided with a

first cable 4 and a second cable 5. The first and second covers 2, 3 comprise channel portions 6 together defining a first channel 7. A second channel 8 is defined entirely within the second cover 3. A perspective view of the second cover 2 is shown in Fig. 2. The first channel 7 extends in a first direction of extension A and the second channel 8 extends substantially parallel to the first channel 7. The second channel 8 is in communication with the first channel 7.

10 In the shown embodiment, the second channel 8 extends as a groove in a substantially radial direction with respect to the first direction A in the first channel 7. With respect to the first direction a radial direction R and a tangential direction T (or angular direction) may be defined as indicated. In a substantially rectangular arrangement (see Fig. 3 to be discussed in more detail below) alternative directions H and W may be defined with respect to a first direction of extension A to provide rectangular reference coordinates.

20 The first channel 7 is provided with retention features 9 and the second channel 8 is provided with retention features 10. As is visible in Fig. 2, connector 1 comprises two adjacent sets of first and second channels 7, 8, contact terminals 11 for connection to the first cables 4 and further contact terminals for connection to the second cables 5 (not shown). Here, all contact terminals are arranged in the second cover 3. The connector 1 further comprises fixation means 12, here a further channel for accommodating a separate fixing means, e.g. a bolt or a rivet.

30 The first channel 7 has a first dimension and the second channel 8 has a second dimension, less than the first channel 7. The first channel 7 is configured to

receive the first cable 4; the first and second covers 2, 3, are configured to clamp the first cable 4 within the first channel 7 to fix the first cable 4 to the connector 1. The second channel 8 is configured to receive and hold
5 the second cable 5 within the second channel 8 to fix the second cable 5 to the connector 1.

During assembly of the connector 1 and the first and second cables 4, 5, the second cable 5 is inserted in the second channel 8 via the first channel portion 6 of the
10 second connector cover 3. Next, the first cable 4 is inserted in the first channel portion 6 of the second connector cover 3. Then, the first and second portions 2, 3, are connected using the fixation means 12 for holding and clamping the first cable within the first channel 7.

15 Since the first cable 4 is much wider than the second cable 5, here having a diameter of more than twice that of the second cable 5, the first cable 4 closes off the second channel 8 and shields the second cable 5 against external influences, in particular protecting the second cable 5
20 against being pinched between the first and second covers 2, 3. Thus, in the connector 1 indicated in Figs. 1 and 2 an operator assembling the connector 1 with cables 4 and 5 need only concentrate on one pair of cables instead of two pairs of cables at the same time. This facilitates the
25 assembly and it facilitates automated assembly.

To increase the holding force the first channel 7 is provided with retention features 9, here in the form of teeth 9, generally circularly arranged on inside walls of the first channel 7. The teeth 9 "bite" into (a sheath of)
30 the first cable 4 to fix the cable 4. The second channel 8 is provided with retention features 10, here in the form of ribs 10, extending substantially parallel to each other on opposite wall portions of the second channel 8 in staggered

formation (most clearly visible in Fig. 2). Different from the teeth 9 the ribs 10 cause the second cable 5 to undulate between the ribs 10, providing a holding force to the second cable 5 without exerting local clamping forces as caused by teeth 9. This enables to use the connector 1 with the second cable 5 being an optical cable. It further prevents a circumferential constriction in the channel 8, as provided by circularly arranged teeth 9, which might cause a weak spot to the second cable 5 facilitating breaking of the second cable at the constriction. A larger-diameter cable is less vulnerable to such constriction effect. The retention features 10 fix the second cable 5 in a direction along the first direction of extension A and in a tangential direction T perpendicular thereto. In a radial direction R perpendicular to both afore-mentioned directions A and T the second cable 8 is held -by friction between the second cable 5 and the ribs 10 and sidewalls of the second channel 8- but the second cable is not fixed tightly. The first or second channel 7,8, may be comprise other types of retention features.

In the shown embodiment of Figs. 1 and 2, the first cable 4 is clamped and fixed within the first channel 7. The first channel 7 is further provided with a chamfered flaring end portion 13 limiting a bending radius for the first cable 4. In case of a bending force on the first cable 4 in the direction of the second cable 5, e.g. by someone pulling on the cable 4 instead of on the connector 1 for disconnecting the connector 1 from a further device, the second cable 5 can be displaced out of the way of the first cable 4. Thus, damaging of the second cable 5 is prevented.

The invention is not restricted to the above described embodiments which can be varied in a number of

ways within the scope of the claims. For instance, the connector may comprise further cables as schematically shown in Figs 3 and 4.

Fig. 3 shows an embodiment comprising one first channel 7 configured to receive a first cable 4 and two second channels 8 each configured to receive a second cable 5. The channels 7, 8 have substantially rectangular shapes in cross-section. Both second cables 5 are protected by the single first cable 4 and are clamped by it into the second channels 8.

Fig. 4 shows an embodiment of a cable clamp comprising two first portions 2A, 2B and one second portion 3. The connector further comprises a first channel 7 with a first dimension configured to receive a first cable 4, a second channel 8A with a second dimension, less than the first dimension, configured to receive a second cable 5A and a third channel 8B with a third dimension, less than the second dimension, configured to receive a third cable 5B. The first channel 7 is defined by channel portions 6 in the first and second portions 2A, 2B, 3. Each first portion 2A, 2B is attached to the second portion 3 by a hinge 14, facilitating coupling the first and second portions to clamp the first cable 4. The second and third channels 8A, 8B are defined within the second portion 3. The third channel 8B is in communication with the second channel 8A. During assembly and use, the second cable 5A holds and protects the third cable 5B, just as the first cable 4 holds and protects the second cable 5A. Thus, plural cables may be securely manipulated and used.

The number of cables may be increased. Adjacent channels and cables may have mutually equal dimensions.

In the presently provided connector adjacent channels and cables are arranged at an angle to the separation

between the first and second portions, instead of adjacent each other in a direction along the separation between the first and second portions. Thus, the presently provided connector has not only a narrower width than a standard
5 cable connector but also a limited height. Indeed, the cable connector of the invention takes the advantage that, once assembled, the first cable is capable to contact and press onto the second cable, providing a crushing effect and thereby allowing reducing the overall height of the
10 connector.

CLAIMS

- 1) A cable connector (1) comprising:
- 5 a first portion (2, 2A, 2B) and a second portion (3) couplable to the first portion,
- a first channel (7) with a first dimension configured to receive a first cable (4) and a second channel (8, 8A, 8B) with a second dimension configured to receive a second
- 10 cable (5, 5A, 5B), the first channel being defined by the first portion and the second portion, wherein the second channel is defined within the second portion and the second channel is in communication with the first channel to receive the second cable.
- 15
- 2) The cable connector (1) of claim 1, wherein the second dimension is less than the first dimension.
- 3) The cable connector (1) of claim 1 or 2, wherein
- 20 the first portion (2, 2A, 2B) and the second portion (3) are configured to clamp the first cable (4) within the first channel (7).
- 4) The cable connector (1) of any preceding claim,
- 25 wherein the second channel (8, 8A, 8B) is configured to clamp the second cable (5, 5A, 5B) within the second channel.
- 5) The cable connector (1) of any preceding claim,
- 30 wherein at least one of the first channel (7) and the second channel (8, 8A, 8B) comprises retention features (9; 10) for fixing the first cable (4) within the first

channel (7) and/or fixing the second cable (5, 5A, 5B) within the second channel (8, 8A, 8B).

6) The cable connector (1) of claim 5, wherein the retention features (9; 10) of the first channel (7) and the second channel (8, 8A, 8B) comprise retention features of a mutually different type.

7) The cable connector (1) of any preceding claim, wherein the first channel (7) extends in a first direction of extension (A), wherein the first and second portion (2, 2A, 2B; 3) are configured to provide a clamping force on at least the first cable (4) for at least 200 degrees, preferably more than about 270 degrees, in a plane substantially perpendicular to the first direction of extension.

8) The cable connector (1) of any preceding claim, wherein the first channel (7) extends in a first direction of extension (A) and wherein the second channel (8, 8A, 8B) extends substantially parallel to the first channel, wherein the second channel is configured to substantially fix the second cable (5, 5A, 5B) within the second channel in one direction (W, H; R, T) perpendicular to the first direction of extension and to allow displacement of the second cable within the second channel in another direction (H, W; T, R) perpendicular to the first direction of extension.

9) The cable connector (1) of claim 8, wherein the first channel (7) extends in a first direction of extension (A) and wherein the second channel (8, 8A, 8B) extends substantially parallel to the first channel, wherein the

second channel is configured to allow displacement of the second cable (5) within the second channel in a substantially radial direction (R) with respect to the first direction of extension and to substantially fix the
5 second cable within the second channel in at least one of
a substantially tangential direction (T) with respect to the first direction of extension and
a direction substantially parallel to the first direction of extension.

10

10) The cable connector (1) of any preceding claim, wherein the first and second portions are comprised in a cable clamp.

15

11) The cable connector (1) of any preceding claim 1-9, wherein the first portion (2, 2A, 2B) and the second portion (3) are comprised in at least one of a connector housing and a connector cover.

20

12) A cable connector (1) comprising:
a first portion (2, 2A, 2B) and a second portion (3) couplable to the first portion,
wherein the cable connector comprises
a first channel (7) with a first dimension extending
25 in a first direction of extension (A) and being configured to receive a first cable (4) and
a second channel (8, 8A, 8B) with a second dimension, less than the first dimension, the second channel extending substantially parallel to the first channel and being
30 configured to receive a second cable (5, 5A, 5B),
wherein the first channel is defined by the first portion and the second portion, the first and second

portion being defined to clamp the first cable within the first channel,

wherein the second channel is defined within the second portion, is in communication with the first channel to receive the second cable and is configured to substantially fix the second cable within the second channel in one direction (W, H; R, T) perpendicular to the first direction of extension and to allow displacement of the second cable within the second channel in another direction (H, W; T, R) perpendicular to the first direction of extension.

13) A cable connector (1) comprising:

a first connector cover (2, 2A, 2B) and a second connector cover (3) couplable to the first connector cover, wherein the connector comprises a first channel (7) with a first dimension extending in a first direction (A) and being configured to receive a first cable (4)

and a second channel (8, 8A, 8B) with a second dimension less than the first dimension extending substantially parallel to the first channel and being configured to receive a second cable (5, 5A, 5B),

wherein the first connector portion and the second connector portion are configured to define the first channel and to clamp the first cable within the first channel,

wherein the second channel is defined within the second connector portion and is in communication with the first channel to receive the second cable such that displacement of the second cable within the second channel in a substantially radial direction (R) with respect to the first direction of extension is allowed and the second

cable is substantially fixed within the second channel in at least one of

a substantially tangential direction (T) with respect to the first direction of extension and

5 a direction substantially parallel to the first direction of extension.

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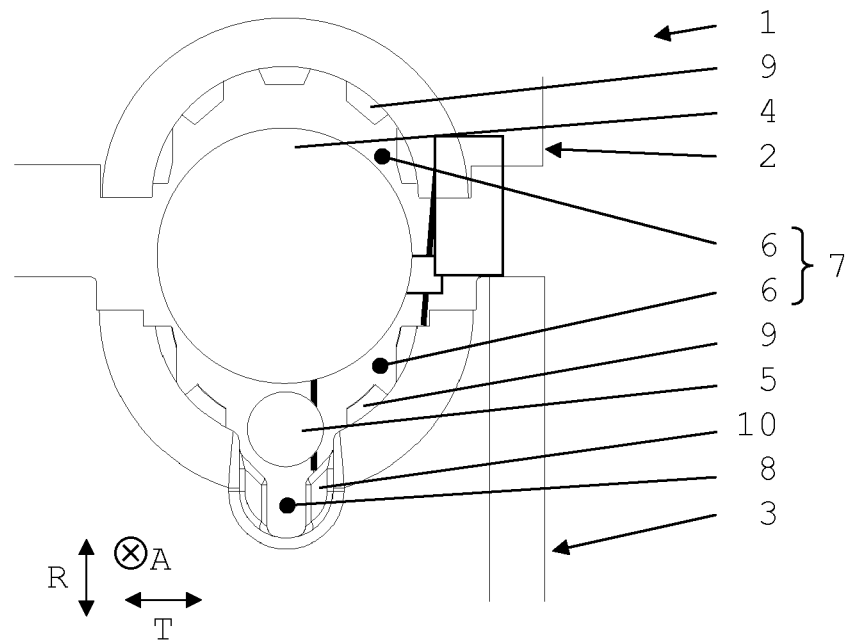


Fig. 1

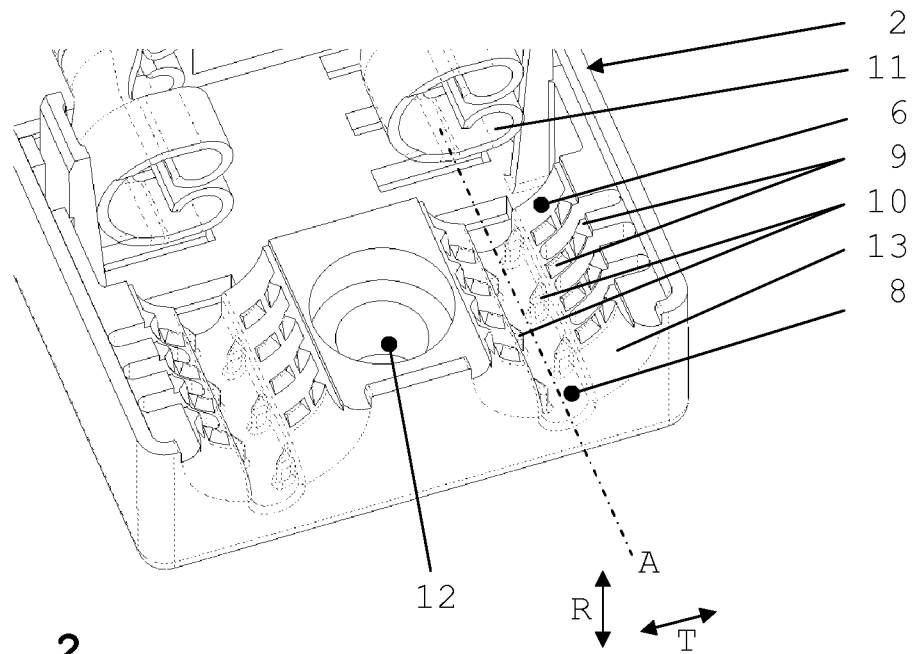


Fig. 2

2 / 2

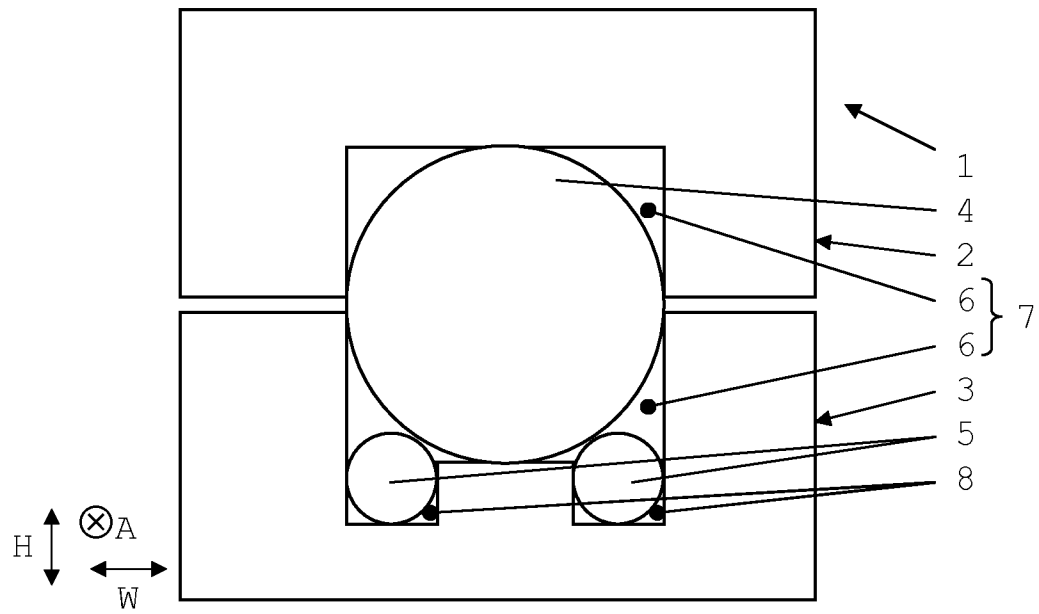


Fig. 3

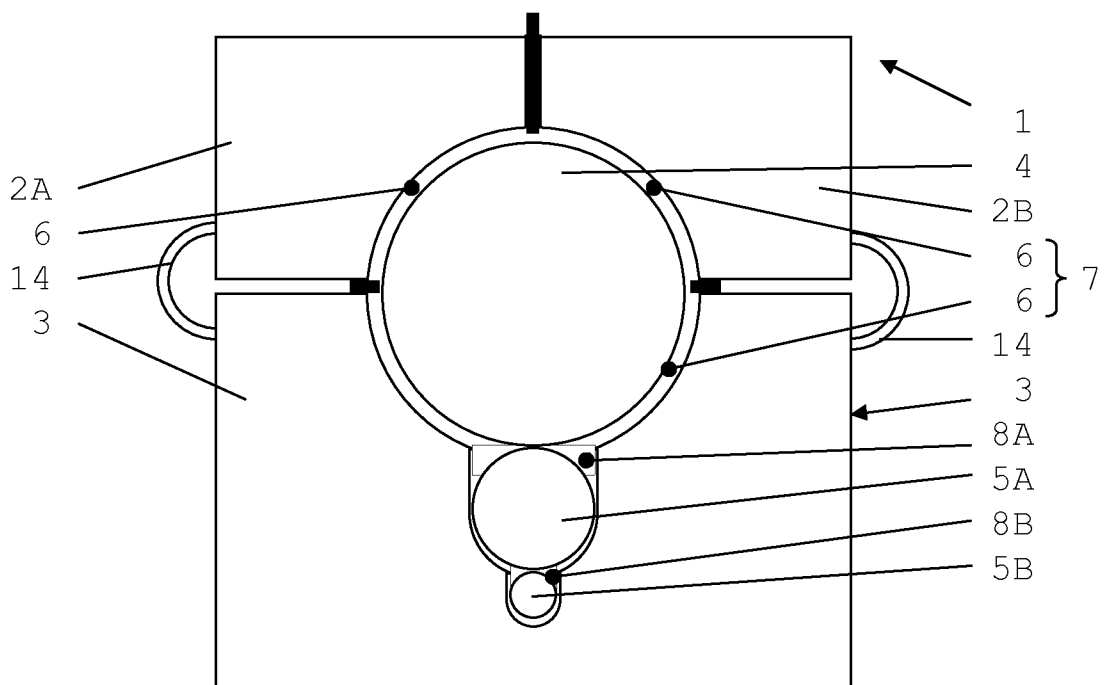


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/069761

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R13/58
ADD.

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

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 practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 430 523 A (HAYES DEREK [GB]) 7 February 1984 (1984-02-07)	1-12
Y	column 4, line 38 - column 5, line 43 -----	13
Y	US 7 275 952 B1 (FABIAN DAVID JAMES [US]) 2 October 2007 (2007-10-02) * abstract -----	13
A	US 2002/042222 A1 (LIN JIAN TAO [CN]) 11 April 2002 (2002-04-11) the whole document -----	1



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2010/069761

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4430523	A	07-02-1984	NONE	
US 7275952	B1	02-10-2007	NONE	
US 2002042222	A1	11-04-2002	TW 490902 B	11-06-2002