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(72) Inventor: **ALISAN, Ahmet**
45030 Manisa (TR)

(74) Representative: **Flint, Adam**
Page White & Farrer
Bedford House
John Street
London WC1N 2BF (GB)

(71) Applicant: **Vestel Elektronik Sanayi ve Ticaret A.S.**
45030 Manisa (TR)

(54) **FEMALE CONNECTOR FOR USE WITH DIFFERENT MALE COAXIAL CONNECTORS**

(57) A female connector (50) for use with different male coaxial connectors is provided. The female connector (50) has at least one outer contact (53, 54) for electrical connection with an outer contact (12, 32) of a male coaxial connector (10, 30). The female connector (50) has first and second inner female contacts (51, 52) for receiving the inner contact (11, 31) of a first male coaxial connector (10) and a second male coaxial connector (30) respectively. The first inner female contact (51) is located within the second inner female contact (52) for reciprocating movement within the second inner female contact (52). When a second male coaxial connector (30) is introduced into the female connector (50), the inner contact (31) of the second male coaxial connector (30) moves the first inner female contact (51) within the second inner female contact (52) to expose at least a portion of the second inner female contact (52) so that the inner contact (31) of the second male coaxial connector (30) makes electrical contact with the second inner female contact (52).

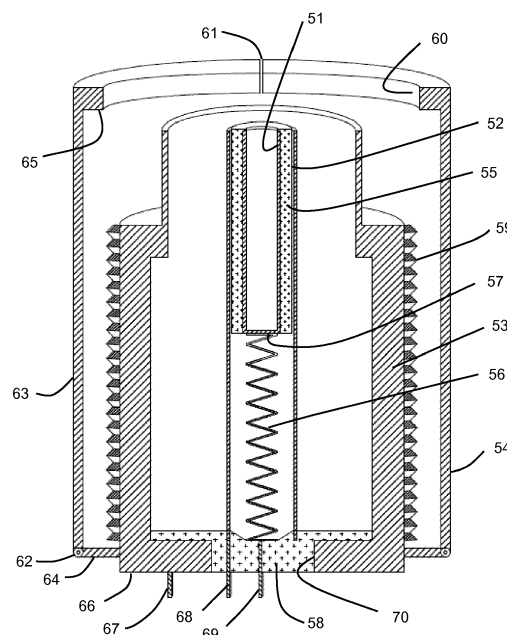


Fig. 6

Description

Technical Field

[0001] The present disclosure relates to a female connector for use with different male coaxial connectors.

Background

[0002] Many different connectors for connecting cables to devices are known. In general, the cables may be for carrying video, audio or other signals. As a particular example, coaxial cables are commonly used as transmission lines for radio frequency signals. Coaxial cables may be used for, for example, connecting a cable television receiver device or a satellite television receiver device to a television, set-top box, video recorder, etc. Coaxial cables may also be used for, for example, connecting a terrestrial television antenna to a television, set-top box, video recorder, etc.

[0003] The different types of cables and/or the purpose of the cable (i.e. the signals that the cable will carry) often mean that different types of connectors for the cables are required. The different connectors typically have different dimensions and other specifications, such as the various components that are used and their physical layout. The sizes and other specifications for such connectors are often set by one industry standard or another.

[0004] Having a number of different connectors on some device can be confusing or inconvenient for users when trying to connect cables to the device. This is particularly the case with some connectors that, at least superficially, look very similar to each other.

Summary

[0005] According to an aspect disclosed herein, there is provided a female connector for use with different male coaxial connectors, including a first male coaxial connector having an outer contact having an internal width and an external width and an inner contact having an external width and a second male coaxial connector having an outer contact having an internal width and an external width and an inner contact having an external width which is greater than the external width of the inner contact of the first male coaxial connector, the female connector having a connector-receiving end and an electrical connection end and comprising:

at least one outer contact for electrical connection with an outer contact of a male coaxial connector; a first inner female contact for receiving the inner contact of a said first male coaxial connector; and a second inner female contact for receiving the inner contact of a said second male coaxial connector; the first inner female contact being located within the second inner female contact for reciprocating movement within the second inner female contact towards

and away from the connector-receiving end of the female connector,

whereby, when a said first male coaxial connector is introduced into the connector-receiving end of the female connector, the inner contact of the first male coaxial connector is received within and makes electrical contact with the first inner female contact and, when a said second male coaxial connector is introduced into the connector-receiving end of the female connector, the inner contact of the second male coaxial connector moves the first inner female contact within the second inner female contact to expose at least a portion of the second inner female contact so that the inner contact of the second male coaxial connector makes electrical contact with the second inner female contact.

[0006] This enables a single female connector to be provided, or at least a single type of female connector if a number of female connectors are provided, on some device, including for example a television set, set-top box, etc. The female connector can be used with different types of male coaxial connector. This makes it much easier for a user to connect a cable having a male coaxial connector to the device. In some examples, the user need not be concerned with attempting to match a specific male coaxial connector on a cable to a specific female coaxial connector on the device, and instead that user can simply plug in the male coaxial connector and the female coaxial connector will accommodate the male coaxial connector as necessary. This makes connecting of cables much easier and less confusing for the user. It is also advantageous in that often the female coaxial connector(s) on a device are at the rear of the device and are often difficult to see and/or are relatively inaccessible.

[0007] The first male coaxial connector may be for example an F type male coaxial connector. The second male coaxial connector may be for example a Belling-Lee or television antenna connector.

[0008] In an example, the female connector comprises a biasing arrangement for biasing the first inner female contact towards the connector-receiving end of the female connector.

[0009] In an example, the biasing arrangement comprises a compression spring. The compression spring may be located within the second inner female contact.

[0010] In an example, the biasing arrangement is electrically conductive and provides an electrical contact to the first inner female contact.

[0011] In an example, the female connector comprises an electrically insulating wall at the electrical connection end of the female connector, the first inner female contact extending through or being electrically connected to a pin that extends through the electrically insulating wall to provide an electrical contact to the first inner female contact, and the second inner female contact extending through or being electrically connected to a pin that extends through the electrically insulating wall to provide

an electrical contact to the second inner female contact.

[0012] In the case that there is an electrically conductive spring which a biasing arrangement for biasing the first inner female contact towards the connector-receiving end of the female connector, the spring may extend through, or be connected to a pin that extends through, the electrically insulating wall at the electrical connection end of the female connector.

[0013] In an example, the female connector comprises an electrically insulating divider between the first inner female contact and the second inner female contact for maintaining a separation between the first inner female contact and the second inner female contact.

[0014] In an example, the female connector comprises a first outer contact for electrical connection with an outer contact of a first male coaxial connector and a second outer contact for electrical connection with an outer contact of a second male coaxial connector, the first outer contact being located within the second outer contact.

[0015] In an example, the first outer contact has a screw thread for receiving a screw thread of a said first male coaxial connector.

[0016] In an example, the second outer contact is arranged so as to be able to open outwardly at the connector-receiving end of the female connector to allow a male coaxial connector to be introduced into the female connector.

[0017] In an example, the first outer contact and the second outer contact are electrically connected to a common ground pin of the female connector which acts as a ground for a first male coaxial connector or a second male coaxial connector when connected to the female connector.

Brief Description of the Drawings

[0018] To assist understanding of the present disclosure and to show how embodiments may be put into effect, reference is made by way of example to the accompanying drawings in which:

Figure 1 shows schematically a perspective view of a known male F type connector;

Figure 2 shows schematically a lateral cross-sectional view of a known female F type connector;

Figure 3 shows schematically a perspective view of a known male Belling-Lee or TV antenna connector;

Figure 4 shows schematically a perspective view of a known female Belling-Lee or TV antenna connector;

Figure 5 shows schematically a partially sectioned lateral view of a female connector for use with different male coaxial connectors as described herein; and

Figure 6 shows schematically a lateral cross-sectional view of the female connector of Figure 5.

Detailed Description

[0019] As mentioned, many different connectors for connecting cables to devices are known. In general, the cables may be for carrying video, audio or other signals. As a particular example, coaxial cables are commonly used as transmission lines for radio frequency signals. Coaxial cables may be used for, for example, connecting a cable television receiver device or a satellite television receiver device to a television, set-top box, video recorder, etc. Coaxial cables may also be used for, for example, connecting a terrestrial television antenna to a television, set-top box, video recorder, etc.

[0020] The different types of cables and/or the purpose of the cable (i.e. the signals that the cable will carry) often mean that different types of connectors for the cables are required. The different connectors typically have different dimensions and other specifications, such as the various components that are used and their physical layout. The sizes and other specifications for such connectors are often set by one industry standard or another.

[0021] As a specific example, Figures 1 and 2 show respectively known male and female F type connectors 10, 20. Commonly, the male connector 10 is fitted to a cable and the female connector 20 is fitted to a device, such as a television, set-top box, video recorder, etc., though the male and female connectors 10, 20 may be fitted to the device and cable respectively in other examples. F type connectors are commonly used to connect coaxial cables between a cable television receiver device or a satellite television receiver device and a television, set-top box, video recorder, etc., to carry at least video and data signals from the receiver device to the television, set-top box, video recorder, etc., and to carry data signals, such as commands, from the television, set-top box, video recorder, etc. to the receiver device. The F type connectors 10, 20 may be in accordance with IEC (International Electrotechnical Commission) 61169-24.

[0022] The male F type connector 10 has a metal central or inner contact 11 and a metal outer contact 12. The metal central contact 11 is generally cylindrical, and is commonly the solid centre conductor of the coaxial cable 13 to which the male F type connector 10 is fitted. The metal outer contact 12 is generally in the form of a hollow cylinder which surrounds and is spaced from the central contact 11, and is in contact with the outer braid (not shown) of the coaxial cable 13 to which the male F type connector 10 is fitted. The interior of the metal outer contact 12 in this example has a screw thread 14 for screw-fitting the male F type connector 10 to a female F type connector 20, though plain, push-on versions with no screw thread are also available.

[0023] Correspondingly, the female F type connector 20 has a metal central or inner contact 21 and a metal outer contact 22. The inner contact 21 is typically in the

form of a narrow hollow cylinder into which the central contact 11 of the male F type connector 10 is inserted. The outer contact 22 is typically in the form of a hollow cylinder which surrounds and is spaced from the inner contact 21. The exterior of the outer contact 22 in this example has a screw thread 23 to which the screw thread 14 of the male F type connector 10 is screw-fitted.

[0024] Figures 3 and 4 show respectively known male and female "Belling-Lee" connectors 30, 40. Commonly, the male connector 30 is fitted to a cable and the female connector 40 is fitted to a device, such as a television, set-top box, video recorder, etc., though the male and female connectors 30, 40 may be fitted to the device and cable respectively in other examples. Belling-Lee connectors are commonly used to connect coaxial cables between a terrestrial television aerial or antenna and a television, set-top box, video recorder, etc. to carry RF (radio frequency) signals from the antenna to the television, set-top box, video recorder, etc. For this reason, Belling-Lee connectors are often referred to as "television antenna connectors" or "TV aerial plugs" or the like. The Belling-Lee connectors 30, 40 may be in accordance with IEC 61169-2.

[0025] The male Belling-Lee connector 30 has a metal central or inner contact 31 and a metal outer contact 32. The metal central contact 31 is generally cylindrical and is often solid though may be hollow. The metal central contact 31 is in contact with the inner conductor of the coaxial cable 33 to which the male Belling-Lee connector 30 is connected. The metal outer contact 32 is generally in the form of a hollow cylinder which surrounds and is spaced from the central contact 31, and is in contact with the outer conductor of the coaxial cable 33 to which the male Belling-Lee connector 30 is fitted.

[0026] Correspondingly, the female Belling-Lee connector 40 has a metal central or inner contact 41 and a metal outer contact 42. The inner contact 41 is typically in the form of a narrow hollow cylinder into which the central contact 31 of the male Belling-Lee connector 30 is inserted. The outer contact 42 is typically in the form of a hollow cylinder which surrounds and is spaced from the inner contact 31. The outer contact 32 of the male Belling-Lee connector 30 is typically a push-fit onto the outer contact 42 of the female Belling-Lee connector 40 and typically fits within the outer contact 42 of the female Belling-Lee connector 40.

[0027] Having a number of different connectors on some device can be confusing or inconvenient for users when trying to connect cables to the device. This is particularly the case with some connectors that, at least superficially, look very similar to each other. This is particularly the case for the known male and female F type connectors 10, 20 and the known male and female Belling-Lee connectors 30, 40, in which the male connectors 10, 30 look similar to each other and the female connectors 20, 40 look similar to each other. This problem is often exacerbated by the fact that the (female) connectors on the device, such as a television, set-top box, video

recorder, etc., are often at the rear of the device, and often cannot be (easily) seen by a user when connecting cables to the device. The user often tries to ascertain which type of connector is which "by feel".

[0028] In examples described herein, a single female connector is provided which can be used with different types of male coaxial connector. In at least some examples, the user can simply plug in the male coaxial connector and the female connector accommodates the male coaxial connector regardless of type.

[0029] An example of a female connector 50 as described herein will be described with reference to Figures 5 and 6. The specific example of the female connector 50 described herein is particularly suitable for use with male F type connectors and Belling-Lee type connectors, such as described above with reference to Figures 1 and 3 respectively. Nevertheless, the female connector 50 may be constructed and configured for use with other types of male connector, including in particular other types of male coaxial connectors.

[0030] The female connector 50 of this example has a first inner female contact 51 and a second inner female contact 52 and a first outer contact 53 and a second outer contact 54. In some cases, depending on the specific male connectors with which the female connector 50 is to be used, it may not be necessary to provide two outer contacts and a single outer contact may be sufficient. The first inner female contact 51, the second inner female contact 52, the first outer contact 53 and the second outer contact 54 are all electrically conductive, and may be formed of metal for example.

[0031] Briefly, and referring to the specific example of the female connector 50 being for use with male F type connectors and Belling-Lee type connectors, such as described above with reference to Figures 1 and 3 respectively, if a male F type connector 10 is connected to the female connector 50, the metal central contact 11 of the male F type connector 10 makes electrical contact with the first inner female contact 51 of the female connector 50 and the metal outer contact 12 of the male F type connector 10 makes electrical contact with the first outer contact 53 of the female connector 50; and if a male Belling-Lee connector 30 is connected to the female connector 50, the metal central contact 31 of the male Belling-Lee connector 30 makes electrical contact with the second inner female contact 52 of the female connector 50 and the metal outer contact 32 of the male Belling-Lee connector 30 makes electrical contact with the second outer contact 54 of the female connector 50. Also, in this example, when a male Belling-Lee connector 30 is introduced into the female connector 50, the metal central contact 31 of the male Belling-Lee connector 30 drives the first inner female contact 51 of the female connector 50 out of the way by driving the first inner female contact 51 of the female connector 50 into the second inner female contact 52 of the female connector 50. This means that the user simply has to introduce the male connector 10, 30 into the female connector 50 and the female con-

connector 50 accommodates the male connector 10, 30 regardless of the specific type of male connector 10, 30 that is being fitted.

[0032] It is mentioned here that it is common for the various inner and outer contacts of such connectors and plugs to be cylinders (which may be hollow or solid, depending on the specific contact and the specific type of connector) and to have a circular cross-sectional shape. Nevertheless, in some connectors and plugs, etc., some of the contacts may be square or hexagonal or some other cross-sectional shape. Accordingly, reference will often be made herein to the "diameter" or similar of a contact for convenience and by convention. However, it is to be understood that this does not necessarily limit the scope to circular cross-sectional shapes, and that this is to be interpreted to include other "widths", such as the side of a square or the maximum lateral extent of a hexagon, etc., unless the context requires otherwise.

[0033] Returning to Figures 5 and 6, the first inner female contact 51 is a hollow cylinder, sized so as to be able to receive the metal central contact 11 of the male F type connector 10 therein. As a specific example, the internal diameter (or other internal width) of the first inner female contact 51 may be around 1 mm, which corresponds to the external diameter of the metal central contact 11 of the male F type connector 10 in this example. Similarly, the second inner female contact 52 is a hollow cylinder, sized so as to be able to receive the metal central contact 31 of the male Belling-Lee connector 30 therein. As a specific example, the internal diameter (or other internal width) of the second inner female contact 52 may be around 2 mm, which corresponds to the external diameter of the metal central contact 31 of the male Belling-Lee connector 30.

[0034] In this example the first inner female contact 51 is located within the second inner female contact 52 and can slide back and forth in a reciprocating manner within the second inner female contact 52. The length of the first inner female contact 51 may be for example around half the length of the second inner female contact 52 so that the first inner female contact 51 can move entirely up and entirely down within the second inner female contact 52.

[0035] An electrically insulating divider 55 is located between the first inner female contact 51 and the second inner female contact 52 for maintaining a separation between the first inner female contact 51 and the second inner female contact 52. The electrically insulating divider 55 may be formed of a plastics, such as for example polypropylene. The electrically insulating divider 55 in this example is a hollow cylinder. Following the example dimensions given above for the first inner female contact 51 and the second inner female contact 52, in a specific example the outer diameter of the divider 55 is around 2 mm and the internal diameter of the divider 55 is around 1 mm. The divider 55 may be fixed to the first inner female contact 51 and so moves with the first inner female contact 51. In that case, the second inner female contact 52

may have an inwardly-facing retainer lip or the like (not shown) at the connector-receiving end of the female connector 50 to retain the divider 55 within the second inner female contact 52. Alternatively, the divider 55 may be fixed to the second inner female contact 52 so that the first inner female contact 51 moves within the divider 55. In that case, the first inner female contact 51 may have an inwardly-facing retainer lip or the like (not shown) at the connector-receiving end of the female connector 50 to retain the divider 55 within the first inner female contact 51.

[0036] A biasing arrangement biases the first inner female contact 51 towards the connector-receiving end of the female connector 50 (i.e. upwards in Figures 5 and 6). In this example, the biasing arrangement includes a spring 56, which may be a compression spring, such as a coil spring. The spring 56 acts between an innermost end 57 of the first inner female contact 51 and an opposed inner wall 58 of the female connector 50. The spring 56 may be fixed or otherwise retained at its opposite ends to the first inner female contact 51 and the opposed inner wall 58 of the female connector 50 respectively.

[0037] The first outer contact 53 of the female connector 50 is generally in the form of a hollow cylinder in which the first inner female contact 51 and the second inner female contact 52 are centrally located. In this example, especially as the female connector 50 is intended to be compatible with F type connectors 10 that have internal screw threads 14, the exterior wall of the first outer contact 53 has a corresponding screw thread 59. Again so as to be compatible with standard F type connectors 10, the maximum external diameter of the screw thread 59 of the first outer contact 53 may in an example be around 9.5 mm. The minimum external diameter of the screw thread 59 of the first outer contact 53 (i.e. measured to the root or base of the screw thread 59) may in an example be around 9 mm.

[0038] The second outer contact 54 of the female connector 50 is generally in the form of a hollow cylinder in which the first outer contact 53 is centrally located. In this example, the second outer contact 54 forms the outermost portion or shell of the female connector 50. The second outer contact 54 is open at the connector-receiving end of the female connector 50 so as to allow a male connector to be inserted into the female connector 50. The open end 60 of second outer contact 54 may in an example have an internal diameter of around 10 mm. This enables both standard F type connectors 10 and standard Belling-Lee connectors 30 to be received by the female connector 50.

[0039] Indeed, to facilitate insertion of standard F type connectors 10 and standard Belling-Lee connectors 30 into the female connector 50, the second outer contact 54 may be arranged so as to be able to open outwardly at the connector-receiving end of the female connector 50. This may be achieved by for example the second outer contact 54 having one or more slots 61 at the connector-receiving end, and the second outer contact 54 being

flexible or hinged (indicated schematically by hinges 62 between the side wall 63 and the opposite end wall 64 of the second outer contact 54 in Figures 5 and 6). The second outer contact 54 may have an inwardly facing retaining lip 65 at its open end 60.

[0040] In this example, the first outer contact 53 and the second outer contact 54 are electrically connected to each other, so as to provide a common ground for the F type connector 10 and the Belling-Lee connector 30. In this example, the end wall 64 of the second outer contact 54 is in contact with the end wall 66 of the first outer contact 53. A ground pin 67 extends from the end wall 66 of the first outer contact 53 outwardly of the female connector 50 for connection to a ground of a device in which the female connector 50 is mounted or fixed.

[0041] In addition, a live or signal pin 68 for the second inner female contact 52 (for the metal central contact 31 of the male Belling-Lee connector 30) extends outwardly of the female connector 50. The live or signal pin 68 for the second inner female contact 52 may be a separate part or may be an extension of the second inner female contact 52. Likewise, a live or signal pin 69 for the first inner female contact 51 (for the metal central contact 11 of the male F type connector 10) extends outwardly of the female connector 50. The live or signal pin 69 for the first inner female contact 51 in this example is in contact with or an extension of the spring 56, which is electrically conductive and may be formed of metal and which is in contact with the innermost end 57 of the first inner female contact 51. In this example, the live or signal pins 68, 69 for the two inner female contacts 52, 51 may pass through the inner wall 58 of the female connector 50, which therefore acts to retain and separate the two live pins 68, 69. In this example, the inner wall 58 is electrically insulating and 55 may be formed of a plastics, such as for example polypropylene. The inner wall 58 may be provided in the form of a plug that is inserted into a recess 70 in the end wall 66 of the first outer contact 53.

[0042] In use and as already described, the user simply has to insert the male connector 10, 30 into the female connector 50. In the case that the male connector is an F type connector 10, the metal central contact 11 of the male F type connector 10 makes electrical contact with the first inner female contact 51 of the female connector 50 and the metal outer contact 12 of the male F type connector 10 makes electrical contact with the first outer contact 53 of the female connector 50. In the case that the male connector is Belling-Lee connector 30, the metal central contact 31 of the male Belling-Lee connector 30 drives the first inner female contact 51 of the female connector 50 out of the way as it the Belling-Lee connector 30 is inserted. The metal central contact 31 of the male Belling-Lee connector 30 can then make contact with the second inner female contact 52 of the female connector 50 and the metal outer contact 32 of the male Belling-Lee connector 30 makes electrical contact with the second outer contact 54 of the female connector 50.

[0043] For completeness, it is noted that in use, an F

type connector 10 is often used to connect a television set or the like to a satellite dish, or, more specifically, the LNB (low-noise block downconverter) of a satellite dish. As such, the cable of the F type connector 10 passes RF signals conveying video, audio, etc., from the satellite dish to the television set or the like and to pass control signals from the television set or the like to the satellite dish. As a specific example to illustrate this, a voltage of 13V may be transmitted to the LNB to select a vertical polarisation and a voltage of 18V may be transmitted to the LNB to select a horizontal polarisation; and a "tone signal" of 22kHz may be transmitted to select a high frequency band, the absence of a tone signal being taken by the LNB 22 as selection of a low frequency band. On the other hand, a Belling-Lee connector 30 is often used to connect terrestrial television antenna to a television, set-top box, video recorder, etc. and so conveys RF signals conveying video, audio, etc., from the terrestrial television antenna to the television, set-top box, video recorder, etc.

[0044] The F type connector 10 and the Belling-Lee connector 30 described above and shown in the drawings are in-line or linear. In other connectors of this type, the connector may be right-angled, such that the cable end and the socket end are at right angles to each other.

[0045] Moreover, a screw thread connection is shown for the F type connector 10 and a push or sliding fit for the Belling-Lee connector 30 are shown. In other examples, other connections for either type of connector may be used, including for example screw, bayonet, push or sliding fit, etc.

[0046] The examples described herein are to be understood as illustrative examples of embodiments of the invention. Further embodiments and examples are envisaged. Any feature described in relation to any one example or embodiment may be used alone or in combination with other features. In addition, any feature described in relation to any one example or embodiment may also be used in combination with one or more features of any other of the examples or embodiments, or any combination of any other of the examples or embodiments. Furthermore, equivalents and modifications not described herein may also be employed within the scope of the invention, which is defined in the claims.

Claims

1. A female connector (50) for use with different male coaxial connectors, including a first male coaxial connector (10) having an outer contact (12) having an internal width and an external width and an inner contact (11) having an external width and a second male coaxial connector (30) having an outer contact (32) having an internal width and an external width and an inner contact (31) having an external width which is greater than the external width of the inner contact (11) of the first male coaxial connector (10),

the female connector (50) having a connector-receiving end and an electrical connection end and comprising:

- at least one outer contact (53, 54) for electrical connection with an outer contact (12, 32) of a male coaxial connector (10, 30);

a first inner female contact (51) for receiving the inner contact (11) of a said first male coaxial connector (10); and

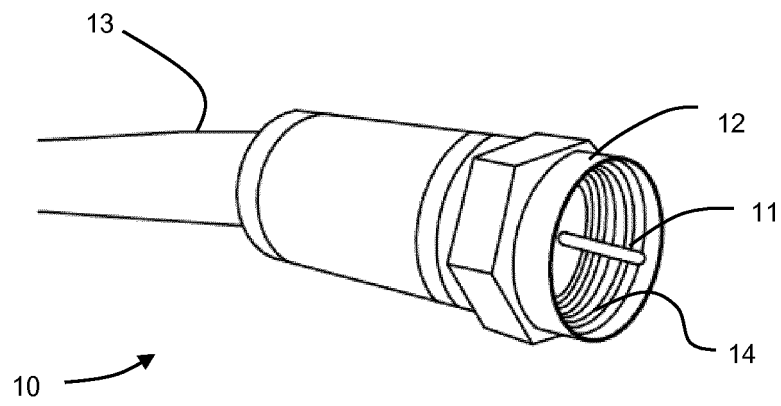
a second inner female contact (52) for receiving the inner contact (31) of a said second male coaxial connector (30);

the first inner female contact (51) being located within the second inner female contact (52) for reciprocating movement within the second inner female contact (52) towards and away from the coaxial connector-receiving end of the female connector (50),

whereby, when a said first male coaxial connector (10) is introduced into the connector-receiving end of the female connector (50), the inner contact (11) of the first male coaxial connector (10) is received within and makes electrical contact with the first inner female contact (51) and, when a said second male coaxial connector (30) is introduced into the connector-receiving end of the female connector (50), the inner contact (31) of the second male coaxial connector (30) moves the first inner female contact (51) within the second inner female contact (52) to expose at least a portion of the second inner female contact (52) so that the inner contact (31) of the second male coaxial connector (30) makes electrical contact with the second inner female contact (52).
- 2. A female connector (50) according to claim 1, comprising a biasing arrangement (56) for biasing the first inner female contact (51) towards the connector-receiving end of the female connector (50).
- 3. A female connector (50) according to claim 2, wherein the biasing arrangement comprises a compression spring (56).
- 4. A female connector (50) according to claim 2 or claim 3, wherein the biasing arrangement (56) is electrically conductive and provides an electrical contact to the first inner female contact (51).
- 5. A female connector (50) according to any of claims 1 to 4, comprising an electrically insulating wall (58) at the electrical connection end of the female connector (50), the first inner female contact (51) extending through or being electrically connected to a pin (69) that extends through the electrically insulating wall (58) to provide an electrical contact to the

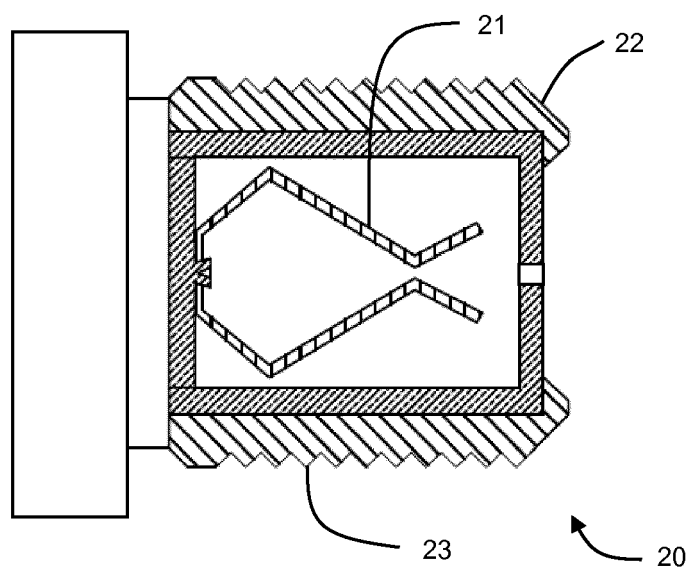
first inner female contact (51), and the second inner female contact (52) extending through or being electrically connected to a pin (68) that extends through the electrically insulating wall (58) to provide an electrical contact to the second inner female contact (52).

- 6. A female connector (50) according to any of claims 1 to 5, comprising an electrically insulating divider (55) between the first inner female contact (51) and the second inner female contact (52) for maintaining a separation between the first inner female contact (51) and the second inner female contact (52).
- 7. A female connector (50) according to any of claims 1 to 6, comprising a first outer contact (53) for electrical connection with an outer contact (12) of a first male coaxial connector (10) and a second outer contact (54) for electrical connection with an outer contact (32) of a second male coaxial connector (30), the first outer contact (53) being located within the second outer contact (54).
- 8. A female connector (50) according to claim 7, wherein the first outer contact (53) has a screw thread (59) for receiving a screw thread (14) of a said first male coaxial connector (10).
- 9. A female connector (50) according to claim 7 or claim 8, wherein the second outer contact (54) is arranged so as to be able to open outwardly at the connector-receiving end of the female connector (50) to allow a male coaxial connector (10, 30) to be introduced into the female connector (50).
- 10. A female connector (50) according to any of claims 7 to 9, wherein the first outer contact (53) and the second outer contact (54) are electrically connected to a common ground pin (67) of the female connector (50) which acts as a ground for a first male coaxial connector (10) or a second male coaxial connector (30) when connected to the female connector (50).



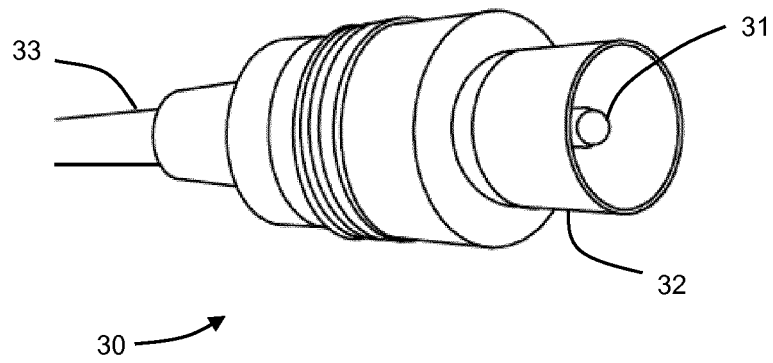
PRIOR ART

Fig. 1

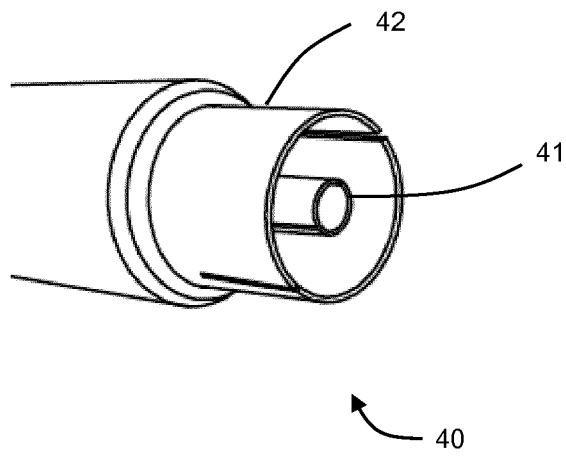


PRIOR ART

Fig. 2



PRIOR ART
Fig. 3



PRIOR ART
Fig. 4

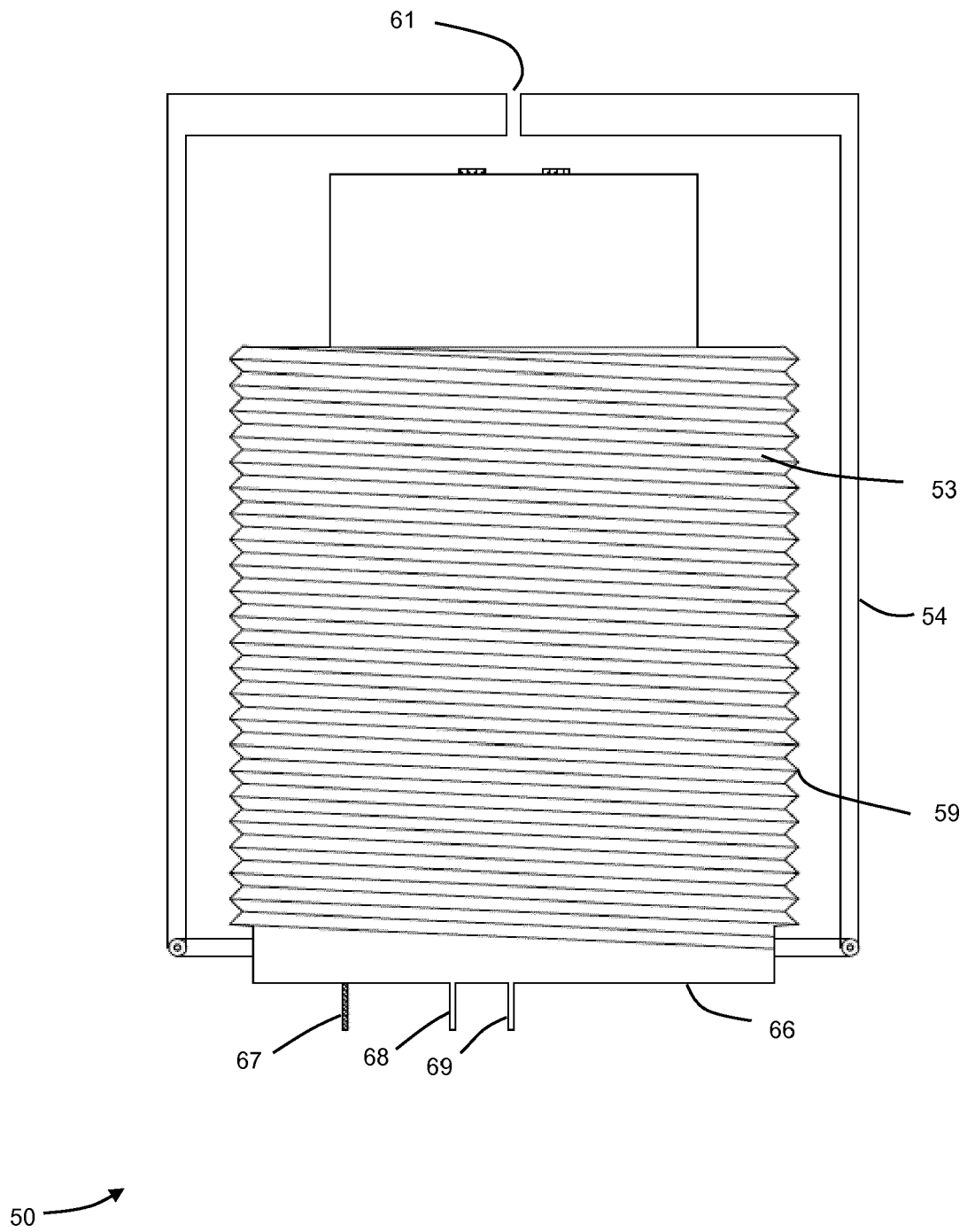


Fig. 5

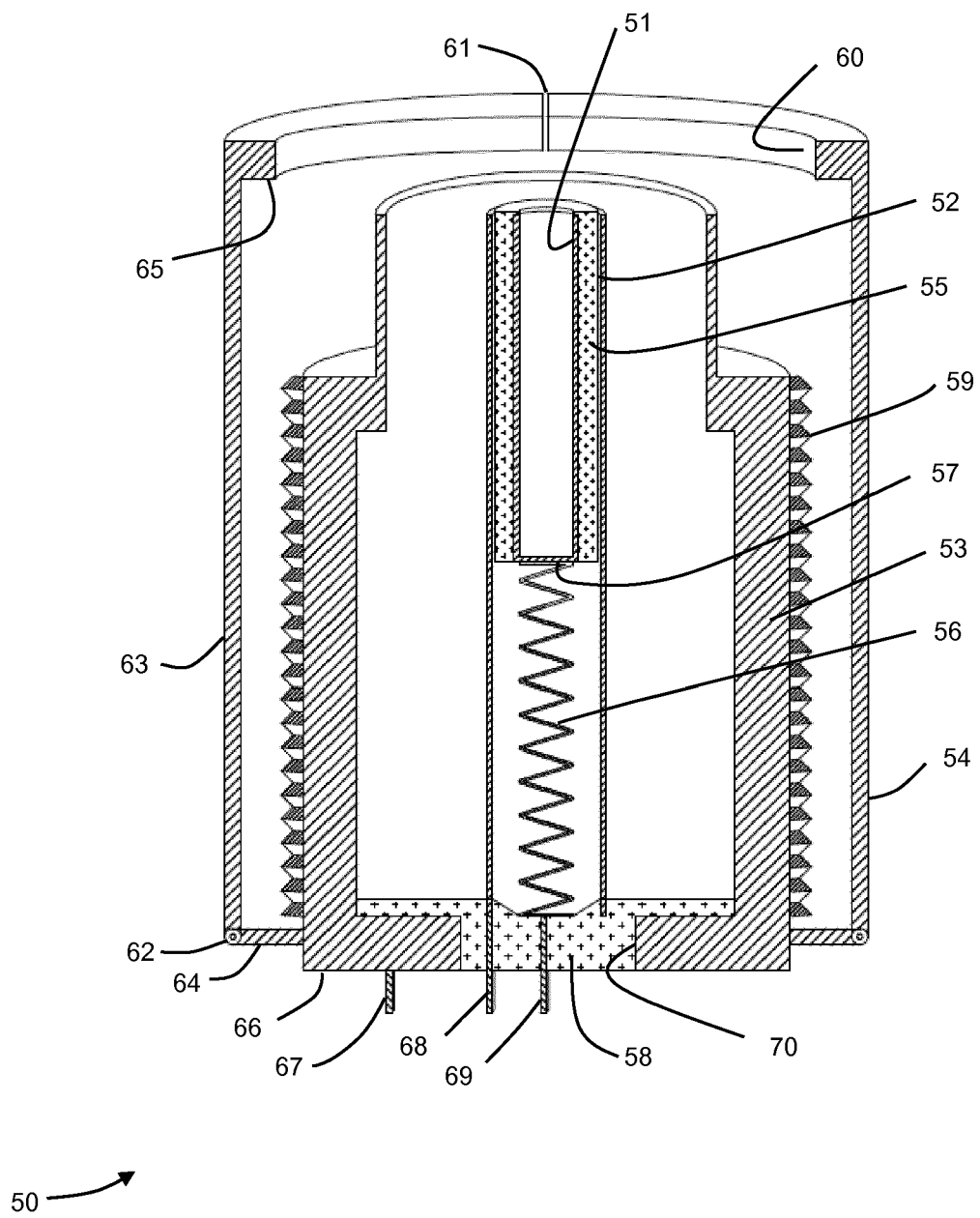


Fig. 6



EUROPEAN SEARCH REPORT

Application Number
EP 17 19 7079

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2017/215483 A1 (LI YONGHAI [CN] ET AL) 3 August 2017 (2017-08-03)	1-6	INV. H01R24/40
A	* paragraph [0017]; figure 2 * -----	7-10	H01R27/00 H01R13/14
A	US 8 550 827 B1 (SANDOVAL ARTHUR G [US] ET AL) 8 October 2013 (2013-10-08) * figures 1-15 *	1-10	ADD. H01R13/622 H01R13/24
A	US 2004/229512 A1 (CHEN PARRY [TW]) 18 November 2004 (2004-11-18) * figures 4,5 *	1-10	
A	EP 0 685 902 A1 (ELETTROMEDIA DI RICCOBELLI MAU [IT]) 6 December 1995 (1995-12-06) * figures 1-4 * -----	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01R
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 3 November 2017	Examiner Ferreira, João
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	

EPO FORM 1503 03/82 (P04C01)

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

EP 17 19 7079

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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03-11-2017

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2017215483 A1	03-08-2017	CN 205624475 U EP 3216358 A1 US 2017215483 A1	12-10-2016 13-09-2017 03-08-2017
US 8550827 B1	08-10-2013	NONE	
US 2004229512 A1	18-11-2004	CA 2432051 A1 JP 2004342571 A TW 1241757 B US 2004229512 A1	16-11-2004 02-12-2004 11-10-2005 18-11-2004
EP 0685902 A1	06-12-1995	CA 2150077 A1 CN 1120747 A EP 0685902 A1 IT 1270305 B JP H07335336 A TW 310491 B US 5676565 A	04-12-1995 17-04-1996 06-12-1995 29-04-1997 22-12-1995 11-07-1997 14-10-1997