

OZONE GENERATING APPARATUS

TECHNICAL FIELD

This invention relates to ozone generating apparatus and has particular relevance to apparatus which operates on corona discharge principles, utilises the phenomenon of air breakdown when electric stress on the surfaces of a conductor exceeds certain values.

BACKGROUND ART

Ozone is used in a wide range of industrial applications such as in the bottling industry to disinfect bottles, in brewing, by the pharmaceutical industry as a disinfectant, in the manufacture of electric components to oxidise surface impurities to breakdown industrial waste like phenol and cyanide so that they become biodegradable, to oxidise mining waste, and for the treatment of harmful compounds such as heavy metals, ethanol and ascetics. It also oxidises phenolics, pesticides, detergents and aromatic (smelly) compounds.

It has also been long recognised that polluted indoor air is a health hazard that causes disease, lost work days and in general reduces quality of life.

Pollution indoors can often exceed outdoor levels and the transmission of respiratory infections in indoor environments continues to be a substantial health concern.

There are many contaminants which contribute to indoor air pollution and the controlled treatment of living environments with ozone will substantially improve conditions.

Excessive levels of ozone can result in the poisoning of humans or animals and it is therefore necessary to control ozone outputs in relation to an environment being treated.

There are numerous enterprises which specialise in the production of ozone generating apparatus and treatments but to date available apparatus has tended to be technically crude, expensive and inefficient.

It is an object of the present invention to provide an ozone

generating apparatus which is efficient compact and one which can be produced at relatively modest cost and be tailored for specific situations.

Ozone is also used for water treatment purposes using what are known as aeration or venturi methods.

5 A typical venturi installation as is known in the art involves the placement of a ozone generating apparatus adjacent to a waterline. Ozone produced by the apparatus is introduced into a waterline using a venturi device placed in a waterline bi-pass from the waterline.

10 It is a further object of the present invention to provide an ozone generating apparatus for general purposes and one which is readily adapted for the treatment of water, air and other bodies of fluid.

Further objects and advantages of the present invention will become apparent from the ensuing description which is given by way of example.

15 DISCLOSURE OF INVENTION

According to the present invention there is provided a corona discharge apparatus comprising an elongate positive electrode, an elongate dielectric sleeve mounted co-axially with the positive charge electrode and an elongate negative electrode mounted co-axially with the dielectric sleeve
20 characterised in that the elongate positive electrode is an interference fit with the negative dielectric.

The positive electrode can be a metal rod provided with an external thread.

25 The negative electrode can be provided with an irregular surface providing venting spaces between the outermost portions of the electrode and the dielectric sleeve.

The negative electrode can be metal mesh in the form of a cylindrical sleeve or wrap.

30 The apparatus can include an elongate tubular outer housing and means for creating a forced draft in an axial direction throughout the housing.

According to another aspect of the present invention there is

provided a corona discharge apparatus comprising positive (outer) and negative (inner) electrodes separated by an air gap and a dielectric member characterised in that the positive and negative electrodes and the dielectric member are co-axial and the air gap between the negative electrode and the dielectric is created by spacers.

The spacers can be resilient o-rings.

The air gap can be defined by the tubular electrode and the spacers.

The air gap is communicable with the interior of the negative electrode.

The inner electrode can be provided with wall apertures which allow air to enter and exit the air gap and internal blocks adapted to divert airflow to and from the air gap.

The inner and outer electrodes can be metal tubes.

BRIEF DESCRIPTION OF THE DRAWINGS

Aspects of the present invention will now be described with reference to the accompanying drawings in which;

Figures 1 to 1c are diagrammatic side perspective views of aspects of an ozone generating apparatus in accordance with one possible embodiment of the present invention, and

Figure 2, 3 and 4 are top, side and exploded views of a further form of corona discharge unit for the ozone generating apparatus of the present invention, and

Figure 5 to 5d are systematic drawings of possible outer electrode arrangements for a corona discharge apparatus of the present invention, and

Figures 6 is a side view and partial cross-section of an electrode according to the present invention, and

Figure 7 is a cross-sectional drawing of the electrode of figure 6 taken at vii:vii.

With respect to figures 1 to 1(d) of the drawings apparatus according to the present invention may comprise a body generally indicated

by arrow 1 which includes a generally tubular outer casing 1a (shown in figure 1 only).

The casing 1a may be provided with vents 2, 3 and may include a carrying handle 4 and attachment means 5.

5 The casing may be cylindrical (as illustrated) square or rectangular (not shown).

The outer surface of the casing 1a of the body 1 may mount an auxiliary and coaxial fan (not shown).

10 Figures 1(b), 1(c) and 1(d) of the drawings are side perspective views of the device of the present invention with the casing 1a removed.

The device is provided with a base generally indicated by arrow 7 an ozone producing region indicated by arrow 8.

The ozone producing region 8 and an internal fan 9 may be fixed to the base 7 by inverted U-shaped rails 10.

15 The base 7 which may be moulded or fabricated in metal or plastic secures free ends 10a of the rails 10 and receives an electrical power cord 11.

The base 7 can house programmable control means (not shown) within a sealed housing 12.

20 The free (upper ends) of the rails 10 can provide support for a corona discharge apparatus generally indicated by arrow 13.

In the example illustrated the frame or casing of the fan 9 is a push fit on the rails 10. In the alternative the frame or body of the fan 9 may fit between the rails 10 in such a manner that it can be repositioned without
25 the need for dismantling.

With respect to figures 2 to 4 of the drawings in accordance with a further possible embodiment of the present invention corona discharge apparatus generally indicated by arrow 15 may be housed within a tube generally indicated by arrow 16.

30 The tube 16 may be made of an ozone resistant material and be in many forms and sizes.

The function of the tube is to isolate the immediate environment

of the corona discharge apparatus from turbulent air which is induced or blown into the generator casing by the main fan and to furthermore improve delivery of ozone from the corona discharge unit.

In other respects the construction of the ozone generator is
5 similar to that previously described.

The discharge unit 15 has positive and negative chargeable electrodes 17, 18 interposed by a dielectric element 19.

Positive electrode 17 can be in the form of a stainless steel rod or bolt charged via electrical connection 20.

10 The negatively charged electrode 18 may be in the form of a tubular wound or wrapped stainless steel mesh charged via an independent electrical connection (now shown).

The dielectric element 19 can be in the form of a ceramic tube.

Where the positively charged electrode 17 is in the form of a
15 bolt the elements of the discharge unit can be conveniently assembled using a nut 21 and washer 22.

A resilient ring 23 can be interposed between washer 22 and the element 19 to lessen the risk of damage to same when assembly nut 21 is tightened.

20 The corona discharge unit 15 can be centralised in tube 16 by a support 24.

The length of the mesh electrode 18 may be varied to suit.

As mentioned earlier the tube 16 can be of varying sizes and configurations.

25 In figure 3 the tube 16 is elongate and has inlet and outlet nozzles 25, and 26 of reduced size with a view to improving the delivery of ozone from the unit.

An auxiliary fan 27 may be positioned within the tube 16 to further enhance ozone delivery from the tube.

30 In some instances a glass tube corona discharge unit may be specified.

The corona discharge apparatus figures 5 to 5(d) illustrate other

aspects of the present invention.

In figure 5 the apparatus has two series wired negative electrodes 18.

In figure 5a the apparatus has four series connected negative electrodes 18 joined by a metal crimp bar 30.

Figure 5b is a sectional drawing taken at V(b):V(b) of figures 5 and 5a. The arrangement shows negative electrodes 18 in the form of a metal mesh wrap on the dielectric 19 where the free ends 32, of the mesh forming the electrode 18 are joined by a crimped bar 30, clamped and pulled taut by the crimp bar.

In figure 5c shows that a negative electrode 18 which is of an irregular surface shape can provide a corona discharge "skin" over the dielectric 19 through which air can pass. The depth of the corona discharge skin is approximately equivalent to the overall depth of the electrode 17. Various kinds of mesh, punched plates and the like can be provided to create this effect.

In figure 5d a positive electrode 18 is created by a material having lengthwise triangular fluting 33. Such an arrangement also provides a corona discharge skin through which air can freely pass.

With respect to figures 6 and 7 of the drawings the present invention also provides an corona discharge apparatus generally indicated by arrow 34 having positive (outer) and negative (inner) electrodes 35 and 36 respectively separated by an airgap 37 and a dielectric 38.

The electrodes 35, 36 and dielectric 38 are co-axial tubular members and the airgap 37 is created by spacers 39.

The spacers 39 can be o-ring seals made of a resilient ozone resistant material such a viton, and are set in grooves 40 in the face of the inner electrode 36.

The air gap 37 is an annular chamber defined by the inner walls of the dielectric 38, o-rings 39 and the outer walls of the inner electrode 36.

Access to the interiors of the air gap 37 is provided by apertures 41 and 41a in the walls of the inner electrode 36.

The inner electrode 35 and/or the dielectric can be connected to incoming and outgoing airlines 42, 43 respectively.

Single or dual plugs 44 prevent the passage of air into the interiors of the inner electrode 36.

5 When the electrodes 35, 36 are charged and a forced draft of air or oxygen is applied to airline 42 plugs 44 block the air and divert it into the interiors of the airgap 37 via the apertures 41, 41a.

The forced air draft now containing ozone is released to the airline 43 via apertures 41a.

10 The size and volume of the air gap can be adjusted by altering the spacings of the o-rings and/or their size.

The apparatus described is readily adapted for introducing ozone into fluid pipes or other bodies of water. The apparatus can also be used as a general purpose ozone generator for air treatment.

15 The apparatus of figures 6 and 7 can be readily adapted for ozone production from air. The inner tube electrode takes the place of the solid rod electrode of the previously described embodiment and the positive electrode is replaced by a negative mesh electrode.

20 The apparatus is constructed from readily available tubestocks and the robust construction ensures maximum operating efficiencies can be maintained.

Apparatus in accordance with the present invention has many advantages including:

- 25 (a) the ability to increase commercial profits by extending shelf life of agricultural and horticultural commodities during storage and transit,
- (b) improved quality of agricultural and horticultural commodities by inhibiting microbial growth on product surfaces,
- 30 (c) lowering the risk of pathogenic agents and cross-contamination in food handling environments,
- (d) the improved quality of indoor air by eliminating

- unpleasant and hazardous odours and reducing risk of respiratory infections and effects of chemical pollutants,
- (e) the enhancements of hygiene by accessing and sterilising difficult to clean places, all of which can be achieved with no chemical residue build-up.

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Aspects of the present invention have been described by way of example only and it will be appreciated that modifications and additions thereto may be made without departing from the scope thereof, as defined in the appended claims.

CLAIMS:

1. Corona discharge apparatus comprising an elongate positive electrode, an elongate dielectric sleeve mounted co-axially with the positive electrode and an elongate negative electrode mounted co-axially with the dielectric sleeve characterised in that the elongate positive electrode is an interference fit on the elongate negative electrode.
2. Corona discharge means as claimed in claim 1 wherein the positive electrode is a metal rod provided with an external thread.
3. Corona discharge means as claimed in claim 1 wherein the negative electrode is provided with an irregular surface provide an air spaces between the outermost portions of the electrode and the dielectric sleeve.
4. Corona discharge means as claimed in claim 1 wherein the negative electrode is a metal mesh in the form of a cylindrical sleeve or wrap.
5. Corona discharge means as claimed in claim 1 including an elongate tubular outer housing and means for creating a forced draft in an axial direction throughout the housing.
6. Corona discharge apparatus comprising positive (outer) and negative (inner) electrodes separated by an air gap and a dielectric member characterised in that the positive and negative electrodes and the dielectric member are co-axial and the air gap between the negative electrode and the dielectric is created by spacers.
7. Corona discharge apparatus as claimed in claim 6 wherein the spacers are resilient O-rings.
8. Corona discharge apparatus as claimed in claim 6 wherein the air gap is defined by the tubular electrode and the spacers.
9. Corona discharge apparatus as claimed in claim 6 wherein the inner electrode is provided with wall apertures which allow air to enter and exit the air gap and internal blocks which divert airflow from the air gap.

