

July 10, 1934.

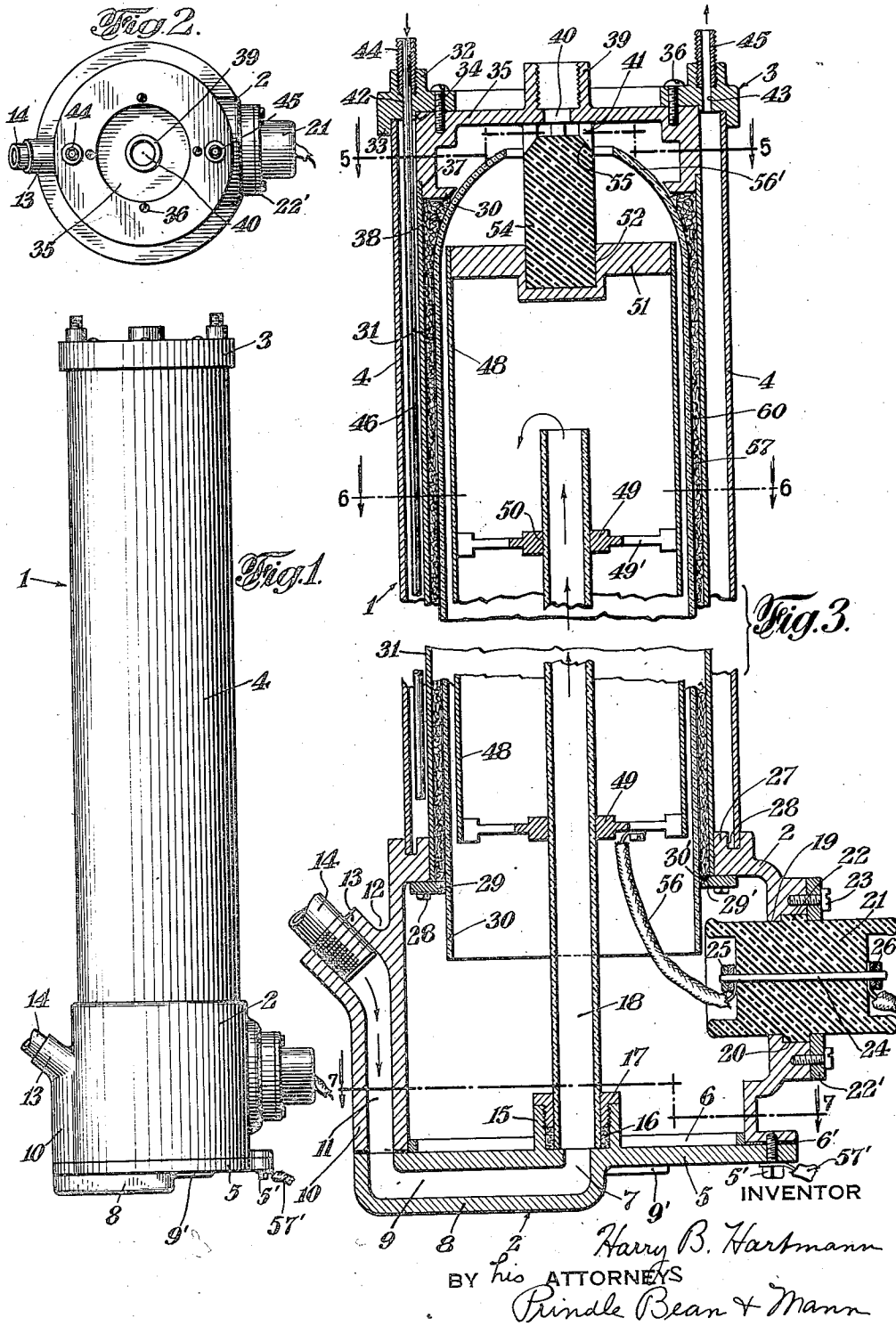
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1,965,766

METHOD OF AND APPARATUS FOR PRODUCING OZONE

Filed Jan. 8, 1931

2 Sheets-Sheet 1



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Fig. 4.

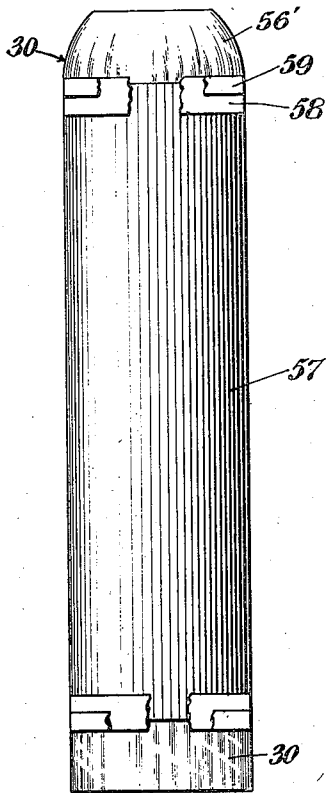


Fig. 5.

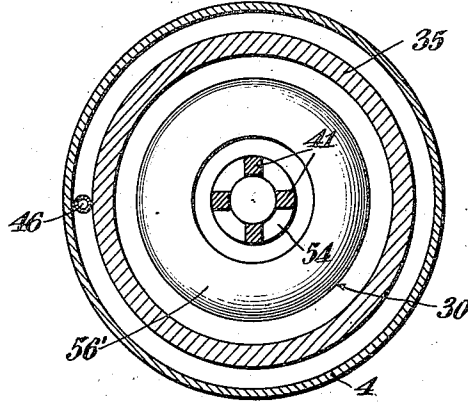


Fig. 6.

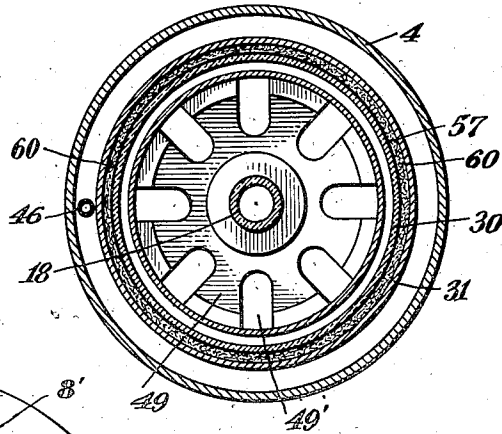
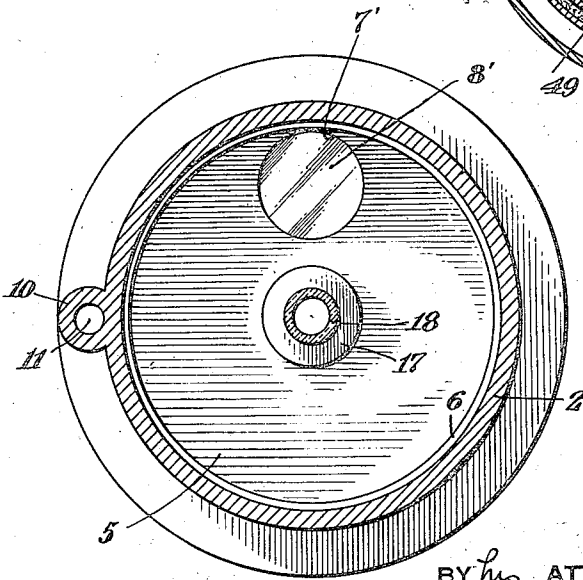


Fig. 7.

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UNITED STATES PATENT OFFICE

1,965,766

METHOD OF AND APPARATUS FOR
PRODUCING OZONE

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Application January 8, 1931, Serial No. 507,321

2 Claims. (Cl. 204—32)

This invention relates to an apparatus of and a method for producing ozone which has for its principal object the production of a maximum amount of ozone at a minimum cost.

5 One object of the invention is the provision of a device in which an electrode may be replaced without dismantling the whole device.

Another object is the provision of a device in which the electrodes are cooled so as to obtain
10 a greater yield of ozone.

A further object of this invention is the provision of a device in which the incoming air is used to cool the electrodes.

Further objects of this invention include improvements in details of construction and arrangement, whereby an efficient and simple mechanism of this character is provided.

In the drawings—

Figure 1 represents a front plan view.

20 Figure 2 represents a top plan view.

Figure 3 represents a vertical, transverse sectional view.

Figure 4 represents a front plan view of the outer electrode, parts being broken away to facilitate the disclosure.

25 Figure 5 is a horizontal, cross sectional view taken substantially on line 5—5 of Figure 3.

Figure 6 is a horizontal, cross sectional view taken substantially on line 6—6 of Figure 3, and

30 Figure 7 is a horizontal, cross sectional view taken substantially on line 7—7 of Figure 3.

Referring now to the drawings, the generator comprises a casing generally indicated by the numeral 1, made up of a bottom hollow member 35 2, and a top member 3, the members 2 and 3 being separated and spaced by a metal tube 4. The casing is coated with a substance to render it impervious to ozone. The hollow member 2 is provided with a bottom plate 5 formed with
40 a ring 6 on its inner surface which is adapted to abut the inner lower edge of the hollow bottom member 2 and center the bottom plate 5 with respect thereto. The bottom plate is connected to the hollow member 2 by means of bolts 5' and
45 a gasket 6' is provided between the parts. The bottom plate 5 is provided with an opening 7, and a hollow radial rib 8 which is provided with a passage-way 9, which is substantially U-shaped, and connects with the opening 7 in the plate 5.
50 On the front portion of hollow bottom member 2 is a vertical rib 10 provided with passage-way 11, the passage-way 11 being in communication with the passage-way 9 formed in radial rib 8. At
55 its upper end the rib 10 extends at an angle 12, and is provided with a threaded opening 13 which

receives the end of a pipe 14. The bottom plate 5 is also provided with a sight opening 7' provided with glass 8' held on a boss 9' for viewing the interior of the generator at all times.

Concentric with the opening 7 and extending
60 interiorly of the device from the top surface of bottom plate 5 is a threaded sleeve 15 which is spaced from the opening 7 to provide space for the packing 16 and gland 17 for a tube 18 that is positioned so as to be in alinement with the
65 opening 7 in bottom plate 5 and so form a conduit with the radial rib 8 and vertical rib 10 to conduct dehydrated air which is to be subjected to treatment to produce ozone. The tube 18 is preferably made of glass.

The bottom member 2 is provided with flanged opening 19 having shoulder 20 for receiving an insulating block 21, the said block being provided with a circumferential projection 22 adapted to abut the shoulder 20. An annular member 22' 75 abuts the other side of said projection, and is secured to the flanged opening by means of bolts 23 so as to hold the insulating block 21 in position. The said insulating block is provided with a copper rod 24 which is screw-threaded at its ends and is provided with nuts 25 and 26 for connecting electric wires thereto.

The top edge of the bottom member 2 is provided with the flanged opening 27 provided in its top with a groove 28 which receives the metal tube 4. The tube may be brazed or otherwise
85 secured to the member 2. Secured to the under side of the flanged opening 27 by means of the bolts 28 is a ring 29 which has a beveled end 29' which projects beyond the flanged opening 27 to form a centering and steadying means for the outer electrode 30, later to be described, and also to support the bottom of tube 31 spaced from, and having a tight fit with, the opening 27, preferably with brazing, or sealing compound, to prevent leakage of water into the generator. The beveled end 29' also holds the asbestos packing 30' against the electrode 30.

The top member 3 comprises a flanged ring 32 provided with the shoulder 33 which receives the top of tube 4, and a second shoulder 34 which is smaller in diameter than shoulder 33, and that receives a positioning ring member 35, the ring 32 and the ring member 35 being connected as by any suitable means as bolts 36. The ring member 35 is formed with the shoulder 37 at its bottom outer edge to receive the top of the tube 31.

The top portion of tube 31 is brazed to the ring member 35, and the top portion of tube 4 is brazed
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to the ring member 32, while the bottom portions of these tubes are brazed or otherwise suitably secured to the bottom member 2. After being brazed, the parts are secured together as by the bolts 36, and as the top member 3 compresses the two parts 32 and 35, it is an easy matter to braze the tubes to the separate parts and then bolt the brazed parts together.

The bottom of member 35 is provided with the annular flange 38 which extends inwardly and is adapted to center and position the top of tube 30. The ring member 35 is provided with the threaded sleeve 39 which extends upwardly therefrom and with an aperture 40 surrounded by the depending spaced projections 41. Top ring member 32 is provided with openings 42 and 43 which are partially threaded to receive sleeves 44 and 45. The openings 42 and 43 communicate with the space between tubes 4 and 31. The sleeve 44 is adapted to receive a pipe 46 which extends between the tubes 4 and 31 to a point near the bottom of the space between them, and is adapted to conduct water into this space to form a water jacket to keep the generator cool. The water leaves the water jacket by means of the opening 43, the sleeve 45 received by this opening being adapted to receive a pipe or hose to conduct the water away.

Positioned substantially centrally of the device are the tubular electrodes 30 and 48, which are supported by the following construction: The inner electrode 48 is made of a non-rusting alloy, such as stainless steel, which is resistant to oxygen and ozone, and is provided with a plurality of ring members 49 which frictionally engage the interior of the inner tubular electrode 48. These ring members 49 may be made of aluminum. Each of the members 49 is provided with a central aperture 50 which receives the tube 18, the members 49 functioning to center the tube 18 and also to hold it steady during the operation of the device. The ring members 49 are provided with a plurality of radial spaced openings 49' which direct the incoming air against the inner electrode to cool the same. Also the air, as it passes into the electrode from tube 18, is directed against the closed end of the electrode and then to the space between the electrodes, so that the entire electrode is cooled. The top of the electrode 48 is closed by the closely fitting imperforate block 51 provided with a seat 52, which receives and positions the insulating spacer member 54, which may be of lava, porcelain or the like. The block 51 may be made of aluminum. The spacer member 54 is provided on its top with the beveled portion 55 which cooperates with the beveled projections 41 provided on ring member 35 so as to form a series of passage-ways into the opening 40 in the ring member 35. The bottom ring member 49 is connected to the copper rod 24 by means of the cable 56. An outlet cable 57' is connected to bottom plate 5 by means of one of the bolts 5' and is adapted to lead current from the outer electrode.

Outer electrode 30 comprises a glass tube which may be made of Pyrex, or any glass having a low coefficient of expansion, and which is provided with the rounded open end 56' that is adapted to assist in centering and positioning the outer electrode. The electrode 30 is covered for a greater portion of its exterior by the metallic coating 57, which may be a copper coating, and at the ends of this metallic coating the resistance coatings or elements 58 and 59 are provided in the

form of bands which may conveniently be made. The resistance coating or element 59 has a greater resistance than the coating or element 58, and the flow of current is reduced to zero near the edge of the metallic resistance coatings, and this prevents an edge discharge. If the edge discharge is not eliminated, nitrous oxide is formed, and this contaminates the product. As shown in Figure 4, the metallic coating 57 is extended under the resistance coatings 58 and 59, and resistance coating 58 extends under resistance coating 59. However, it is to be understood that these coatings need not overlap, and may be made so as to all be in the same plane or adjacent one another.

Positioned between the exterior of outer electrode 30 and the interior of tube 31 is a mass of copper wool or sponge 60 which is adapted to conduct heat away from the outer tubular electrode and maintain the generator at a lower temperature so as to obtain a greater yield of ozone. The copper wool or sponge being of an amorphous nature lends itself readily to changes in shape and position due to the expansion and contraction of the parts of the device.

It is to be noted that the inner and outer electrodes are concentric, and are spaced so as to permit the passage of the air therebetween. The upper end of the outer electrode 30 is open and is spaced from the spacer member 54 on the inner electrode 48 so as to permit the passage of the treated air and ozone through the opening 40 in the top of the generator.

It is to be expressly understood that the device can be operated in either a vertical or horizontal position, thus adapting it for use in places having limited floor space.

From the construction described, it will be apparent that if bottom plate 5 is removed and cable 56 detached the electrodes may easily be removed and replaced without disturbing the air or water connections.

The operation will now be described. Air is dehydrated by passing it through a dehydrator, one form containing silica gel, such as disclosed in my copending application, filed on even date herewith. When it is desired to regenerate the silica gel, the operation is stopped and heated air is passed through the silica gel. It is to be expressly understood that other dehydrators may be used. The dehydrated air is then conducted from the pipe 14, through the tube 18 to one end of the interior of inner electrode 48, and due to the fact that the upper end of the inner electrode 48 is closed, the air is forced downwardly, and, in passing through the slots or openings 49' in the ring members 49, is given a swirling motion which helps to keep the inner electrode and the device cool. Residual moisture is also removed by this motion of the air. The air next passes into the polar space between the inner electrode 48 and the outer electrode 30, while the inner electrode is subjected to a high voltage of electricity, of the magnitude of substantially 10,000 volts, so that there is a silent brush discharge between the two electrodes, the copper sponge and water jacket conducting the current to outlet cable 57'. It is to be expressly understood that the voltage is not to be limited to 10,000 as this number is given by way of example only and that the voltage may be varied. This discharge transforms some of the oxygen into the form of ozone, and the gases pass up between these tubes to the exit opening 40 in the top of the generator, from which point they are led to the place to be used. The device is, therefore, maintained at a rela-

tively low temperature by means of the water jacket 4 through which water is continually circulated and the copper wool or sponge 60 forms the conducting means between the water jacket 5 and the outer electrode 30. When the generator is maintained at a low temperature, a greater production of ozone results.

From the foregoing disclosure it will be apparent that I have described an apparatus of and a method for producing ozone which will produce a maximum of ozone at a relatively small cost and that the apparatus is of a relatively simple construction.

What I claim is:

1. In a device of the character described, a tubular inner electrode, an outer concentric electrode, tubular means extending into said inner electrode for conducting air thereto, means for centering said tubular means with respect to said

inner electrode, said last mentioned means being adapted to direct the air admitted by the tubular means against the inner walls of the inner electrode.

2. In a device of the character described, an inner electrode having a closed end, an outer concentric electrode, means for holding said outer electrode in proper position, a tube surrounding said outer electrode, conducting means between said tube and said outer electrode, said means comprising copper wool, another tube surrounding said first mentioned tube and being spaced therefrom to form a water space adapted for cooling said outer electrode, said closed end of said inner electrode having a depression, and a spacer member in said depression and adapted to correctly position said inner electrode.

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