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CA 2715651 C 2016/05/24

(11)(21) **2 715 651**

(12) **BREVET CANADIEN**
CANADIAN PATENT
(13) **C**

(86) **Date de dépôt PCT/PCT Filing Date:** 2009/02/12
(87) **Date publication PCT/PCT Publication Date:** 2009/08/20
(45) **Date de délivrance/Issue Date:** 2016/05/24
(85) **Entrée phase nationale/National Entry:** 2010/08/16
(86) **N° demande PCT/PCT Application No.:** EP 2009/000983
(87) **N° publication PCT/PCT Publication No.:** 2009/100904
(30) **Priorité/Priority:** 2008/02/14 (DE10 2008 009 333.5)

(51) **Cl.Int./Int.Cl.** ***H01B 17/42*** (2006.01), *H01B 19/00* (2006.01)

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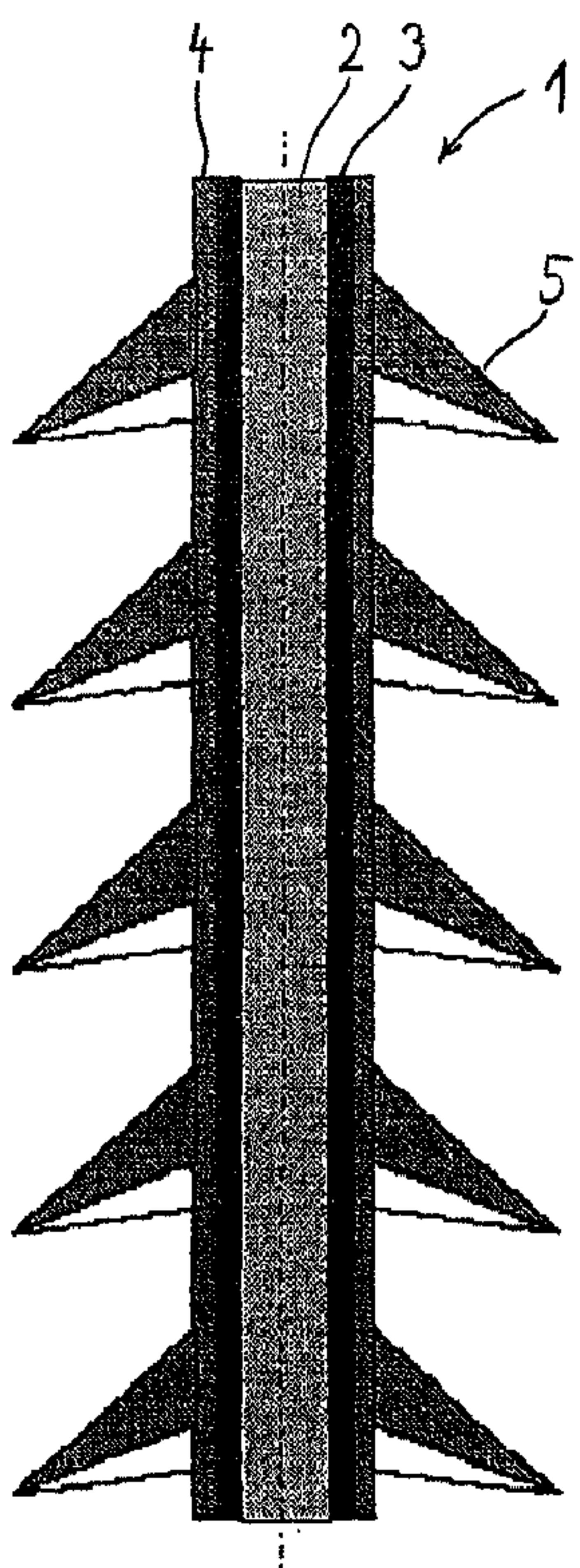
(54) **Titre : ISOLATEUR COMPOSITE A COMMANDE DE CHAMP**
(54) **Title: FIELD-CONTROLLED COMPOSITE INSULATOR**



(57) **Abrégé/Abstract:**
The materials of an insulator are greatly stressed by the inhomogeneous distribution of the electric field across the surface thereof. One of the causes is the design configuration of the insulator. The field strength changes particularly in the region of the fittings due

(57) **Abrégé(suite)/Abstract(continued):**
to the transition from the insulating materials of the shields and the insulator core to a metal material, due to the transition from the ground potential at the cross arm, or to the conductor potential at that location, where the conductor cables are attached. A further cause is the deposit of dirt, which is stress affecting an insulator overall. The invention therefore provides that a field control layer (3) is disposed between the core (2) and the protective layer (4) in at least one section (15; 16) of the insulator (1; 10), said control layer comprising particles as the filler, which influence the electric field of the insulator.

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
20. August 2009 (20.08.2009)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2009/100904 A1

(51) Internationale Patentklassifikation:
H01B 17/42 (2006.01) *H01B 19/00* (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2009/000983

(22) Internationales Anmeldedatum:
12. Februar 2009 (12.02.2009)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10 2008 009 333.5
14. Februar 2008 (14.02.2008) DE

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(84) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, MD, RU,

[Fortsetzung auf der nächsten Seite]

(54) Title: FIELD-CONTROLLED COMPOSITE INSULATOR

(54) Bezeichnung: FEELDGESTEUERTER VERBUNDISOLATOR

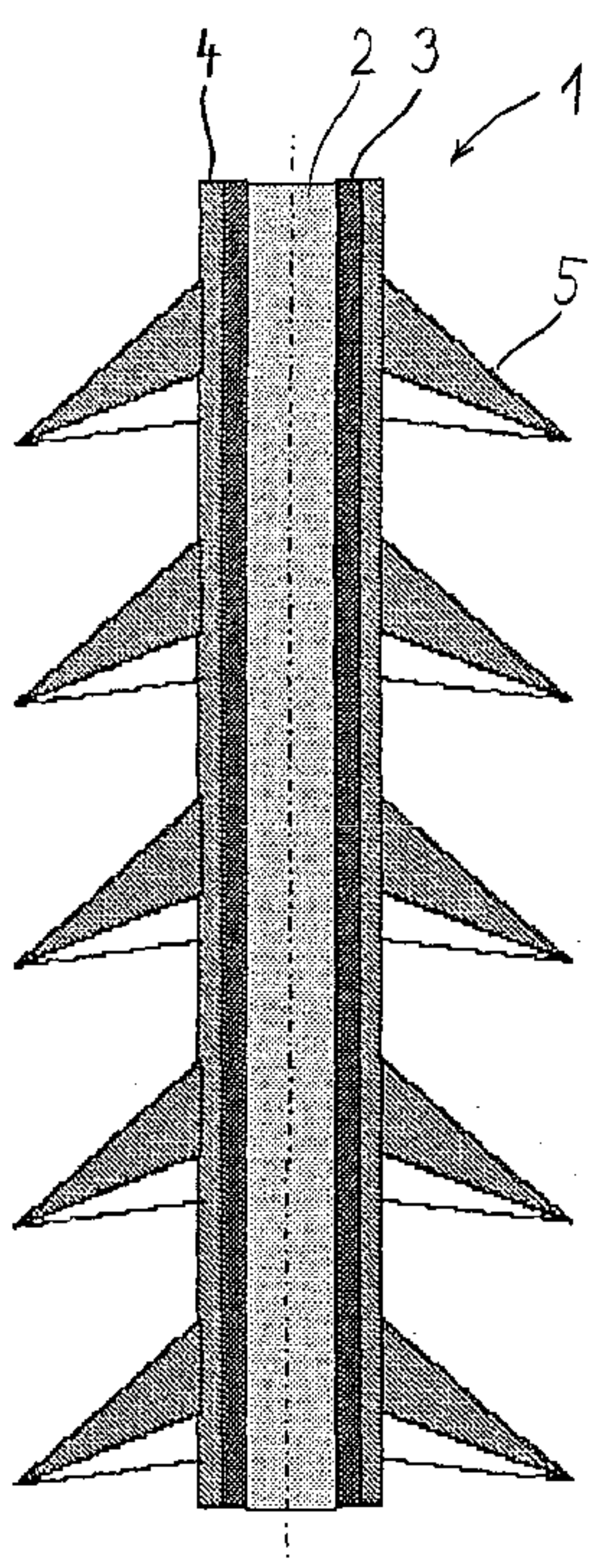

Fig. 1

(57) Abstract: The materials of an insulator are greatly stressed by the inhomogeneous distribution of the electric field across the surface thereof. One of the causes is the design configuration of the insulator. The field strength changes particularly in the region of the fittings due to the transition from the insulating materials of the shields and the insulator core to a metal material, due to the transition from the ground potential at the cross arm, or to the conductor potential at that location, where the conductor cables are attached. A further cause is the deposit of dirt, which is stress affecting an insulator overall. The invention therefore provides that a field control layer (3) is disposed between the core (2) and the protective layer (4) in at least one section (15; 16) of the insulator (1; 10), said control layer comprising particles as the filler, which influence the electric field of the insulator.

(57) Zusammenfassung: Die Werkstoffe eines Isolators werden durch die inhomogene Verteilung des elektrischen Feldes über seine Oberfläche stark belastet. Eine der Ursachen liegt in der konstruktiven Ausgestaltung eines Isolators. Insbesondere im Bereich der Armaturen verändert sich die Feldstärke wegen des Übergangs von den isolierenden Werkstoffen der Schirme und des Isolatorkerns zu einem metallischen Werkstoff, wegen des Übergangs zum Erdpotential an der Masttraverse beziehungsweise zum Leiterpotential, dort, wo die Leiterseile befestigt sind. Eine weitere Ursache sind die Schmutzablagerungen, eine Belastung, die einen Isolator insgesamt betrifft. Erfindungsgemäß wird deshalb vorgeschlagen, dass zwischen Kern (2) und Schutzschicht (4) mindestens in einem Abschnitt (15; 16) des Isolators (1; 10) eine Feldsteuerschicht (3) angeordnet ist, die das elektrische Feld des Isolators beeinflussende Partikel als Füllstoff enthält.

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TJ, TM), europäisches (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Veröffentlicht:

— *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

— *vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eingehen (Regel 48 Absatz 2 Buchstabe h)*

Field-controlled composite insulator

The invention relates to a field-controlled composite insulator, containing a rod or tube as an insulator core composed of fiber-reinforced plastic, which is covered with a shed sleeve and has fittings fitted at its ends.

The materials of an insulator are severely loaded by the inhomogeneous distribution of the electrical field over its surface. One of the reasons is the design configuration of an insulator. Particularly in the area of the fittings, the field strength varies because of the transition from the insulating materials of the sheds and of the insulator core to a metallic material, because of the transition to the ground potential on the mast cross member and to the conductor potential, where the conductor cables are attached. In order to prevent the local field disturbance caused by this, in particular field strength peaks, it is possible to use the so-called geometric field control. The geometry of the workpieces, in particular the live parts, is smoother out by rounding the corners and edges.

A further reason is dirt deposits, a load which affects an insulator overall. Over time, thin dirt layers are deposited on composite insulators which, as outdoor installations, are subject to the weather. Because of the electrical conductivity of these layers, charging currents can flow on the insulator surfaces. If those layers become wet, for example as a result of rain or dew, the conductivity is increased even further, leading to increased current levels of the leakage and discharge currents, and to resistive losses. This results in heating of the dirt layers, as a consequence of which they dry out. The drying-out dirt layers locally have a high impedance, as a result of which high voltage drops can occur here. If this results in electrical breakdown strength of the surrounding air being exceeded, corona discharges occur, or electrical flashover discharges, which cause ageing, and finally destruction, of the material of the insulator surface. Local coverings or coatings of insulating materials, for example plastics such as epoxy resins and polymers, with additives composed of dielectric and/or ferroelectrical substances, are applied as field control layers, as measures to unify the electrical field and to avoid local field disturbance, in particular field strength peaks.

It is known from an exemplary embodiment of the high-voltage composite insulator according to DE 32 14 141 A1 (figure 2 there) that a multiplicity of sheds with a collar pushed over the core and with a contact sleeve between the last shed and the metal fitting are semiconductive. In this embodiment of the insulator, there is a risk of metal particles and other dirt particles in the air being deposited directly on the electrically semiconductive layer, from where - as a result of electrical interactions - it is difficult to wash them away, because of the natural weathering. With appropriate geometry, these particles can lead to local field strength peaks, and thus to damage to the insulator.

DE 197 00 387 B4 discloses a composite insulator whose shed element and, if appropriate, the core are each manufactured from a semiconductive material. The semiconductor capability of the shed sleeve and of the core are of the same magnitude at every point on the insulator. Because of weathering influences and dirt, the shed sleeve must additionally be coated with a protective layer.

Furthermore, EP 1 577 904 A1 proposes a composite insulator, in which a field control layer is arranged in at least one section between the core and the protective layer and contains particles, as a filler, which influence the electrical field of the insulator. A composite insulator such as this is also disclosed in DE 15 15 467 A1.

The object of the present invention is to propose a composite insulator in which the reasons for formation of local field disturbances, in particular field strength peaks and corona discharges, are very largely overcome by a field control layer which is matched to the respective disturbance.

The present invention provides a composite insulator containing a core and a protective layer which surrounds the core, wherein a field control layer which contains particles, as a filler, which influence the electrical field of the insulator, is arranged between the core and the protective layer in at least one section of the insulator,

wherein the field control layer has a stratum wherein the proportion of the particles which influence the electrical field differs over the length of the stratum.

The field control layer can consist of one, two or more strata, wherein the individual strata can have different field control characteristics.

The field control layer can consist of one stratum and can contain exclusively resistive or capacitive particles as a filler.

The field control layer can consist of at least two strata, wherein one of the strata has a higher proportion of resistive or capacitive particles than the other.

The field control layer can consist of at least two strata, wherein one of the strata can contain exclusively resistive particles, and the other stratum can contain exclusively capacitive particles.

The field control layer can consist of one stratum and contains a mixture of resistive and capacitive particles.

The field control layer can consist of at least two strata, wherein one stratum can contain a mixture of resistive or capacitive particles, and the other stratum can contain exclusively resistive or capacitive particles.

The strata in a field control layer when there are a plurality of strata one on top of the other can alternate with respect to their effect on the electrical field, in their sequence and/or composition.

The proportion of the capacitive and/or resistive particles in the individual strata of the layer can be different.

The field control layer can be applied in individual sections over the length of the core of the insulator.

In the case of a field control layer which is subdivided into individual sections and consists of at least two strata, one stratum in the boundary area to the layer-free section can be longer than the other and can extend beyond the stratum located above or below it, to the layer-free section.

The individual strata of the field control layer can be separated from one another by a stratum composed of an insulating material.

The proportion of the particles in a layer can be between 50 and 90 per cent by weight, preferably 70 per cent by weight.

The proportion of the particles, the filling level, can be above the percolation limit.

The present invention also provides a method for producing a composite insulator containing a core and a protective layer which surrounds the core, in particular as disclosed herein, wherein in the method:

a field control layer comprising at least one stratum of an elastomer material having a proportion of particles, which influence the electrical field of the insulator, which proportion changes over the length of the layer, is applied to the core of the insulator in at least one section, and the entire core is coated with the applied field control layer with the protective layer, and the insulator is then subjected to heat treatment in order to vulcanize the plastics.

The field control layer can be applied in at least two strata with different effects on the electrical field.

The field control layer can be applied in sections to the core of the insulator.

In the case of a field control layer which is subdivided into individual sections and consists of at least two strata, one stratum is applied in the boundary area to the layer-free section, beyond the stratum which is located above or below it, to the layer-free section.

The particles which influence the electrical field of the insulator can be added to the extrudate in a different amount, during the application of the stratum of the field control layer to the core.

The field control layer of the composite insulator according to the invention accordingly has a stratum wherein the proportion of the particles which influence the electrical field differs over the length of the stratum.

The conductive contact between the field control layer and the fitting can be produced, for example, by a conductive lacquer, metal rings or wire mesh. Outside the fitting, the field control layer is surrounded by a protective layer, or directly by sheds which are extruded seamlessly onto the core. The insulator core, as a tube or rod, generally consists of thermoset material, such as epoxy resin or polyester resin, reinforced with glass fibers.

The invention is suitable for all types of composite insulators, in particular for hanging insulators, post insulators or bushing insulators. The field of use starts at high voltages above 1 kV, and is particularly effective at voltages above 72.5 kV.

The field control layer is generally composed of the same material as the protective layer covering it. However, the protective layer can also advantageously be composed of a material which is more resistant to erosion and creepage current. In any case, the protective layer is composed of a material having good insulation characteristics. Materials having these characteristics are elastomer materials, for example polymer plastics such as silicone rubber (HTV) of hardness classes Shore A 60 to 90, or ethylene-propylene copolymer (EPM). The sheds are pushed onto the core prepared in this way, with a field control layer and protective layer, and the sheds may be composed of the same material as the protective layer. The protective layer and the sheds can also be extruded onto the core from the same material in one and the same process, as is known from European patent 1147525 B1.

The field can be controlled resistively or capacitively, or by a combination of the two together. For this purpose, the material of the field control layer is filled with particles, as a filler, which control the field.

A field control layer is provided with resistive conductive and/or semiconductive fillers for resistive field control. The linear material relationship between voltage and current is used in the resistive conductive fillers. The conductive fillers include, for example, carbon black, Fe_3O_4 and other metal oxides.

Semiconductive materials exist which have a non-linear relationship between the voltage and current.

Varistors, for example, ZnO, have these characteristics and become conductive above a defined voltage or field strength, and therefore have the capability to limit overvoltages. Microvaristors are particularly suitable for resistive field control. These are varistors in powder form with grain diameters of between 50 nm and 100 µm. When suitably designed, a material filled with microvaristors, in particular a silicone material, can achieve a high electrical conductivity when loaded with surge voltages, while creating little power loss during continuous operation.

Materials with dielectric characteristics such as TiO_2, $BaTiO_3$ or TiOx are used for capacitive field control. These materials have a high dielectric constant (permittivity).

Refractive field control is a special form of capacitive field control. The lines of force are interrupted at the junctions between the materials by suitable arrangement of materials with dielectric constants of different magnitude, such that local field disturbances, in particular field strength peaks, are overcome as much as possible. The field control layer may consist of one stratum or a plurality of strata, in which case the individual strata may have different field control characteristics.

The particles which are added as fillers to the strata of the field control layer have a diameter of 10 nm to 100 µm, preferably in a range from 0.1 µm to 10 µm. Their size is governed by the thickness of the stratum and the intensity and the extent of the field disturbance to be expected.

The proportion of particles is between 50 and 90% by weight, advantageously 70%.

The proportion of the particles, the filling level, may be above the percolation limit, that is to say the particles make direct electrical contact.

The thickness of a stratum of a field control layer may be 1 mm to 5 mm, generally 2 mm to 3 mm. This is governed by the intensity and the extent of the field disturbance to be expected.

The field control layer may consist of one stratum and may contain exclusively resistive particles as a filler. A layer such as this is provided at those points on the insulator where resistive field control is preferably required.

The field control layer may consist of one stratum and may contain exclusively capacitive particles as a filler. A layer such as this is provided at those points on the insulator where capacitive, or specifically refractive, field control is preferably required.

The field control layer may consist of one stratum, and the proportion of the resistive or capacitive particles may differ over the length of the stratum. The intensity of the effect on the field disturbances can be varied locally, with the same thickness, by varying the proportion of fillers in the stratum. The proportion of the filler can be varied if the filler has not already been mixed to the material of the stratum before application, but it is added to the material only in or before the nozzle for application of the stratum.

The thickness of a stratum of a field control layer may vary over its length. This can be done by varying the feed rate within the extruder which applies the stratum to the core.

The field control layer may also consist of at least two strata with resistive or capacitive particles as fillers. In this case, one stratum may have a higher proportion of resistive or capacitive particles than the other stratum.

The field control layer may also consist of at least two strata, with one stratum containing exclusively resistive particles, and another stratum containing exclusively capacitive particles. When there are a plurality of strata one above the other, the strata may alternate in their sequence.

The field control layer may consist of one stratum, and may contain a mixture of resistive and capacitive particles.

The field control layer may also consist of at least two strata, with one stratum containing a mixture of resistive and capacitive particles, and the other stratum containing exclusively resistive or capacitive particles.

When there are plurality of strata one above the other, the strata may alternate in their sequence and/or composition with respect to their effect on the electrical field. In addition, the proportion of the capacitive and/or resistive particles in the individual strata of the layer may be different.

The field control layer may be applied over the entire length of the insulator core. However, it may also extend only over subareas, for example in the area of the fittings. The field control layer may also be subdivided into individual sections, and therefore interrupted.

In the situation in which the field control layer is subdivided into individual sections and consists of at least two strata, one stratum in the boundary area to the layer-free section may be longer than the other and extend beyond the stratum located above or below it, to the layer-free section, as a result of which the field-influencing character of this stratum is exclusively effective.

The discontinuous arrangements of the layer as described above make it possible to avoid high power losses.

The individual strata of a field control layer may if required by separated from one another by insulating intermediate strata, when differences in the conductivity in the conduct area of the two strata could themselves lead to undesirable changes in the field.

The combination options as stated above of the number of strata, the arrangement of the individual strata within a layer and the degree of filling with capacitive and/or resistive particles makes it possible, at the possible points where an inhomogeneity in the electrical field which would be damaging to the insulator can occur, for this to be prevented and to be suppressed by a layer matched thereto.

Microvaristors, in particular ZnO, are preferred for resistive field control.

In order to protect the field control layer, this layer can be covered with a protective layer, for example an insulating HTV-silicone extrudate layer with extremely good creepage-current, erosion and weather resistances, onto which the sheds are then pushed. This protective layer improves the open-air resistance and may be up to 5 mm thick, advantageously between 2 mm and 3 mm.

However, sheds can also be extruded directly onto the core with the field control layer, without any gaps, as is known from European patent 1147525 B1. The protective layer and sheds are then composed of the same material.

The field control layer can be applied to the core by an extruder through which the core is pushed. If the intention is to apply a layer with a plurality of strata on the core, then this can be done through a multistage nozzle or through a plurality of extruders arranged one behind the other. The strata must be applied such that they adhere well to the insulator core and are connected to one another to form a layer. It may be necessary to apply adhesion promoters.

The invention offers the capability to use a field control layer only at those points at which critical disturbances in the electrical field, in particular field strength peaks, can occur. This makes it possible to reduce the power losses on the insulators to minimal values.

The composition of the field control layer with strata with resistive and/or capacitive particles or the formation of the layer from two or more strata, in particular with different particles and/or particle proportions, as well as the variation of the coverage lengths of the strata can advantageously be matched to the field disturbances to be overcome, in particular field strength peaks, caused in particular by local dirt. This unifies the field distribution along the insulator. This prevents the creation of corona discharges and flashovers, thus preventing premature ageing of the material.

The invention will be explained in more detail with reference to examples. In the figures:

Figure 1 shows a longitudinal section through a detail of a composite insulator with a field control layer consisting of one stratum,

Figure 2 shows a detail of a composite insulator with a field control layer consisting of two strata, in which one stratum covers only a part of the core,

Figure 3 shows a long rod insulator, identifying those areas in which a field control layer is applied,

Figure 4 shows a long rod insulator, in which a field control layer is applied in the area of the fitting to which the conductor cables are attached,

Figure 5 shows a longitudinal section through the junction area between an insulator core and a fitting,

Figure 6 shows a comparison test between an insulator with a field control layer and a conventional insulator when an AC voltage is applied, during rainfall, and

Figure 7 shows a flowchart in order to explain the production of an insulator.

Figure 1 shows a longitudinal section through a composite insulator 1, in the present case showing the detail from a long rod insulator. A field control layer 3 is applied to a core 2 composed of glass-fiber-reinforced plastic. This may have capacitive or resistive characteristics, in order to match the field disturbances which occur. For example, it may contain microvaristors composed of ZnO for resistive field control. The field control layer 3 is covered by a protective layer 4 which consists of a material which is resistant to erosion and creepage currents, and which protects the field control layer 3 against weather influences and dirt. The sheds 5 are arranged at regular intervals on this protective layer 4 and are molded from one of the known polymer plastics.

Figure 2 likewise shows a longitudinal section through a composite insulator 1. Features which correspond to those in Figure 1 are annotated with the same reference numbers. In the present exemplary embodiment, the field control layer 3 in one subarea of the insulator 1 consists of two strata 31 and 32, of which the stratum 32 is arranged above the continuous stratum 31. The two strata 31 and 32 may have different field control characteristics. For example, the outer stratum 32 may have capacitive characteristics, and the continuous stratum 31 may have resistive characteristics. An arrangement of layers such as this may be advantageous, for example, in the area of the fittings, with respect to field disturbances caused by the design. In the present exemplary embodiment, the field control layer 3 has a continuous uniform thickness. In the area in which the field control layer 3 has two strata, the inner stratum 31 can be applied more thinly by reducing the extrusion. In a second process step, the outer stratum 32 can thus be applied sufficiently thickly to achieve a continuously uniform layer thickness.

Figures 3 and 4 show long rod insulators 10 such as those used for high-voltage overhead lines. The design of the field control layers of these insulators may, for example, correspond to the design as described for the insulators illustrated in Figures 1 and 2. The insulators 10 are each suspended on a cross member 11 of a high-voltage mast, which is not illustrated here. They are attached in a known manner to a fitting 12 composed of metal. The conductor cables 14 are attached to the lower end by means of a further fitting 13. In the present exemplary embodiments, the insulators 10, which have a length of 4 m, are covered with a field control layer either only in places, as is illustrated in Figure 3, or only in a specific area on a fitting, as is illustrated in Figure 4, in order to avoid excessively high power losses. The insulator 10 in Figure 3 in each case has five areas 15 of equal size, in which the core is covered with a field control layer. These are each interrupted by areas of equal size without a field control layer. The insulator 10 in Figure 4 has an area 16 which is covered with a field control layer and which extends from the fitting 13, to which the conductor cables 14 are attached, upwards over a third of the rod length.

Figure 5 shows a schematic illustration of a junction area between a fitting and the shed sleeve area, in the form of a longitudinal section. This shows a section through the end of an insulator with a fitting, to which the conductor cables are attached, as illustrated in Figure 3 or 4. Corresponding features to those in Figures 2, 3 and 4 are annotated with the same reference numbers.

In the insulator 1 or 10, the core consists of a rod 2 composed of glass-fiber-reinforced plastic, which is covered with a field control layer 3 which is in turn sheathed by a protective layer 4. The sheds 5 are pulled onto this protective layer. The design of the field control layer 3 corresponds to that illustrated in Figure 2. The end of the rod 2 is surrounded by the fitting 13. A stratum 31 covers the core 2 of the insulator completely over the length which is visible in the illustration. This is a stratum with resistive effect, and contains microvaristors. A stratum 32 with a capacitive effect, and which contains fillers with dielectric characteristics, is located above this on the outside. The stratum 32 extends from the interior of the fitting 13 to above the first shed 5. The capacitive field control is particularly suitable for dissipating field strength peaks which are caused by design, for example by edges or stepped junctions, such as those which occur at the junction between a fitting and the insulator rod. In order to improve the conductive contact between the strata and the fitting, the cavity in the fitting which surrounds the core can be covered with a conductive lacquer. Although not illustrated here, inserts of wire loops or wire meshes are also possible.

Figure 6 shows the result of a comparative test between a long rod insulator, whose surface was covered with a field control layer corresponding to Figure 1, and a conventional long rod insulator as a reference insulator, which was equipped exclusively with HTV silicone without a field control layer. The sheds were each composed of HTV silicone. The flashover distance was 2765 mm. In both samples, a 3 mm-thick polymer layer (cross-sectional area: 1.8 cm^2) was applied to a GFC rod with a diameter of 16 mm. In one of the samples, the polymer layer for field control had microvaristors, ZnO varistors in power form, added in a proportion of 50 to 90% by weight, preferably 70% by weight, with a grain size of 10 nm to 100 μm, preferably between 0.1 μm and 10 μm. In the present exemplary embodiment, the filling level of the microvaristors was above the percolation limit, that is to say the microvaristors made direct electrical contact with one another.

In Figure 6, the insulator with a field control layer, can be seen on the left, and the reference insulator on the right, during the comparative test. Rain was applied to the insulators with an AC voltage of 750 kV (rms) applied to them. While the reference insulator under the lowest five sheds facing the conductor size exhibited strong discharge activities, the insulator equipped with the field control layer was completely discharge-free.

Figure 7 shows a flowchart in order to explain the production of an insulator. The core 2 of the insulator to be produced is a rod which is composed of a glass-fiber-reinforced plastic. This rod 2 is passed in the feed direction 20 through successively arranged stations where it is completed to form the insulator. An adhesion promoter 211 is applied in the first station 21, in order to closely connect the strata, to be applied subsequently, of the field control layer 3 to the core 2. A first stratum 31 of the field control layer is applied in the extruder 22, for example a stratum with varistors, a stratum with resistive character. If a further stratum is intended to follow, a further extruder 23 is provided for application of the further stratum 32, for example a stratum with a capacitive character. Instead of two extruders arranged one behind the other, it is also possible to use a two-nozzle extruder, which extrudes the two strata one on top of the other onto the rod. The next extruder 24 applies the protective layer 4.

Depending on the method used to produce the shed sleeve, the insulator core can now be separated by a separating tool 25. In the next step 26, the sheds can be extruded on, or the already prefabricated sheds 5 can be pushed on. Heat treatment 27 in order to cure the field control layer, the protective layer and the sheds completes the production of the insulator 1; 10.

After preparation of the ends of the rod, the fittings can be attached to it.

If the protective layer and the shed sleeve are applied to the insulator core 2 as a common layer in one and the same process, the production takes place in the station 26, corresponding to European patent 1147525 B1. In this case, the individual, completed insulators 1; 10 are separated by a separating tool 28 only after the heat treatment 27.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A composite insulator, comprising:

a core;

a protective layer surrounding said core; and

a field control layer disposed between said core and said protective layer in at least one section of the insulator, said field control layer having a stratum with a length, and said field control layer containing particles, as a filler, influencing an electrical field of the insulator;

said stratum containing a proportion of said particles influencing the electrical field, said proportion differing over said length of said stratum.

2. The composite insulator according to claim 1, wherein said stratum is one of two or more individual strata of said field control layer, and said individual strata have different field control characteristics.

3. The composite insulator according to claim 1 or 2, wherein said field control layer contains exclusively resistive or capacitive particles as said filler.

4. The composite insulator according to claim 1, wherein said stratum is one of at least two strata of said field control layer, and one of said strata has a higher proportion of resistive or capacitive particles than the other of said strata.

5. The composite insulator according to claim 1, wherein said stratum is one of at least two strata of said field

control layer, one of said strata contains exclusively resistive particles, and the other of said strata contains exclusively capacitive particles.

6. The composite insulator according to claim 1, wherein said particles contain a mixture of resistive and capacitive particles.

7. The composite insulator according to claim 1, wherein said stratum is one of at least two strata of said field control layer, one stratum contains a mixture of resistive or capacitive particles, and the other stratum contains exclusively resistive or capacitive particles.

8. The composite insulator according to claim 1, wherein said stratum is one of a plurality of strata of said field control layer alternating one on top of the other in their sequence and/or composition with respect to their effect on the electrical field.

9. The composite insulator according to claim 1, wherein said stratum is one of a plurality of individual strata of said field control layer, said particles are capacitive and/or resistive particles, and said proportion of said capacitive and/or resistive particles is different in said individual strata.

10. The composite insulator according to any one of claims 1 to 9, wherein said field control layer is applied in individual sections over a length of said core.

11. The composite insulator according to claim 1, wherein:

said stratum is one of a plurality of individual strata of said field control layer, and

the composite insulator further comprises a stratum composed of an insulating material separating said individual strata from one another.

12. The composite insulator according to any one of claims 1 to 11, wherein said proportion of said particles is between 50 and 90 per cent by weight.

13. The composite insulator according to claim 12, wherein said proportion of said particles in said stratum is 70 per cent by weight.

14. The composite insulator according to claim 12 or 13, wherein said proportion of said particles has a filling level above a percolation limit.

15. A method for producing a composite insulator, the method comprising the following steps:

providing a core;

providing a protective layer surrounding the core;

providing a field control layer including at least one stratum of an elastomer material having particles influencing an electrical field of the insulator in a particle proportion differing over a length of the stratum;

applying the field control layer to the core in at least one section of the insulator;

entirely coating the core having the applied field control layer, with the protective layer; and

then subjecting the insulator to a heat treatment to vulcanize plastics.

16. The method according to claim 15, which further comprises providing the at least one stratum as at least two strata having different effects on the electrical field, and applying the field control layer having the at least two strata.

17. The method according to claim 15 or 16, which further comprises applying the field control layer to the core in the at least one section.

18. The method according to claim 15, 16 or 17, which further comprises adding the particles influencing the electrical field of the insulator to an extrudate in a different amount, during an application of the stratum of the field control layer to the core.

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Unscannable items
received with this application
(Request original documents in File Prep. Section on the 10th floor)

Documents reçu avec cette demande ne pouvant être balayés
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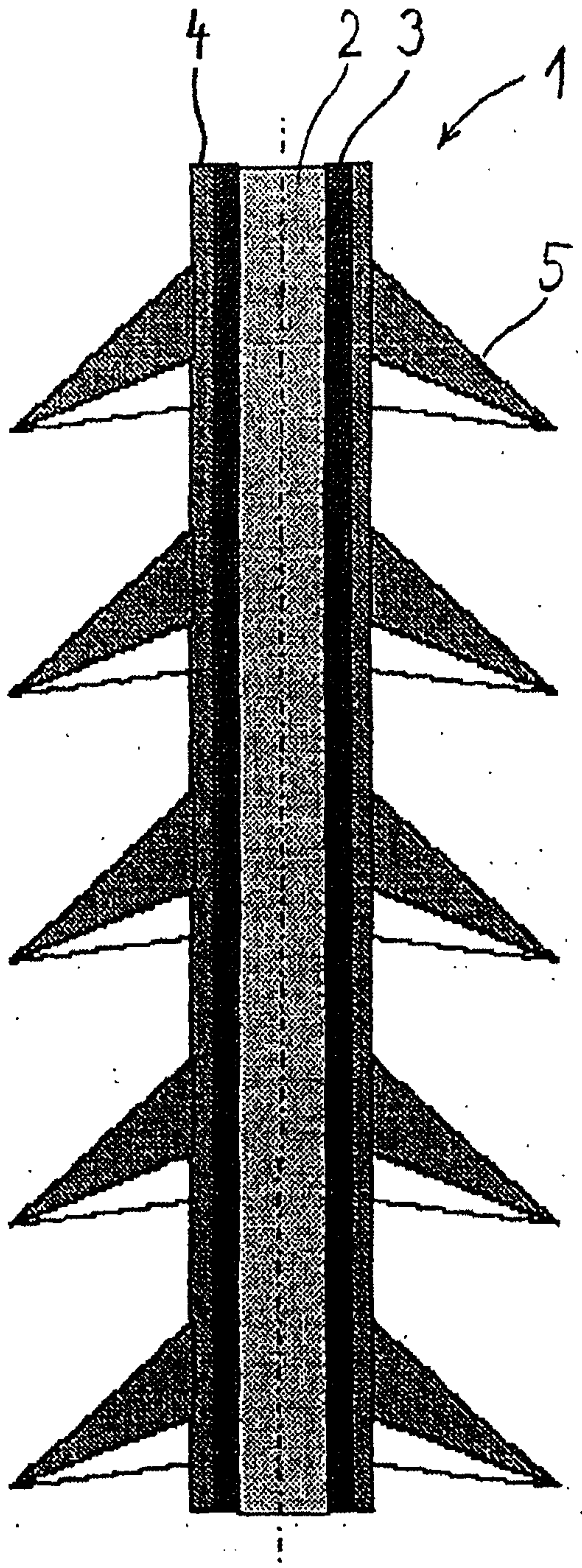


Fig. 1

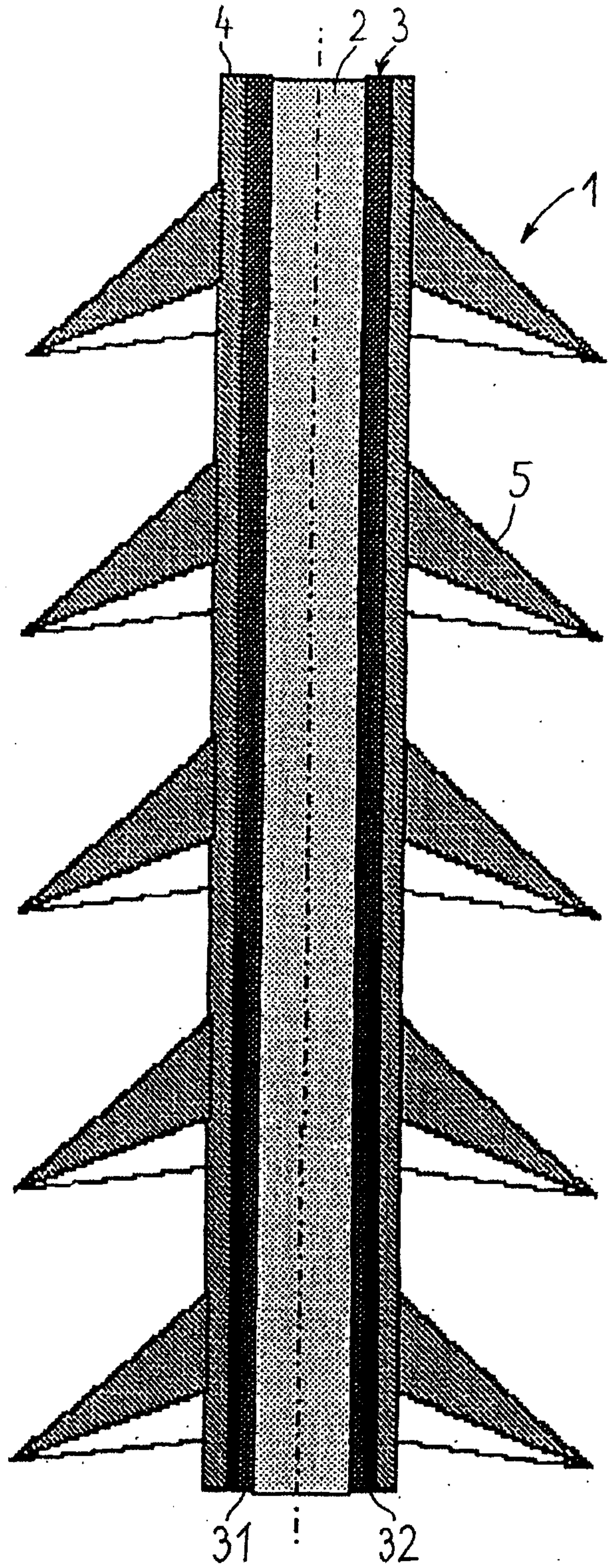


Fig.2

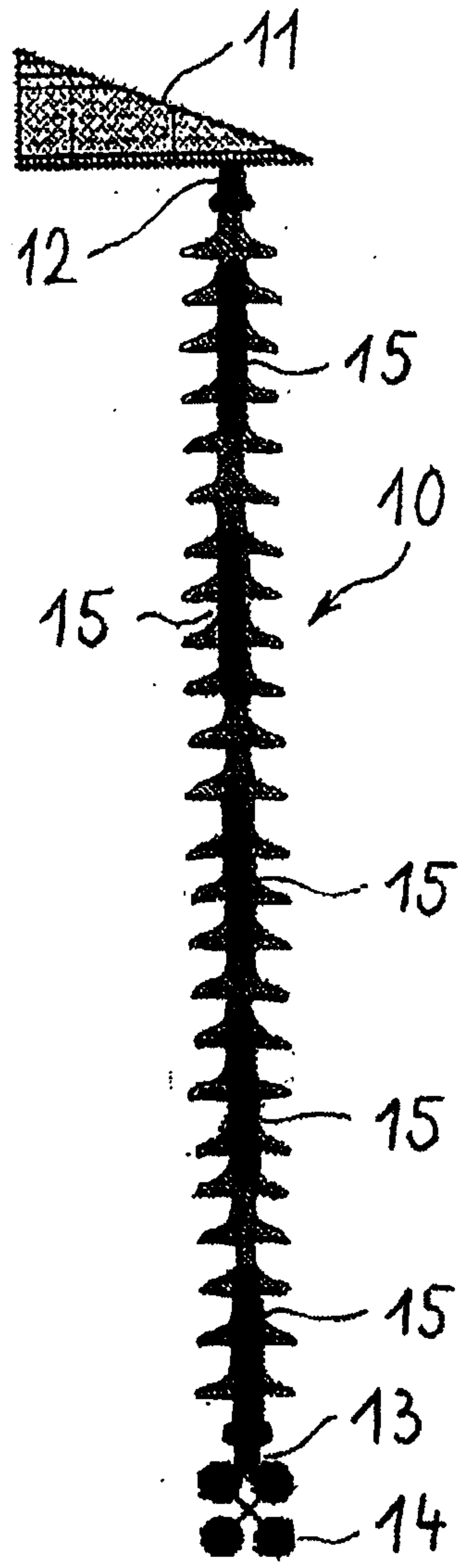


Fig.3

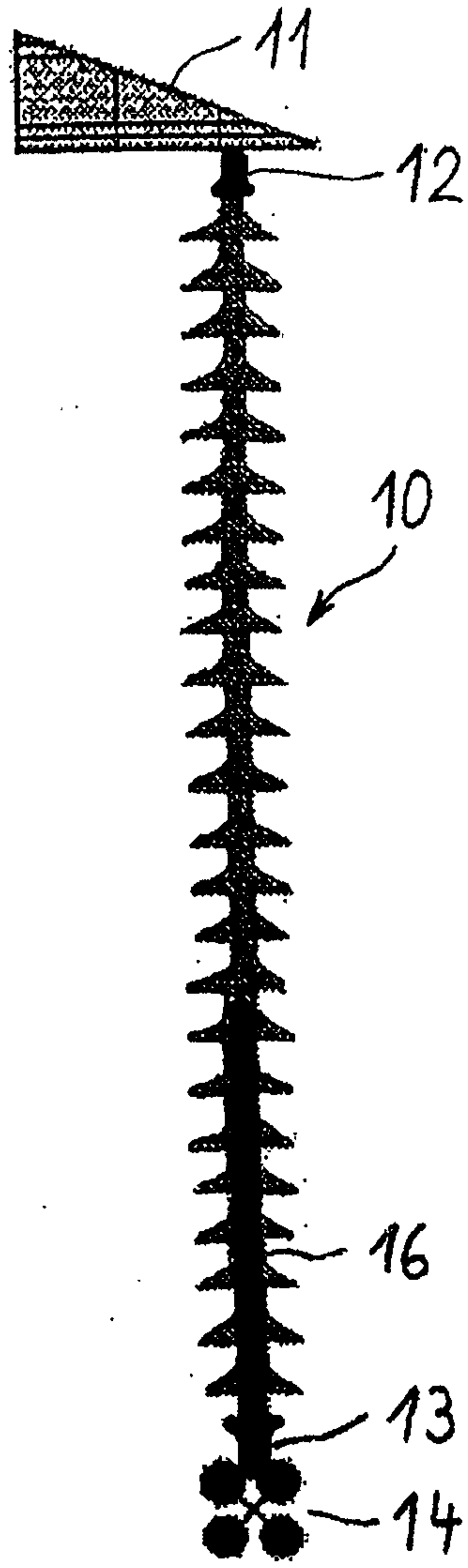


Fig.4

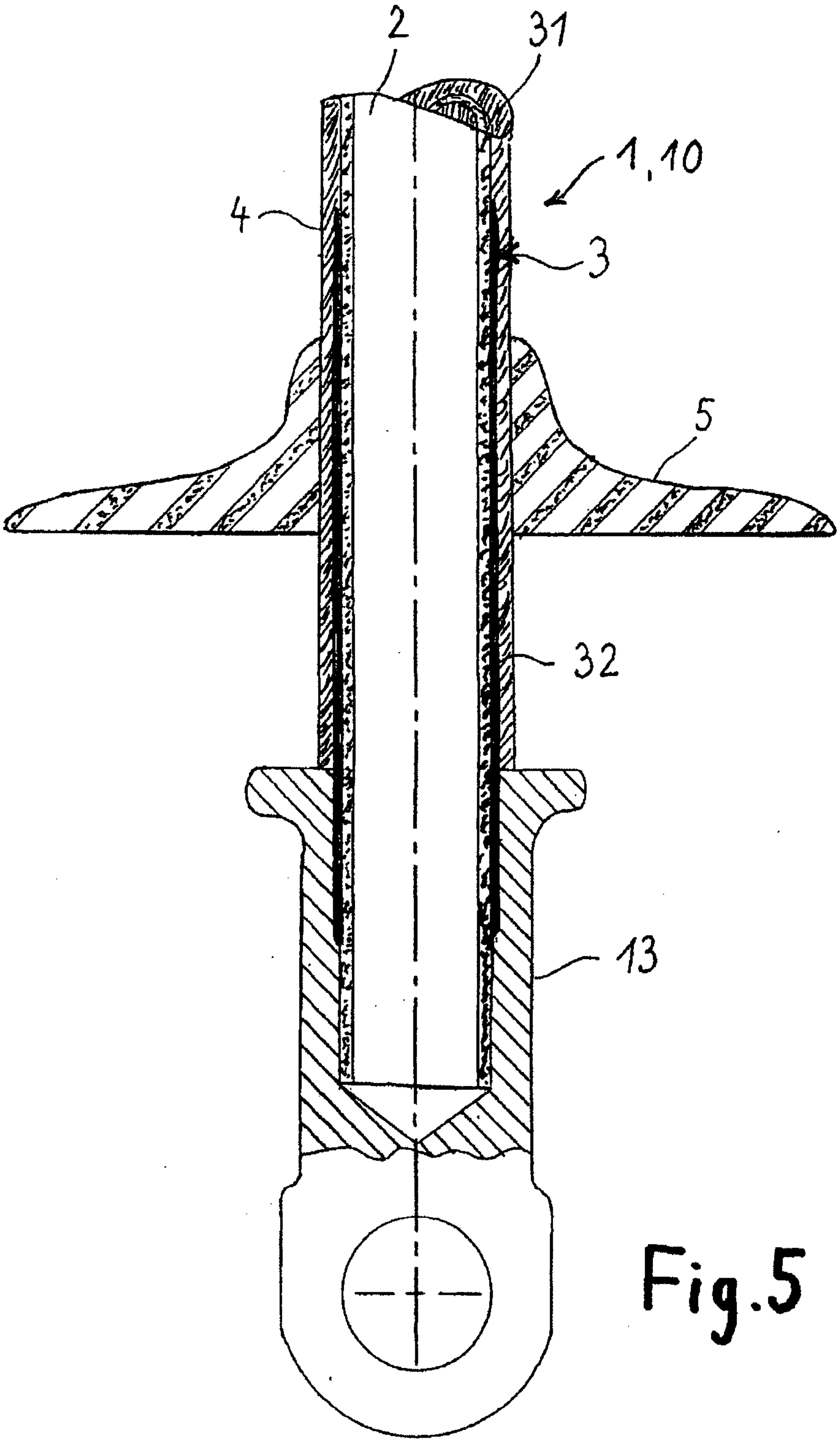


Fig.5

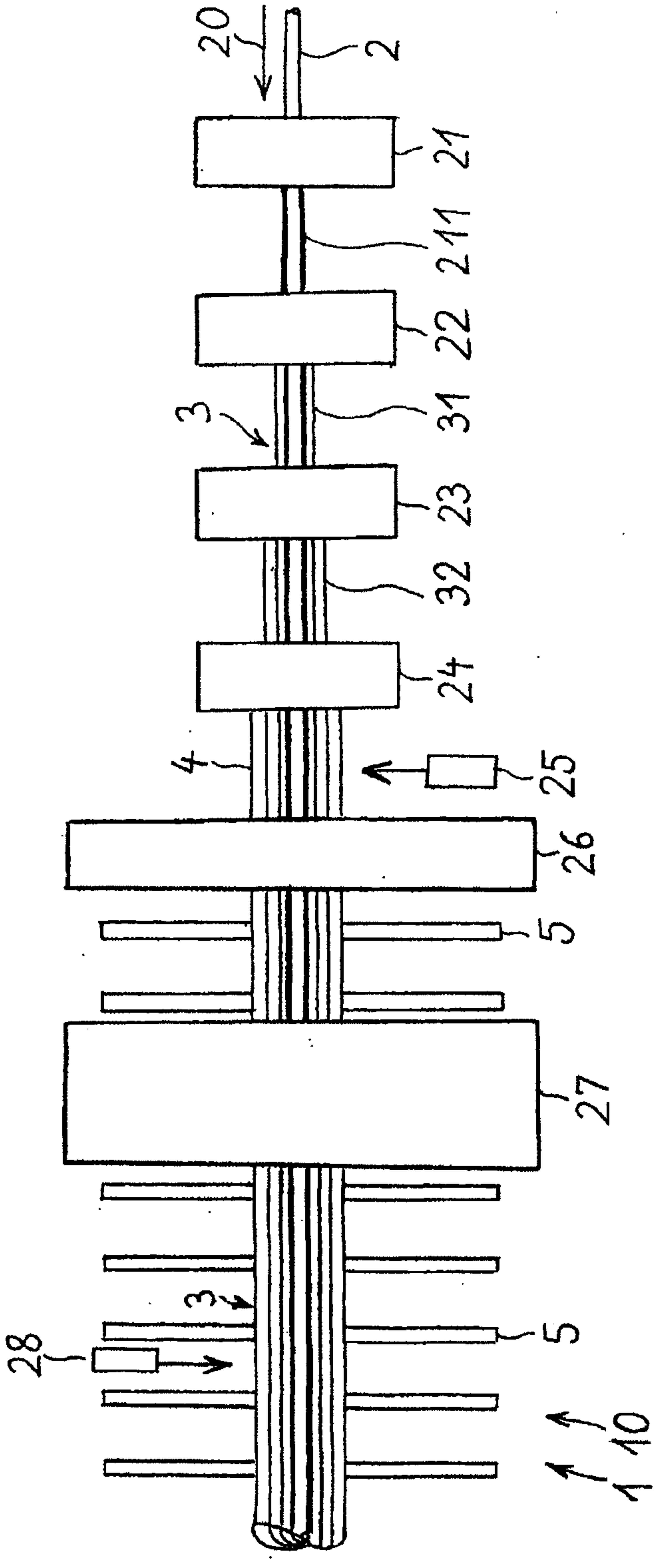
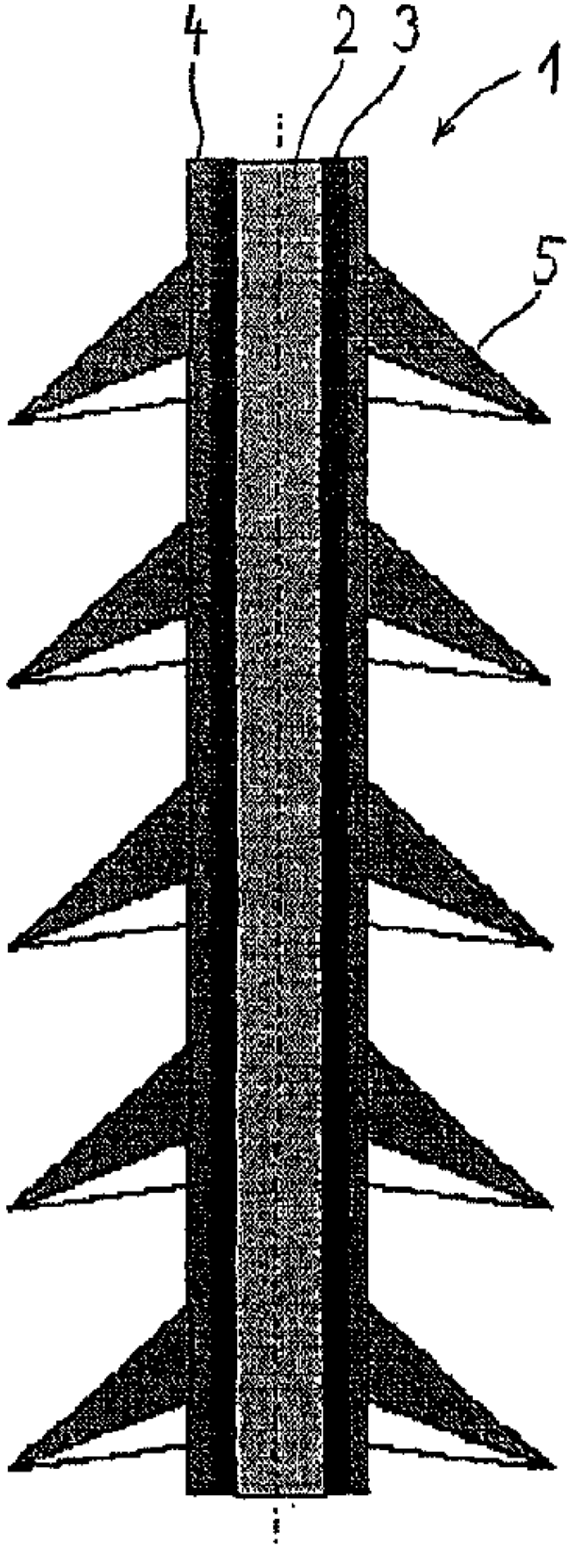


Fig. 7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