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APPARATUS FOR CONVERTING OXYGEN INTO OZONE.

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NO MODEL.

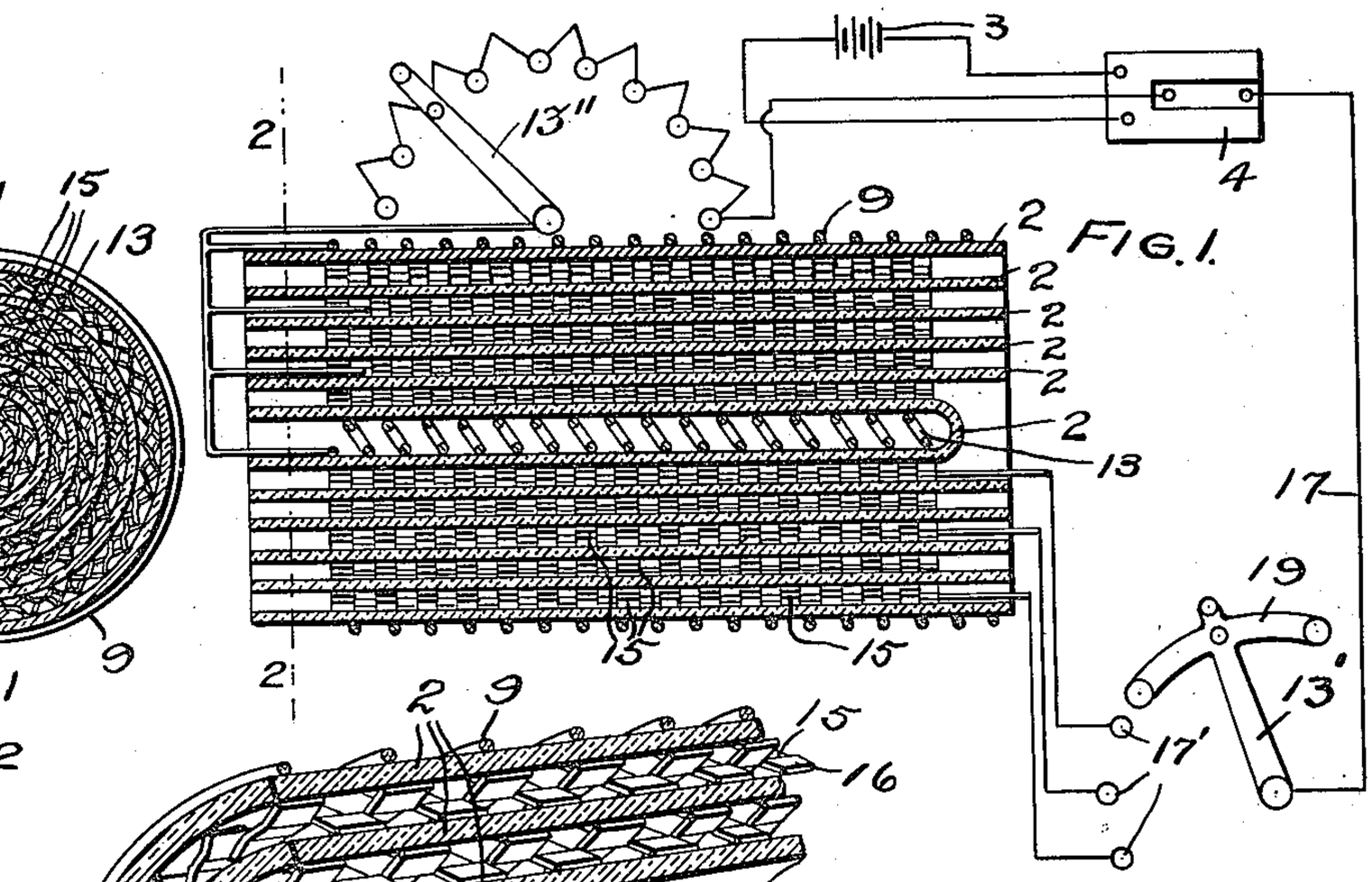

FIG. 1.

FIG. 2

FIG. 5

FIG. 6

FIG. 3

FIG. 4

Witnesses
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UNITED STATES PATENT OFFICE.

FREDERICK S. BLACKMARR AND JOSEPH L. WILLFORD, OF MINNEAPOLIS, MINNESOTA.

APPARATUS FOR CONVERTING OXYGEN INTO OZONE.

SPECIFICATION forming part of Letters Patent No. 743,433, dated November 10, 1903.

Application filed October 27, 1902. Serial No. 128,879. (No model.)

To all whom it may concern:

Be it known that we, FREDERICK S. BLACKMARR and JOSEPH L. WILLFORD, of the city of Minneapolis, in the county of Hennepin, State of Minnesota, have invented certain new and useful Improvements in Apparatus for Converting Oxygen into Ozone, of which the following is a specification.

Our invention relates to the production of ozone by electricity, and our present invention relates particularly to improvements in the converter, our object being to provide an apparatus in which a large amount of oxygen may be converted into ozone.

The invention consists generally in a converter consisting of a series of tubes formed of dielectric material arranged one within the other, with electrodes or terminals of interrupted electric circuits arranged upon the opposing walls of each tube.

The invention consists, further, in means for cutting out the electrodes or terminals between two or more of the tubes while still maintaining the same resistance from the electrodes left in use.

The invention consists also in electrodes or terminals formed of corrugated metal plates arranged in air or oxygen passages between the tubes.

The invention consists, further, of electrodes or terminals formed of strips of spring metal arranged in air or oxygen passages between the tubes.

In the accompanying drawings, forming part of this specification, Figure 1 is a longitudinal section of a converter embodying our invention, showing also the electrical connections therewith, the section being taken on line 1 1 of Fig. 2. Fig. 2 is a section on line 2 2 of Fig. 1. Fig. 3 is a longitudinal section showing a modified construction. Fig. 4 is a section on line 4 4 of Fig. 3. Figs. 5 and 6 are details.

In the drawings, 3 represents a suitable battery or other electric generator.

4 represents an ordinary induction-coil provided with a suitable circuit-breaker, said coil being in circuit with the battery 3. The ozone converter or generator consists of a series of glass tubes 2, arranged one within the other, with narrow annular spaces between said tubes. These tubes are preferably open at both ends, although, if preferred, the center tube may be closed, as shown in Figs. 1 and 3 of the drawings. The electrode or terminal of one pole of the induction-coil 4 is arranged upon the outside of the outer tube and consists of the spirally-wound wire 9, suitably secured upon the outer surface of said outer tube. The intermediate electrodes or terminals consist of a series of thin corrugated metal plates 11, each of which is arranged with the angles of the corrugations in contact with the inner surface of one tube and the outer surface of the other. (See Fig. 4.) These plates are arranged between every two tubes, and thus each plate forms a terminal from one pole of the induction-coil between the outer surface of one tube and the inner surface of the other. All of the annular spaces between the tubes are similarly filled. The inner tube, which is preferably open only at one end, has arranged within it a terminal consisting of a suitable coiled wire 13. The conductor from each pole of the induction-coil is connected through a controller or cut-out to a series of terminals upon or within the dielectric tubes. As here shown, the conductor from one pole of the induction-coil is connected through a controller to the terminal upon the outer surface of the outer tube, to the terminal upon the inner surface of the inner tube, and to two of the intermediate terminals, while the conductor from the other pole of the induction-coil is connected through a cut-out to the remaining terminals. Instead of using the corrugated plates 11 we may employ a series of narrow metal strips 15, each having a series of spring-tongues 16 at its opposite edges. These strips are placed between the dielectric cylinders and are arranged to be in contact with the walls of every two cylinders. This construction is especially advantageous, as the ordinary glass tubes are not perfectly cylindrical, and where corrugated plates such as illustrated in Fig. 4 are employed it will sometimes occur that at certain points in the cylinder or tube the metal plates will not be in contact with the tube. Whenever there is a space between the plate and tube, a spark will be formed, and this sparking within the

generator generates nitrous vapors, and the ozone does not possess those desirable medicinal qualities which are found to be present in ozone generated by the electrical current where no spark is produced. We also prefer to provide the spring projections 16 upon the plate 15 of unequal sizes, so that when said plates are in position the projections upon each plate cannot enter the spaces between the projections upon the next adjacent plate. We find this to be a particularly advantageous construction and that it materially expedites the work of putting the plates in position between the glass tubes. These projections on the metal plates make irregular passages through which the air must pass and by which it will be deflected and retarded. The conductor 17 from one pole of the induction-coil is preferably connected to a cut-out 13'. A series of contact-points 17' are provided, and the alternate terminals within the converter are connected to these contact-points. The cut-out 13' is suitably pivoted and is provided with a curved plate 19, that is adapted to pass over the contact-points 17' and make electrical connection therewith. This cut-out may be turned so that the plate 19 will be in contact with all of the contact-points 17', or it may be in contact with either of the outer ones or with either of the outer ones and center one or with all three. When this cut-out is in contact with all three of the contact-points, the electric circuit will be connected to all of the terminals within the tubes of the converter, and by this means the greatest action of the converter will be secured. A suitable controller 13'' is located between the induction-coil and the opposite terminals. By means of the cut-out any number of the terminals may be left in circuit, and by means of the controller the current through the terminals may be regulated. By this means we can regulate the qnantity of ozone produced, and thus control the strength of the ozonized air.

In Fig. 3 of the drawings we have shown a suitable fan-case 21 and fan 22 connected to the converter and so arranged that a current of air is drawn through the air or oxygen passages between the tubes and through the spaces between the corrugations of the plates. The air thus passing through the converter will have a large portion of its oxygen converted into ozone. From the fan-casing the ozonized air may be conducted to any suitable point and may be used for any purpose desired. For instance, the ozone or ozonized air may be conducted to a suitable inhaler, to a house-ventilator apparatus, to apparatus designed for storing meats or other perishable articles, to a cabinet designed for applying ozone or ozonized air to the human body, or to apparatus designed for impregnating water or other liquid with ozone or ozonized air. We do not, therefore, confine ourselves to any particular use or application of the ozone or ozonized air.

In an application filed by us April 26, 1902, Serial No. 104,829, we have illustrated a number of different applications of apparatus for converting oxygen into ozone. The converter herein shown and described may obviously be used in place of the converter shown and described in our said application and in any of the applications therein illustrated. While we have shown an induction-coil as the means for producing the electric current used in our converter, we do not limit ourselves to the use of this generator, as any other suitable alternating-current generator may be employed.

We claim as our invention—

1. An apparatus for converting oxygen into ozone, comprising, in combination, a series of tubes or cylinders arranged one within another with air or oxygen passages between said tubes or cylinders, and formed of suitable dielectric material, an electric generator, electrodes or terminals arranged between said tubes or cylinders in said air or oxygen passages and connected alternately to the opposite poles of said generator, and means for cutting out one or more of said electrodes or terminals.

2. An apparatus for converting oxygen into ozone, comprising, in combihation, a series of tubes or cylinders arranged one within another with air or oxygen passages between them and formed of suitable dielectric material, an electric generator, and electrodes or terminals formed of corrugated plates arranged in said air or oxygen passages between said tubes or cylinders and in contact therewith, and connected to the opposite poles of said generator.

3. An apparatus for converting oxygen into ozone, comprising, in combination, a series of tubes or cylinders arranged one within another with air or oxygen passages between them and formed of suitable dielectric material, an electric generator, electrodes or terminals arranged in the air or oxygen passages between said tubes or cylinders, one or more of said electrodes being in contact with the inner surface of one tube or cylinder and the outer surface of another, and means connecting alternate electrodes or terminals with the opposite poles of the generator.

4. An apparatus for converting oxygen into ozone, comprising, in combination, a series of tubes or cylinders arranged one within another and formed of suitable dielectric material, an electric generator, electrodes or terminals arranged between said tubes or cylinders and formed of spring-plates in contact both with the inner wall of one cylinder and the outer wall of another, and means connecting alternate electrodes or terminals with the opposite poles of said generator.

5. An apparatus for converting oxygen into ozone, comprising, in combination, a series of tubes or cylinders arranged one within another with air or oxygen passages between them and formed of suitable dielectric material, an electric generator, electrodes or ter-

minals formed of corrugated metal plates arranged in the air or oxygen passages between said tubes or cylinders and connected alternately to the opposite poles of said generator, and means for cutting out one or more of said electrodes or terminals.

6. The combination, with the series of tubes formed of dielectric material and arranged with spaces between them, of electrodes or terminals arranged between said tubes and formed of plates provided with spring-tongues adapted to make close connection with the surfaces of said tubes and to deflect and retard the air passing between said tubes.

7. An apparatus for converting oxygen into ozone consisting of a series of tubes or cylinders, each formed of dielectric material, said cylinders being arranged one within another with open spaces between them, forming passages for air or oxygen, electric conductors arranged in the passages for air or oxygen between said cylinders and in contact with the inner and outer surfaces thereof, means connected with said conductors for generating an interrupted current, and means for conveying a gaseous body through the spaces between said cylinders and in contact with the surfaces thereof, substantially as described.

8. An apparatus for converting oxygen into ozone consisting of tubes or cylinders arranged one within another with air or oxygen passages between them and each formed of a dielectric material having in contact with the inner and outer surfaces thereof in said air or oxygen passages a material capable of conducting electricity, means connected with the conductors for generating an interrupted current, and means for conveying a gaseous body through the spaces between said cylinders.

In witness wheref we have hereunto set our hands this 20th day of October, 1902.

FREDERICK S. BLACKMARR.
JOSEPH L. WILLFORD.

In presence of—
A. C. PAUL,
C. G. HANSON.