

[54] **DIELECTRICS FOR OZONE-GENERATING APPARATUSES**

[72] Inventor: **Robert Louboutin**, La Celle St. Cloud, France

[73] Assignee: **Degremont, Societe Generale D'Epurat
et D'Assainissement**, Rueil-Malmaison, France

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[56] **References Cited**

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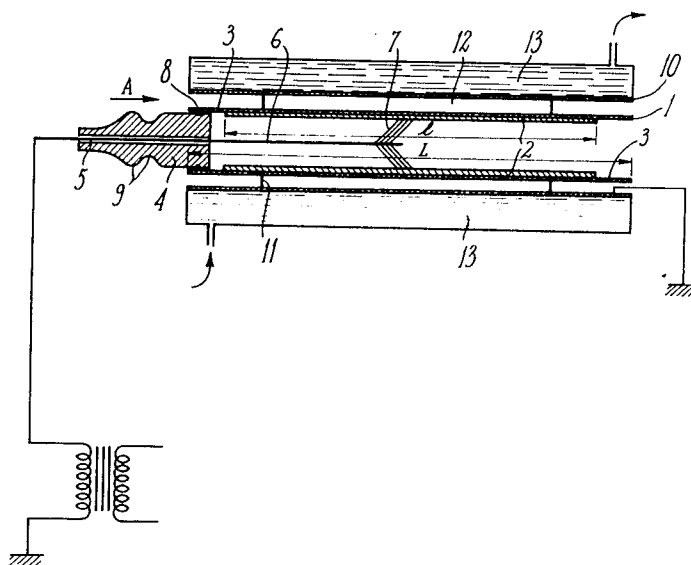
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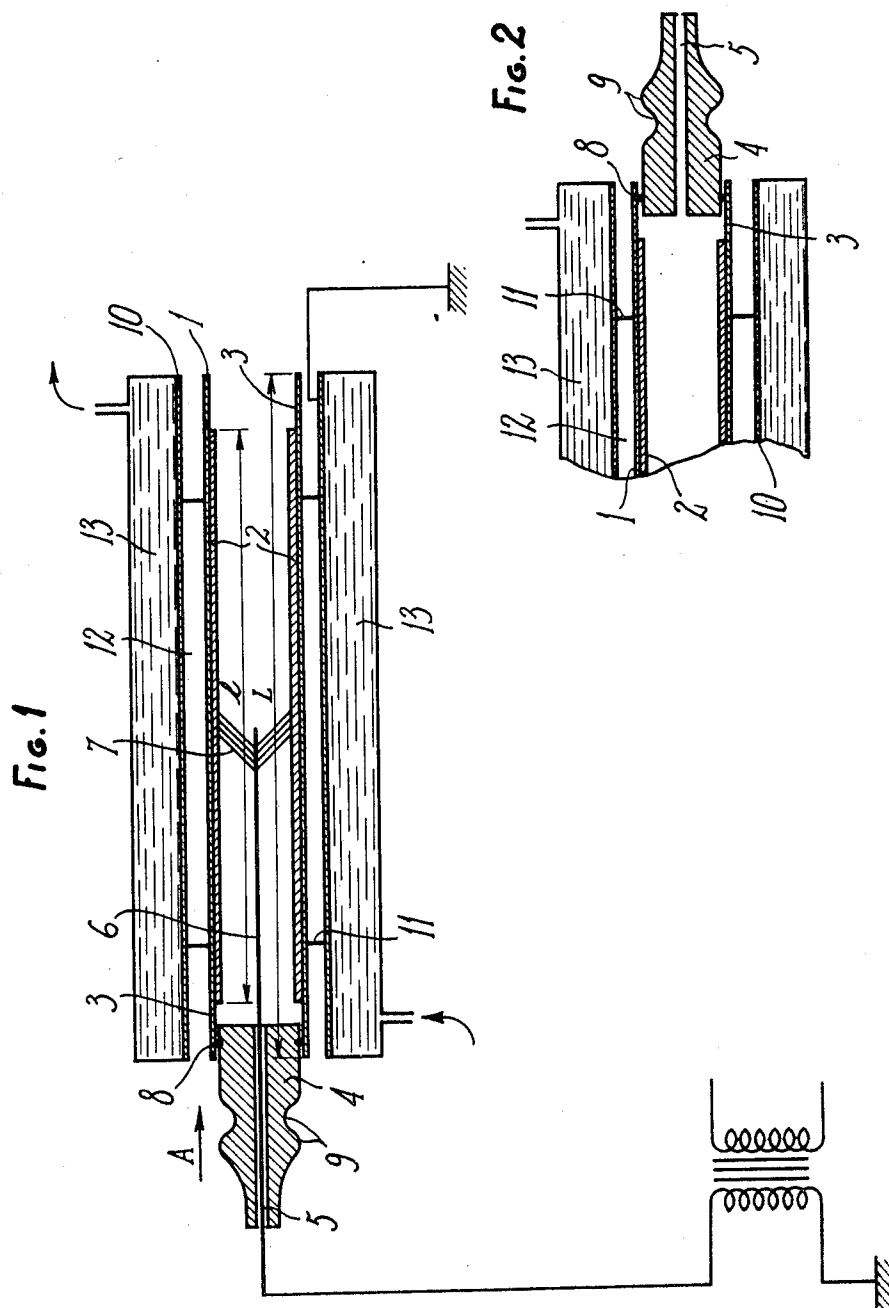
Primary Examiner—John H. Mack
Assistant Examiner—Neil A. Kaplan
Attorney—Wenderoth, Lind & Ponack

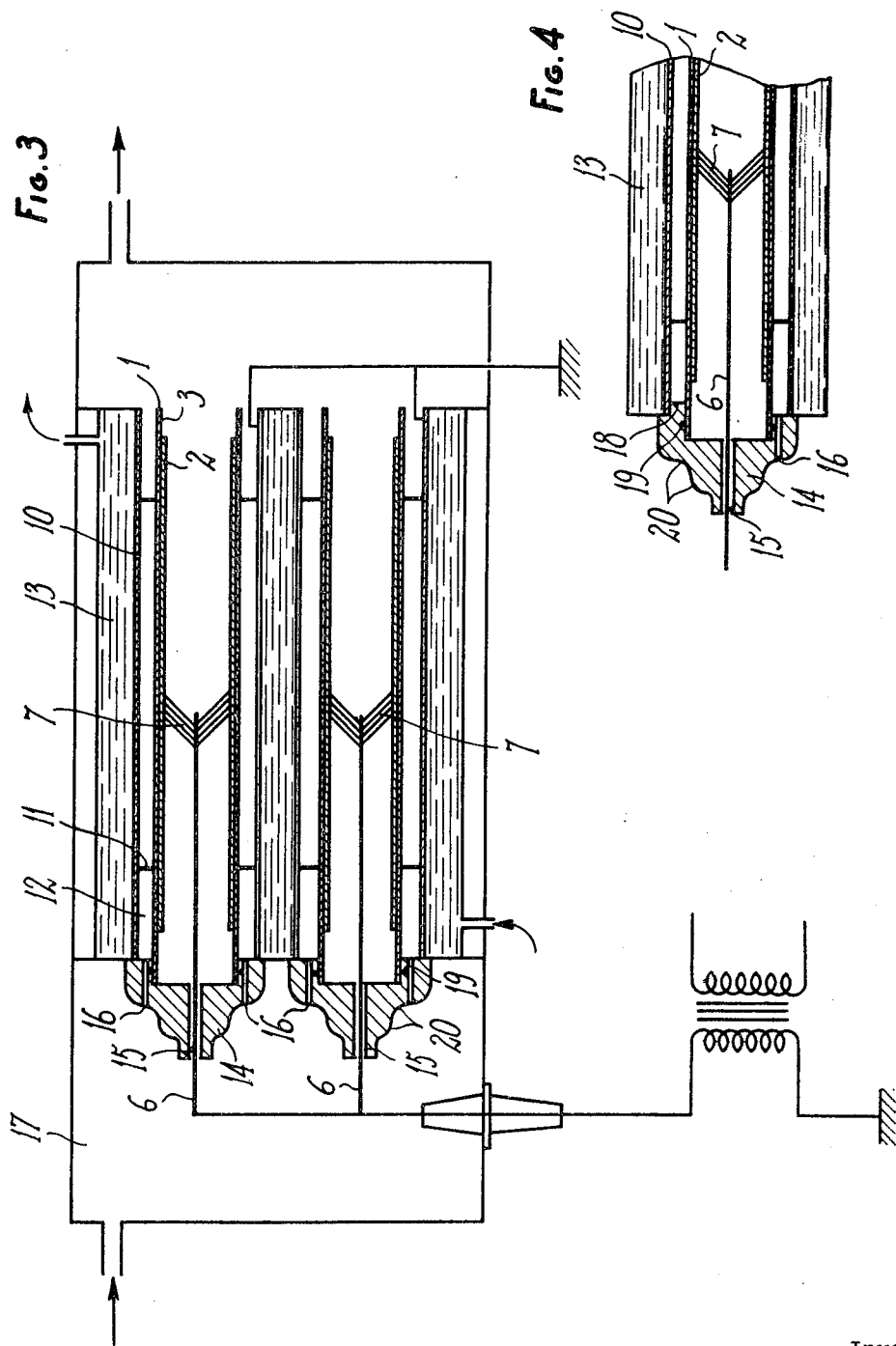
[57] **ABSTRACT**

An assembly for an ozone-generating apparatus consisting of a cylindrical tube of constant thickness which is provided with an internal metal coating and which is characterized in that said tube, which is made of glass or of any other suitable material able to be used in an ozone-generating apparatus, is essentially open at both ends but fitted at one end (or both ends in some cases) with a removable plug which is formed of ozone-resistant insulating material and provided with an axial passageway. A metal rod is adapted to pass through the passageway and serves to apply voltage to the metal coating which is formed on the internal face of the dielectric tube, the length of said coating being slightly smaller than the length of said tube. The rod is of smaller diameter than the passageway in order to admit cooling air into the dielectric tube. The plug may either be inserted into the corresponding extremity of the tube of insulating material or placed over said extremity.

6 Claims, 4 Drawing Figures







Inventor
ROBERT LOUBOUTIN
By *Wendroth, Lind & Ponack*
Attorneys

DIELECTRICS FOR OZONE-GENERATING APPARATUSES

This invention relates to assemblies for ozone-generating appliances.

It is a known practice in the case of ozonizers of the tube type to make use of a dielectric consisting of a glass cylinder having a constant thickness and closed at one extremity by an end wall which is advantageously in the form of either a spherical segment, or a cone or a flat base whilst the other extremity is open and provided with corrugations. Said cylindrical glass tube is lined or coated internally with metal which is connected by means of a brush to one of the terminals of a high-voltage alternating-current source whilst the second terminal is connected to ground. Said glass tube is placed within a grounded coaxial metal cylinder whilst centering devices serve to maintain a constant distance or so-called "discharge gap" between the glass tube and the metal tube.

This known assembly forms a capacitor in which the capacitor plates are formed by the metal tube and the metal deposited on the glass tube whilst the dielectric is constituted by the glass tube itself and by the air contained in the discharge gap. Ozone is formed within this gap from atmospheric oxygen under the action of the applied high-voltage. Production of ozone is thus carried out continuously by renewal of the oxygen within the discharge gap, this being achieved by blowing a stream of air from the open end of the tube towards the closed end. The evolution of heat which is found to take place during the operation of this known device can cause destruction of the formed ozone and the discharge gap must therefore be cooled by circulating water around the metal tube.

It is also known that, in the case of a given ozonizer and the same value of applied voltage, the production of ozone is the greater in proportion as the capacitance of the capacitor of the type described in the foregoing is high. A high capacitance is obtained by employing glass which has a small thickness and high permittivity but the dielectric strength of which must nevertheless be of sufficiently high value to be compatible with the voltage applied thereto. Glass tubes having a constant small thickness of the type which has just been described can be fabricated from glass having high permittivity but this is a costly and difficult process. In particular, while a practically constant thickness can be obtained in the cylindrical portion of the tube, an appreciable reduction in thickness in the vicinity of the end wall usually appears. This reduced thickness results in excessive mechanical fragility of the end portion of the tube and in a substantially lowering of its dielectric strength.

The object of this invention is to provide assemblies for ozone-generating appliances which satisfy practical requirements more effectively than the dielectrics which have been employed for the same purpose up to the present time, especially insofar as the constructional difficulties which were inherent in dielectrics of the prior art now no longer arise and the cost price of the dielectrics according to the present invention is appreciably lower than that of comparable dielectrics of the prior art.

This invention is concerned with a dielectric for an ozone-generating apparatus, said dielectric being constituted by a cylindrical tube of constant thickness provided with an internal metal coating and characterized in that said tube, which is formed of glass or of any suitable insulating material for use in an apparatus for the production of ozone, is open at both ends.

In an advantageous form of embodiment of the dielectric in accordance with the invention for use in ozone-generating apparatuses, one end of the tube of insulating material is closed by means of a removable plug of ozone-resistant insulating material, said plug being provided with an axial passageway through which is passed a metal rod for applying voltage to the metal coating which covers the internal face of the dielectric.

In a preferred arrangement of this form of embodiment, the passageway for the metal rod which serves to apply voltage to the internal metal coating of the dielectric has a diameter which is slightly larger than diameter of said rod.

In another preferred arrangement of the same form of embodiment, the plug is fitted with a seal which is advantageously circular and forms a spring in order to ensure positional maintenance of the plug in conjunction with the end of the tube which is sealed off by means of said plug.

In a third preferred arrangement of this form of embodiment, the plug is provided externally with corrugations which are intended to prevent flashover phenomena.

In an advantageous form of embodiment of the plug in accordance with the present invention, said plug is inserted into the corresponding extremity of the tube of insulating material.

In a further advantageous form of embodiment of the plug in accordance with this invention, the plug is placed over the corresponding extremity of the tube of insulating material and is provided in this case with additional lateral passageways for establishing a communication between the chamber into which air is admitted and the discharge gaps.

In a particular form of embodiment of the dielectric as contemplated by the present invention for use in an ozone-generating apparatus, the other extremity of the tube of insulating material is also closed by means of a plug of the type hereinabove described.

In yet another advantageous form of embodiment of the dielectric for ozone generators as contemplated by the present invention, the internal metal coating of the tube of insulating material is deposited over a length which is preferably smaller than the length of said tube.

In a preferred arrangement of this form of embodiment of the dielectric for ozone-generating apparatuses as contemplated by the present invention, the ends of the tube of insulating material are unmetallized in the case in which the length of the internal metal coating of the tube is smaller than the length of said tube.

In another preferred arrangement of said form of embodiment, the ends of the tube of insulating material are unmetallized over distances which are substantially equal to each other.

In addition to the arrangements which have just been mentioned, the invention further comprises a number of other arrangements which will become apparent from the following description.

The present invention is directed in particular to dielectrics for ozone-generating appliances in accordance with the foregoing arrangements and the elements which are suited for the manufacturing of said dielectrics.

A better understanding of the invention will be gained from the complementary description which now follows below, reference being made to the accompanying drawings, in which:

FIG. 1 is an axial sectional view of one form of embodiment of the dielectric according to the present invention for use in an ozone-generating apparatus;

FIG. 2 is a fragmentary axial sectional view of another form of embodiment of the dielectric according to the invention for use in an ozone-generating apparatus;

FIG. 3 is an axial sectional view of a third form of embodiment of the dielectric according to the invention for use in an ozone-generating apparatus;

FIG. 4 is an axial sectional view corresponding to FIG. 3 and showing another form of embodiment of the dielectric according to the present invention for use in an ozone-generating apparatus.

It must be clearly understood that both the following description and the drawings to which it refers are given solely as an explanatory illustration of the subject-matter of this invention and are not intended to imply any limitation whatsoever.

The dielectric which is intended for an ozone-generating apparatus and illustrated in FIG. 1 is made up of a cylindrical tube 1 of constant thickness, said tube being formed of glass or any other insulating material which can be employed in an apparatus for the production of ozone. The tube is open at both ends and is provided with an internal metal coating 2 over a length l which is preferably smaller than the length L of the

tube, the extremities 3 of said tube being unmetallized over distances which can advantageously be equal at each end.

One of the open ends of said tube 1 is closed by a removable plug 4 which is made of an insulating material affording resistance to ozone such as porcelain, glass, polyvinyl chloride, hypalon, and so forth. Said plug is provided with an axial passageway 5 through which is passed the rod 6 of the brush 7 (or the like) which is employed for applying voltage to the metal coating 2 formed on the internal face of the dielectric. Said plug is advantageously fitted with a seal 8 which can be of the O-ring type and forms a spring, said seal being intended to maintain the plug 4 in position within the dielectric tube 1. External corrugations 9 which are formed on the plug 4 serve to prevent flashover phenomena. The dielectric tube 1 which is sealed off at one end by means of the plug 4 is mounted in known manner within the interior of a coaxial and grounded steel tube 10 and is positionally maintained within this latter by means of centering devices 11 which maintain a constant discharge gap 12 between said tube 1 of insulating material and the metal tube 10. Air is admitted into the discharge gap 12 in the direction of the arrow A and ozone is formed within said gap 12 from the oxygen contained in the air. Cooling of the discharge gap is carried out by circulation of water around the metal tube 10 through ducts 13.

The diameter of the passageway 5 which is formed at the center of the plug 4 is slightly larger than the diameter of the rod 6 of the brush 7. Since the diameter of the passageway 5 is slightly larger than that of the rod 6, a flow of air is admitted into the dielectric tube 1, thereby producing a renewal of air and appreciably enhanced cooling of the dielectric, there being consequently no further danger of destruction of the newly formed ozone under the action of heat emitted as a result of operation of the device.

In order to increase the flashover distance between the metal coating 2 and the metal tube 10, it would also be possible as shown in FIG. 2 to place a plug 4 which is identical with the plug hereinabove described at that end of the dielectric tube 1 which is remote from the supply.

An apparatus for the production of ozone is usually equipped with an appreciable number of dielectrics and it appears advantageous to make provision for a uniform distribution of the overall air flow within all the discharge gaps. Since it is not possible to obtain such a uniform distribution by natural means by reason of the low rates of flow within the discharge gaps (of the order of 2 mm./second), an advantageous expedient in accordance with the invention therefore consists in the use of a plug 14 of the type illustrated in FIGS. 3 and 4. This plug 14 does not penetrate into the dielectric tube 1 as in FIGS. 1 and 2 but is fitted over the extremity of said tube. A passageway for the rod 6 of the brush 7 is pierced within said plug 14 and this latter is preferably provided in addition with lateral ducts 16 in order that a communication may thus be established between the chamber 17 into which air is admitted and the discharge gaps 12. The diameter of the ducts 16 is calculated in order to produce a pressure drop such that the total flow is uniformly distributed between all the passageways and ducts.

The plug 14 can usefully be provided with centering nipples 18 which serve to maintain the requisite spacing between the

dielectric tube 1 and the metal tube 10. As in the case of the plug illustrated in FIGS. 1 and 2, said plug 14 is also provided with an O-ring seal 19 and with external corrugations 20.

As was the case with the embodiment shown in FIGS. 1 and 2, the flashover distance between the metal coating 2 and the metal tube 10 is increased by placing an additional plug 14 at the other end of the dielectric tube 1.

No matter what forms of embodiment, application or utilization may be adopted, it is clear from the foregoing description that the dielectrics which are thus obtained for use in ozone-generating appliances as compared with the dielectrics employed for the same purpose in the prior art provide substantial advantages in addition to those mentioned earlier, and in particular:

the advantage of avoiding embrittlement in the end portions of dielectric tubes while permitting the fabrication of dielectric tubes of insulating material having small thickness and high permittivity.

The advantage of additional cooling which is carried out by circulating air within the interior of the dielectric tube and which is added to the external cooling by water circulation, thus completely eliminating any danger of destruction of the ozone which is formed in the apparatus.

As is clearly brought out in the foregoing, the invention is not limited in any sense to those forms of embodiment and application which have just been described in detail. On the contrary, all alternative forms which may become apparent to any one versed in the art can be considered to come within the broad purview of this invention.

What I claim is:

1. An assembly for a generating apparatus of ozone comprising a cylindrical tube of insulating material, a metal interior covering in said cylindrical tube, said tube having a constant thickness and being open at its two ends, said ends being internally non-metallized ends, a removably plug of insulating material resistant to ozone closing at least one of said ends, said plug having an axial orifice, a metallic rod extending through said orifice to the interior of said tube, means upon said rod providing electrical contact with said interior covering, said orifice having a diameter slightly more than the diameter of said rod and said plug having upon its external portion corrugations to avoid flashover phenomena and a spring joint between said plug and said tube to assure the maintenance in place of said plug with the end of said tube which it closes.

2. Dielectric according to claim 1 wherein said plug is enclosed within the corresponding end of said tube of insulating material.

3. Dielectric according to claim 1 wherein said plug covers the corresponding end of the tube of insulating material.

4. Dielectric according to claim 3 wherein said plug has lateral supplementary orifices which place in communication the chamber in which is admitted the air and the discharge intervals.

5. Dielectric according to claim 3 wherein said plug has centering projections for said dielectric tube in a metallic tube in which it is mounted.

6. Dielectric according to claim 1 wherein the other end of said tube of insulating material is also closed by a plug.

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