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(54) A MULTICHANNEL CONNECTOR FOR SAFE AREAS, A FILTERING GROUP FOR A MULTICHANNEL CONNECTOR, AND AN EXPLOSION-PROOF BOX

(57) A multichannel connector (10) for safe areas comprises:
- a housing (30) defining a cavity (36) between a first (32) and a second end (34);
- two or more filtering groups (6) accommodated in the cavity (36) and each comprising:
- a capacitive blocking circuit (44);
- a shielding casing (5), about said capacitive blocking circuit (44) and spaced apart therefrom, to form an interspace (7).

The shielding casing (5) remains spaced apart from the housing (30) and the remaining filtering groups (6).

A sealing compound (50) enclosing said two or more filtering groups (6) is arranged in the cavity (36).

A filtering group (6) for a multichannel connector (10) and an explosion-proof box (14) comprising a multichannel connector (10) according to the present invention.

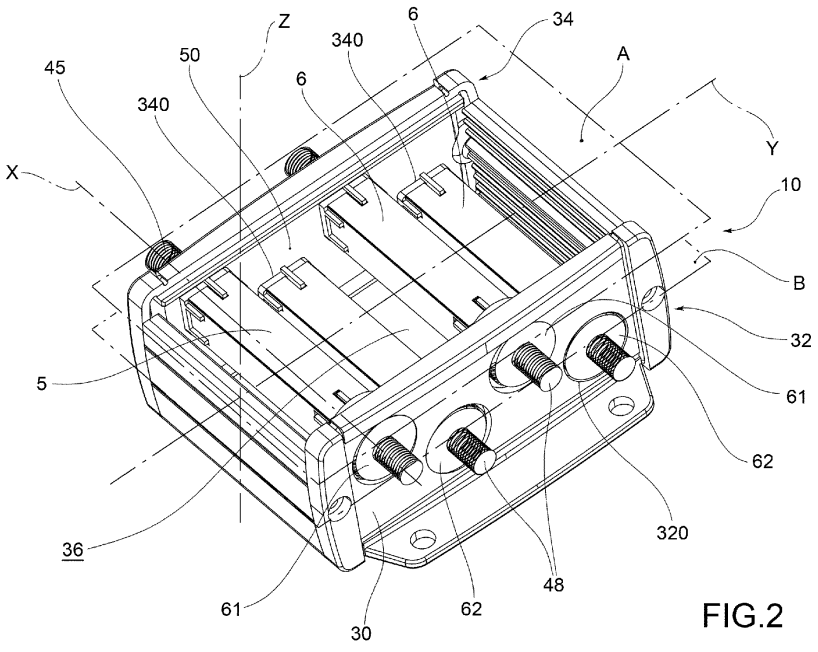

FIG.2

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Description

[0001] The present invention relates to a multichannel connector for safe areas. More specifically, it relates to a multichannel connector adapted to be placed in a safe area, e.g., inside an explosion-proof box, and acting as an access point for the connection of antennas placed in hazardous areas.

[0002] The installation of electrical equipment in environments with the presence of hazardous areas, e.g., areas at risk of explosion, requires the potential suppression of any hazardous electrical impulse intended to cross the electrical equipment, and the insertion of the electrical equipment into an explosion-proof box for withstanding the maximum force provided during an explosion.

[0003] The use of a multiplicity of explosion-proof fittings for antennas in hazardous areas, which can act as an access point for a multiplicity of antennas when used at the same time, is known in the art.

[0004] Italian patents IT201900001079, IT201800021403 and Italian utility model IT201800005206 disclose a solution of an explosion-proof fitting for connecting an antenna to a casing for electrical circuits in an environment with the presence of a hazardous area. In such documents, the explosion-proof fitting consists of an outer housing delimiting an inner cavity, in which a capacitive blocking circuit is accommodated being immersed in a sealing compound, which acts as a dielectric and protects the components from humidity.

[0005] Disadvantageously, for the application of the present application, i.e., in order to act as an access point for different antennas placed outside the safe area, i.e., placed in a hazardous area, the explosion-proof box of the prior art should be provided with a plurality of explosion-proof fittings according to the prior art.

[0006] In fact, disadvantageously, it is not possible to use the capacitive blocking circuits of each explosion-proof fitting together to create a single multichannel connector to be placed in a safe area acting as an access point for the antennas in a hazardous area. In fact, if a multichannel connector comprising a plurality of capacitive blocking circuits like those of the prior art were created, a mutual interference between the radiofrequencies of each capacitive blocking circuit would be generated, thus invalidating the performance of the access point.

[0007] Moreover, disadvantageously, each circuit would be buried in a sealing compound, generally resin, which alters the performance of the circuit in terms of the passive filtering properties, once again negatively affecting the performance of the whole connector.

[0008] Therefore, the need is felt for a multichannel connector for a safe area, for connecting antennas placed in a hazardous area, being capable of overcoming the aforesaid drawbacks of the prior art while being capable of maintaining the performance of a radio system to which the antenna is connected.

[0009] In particular, it is the object of the present invention to provide a multichannel connector adapted to generate a shielding of the signal by blocking any inherent interference between the components, and which maintains unaltered the passive design filtering properties of each capacitive blocking circuit placed therein.

[0010] This is achieved by a multichannel connector for a safe area according to independent claim 1, a filtering group for a multichannel connector according to independent claim 18, and an explosion-proof box according to independent claim 19, all claims being here appended. The claims dependent thereon show preferred constructional variants, implying further advantageous aspects.

[0011] The subject of the present invention will now be described in detail with the aid of the accompanying drawings, in which:

figure 1 is a diagrammatic view of an application of a multichannel connector for safe areas for connecting antennas placed in a hazardous area, made according to an embodiment of the present invention;

figure 1a is a diagrammatic view of an application of a multichannel connector for safe areas for connecting antennas placed in a hazardous area, where the multichannel connector is placed inside an explosion-proof box according to an embodiment of the present invention;

figure 2 is a perspective view of a multichannel connector for safe areas made according to an embodiment of the present invention, from which a housing portion has been removed to show the cavity of the multichannel connector;

figure 3 is a longitudinal section view of a filtering group for a multichannel connector for antennas made according to an embodiment of the present invention;

figure 3a is a detailed view of the filtering group for a multichannel connector shown in figure 3;

figure 4 is a cross-section view of the filtering group for a multichannel connector in figure 3, cut with the plane A-A;

figure 5 is a longitudinal section view of a filtering group for a multichannel connector made according to a further embodiment of the present invention;

figures 6a and 6b show two detailed views of a radio attachment of a filtering group for a multichannel connector, each in a different embodiment of the present invention;

figures 7a, 7b and 7c show three detailed views of the antenna attachment of a filtering group for a multichannel connector, in three different embodiments of the present invention;

figure 8 shows a diagram of an electrical circuit of a filtering group for a multichannel connector according to an embodiment of the present invention.

[0012] With reference to the accompanying figures, a multichannel connector 10 for safe areas for connecting antennas 12 in a hazardous area, is indicated by reference numeral 10.

[0013] As discussed in greater detail below, figure 1 shows an example of an application of the multichannel connector 10 in a safe area, for connecting antennas placed in a hazardous area.

[0014] With reference to figure 1, the area in which the multichannel connector 10 is located represents, for example, an electrically safe area inside an explosion-proof box 14. The area in which the antenna 12 is placed represents an environment with an electrically hazardous area classification, for example outside an explosion-proof box 14.

[0015] In the present disclosure, the box 14 is an explosion-proof box 14 for use in an environment comprising electrically hazardous areas.

[0016] The antenna 12 is preferably connected to a radio unit 26 in a safe area through a multichannel connector 10 placed inside the safe area, for ensuring an inherently safe barrier.

[0017] As better detailed below, the multichannel connector 10 comprises a plurality of filtering groups, each comprising a capacitive blocking circuit 44 providing an inherently safe barrier for suppressing an electrical impulse, which can potentially travel through the multichannel connector along a radio frequency signal conductor. A radio unit 26 receives power from an external power supply (not shown).

[0018] With reference to the example in figure 2, the multichannel connector 10 comprises a housing 30, preferably made of aluminum, defining and extending between a first end 32 and a second end 34. A cavity 36 is defined in the housing 30 between said first 32 and second 34 ends.

[0019] At said first end 32, the multichannel connector 10 comprises first end seats 320 obtained in said housing 30.

[0020] At the second end 34, the multichannel connector 10 comprises second end seats 340 obtained in said housing 30.

[0021] The multichannel connector 10 further comprises two or more filtering groups 6 accommodated in the cavity 36. Each filtering group 6 of said filtering groups 6 extends along a main extension axis X thereof between an antenna attachment 48 and a radio attachment 45.

[0022] According to the present invention, each filtering group 6 is engaged in a respective first-end seat 320 of said first-end seats 320 at the antenna attachment 48 and is engaged in a respective second-end seat 340 of said second-end seats 340 at the radio attachment 45.

[0023] In an advantageous embodiment, each filtering group 6 is spaced apart from the remaining filtering groups 6 at least along the transverse direction Y orthogonal to said main extension axis X.

[0024] Moreover, in an advantageous variant, each filtering group 6 is spaced apart from the housing 30 at least along the transverse direction Y and at least along a second direction Z orthogonal to the main extension axis X and the transverse direction Y.

[0025] Said two or more filtering groups 6 are preferably arranged parallel to one another.

[0026] In a preferred embodiment, the two or more filtering groups 6 comprise a first series of filtering groups 61 lying on a first imaginary plane A and a second series of filtering groups 62 lying on a second imaginary plane B, where the first imaginary plane A is parallel to the second imaginary plane B, and where, along the transverse direction Y, at least one filtering group 6 of the second series of filtering groups 62 is placed between two filtering groups 6 of the first series of filtering groups 61, and vice versa.

[0027] In other words, the filtering groups 6 are arranged in a mutually offset manner, that is, by observing one of the ends of the housing, the filtering groups 6 form a zig zag pattern in the respective seats.

[0028] Such an embodiment allows keeping the multichannel connector compact and efficiently occupying the cavity inside the housing.

[0029] Each filtering group 6 further comprises a capacitive blocking circuit 44 electrically connected to the antenna attachment 48 and the radio attachment 45.

[0030] Each filtering group 6 further comprises a shielding casing 5, running about said capacitive blocking circuit 44 along said main extension axis X and remaining spaced apart from such a capacitive blocking circuit 44 at least along a transverse direction Y orthogonal to said main extension axis X, so that an interspace 7 between such a shielding casing 5 and such a capacitive blocking circuit 44 is formed.

[0031] Moreover, in particular, each filtering group 6 is accommodated in the cavity 36 so that the shielding casing 5 of each filtering group 6 also remains, in turn, spaced apart from the housing 30 and the shielding casing 5 of the remaining filtering groups 6 of the two or more filtering groups 6 accommodated in the cavity 36.

[0032] Preferably, the shielding casing 5 comprises a side wall running about and along the main extension axis X, having a plurality of sides, and such a shielding casing 5 remains spaced apart from the housing 30 and the other filtering groups 6 about the whole side wall, i.e., along all sides of such a plurality of sides.

[0033] Inside the cavity 36, the multichannel connector 10 comprises at least one sealing compound 50 which at least partially or completely enclose the filtering group 6. Preferably, the sealing compound 50 completely fills the cavity 36.

[0034] In other words, the sealing compound 50 fills the space resulting between the shielding casing 5 of each filtering group 6 and the housing 3 in the cavity 36.

[0035] Moreover, each filtering group 6 is preferably totally accommodated in the cavity 36.

[0036] In an embodiment of the invention, the interspace 7 is filled with a gas, a gas mixture, or air. Advantageously, the gas or gas mixture or air allows keeping

the passive filtering features of the capacitive blocking circuit unaltered within the limits of the design tolerances.

[0037] In an alternative embodiment of the invention, for example with reference to the accompanying figures 3a and 4, each filtering group 6 comprises a filling material 71, 72 accommodated in the interspace, between the shielding casing 5 and the capacitive blocking circuit 44.

[0038] Preferably, such a filling material 71, 72 is a material suited to not alter at least the passive filtering features of the capacitive circuit 44, so as to keep the passive filtering features within the design filtering tolerances.

[0039] Even more preferably, the filling material 71, 72 is polytetrafluoroethylene (PTFE, also known under the trade name Teflon).

[0040] Alternatively, the filling material 71, 72 is composed of a material selected from the group comprising: Polyethylene, Polyamide, Polypropylene, Polystyrene, paper, Mica, Dioxide Silicon, Carbon Sulfide, PVC, Bi-Oriented Polyethylene Terephthalate (BoPET) .

[0041] In a preferred embodiment, the filling material 71, 72 completely occupies the interspace 7.

[0042] In one embodiment, the filling material 71, 72 is liquid-based and adapted to solidify once inserted into the interspace 7.

[0043] In one embodiment of the invention, the capacitive blocking circuit 44 divides the interspace 7 into a first half-space 7' and a second half-space 7" arranged on the side opposite to the first half-space 7' with respect to the capacitive blocking circuit 44 and where the filling material 71, 72 consists of at least a first slat 71 arranged in the first half-space 7' and a second slat 72 arranged in the second half-space 7".

[0044] That is, in such an embodiment, the filling material 71, 72 is inserted directly into the interspace 7 in solid form, i.e., in the form of slats.

[0045] In a preferred embodiment, the shielding casing 5 is a bent metal sheet surrounding the capacitive blocking circuit 44.

[0046] Advantageously, such a metal sheet efficiently performs the function of shielding the circuit while ensuring the insulation of the capacitive circuit with respect to the sealing compound, which is always outside the shielding casing 5.

[0047] Preferably, the metal sheet is bent about the capacitive blocking circuit, giving the shielding casing 5 a prismatic shape, even more preferably a rectangular parallelepiped shape. Such a shape facilitates the steps of assembling and producing the filtering group 6.

[0048] Even more preferably, the shielding casing 5 is made of a copper-nickel-zinc alloy, even more preferably is made of an alloy comprising a percentage of copper between 50% and 60%, a percentage of zinc between 15% and 30%, and a percentage of nickel between 10% and 30%. In other words, the shielding casing 5 is preferably made of German silver.

[0049] Advantageously, the German silver is a material characterized by good weldability and thus facilitates the production of the shielding casing 5, preferably in the form of metal sheet.

[0050] Moreover, preferably with reference to the embodiment in figure 4, the shielding casing 5 is at least partially in contact with a periphery of the capacitive blocking circuit 44.

[0051] In one embodiment of the present invention, the capacitive blocking circuit 44 comprises a first capacitive blocking circuit 44' connected between the electrical signal conductor 451 and the antenna signal conductor 481. The capacitive blocking circuit 44 further comprises a second capacitive blocking circuit 44" connected between the electrical return conductor 452 and the antenna return conductor 482.

[0052] Preferably, the first capacitive blocking circuit 44' comprises a first series of two capacitors 441, 442, and the second capacitive blocking circuit 44'' comprises a second series of two capacitors 443, 444. In such embodiments, the first series of capacitors 441, 442 and the second series of capacitors 443, 444 only consist of a series of two capacitors each, thus providing a more compact solution.

[0053] In one embodiment, each capacitor 441, 442, 443, 444 of first capacitive blocking circuit 44' and second capacitive blocking circuit 44" has a capacity value between 10 and 68 pF. This allows obtaining an optimized tuning to reduce the signal loss and minimizing the interacting capacity between the protective circuit on the power supply and the electrical return conductor 452 (return circuit).

[0054] Each capacitor of the first capacitive blocking circuit 44' and the second capacitive blocking circuit 44" preferably has a minimum RMS voltage of 1500V.

[0055] Moreover, each capacitor preferably has a maximum tolerance of 10%.

[0056] In one embodiment of the present invention, for example shown in figure 5, the capacitive blocking circuit 44 is a series of capacitors 441, 442.

[0057] The series of capacitors preferably only consists of a series of two capacitors 441, 442, thus providing a more compact solution.

[0058] In a particularly advantageous embodiment, with reference to the embodiment shown in figure 3, each filtering group 6 comprises a circuit board 60, including the capacitive blocking circuit 44. Preferably, such a circuit board 60 is completely accommodated inside the shielding casing 5.

[0059] In a preferred embodiment, the circuit board 60 is a Printed Circuit Board, PCB.

[0060] Even more preferably, the circuit board 60 is an insulated flexible support, preferably a support made of a polyamide material, for example of the material known under the trade name Kapton, and comprises a series of capacitors 441, 442, preferably directly obtained in the flexible support.

[0061] This provides a compact solution, further reducing the volume of each filtering group 6.

[0062] Preferably, the capacitive blocking circuit 44 is

electrically connected to the antenna attachment 48 at an antenna connection end 98 and is electrically connected to the radio attachment 45 at a radio connection end 95.

[0063] The antenna attachment 48 preferably comprises an antenna signal conductor 481 and an antenna return conductor 482.

[0064] Moreover, the radio attachment 45 preferably comprises an electrical signal conductor 451 and an electrical return conductor 452.

[0065] Preferably, the radio attachment 45 is connected, preferably by means of said electrical return conductor 452, directly to the explosion-proof box 14, which is generally connected to a ground, e.g. a power ground and/or to the conductor of the power ground on the radio unit 26.

[0066] Moreover, the capacitive blocking circuit 44 is preferably directly connected to said electrical signal 451 and return 452 conductors, i.e., without any other intermediate electrical component, except for a simple conductor.

[0067] The electrical signal conductor 451 and the electrical return conductor 452 can be used to be directly connected to the radio unit 26.

[0068] Moreover, the capacitive blocking circuit 44 is preferably accommodated inside the shielding casing 5 in a suspended manner, and is held in place in the shielding casing 5 only by means of the connection to the antenna attachment 48 at the antenna connection end 98 and to the radio attachment 45 at the radio connection end 95.

[0069] Preferably, the antenna attachment 48 comprises a first connection seat 480 at the antenna connection end 98 of the capacitive blocking circuit 44, and the radio attachment 45 comprises a second connection seat 450 at the radio connection end 95 of the capacitive blocking circuit.

[0070] In particular, such first and second connection seats 480, 450 each accommodate a respective engagement portion 580, 550 of the shielding casing.

[0071] Even more preferably, the first and second connection seats 480, 450 comprise coupling pins 80 which are firmly fastened, e.g., welded, to the respective engagement portion 580, 550 of the shielding casing 5.

[0072] In other words, the shielding casing 5 is directly fastened at the ends thereof (or more generally, at the ends of the capacitive blocking circuit 44) to radio attachment 48 and antenna attachment 45.

[0073] Moreover, the shielding casing 5 is preferably accommodated inside the cavity 36 in a suspended manner and is kept connected to the housing 30 only at the engagement of the respective filtering group 6 in such first and second end seats 320, 340 defined above.

[0074] Preferably, the multichannel connector 10 comprises a number of filtering groups between two and ten, preferably between four and seven.

[0075] In an embodiment, for example shown in figure 6a, the radio attachment 45 comprises a coaxial cable 70.

[0076] The coaxial cable 70 preferably comprises a central conductor and a shield.

[0077] In an embodiment, the central conductor of the coaxial cable 70 is connected to (or it itself) the electrical signal conductor 451, while the shield of the coaxial cable 70 is connected to the electrical return conductor 452. In a second embodiment, for example shown in figure 6b, the radio attachment 45 comprises a coaxial connector 80', protruding from the second end 34, which is adapted to receive a coaxial cable.

[0078] In a constructional variant, for example shown in figure 7a, the antenna attachment 48 has outer threads 49 and protrudes from the first end 32. For example, the antenna attachment can be an SMA or RP-SMA connector.

[0079] In an alternative constructional variant, for example shown in figure 7b, the antenna attachment 48 is a BNC-type connector 48'.

[0080] In a still alternative constructional variant, for example shown in figure 7c, the antenna attachment 48 is a TNC-type connector 48".

[0081] Preferably, the sealing compound 50 is a sealing compound for hazardous areas which acts as a dielectric, protects the filtering group 6 from humidity, potentially provides a traction release for the coaxial cable 70, and can withstand the force of an explosion.

[0082] Preferably, the sealing compound 50 is an epoxy compound, even more preferably an epoxy resin.

[0083] The housing 30 is preferably made of aluminum.

[0084] It is apparent that a filtering group 6 for a multichannel connector 10 is also a subject per se of the present invention.

[0085] According to the present invention, the filtering group 6 extends along a main extension axis X between an antenna attachment 48 and a radio attachment 45, and comprises:

- a capacitive blocking circuit 44 electrically connected to the antenna attachment 48 and the radio attachment 45;
- a shielding casing 5, running about the aforesaid capacitive blocking circuit 44 along such a main extension axis X and remaining spaced apart from such a capacitive blocking circuit 44 at least along a transverse direction Y orthogonal to the main extension axis X, so that an interspace 7 between said shielding casing 5 and said capacitive blocking circuit 44 is formed.

[0086] According to the present invention, the filtering group 6 is housable in a cavity 36 of a multichannel connector 10.

[0087] Preferably, the filtering group 6 is housable in the cavity in a suspended manner by means of the engagement of the filtering group 6 at the radio attachment 45 and the antenna attachment, in appropriate seats 320, 340 obtained in a housing 30 of the multichannel connector 10.

[0088] It is also apparent that all alternative constructional variants described in the present disclosure relating to detailed technical features of the multichannel connector 10 of the present invention, with particular reference to the detailed technical features of the elements of a filtering group 6, also equally apply to the filtering group 6 per se, irrespective of whether such a filtering group 6 is accommodated in a cavity 36 of a multichannel connector 10 or not.

[0089] As already mentioned, and with reference to the diagrammatic view shown in figure 1a, it is further apparent that the present invention is also directed to an explosion-proof box 14 for hazardous areas, comprising a containment wall 141, defining a safe area 142 on one side of said containment wall 141 and a hazardous area 143 on the other side of said containment wall 141. The explosion-proof box 14 comprises a multichannel connector 10 for a safe area, as described in the preceding paragraphs, and in particular accommodated therein.

[0090] Innovatively, the multichannel connector for safe areas, the filtering group, and the explosion-proof box according to the present invention allow overcoming all drawbacks of the prior art.

[0091] In particular, the multichannel connector according to the present invention is inherently protective and anti-interfering, and ensures the performance of the radio unit, minimizing the signal loss in the passage through the capacitive blocking circuits contained in the filtering groups contained in the multichannel connector.

[0092] Innovatively, by virtue of the shielding casing, each filtering group generates a signal shielding, while maintaining the sealing properties provided by the sealing compound surrounding each filtering group in the cavity of the multichannel connector.

[0093] According to a further advantage, the multichannel connector of the present invention is compact and allows integrating a plurality of filtering groups into the same housing, without generating interference between each filtering group.

[0094] Moreover, the multichannel connector of the present invention allows avoiding the use of a plurality of separate and shielded explosion-proof fittings, each containing a specific filtering group to act as an access point for a plurality of antennas located in hazardous areas.

[0095] According to an even further advantage, the present multichannel connector comprises a plurality of filtering groups, each being independent, that is, in the present multichannel connector, the radio frequency of each filtering group remains limited to that filtering group, without interfering with the radio frequencies of the remaining neighboring filtering groups.

[0096] Moreover, the filtering group described generates a little or even no alteration of the passive design filtering properties of the capacitive blocking circuit precisely due to the presence of the shielding casing interposed between the capacitive blocking circuit and the sealing compound, thus avoiding the direct contact thereof.

[0097] According to a further synergistic advantage, the shielding casing consisting of a bendable metal sheet provides the filtering group with a good shielding performance and acts as a ground for the circuit itself.

[0098] Moreover, according to an even further advantage, the metal sheet facilitates the operations of assembling the filtering group and the multichannel connector, and is easily assemblable with the radio and antenna attachments, by virtue of the convenient prismatic shape.

[0099] Moreover, the multichannel connector of the present invention is advantageously compact and easy to construct.

[0100] Advantageously, the multichannel connector of the present invention is scalable to comprise a number of filtering groups from 2 to 10, preferably from 4 to 7.

[0101] Moreover, advantageously, the filtering group of the present invention also lends itself to being used for applications inside explosion-proof fittings for antennas for applications in unsafe areas. In particular, the filtering group lends itself to being integrated into the already known explosion-proof fittings, i.e., it does not require a conversion of the housings of such explosion-proof fittings to fit into the filtering group of the present invention.

[0102] It is apparent that those skilled in the art may make changes to the embodiments of the aforesaid multichannel connector for safe areas and explosion-proof box, or may replace elements with others which are functionally equivalent in order to meet specific needs.

[0103] Such variants are also within in the scope of protection as defined by the following claims. Moreover, each variation described as belonging to a possible embodiment can be implemented irrespective of the other variations described.

Claims

1. A multichannel connector (10) for safe areas, for the connection of antennas (12) located in hazardous areas, comprising:

- a housing (30) defining and extending between a first (32) and a second end (34) and defining a cavity (36) between said first (32) and second end (34);
- two or more filtering groups (6), each extending along a main extension axis (X) thereof between an antenna attachment (48) and a radio attachment (45);

each filtering group (6) of said two or more filtering groups (6) being accommodated in said cavity (36) and said each filtering group (6) comprising:

- a capacitive blocking circuit (44) electrically connected to said antenna attachment (48) and

said radio attachment (45);
- a shielding casing (5), running about said capacitive blocking circuit (44) along said main extension axis (X) and remaining spaced apart from said capacitive blocking circuit (44) at least along a transverse direction (Y), orthogonal to said main extension axis (X), so that an interspace (7) between said shielding casing (5) and said capacitive blocking circuit (44) is formed,

each filtering group (6) being accommodated in the cavity (36) so that the shielding casing (5) remains spaced apart from the housing (30) and the remaining filtering groups (6) of said two or more filtering groups (6),
and wherein the multichannel connector (10) comprises a sealing compound (50) in the cavity (36), arranged between the shielding casing (5) and the housing (30), said sealing compound (50) at least partially or completely enclosing said two or more filtering groups (6) .

2. Multichannel connector (10) according to claim 1, wherein said two or more filtering groups (6) are completely accommodated in the cavity (36).

3. Multichannel connector (10) according to claim 1 or 2, wherein each filtering group (6) is spaced apart with respect to the remaining filtering groups (6) at least along the transverse direction (Y) orthogonal to said main extension axis (X).

4. Multichannel connector (10) according to any one of the preceding claims, wherein each filtering group (6) is spaced apart from the housing (30) at least along the transverse direction (Y) and at least along a second direction (Z) orthogonal to the main extension axis (X) and the transverse direction (Y).

5. Multichannel connector (10) according to any one of the preceding claims, wherein said two or more filtering groups (6) are arranged parallel to one another.

6. Multichannel connector (10) according to any one of the preceding claims, wherein said two or more filtering groups (6) comprise a first series of filtering groups (61) lying on a first imaginary plane (A) and a second series of filtering groups (62) lying on a second imaginary plane (B), wherein the first imaginary plane (A) is parallel to the second imaginary plane (B), and wherein, along the transverse direction (Y), at least one filtering group (6) of the second series of filtering groups (62) is placed between two filtering groups (6) of the first series of filtering groups (61), and vice versa.

7. Multichannel connector (10) according to any one of the preceding claims, wherein the interspace (7) of each filtering group (6) is filled with a gas, a gas mixture, or air.

8. Multichannel connector (10) according to any one of claims 1 to 6, wherein each filtering group (6) comprises a filling material (71, 72) accommodated in said interspace (7) between said shielding casing (5) and said capacitive blocking circuit (44).

9. Multichannel connector (10) according to claim 8, wherein, in each filtering group (6), the capacitive blocking circuit (44) divides the interspace (7) into a first half-space (7') and a second half-space (7") arranged on the side opposite to the first half-space (7') with respect to the capacitive blocking circuit (44) and wherein the filling material (71, 72) consists of at least a first slat (71) arranged in the first half-space (7') and a second slat (72) arranged in the second half-space (7").

10. Multichannel connector (10) according to any one of the preceding claims, wherein in each filtering group (6) the shielding casing (5) is a bent metal sheet surrounding the capacitive blocking circuit (44).

11. Multichannel connector (10) according to any one of the preceding claims, comprising first-end seats (320) obtained in said housing (30) at the first end (32) and comprising second-end seats (340) obtained in said housing (30) at the second end (34), and wherein each filtering group (6) is engaged in a respective first-end seat (320) of said first-end seats (320) at the antenna attachment (48) and is engaged in a respective second-end seat (340) of said second-end seats (340) at the radio attachment (45).

12. Multichannel connector (10) according to any one of the preceding claims, wherein the housing (30) is made of aluminum.

13. Multichannel connector (10) according to any one of the preceding claims, comprising a number of filtering groups (6) between four and seven.

14. A filtering group (6) for a multichannel connector (10) for safe areas, extending along a main extension axis (X) between an antenna attachment (48) and a radio attachment (45), said filtering group (6) comprising:

- a capacitive blocking circuit (44) electrically connected to said antenna attachment (48) and said radio attachment (45);
- a shielding casing (5), running about said capacitive blocking circuit (44) along said main extension axis (X) and remaining spaced apart from said capacitive blocking circuit (44) at least

along a transverse direction (Y), orthogonal to said main extension axis (X), so that an interspace (7) between said shielding casing (5) and said capacitive blocking circuit (44) is formed, said filtering group (6) being accommodable in a cavity (36) of a multichannel connector (10) for safe areas.

15. An explosion-proof box (14) for hazardous areas, comprising:

a containment wall (141) defining a safe area (142) on one side of said containment wall (141) and a hazardous area (143) on the other side of said containment wall (141); and
a multichannel connector (10) for safe areas according to any one of claims 1 to 13, accommodated within the safe area (142).

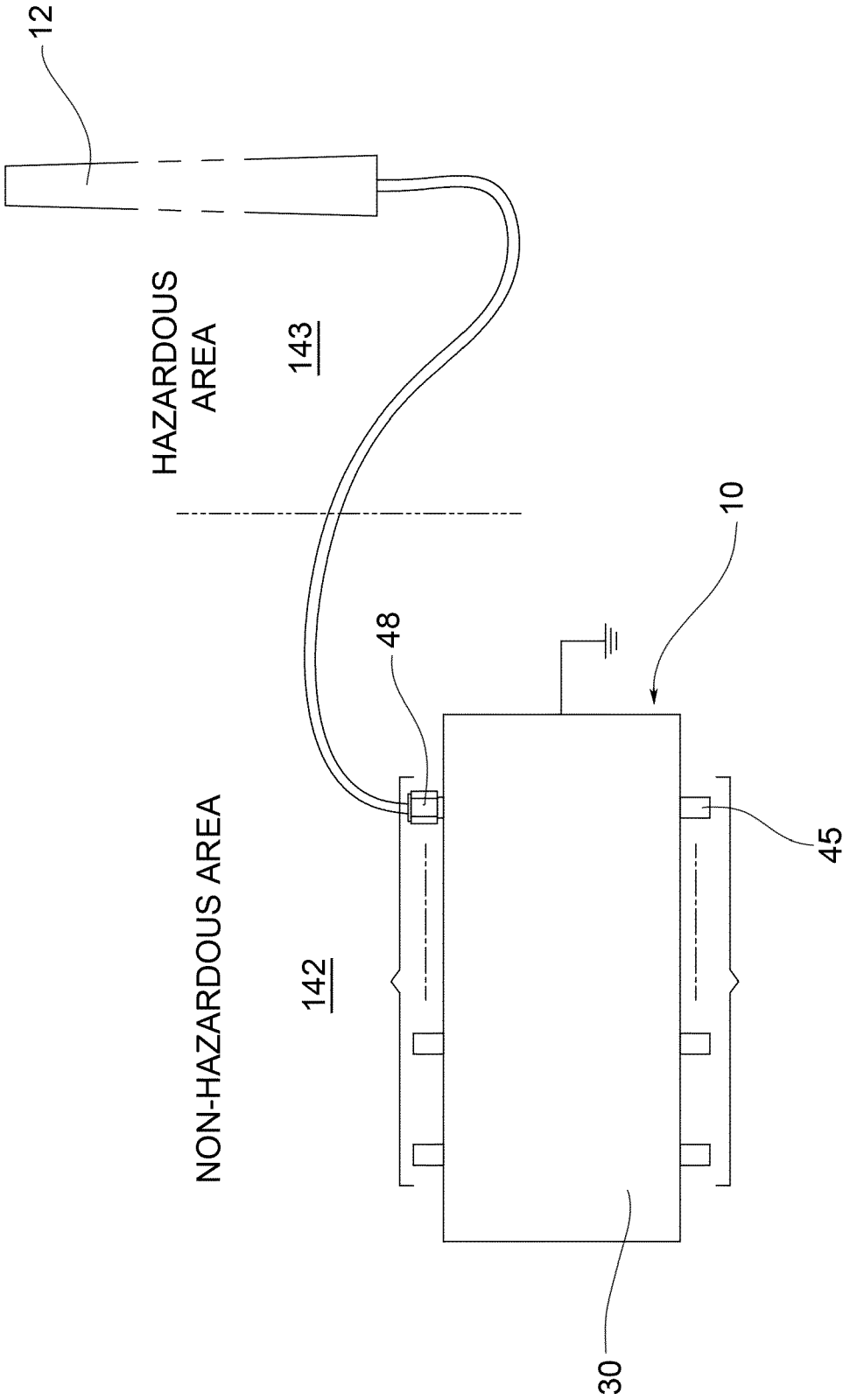

FIG.1

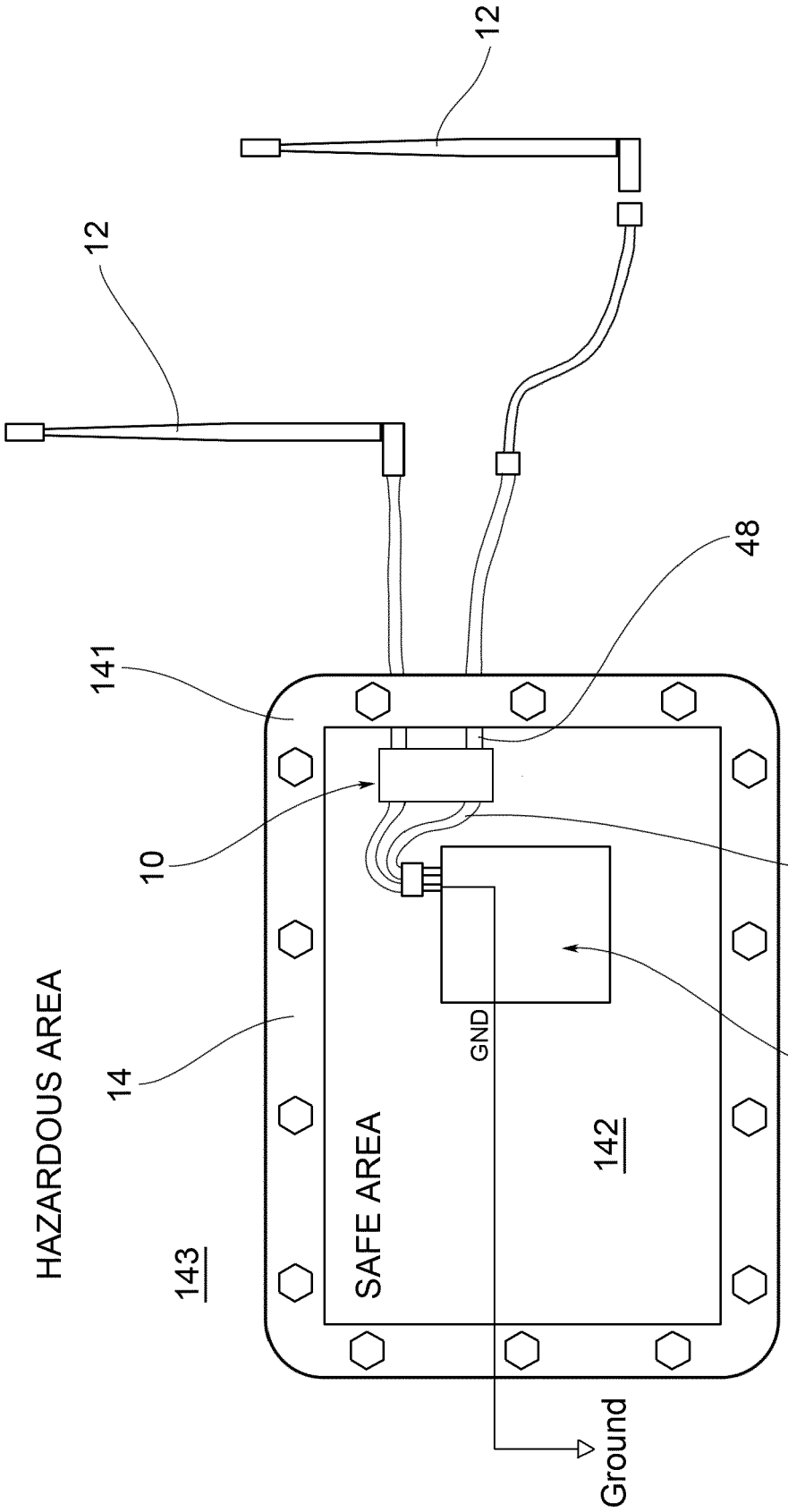
12
12
48
141
10
45
14
26
GND
HAZARDOUS AREA
143
SAFE AREA
142
Ground

FIG.1a

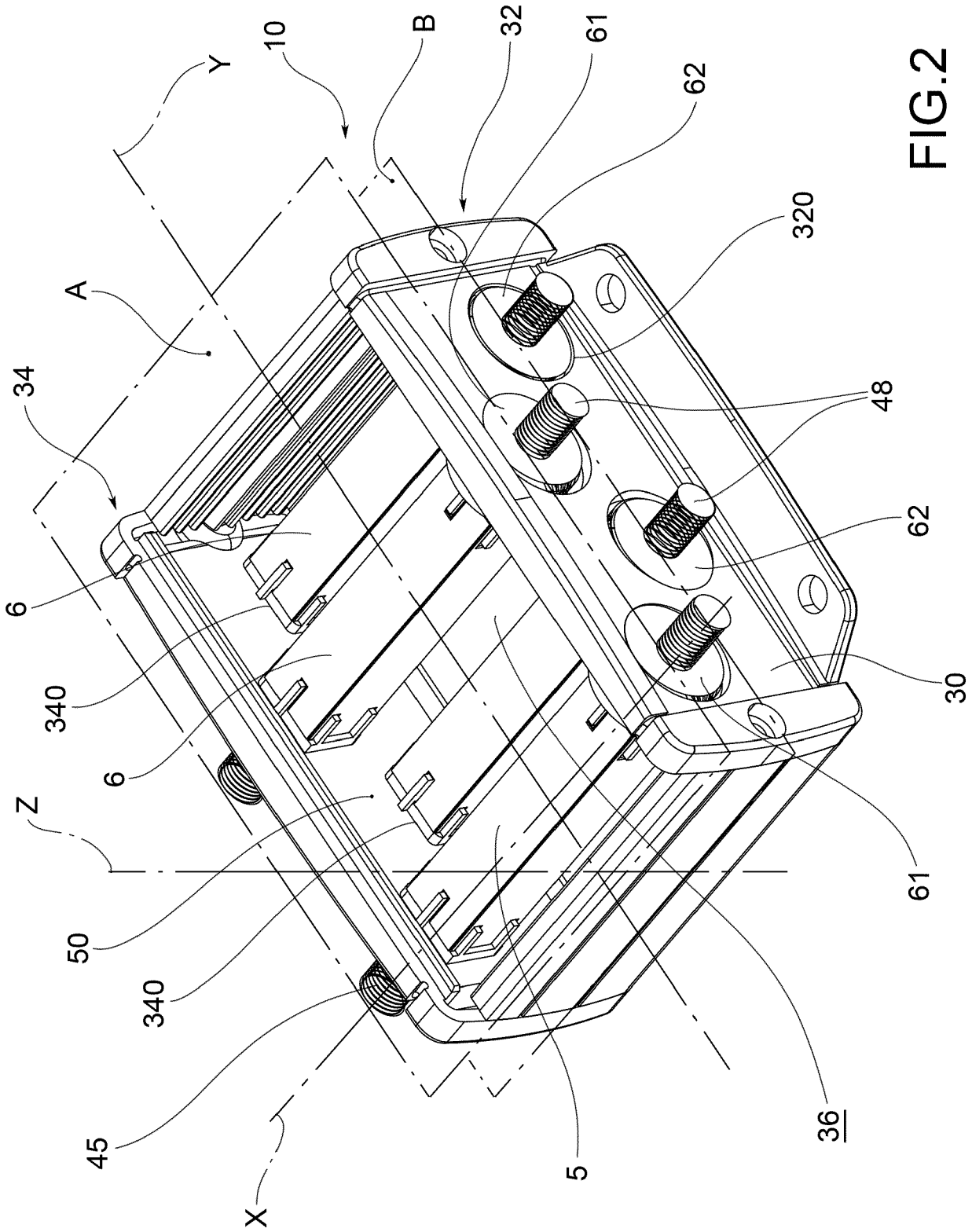

FIG.2

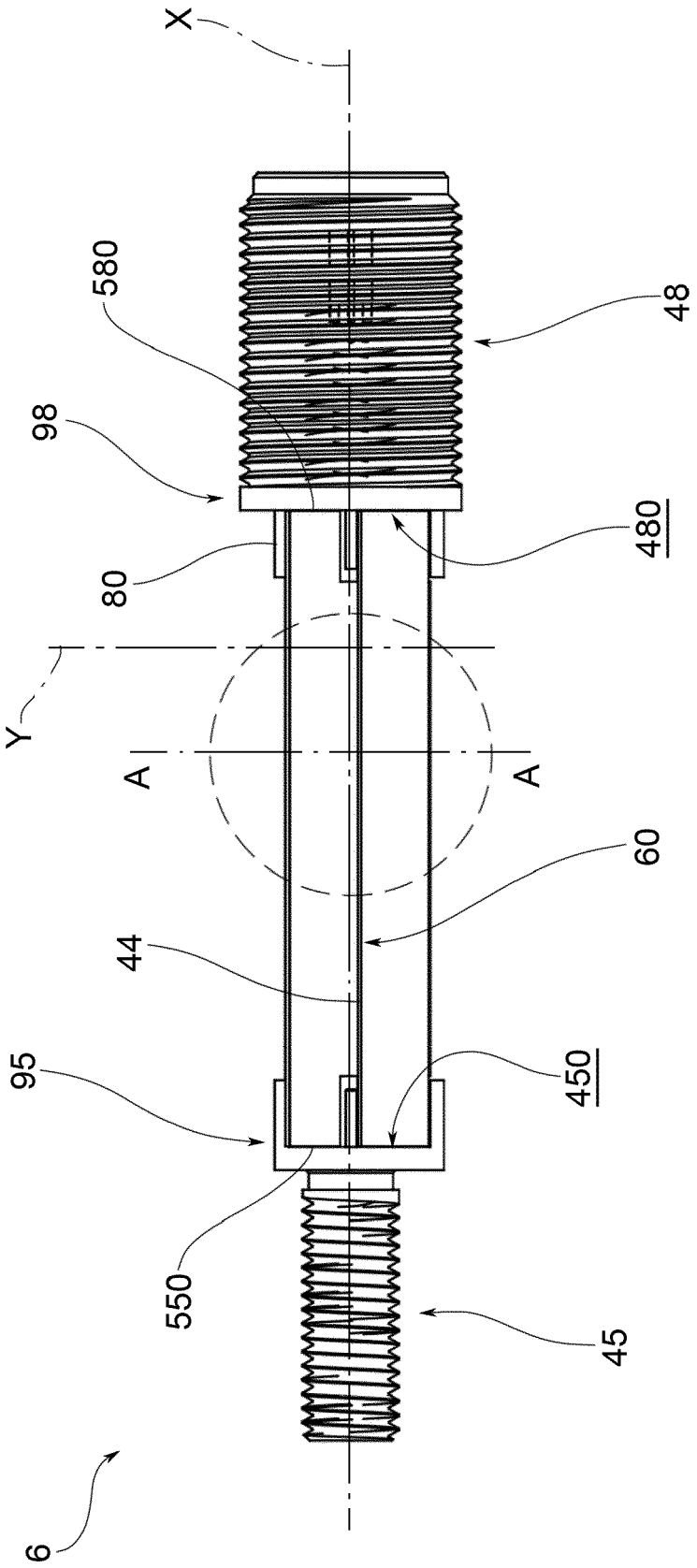

FIG.3

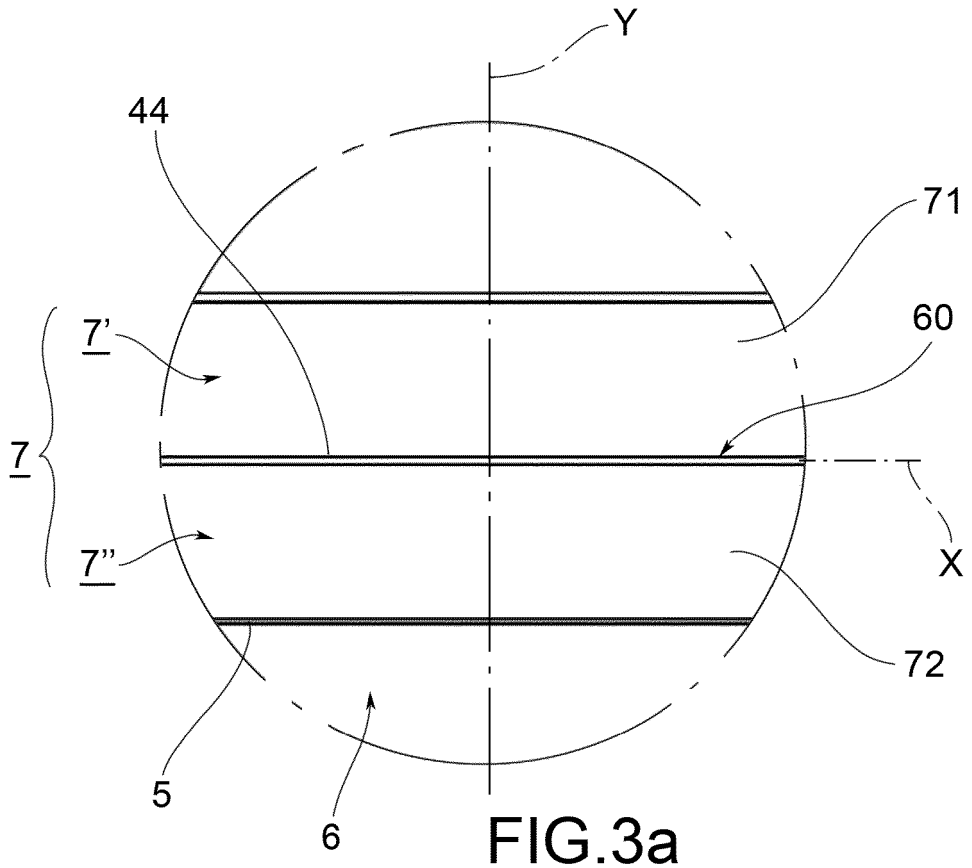

FIG.3a

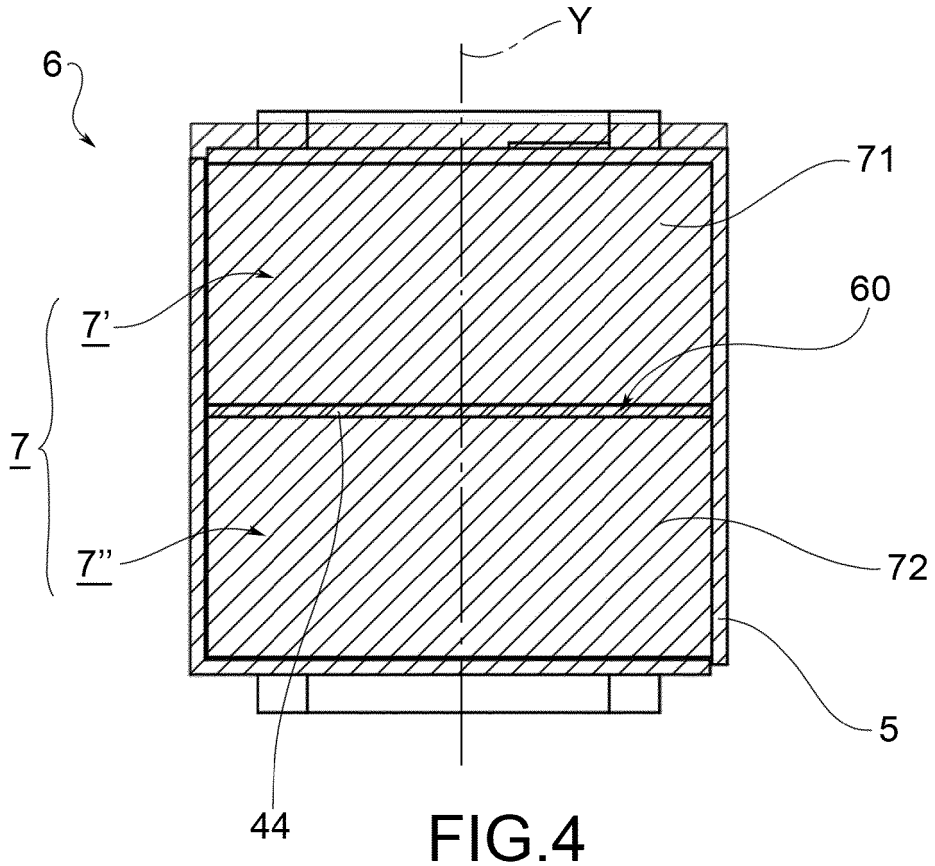

FIG.4

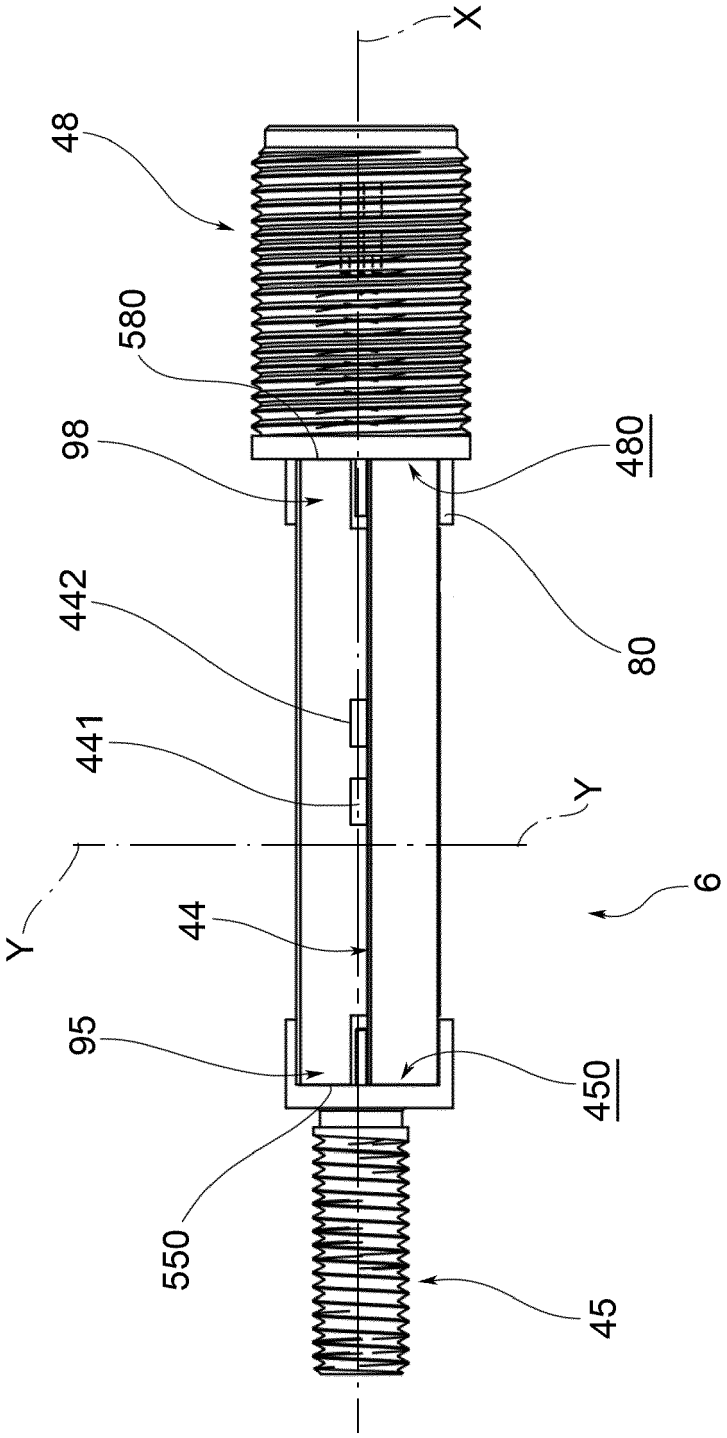

FIG.5

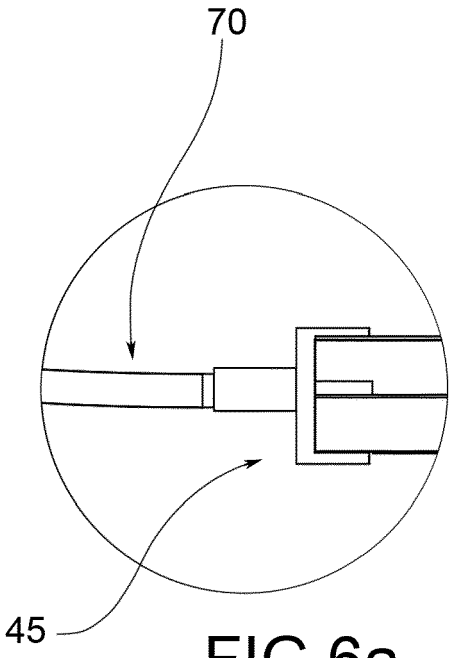

FIG.6a

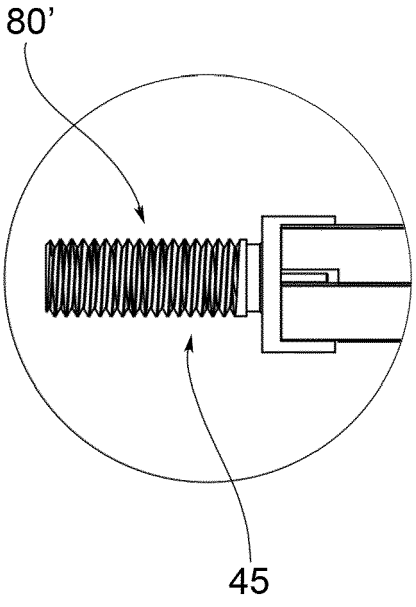

FIG.6b

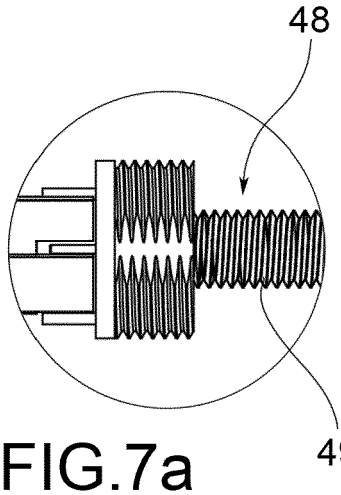

FIG.7a

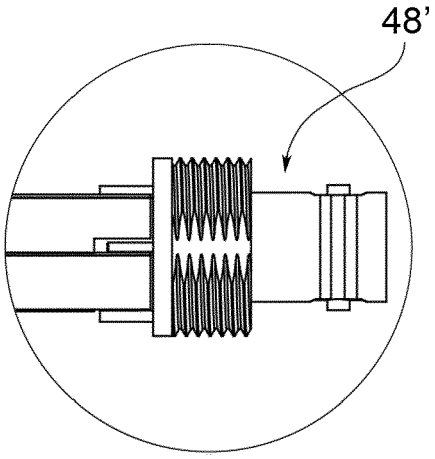

FIG.7b

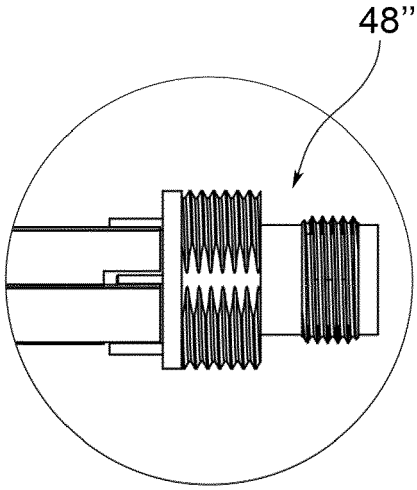

FIG.7c

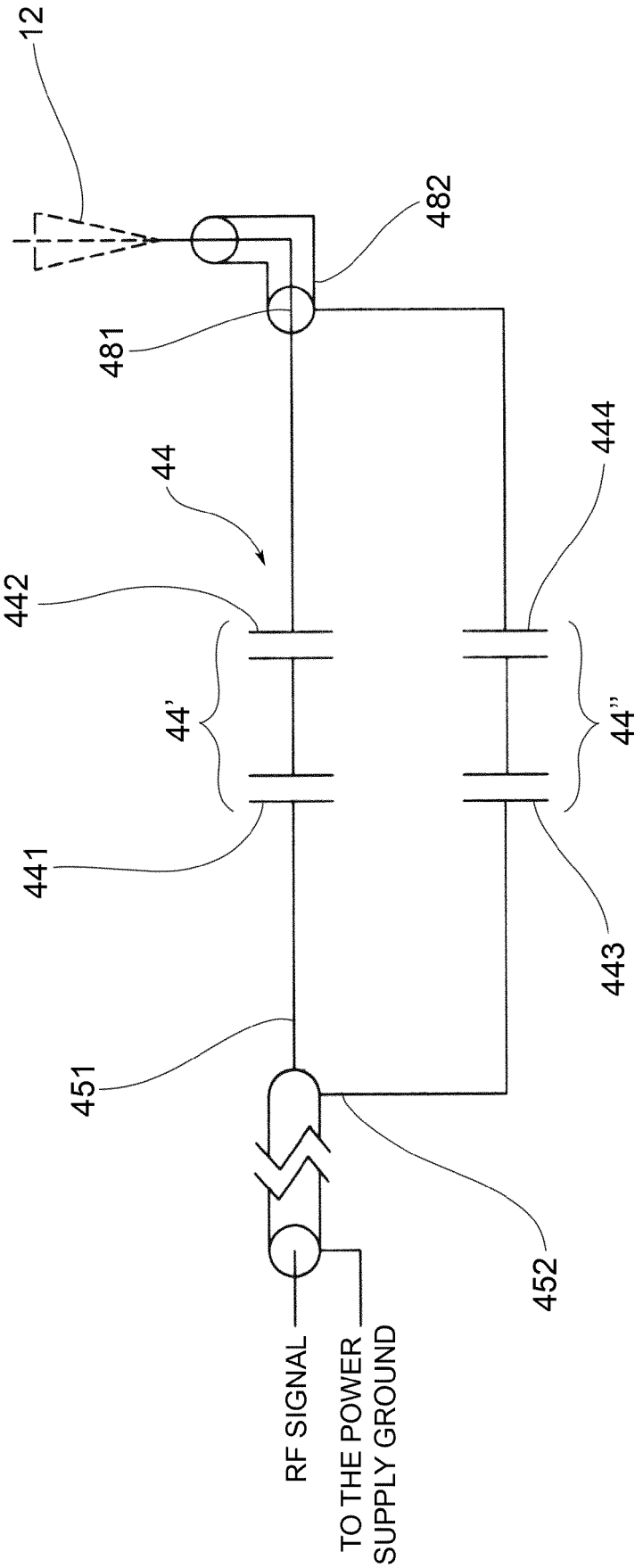
12
482
481
44
444
442
44'
44''
441
443
451
452
RF SIGNAL
TO THE POWER SUPPLY GROUND

FIG.8

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EUROPEAN SEARCH REPORT

Application Number
EP 23 18 3332

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 1 689 056 A1 (PHOENIX CONTACT GMBH & CO [DE]) 9 August 2006 (2006-08-09)	1-5,7-13	INV. H01P1/20 H01P1/30 H01Q1/00 H01Q1/50 H01R13/66 H01R24/48
A	* paragraph [0015] - paragraph [0020] * * figures 1-5 *	6,15	
X	US 6 243 247 B1 (AKDAG OMER [US] ET AL) 5 June 2001 (2001-06-05)	14	
Y	* column 5, lines 5-9 *	1-5,7-13	
A	* column 6, line 39 - column 8, line 38 * * figures 2, 5, 7, 8 *	6,15	
A	US 5 225 799 A (WEST LAURICE J [US] ET AL) 6 July 1993 (1993-07-06) * column 5, lines 46-58 * * figure 7 *	7,10	

TECHNICAL FIELDS SEARCHED (IPC)

H01P
H01R
H01Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 October 2023	Culhaoglu, Ali

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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23-10-2023

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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- IT 201800021403 **[0004]**
- IT 201800005206 **[0004]**