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(54) **Coaxial cable connector**

Koaxialkabelverbinder

Connecteur de câble coaxial

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally to a connector, and more particularly to a coaxial cable connector with a good grounding effect.

2. Description of the related art

[0002] It is well known that a coaxial cable connector is connectable with a threaded interface connector of an electronic device to electrically connect a coaxial cable with the electronic device.

[0003] The conventional coaxial cable connector has some defects. For example, the main body of the coaxial cable connector must be connected with the interface connector with a good grounding connection. This is involved in whether the coaxial cable connector is well grounded. Fig. 1 shows an F-type connector as a typical example of the conventional connector. The F-type connector includes a connector main body 10. The connector main body 10 includes an outer sleeve 11, an inner sleeve 12 coaxially positioned in the outer sleeve 11 and a nut 13 rotatably fitted around the inner sleeve 12. The connector main body 10 serves to mechanically and electrically connect a coaxial cable with a threaded interface connector 15 of an electronic device 14.

[0004] There is an inherent problem existing in the connection between the F-type connector main body 10 and the threaded interface connector 15. That is, the nut 13 cannot be fully connected with the threaded interface connector 15 and a gap S is left between the inner sleeve 12 and the threaded interface connector 15. The gap S leads to poor contact between the connector main body 10 and the threaded interface connector 15 and poor grounding thereof. As a result, the electrical signal transmission performance is deteriorated.

[0005] It is therefore tried by the applicant to provide a grounding electrical connector, which can be effectively and lastingly connected with the threaded interface connector with a good grounding connection so as to achieve a good electrical performance.

[0006] US 2006/0166552 A1, WO 2010/135181 A2, US 2008/0311790 A1 and US 7,674,132 B1 describe conventional electrical connectors including an inner sleeve, an outer sleeve, a nut and a conductive grounding spring, wherein the conductive grounding spring is arranged so as to allow a contact between the inner sleeve and the nut. However, the conductive grounding spring is arranged and formed in a way that the conductive spring negatively influences the rotation between the nut and the inner sleeve and thus complicates the process of connecting the connector to the electrical device to be connected. Thus, starting from the cited prior art it is the object of the present application to provide a coaxial cable connector which is configured to be simply connected to the electrical device and at the same time guarantees an optimal contact between the inner sleeve and the nut, when connected to the electrical device.

SUMMARY OF THE INVENTION

[0007] A primary object of the present invention is to provide a coaxial cable connector, which includes a conductive grounding spring mounted between a nut and an inner sleeve. The conductive grounding spring has resilient tongue sections for securely mechanically and electrically connecting with an inner flange of the nut.

[0008] The above-mentioned objects are solved by the coaxial cable connector according to claim 1. Advantageous improvements of the invention are described by the dependent claim.

[0009] To achieve the above and other objects, the coaxial cable connector of the present invention includes: coaxial and radially spaced inner sleeve and outer sleeve, a front end of the inner sleeve having an outer flange and a first and a second interface sections, a rear end of the inner sleeve having a rearward extending section; a nut, a rear end of the nut having an inner flange; and a conductive grounding spring mounted between the first interface section of the inner sleeve and the inner flange of the nut. The conductive grounding spring has an inner annular section fitted around the first interface section of the inner sleeve in secure contact therewith, and multiple plate-like resilient tongue sections extending from an end of the inner annular section and outward bent and expanded for mechanically and electrically connecting with the inner flange of the nut. Accordingly, the coaxial cable connector can be reliably electrically connected with a threaded interface connector of an electronic device via the nut.

[0010] When the nut of the coaxial cable connector is fully locked to the threaded interface connector of the electronic device, the resilient tongue sections are compressed from an outward expanded position to a contracted position where the resilient tongue sections are positioned between the inner flange of the nut and the first interface section of the inner sleeve. Accordingly, the nut is securely electrically connected with the inner sleeve.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The structure and the technical means adopted by the present invention to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiment and the accompanying drawings, wherein:

Fig. 1 is a sectional view showing that a conventional coaxial cable connector is not fully connected with a threaded interface connector of an electronic device;

Fig. 2 is a perspective sectional view of the coaxial cable connector of the present invention;

Fig. 3 is a sectional view of the coaxial cable connector of the present invention;

Fig. 4 is a perspective view of the conductive grounding spring of the coaxial cable connector of the present invention;

Fig. 5 is a left view of the conductive grounding spring of the coaxial cable connector of the present invention; and

Figs. 6A and 6B show the connection process of the coaxial cable connector of the present invention with a threaded interface connector of an electronic device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0012] Please refer to Figs. 2 and 3, in which Fig. 2 is a perspective sectional view of the coaxial cable connector of the present invention and Fig. 3 is a sectional view of the coaxial cable connector of the present invention. The coaxial cable connector 20 includes an inner sleeve 21, an outer sleeve 26 coaxially positioned around the inner sleeve 21 and radially spaced therefrom, and a conductive grounding spring 30. The inner and outer sleeve 21, 26 serve to coaxially receive a coaxial cable. A front end of the inner sleeve 21 has an outer flange 22, a first interface section 23, and a second interface section 24. A rear end of the inner sleeve 21 has a rearward extending section 25. The rearward extending section 25 has an outer diameter and a wall thickness smaller than those of the second interface section 24. A front end of the outer sleeve 26 has an outer sleeve main body 27 embracing the second interface section 24 of the inner sleeve 21. A rear end of the outer sleeve 26 has a rearward extending section 28. The rearward extending section 28 has an outer diameter and a wall thickness smaller than those of the outer sleeve main body 27. The rearward extending section 28 of the outer sleeve 26 coaxially surrounds the rearward extending section 25 of the inner sleeve 21 to define an annular space between the rearward extending section 28 of the outer sleeve 26 and the rearward extending section 25 of the inner sleeve 21. A nut 29 is disposed at a front end of the coaxial cable connector 20. A rear end of the nut 29 has an inner flange 291 freely rotatably sandwiched between the outer flange 22 and the outer sleeve main body 27. The nut 29 is formed with an inner thread 292 and an outer hexagonal section, whereby the coaxial cable connector 20 can be locked to an electronic device via the nut 29 by means of a wrench or the like tool.

[0013] Referring to Figs. 4 and 5, the conductive grounding spring 30 includes an inner annular section 31 defining a hole 32. The hole 32 has such a diameter that the spring 30 can be fitted around the first interface section 23 of the inner sleeve 21 in secure contact with a circumference of the first interface section 23. The conductive grounding spring 30 further includes multiple plate-like resilient tongue sections 33 formed at an end of the inner annular section 31 at equal intervals. The resilient tongue sections 33 extend from the end of the inner annular section 31 and are outward bent and expanded by a predetermined angle for mechanically and electrically connecting with the inner flange 291 of the nut 29 (as shown in Fig. 3). Accordingly, the coaxial cable connector 20 can be reliably electrically connected with an electronic device 40 via the nut 29 so as to ensure good signal transmission quality and good electrical performance.

[0014] The conductive grounding spring 30 further includes multiple plate-like outer arcuate sections 34 integrally connected with the inner annular section 31 and positioned between the resilient tongue sections 33. The outer arcuate sections 34 tightly contact with the circumference of the first interface section 23, whereby the conductive grounding spring 30 is more securely connected with the inner sleeve 21.

[0015] Figs. 6A and 6B show the installation process of the coaxial cable connector 20 to the electronic device 40. First, the coaxial cable connector 20 is locked to the electronic device 40. At this time, the nut 29 has not yet fully connected with a threaded interface connector 41 of the electronic device 40. In the coaxial cable connector 20, the nut 29 is in good metal-to-metal contact with the inner sleeve 21 via the resilient tongue sections 33 of the conductive grounding spring 30. Substantially, the resilient tongue sections 33 are outward expanded by a predetermined angle in contact with the inner flange 291 of the nut 29. Accordingly, the coaxial cable connector 20 can be reliably electrically connected with the electronic device 40 via the nut 29 as shown in Fig. 6A.

[0016] Afterwards, the nut 29 is fully locked onto the threaded interface connector 41 of the electronic device 40 to make the outer flange 22 of the inner sleeve 21 into contact with the inner flange 291 of the nut 29. When locked, the resilient tongue sections 33 of the conductive grounding spring 30 are compressed from an outward expanded position (as shown in Fig. 6A) to a contracted position (as shown in Fig. 6B). Eventually, the resilient tongue sections 33 are positioned between the inner flange 291 of the nut 29 and the first interface section 23 of the inner sleeve 21. In this case, the nut 29 is securely electrically connected with the inner sleeve 21.

[0017] The above embodiment is only used to illustrate the present invention, not intended to limit the scope thereof. It is understood that many changes or modifications of the above embodiment can be made by those who are skilled in this field without departing from the scope of the claims. The scope of the present invention is limited only by the appended claims.

Claims

1. A coaxial cable connector (20) configured to mechanically connect with a threaded connector (41) of an electronic device (40), comprising:

   an inner sleeve (21);
   an outer sleeve (26) arranged coaxially around the inner sleeve (21) with respect to an axis:

   a nut (29) arranged around the inner sleeve (21), wherein the nut (29) has an inner thread configured to engage with an outer thread of the threaded connector (41) of the electronic device (40), wherein the inner sleeve (21) has an outer flange (22) configured to be arranged axially between an inner flange (291) of the nut (29) and the threaded connector (41) of the electronic device (40); and
   a conductive grounding spring (30) mounted to the inner sleeve (21),

   characterized in that the conductive grounding spring (30) comprises a plurality of plate-like resilient tongue sections (33) configured to expand by a predetermined acute angle from the inner sleeve (21) when the nut (29) is loosely locked to the outer thread of the threaded connector (41) of the electronic device (40), wherein, when the nut (29) is fully locked to the outer thread of the threaded connector (41) of the electronic device (40), the plurality of plate-like resilient tongue sections (33) is in a contracted position with a less acute angle from the inner sleeve (21) than the predetermined acute angle, the plurality of plate-like resilient tongue sections (33) being radially positioned between the inner flange (291) of the nut (29) and the inner sleeve (21).

2. The coaxial cable connector (20) as claimed in claim 1, wherein the plurality of plate-like resilient tongue sections (33) has two plate-like resilient tongue sections (33) arranged at opposite sides of the inner sleeve.

3. The coaxial cable connector (20) as claimed in claim 1 or 2, wherein the conductive grounding spring (30) further comprises an inner annular section (31) having the plurality of plate-like resilient tongue sections (33) extend therefrom and a plurality of plate-like outer arcuate sections (34) extending from the inner annular section (31).

4. The coaxial cable connector (20) as claimed in claim 3, wherein the inner annular section (31) is arranged around and in contact with the inner sleeve (21).

5. The coaxial cable connector (20) as claimed in claim 1 or 2, wherein the conductive grounding spring (30) further comprises an inner annular section (31) having the plurality of plate-like resilient tongue sections (33) extend therefrom.

6. The coaxial cable connector (20) as claimed in claim 5, wherein the inner annular section (31) is arranged around and in contact with the inner sleeve (21).

7. The coaxial cable connector (20) as claimed in claim 1, 2, 5 or 6, wherein the conductive grounding spring comprises a plurality of plate-like outer arcuate sections (34) integral with the plurality of plate-like resilient tongue sections (33).

8. The coaxial cable connector (20) as claimed in claim 1, 2, 3, 4, 5, 6 or 7, wherein the inner sleeve (21) has a step against the outer sleeve (26) and the inner flange (291) of the nut (29) is axially arranged between the outer flange (22) of the inner sleeve (21) and the outer sleeve (26).

9. The coaxial cable connector (20) as claimed in claim 1, 2, 3, 4, 5, 6, 7 or 8, wherein a gap is radially between the inner and outer sleeves (21) and (26).

10. The coaxial cable connector (20) as claimed in claim 1, 2, 5, 6, 7, 8 or 9, wherein the inner flange (291) of the nut (29) has a surface, sloped to the axis, contacting the plurality of plate-like resilient tongue sections (33) in the expanded position when the nut (29) is loosely locked to the outer thread of the threaded connector (41) of the electronic device (40).

11. The coaxial cable connector (20) as claimed in claim 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, wherein when the nut (29) is fully locked to the outer thread of the threaded connector (41) of the electronic device (40), the inner flange (291) of the nut (29) contacts the outer flange (22) of the inner sleeve (21).

12. The coaxial cable connector (20) as claimed in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11, wherein when the nut (29) is fully locked to the outer thread of the threaded connector (41) of the electronic device (40), the outer flange (22) of the inner sleeve (21) axially contacts the threaded connector (41) of the electronic device (40).

13. The coaxial cable connector (20) as claimed in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 or 12, wherein when the nut (29) is loosely locked to the outer thread of the threaded connector (41) of the electronic device (40), the nut (29) axially contacts the outer sleeve (26).

Patentansprüche

1. Koaxial-Kabelverbinder (20), der dazu ausgestaltet ist, mechanisch mit einem Gewindeverbinder (41) einer elektronischen Einrichtung (40) verbunden zu werden, aufweisend:

   - eine innere Hülse (21);
   - eine äußere Hülse (26), die koaxial um die innere Hülse (21) bezüglich einer Achse angeordnet ist;
   - eine Nuss (29), die um die innere Hülse (21) angeordnet ist, wobei die Nuss (29) ein Innengewinde aufweist, das dazu ausgestaltet ist, mit einem Außengewinde des Gewindeverbinders (41) der elektronischen Einrichtung (40) zusammenwirken, wobei die innere Hülse (21) einen Außenflansch (22) aufweist, der dazu ausgestaltet ist, koaxial zwischen einem inneren Flansch (291) der Nuss (29) und dem Gewindeverbinder (41) der elektronischen Einrichtung (40) angeordnet zu werden; und
   - eine leitende Massefeder (30), die an der inneren Hülse (21) angebracht ist, **dadurch gekennzeichnet, dass** die leitende Massefeder (30) eine Mehrzahl von plattenartigen elastischen Zungenabschnitten (33) aufweist, die dazu ausgestaltet sind, sich um einen vorbestimmten spitzen Winkel von der inneren Hülse (21) auszudehnen, wenn die Nuss (29) locker mit dem Außengewinde des Gewindeverbinders (41) der elektronischen Einrichtung (40) gesichert ist, wobei, wenn die Nuss (29) vollständig mit dem Außengewinde des Gewindeverbinders (41) der elektronischen Einrichtung (40) verriegelt ist, sich die Mehrzahl plattenartiger elastischer Zungenabschnitte (33) in einer zusammen gezogenen Stellung mit einem weniger spitzen Winkel von der inneren Hülse (21) als der vorbestimmte spitze Winkel befindet, wobei die plattenartigen elastischen Zungenabschnitte (33) radial zwischen dem inneren Flansch (291) der Nuss (29) und der inneren Hülse (21) positioniert sind.

2. Koaxial-Kabelverbinder (20) nach Anspruch 1, wobei die Mehrzahl von plattenartigen elastischen Zungenabschnitten (33) zwei plattenartige elastische Zungenabschnitte (32) aufweist, die an entgegengesetzten Seiten der inneren Hülse angeordnet sind.

3. Koaxial-Kabelverbinder (20) nach Anspruch 1 oder 2, wobei die leitende Massefeder (30) ferner einen inneren ringförmigen Abschnitt (31) mit der Mehrzahl plattenartiger elastischer Zungenabschnitte (32), die sich davon erstrecken, und eine Mehrzahl plattenartiger äußerer bogenförmige Abschnitte (34) aufweist, die sich von dem inneren ringförmigen Abschnitt (31) erstrecken.

4. Koaxial-Kabelverbinder (20) nach Anspruch 3, wobei der innere ringförmige Abschnitt (31) um die innere Hülse (21) angeordnet ist und diese kontaktiert.

5. Koaxial-Kabelverbinder (20) nach Anspruch 1 oder 2, wobei die leitende Massefeder (30) ferner einen inneren ringförmigen Abschnitt (31) mit der Mehrzahl plattenartigen elastischen Zungenabschnitten (33), die sich davon erstrecken, aufweist.

6. Koaxial-Kabelverbinder (20) nach Anspruch 5, wobei der innere ringförmige Abschnitt (31) um die innere Hülse (21) angeordnet ist und diese kontaktiert.

7. Koaxial-Kabelverbinder (20) nach Anspruch 1,2,5 oder 6, wobei die leitende Massefeder eine Mehrzahl plattenartiger äußerer bogenförmiger Abschnitte (34) integral mit der Mehrzahl plattenartiger elastischer Zungenabschnitte (33) aufweist.

8. Koaxial-Kabelverbinder (20) nach Anspruch 1, 2, 3, 4, 5, 6 oder 7, wobei die innere Hülse (21) eine Stufe gegenüber der äußeren Hülse (26) aufweist und der innere Flansch (291) der Nuss (29) axial zwischen dem äußeren Flansch (22) der inneren Hülse (21) und der äußeren Hülse (26) angeordnet ist.

9. Koaxial-Kabelverbinder (20) nach Anspruch 1, 2, 3, 4, 5, 6, 7 oder 8, wobei sich ein Spalt radial zwischen der inneren und äußeren Hülse (21, 26) befindet.

10. Koaxial-Kabelverbinder (20) nach Anspruch 1, 2, 5, 6, 7, 8 oder 9, wobei der Innenflansch (291) der Nuss (29) eine Oberfläche aufweist, die zu der Achse geneigt ist und die Mehrzahl plattenartiger elastischer Zungenabschnitte (33) in der ausgedehnten Stellung kontaktiert, wenn die Nuss (29) locker auf dem Außengewinde des Gewindeverbinders (41) der elektronischen Einrichtung (40) verriegelt ist.

11. Koaxial-Kabelverbinder (20) nach Anspruch 1, 2, 3, 4, 5, 6, 7, 8, 9 oder 10, wobei, wenn die Nuss (29) auf dem Außengewinde des Gewindeverbinders (41) der elektronischen Einrichtung (40) vollständig verriegelt ist, der innere Flansch (291) der Nuss (29) den äußeren Flansch (22) der inneren Hülse (21) kontaktiert.

12. Koaxial-Kabelverbinder (20) nach Anspruch 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 oder 11, wobei, wenn die Nuss (29) an dem äußeren Gewinde des Gewindeverbinders (41) der elektronischen Einrichtung (40) vollständig verriegelt ist, der äußerer Flansch (22) der inneren Hülse (21) den Gewindeverbinder (41) der elektronischen Einrichtung (40) axial berührt.

13. Koaxial-Kabelverbinder (20) nach Anspruch 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 oder 12, wobei, wenn die Nuss (29) an dem Außengewinde des Gewindeverbinders (41) der elektronischen Einrichtung (40) lose verriegelt ist, die Nuss (29) das Außengewinde (26) axial kontaktiert.

Revendications

1. Connecteur de câble coaxial (20) configuré de manière à être connecté mécaniquement à un connecteur fileté (41) d'un dispositif électronique (40), comprenant :

un manchon interne (21) ;
un manchon externe (26) agencé de façon coaxiale autour du manchon interne (21) par rapport à un axe ;
un écrou (29) agencé autour du manchon interne (21), dans lequel l'écrou (29) comporte un filetage interne configuré de manière à coopérer avec un filetage externe du connecteur fileté (41) du dispositif électronique (40), dans lequel le manchon interne (21) comporte une collerette externe (22) configurée de manière à être agencée axialement entre une collerette interne (291) de l'écrou (29) et le connecteur fileté (41) du dispositif électronique (40) ; et
un ressort de mise à la masse conducteur (30) monté sur le manchon interne (21),

caractérisé en ce que le ressort de mise à la masse conducteur (30) comprend une pluralité de sections de languette élastiques en forme de plaque (33) configurées de manière à s'étendre sur un angle aigu prédéterminé par rapport au manchon interne (21) lorsque l'écrou (29) est serré avec un certain jeu sur le filetage externe du connecteur fileté (41) du dispositif électronique (40), dans lequel, lorsque l'écrou (29) est complètement serré sur le filetage externe du connecteur fileté (41) du dispositif électronique (40), les sections de la pluralité de sections de languette élastiques en forme de plaque (33) sont dans une position contractée selon un angle aigu par rapport au manchon interne (21) plus petit que l'angle aigu prédéterminé, les sections de la pluralité de sections de languette élastiques en forme de plaque (33) étant positionnées radialement entre la collerette interne (291) de l'écrou (29) et le manchon interne (21).

2. Connecteur de câble coaxial (20) selon la revendication 1, dans lequel la pluralité de sections de languette élastiques en forme de plaque (33) comporte deux sections de languette élastiques en forme de plaque (33) agencées au niveau de côtés opposés du manchon interne.

3. Connecteur de câble coaxial (20) selon la revendication 1 ou 2, dans lequel le ressort de mise à la masse conducteur (30) comprend en outre une section annulaire interne (31) comportant la pluralité de sections de languette élastiques en forme de plaque (33) qui s'étendent depuis et une pluralité de sections incurvées externes en forme de plaque (34) qui s'étendent depuis la section annulaire interne (31).

4. Connecteur de câble coaxial (20) selon la revendication 3, dans lequel la section annulaire interne (31) est agencée autour du manchon interne (21) et en contact avec celui-ci.

5. Connecteur de câble coaxial (20) selon la revendication 1 ou 2, dans lequel le ressort de mise à la masse conducteur (30) comprend en outre une section annulaire interne (31) comportant la pluralité de sections de languette élastiques en forme de plaque (33) qui s'étendent depuis.

6. Connecteur de câble coaxial (20) selon la revendication 5, dans lequel la section annulaire interne (31) est agencée autour du manchon interne (21) et en contact avec celui-ci.

7. Connecteur de câble coaxial (20) selon la revendication 1, 2, 5 ou 6, dans lequel le ressort de mise à la masse conducteur comprend une pluralité de sections incurvées externes en forme de plaque (34) d'un seul tenant avec la pluralité de sections de languette élastiques en forme de plaque (33).

8. Connecteur de câble coaxial (20) selon la revendication 1, 2, 3, 4, 5, 6 ou 7, dans lequel le manchon interne (21) comporte un épaulement contre le manchon externe (26) et la collerette interne (291) de l'écrou (29) est agencée axialement entre la collerette externe (22) du manchon interne (21) et le manchon externe (26).

9. Connecteur de câble coaxial (20) selon la revendication 1, 2, 3, 4, 5, 6, 7 ou 8, dans lequel un espace est présent radialement entre les manchons interne et externe (21, 26).

10. Connecteur de câble coaxial (20) selon la revendication 1, 2, 5, 6, 7, 8 ou 9, dans lequel la collerette interne (291) de l'écrou (29) comporte une surface, inclinée par rapport l'axe, en contact avec la pluralité de sections de languette élastiques en forme de plaque (33) dans la position étendue lorsque l'écrou (29) est serré avec un certain jeu sur le filetage externe du connecteur fileté (41) du dispositif électronique (40).

11. Connecteur de câble coaxial (20) selon la revendication 1, 2, 3, 4, 5, 6, 7, 8, 9 ou 10, dans lequel,

lorsque l'écrou (29) est complètement serré sur le filetage externe du connecteur fileté (41) du dispositif électronique (40), la collerette interne (291) de l'écrou (29) entre en contact avec la collerette externe (22) du manchon interne (21).

12. Connecteur de câble coaxial (20) selon la revendication 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 ou 11, dans lequel, lorsque l'écrou (29) est complètement serré sur le filetage externe du connecteur fileté (41) du dispositif électronique (40), la collerette externe (22) du manchon interne (21) entre en contact axialement avec le connecteur fileté (41) du dispositif électronique (40).

13. Connecteur de câble coaxial (20) selon la revendication 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 ou 12, dans lequel, lorsque l'écrou (29) est serré avec un certain jeu sur le filetage externe du connecteur fileté (41) du dispositif électronique (40), l'écrou (29) entre en contact axialement avec le manchon externe (26).

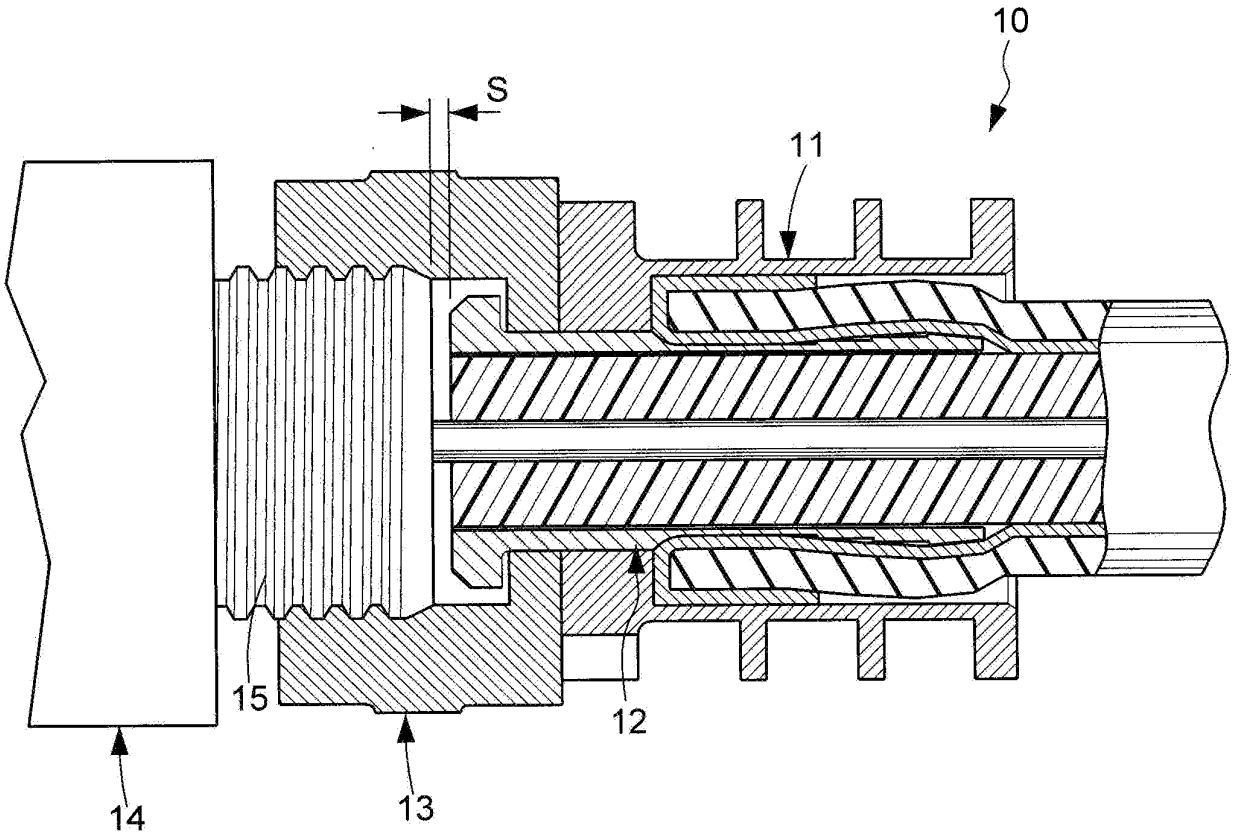
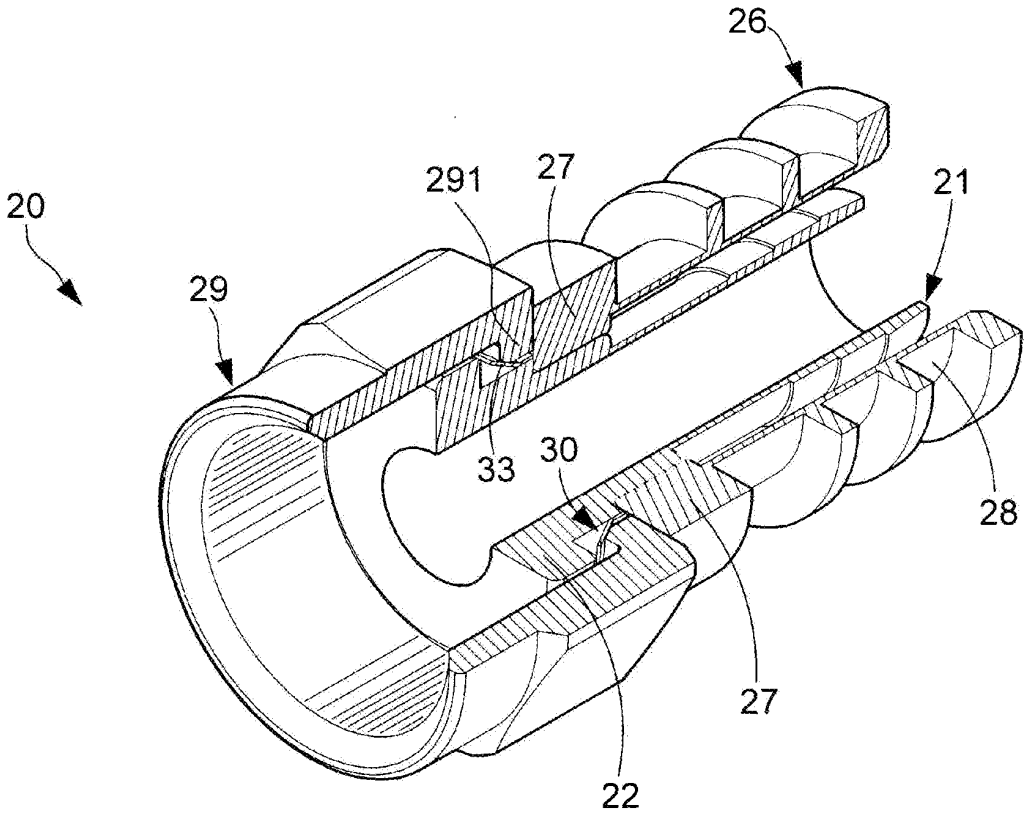


FIG.1


26
291
27
21
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33
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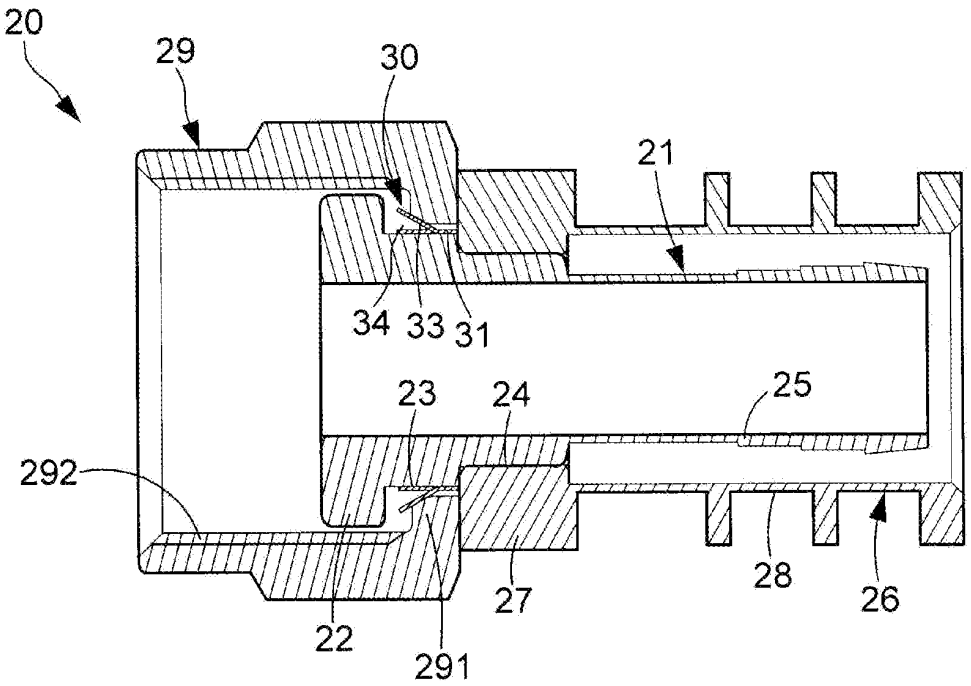
28
27
22

FIG.2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292
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291

FIG.3

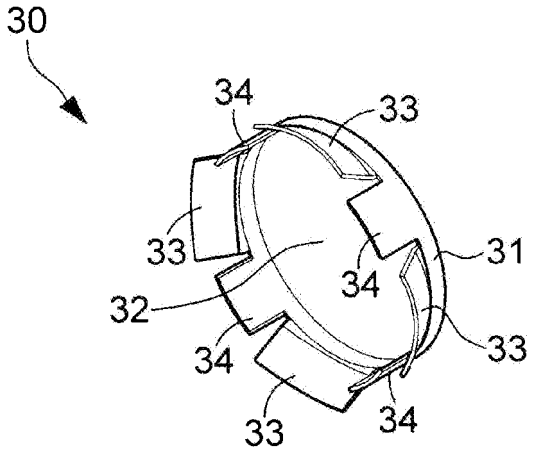

FIG.4

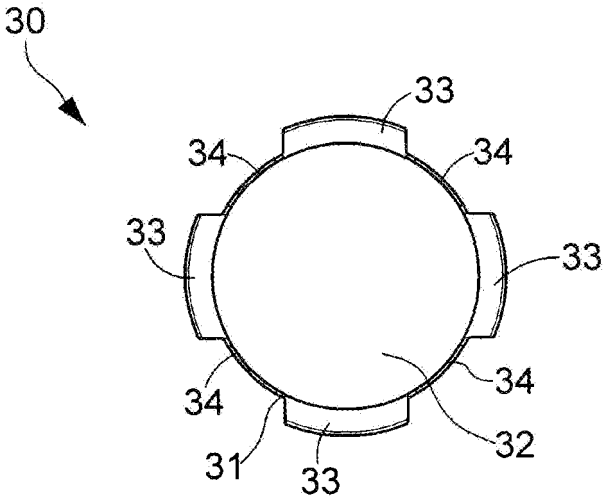

FIG.5

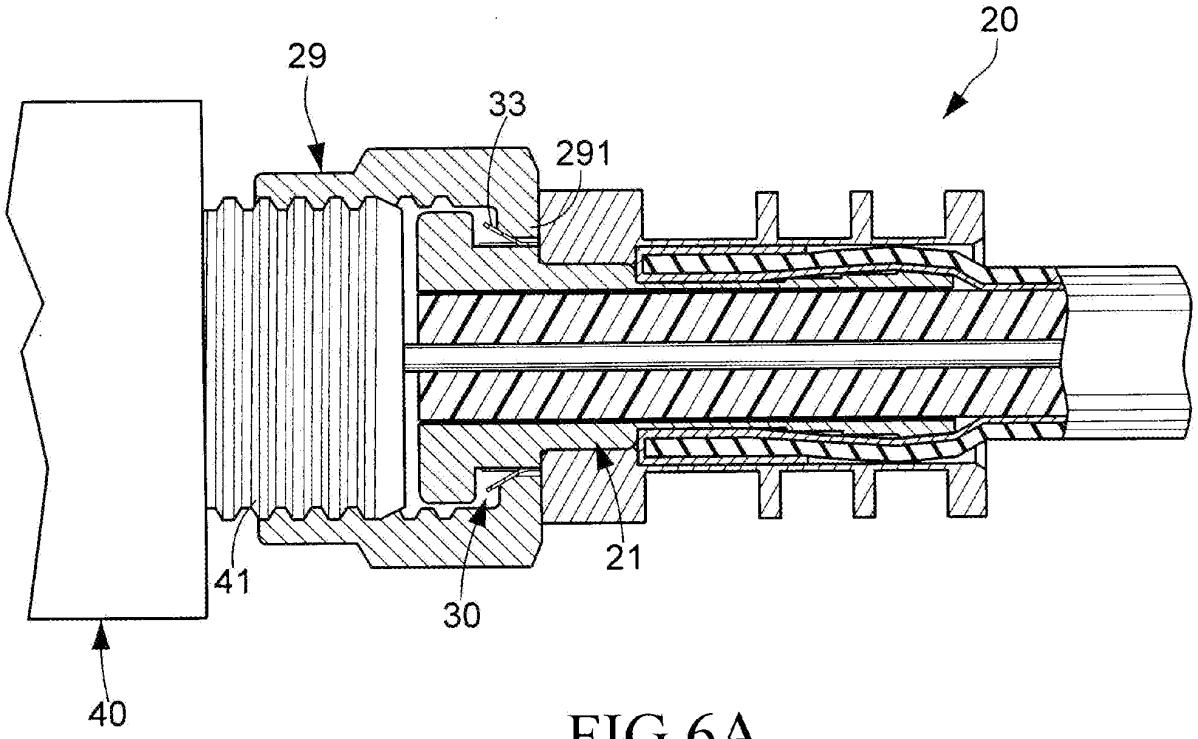

FIG.6A

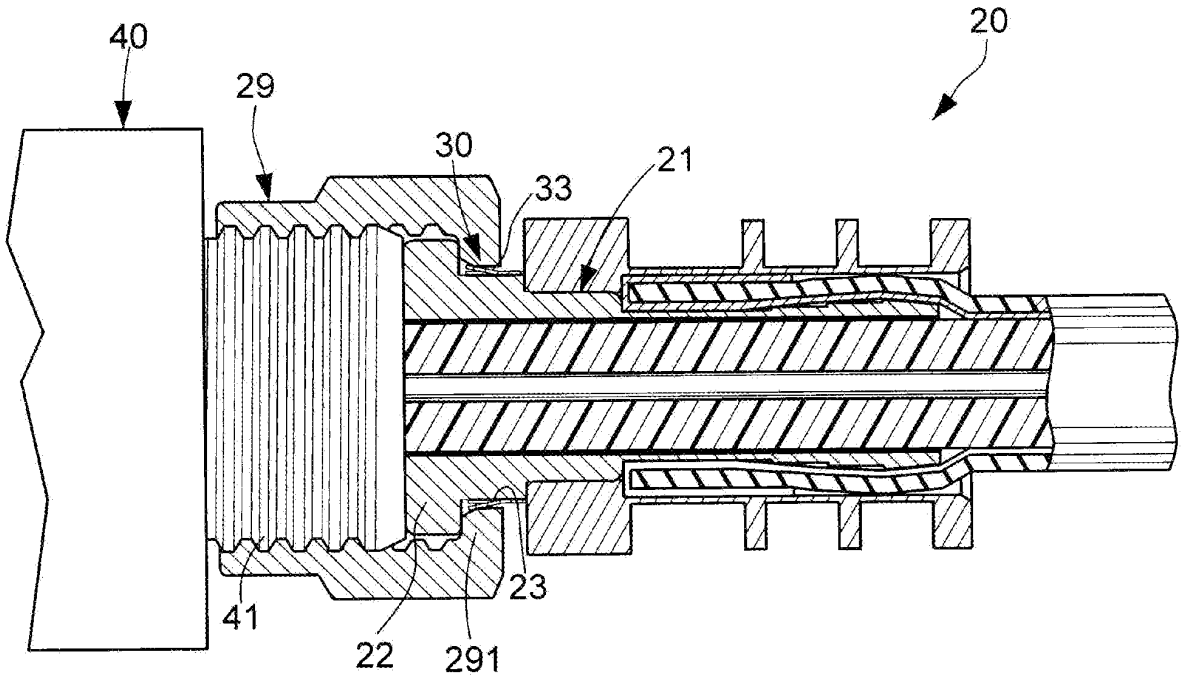

FIG.6B

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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