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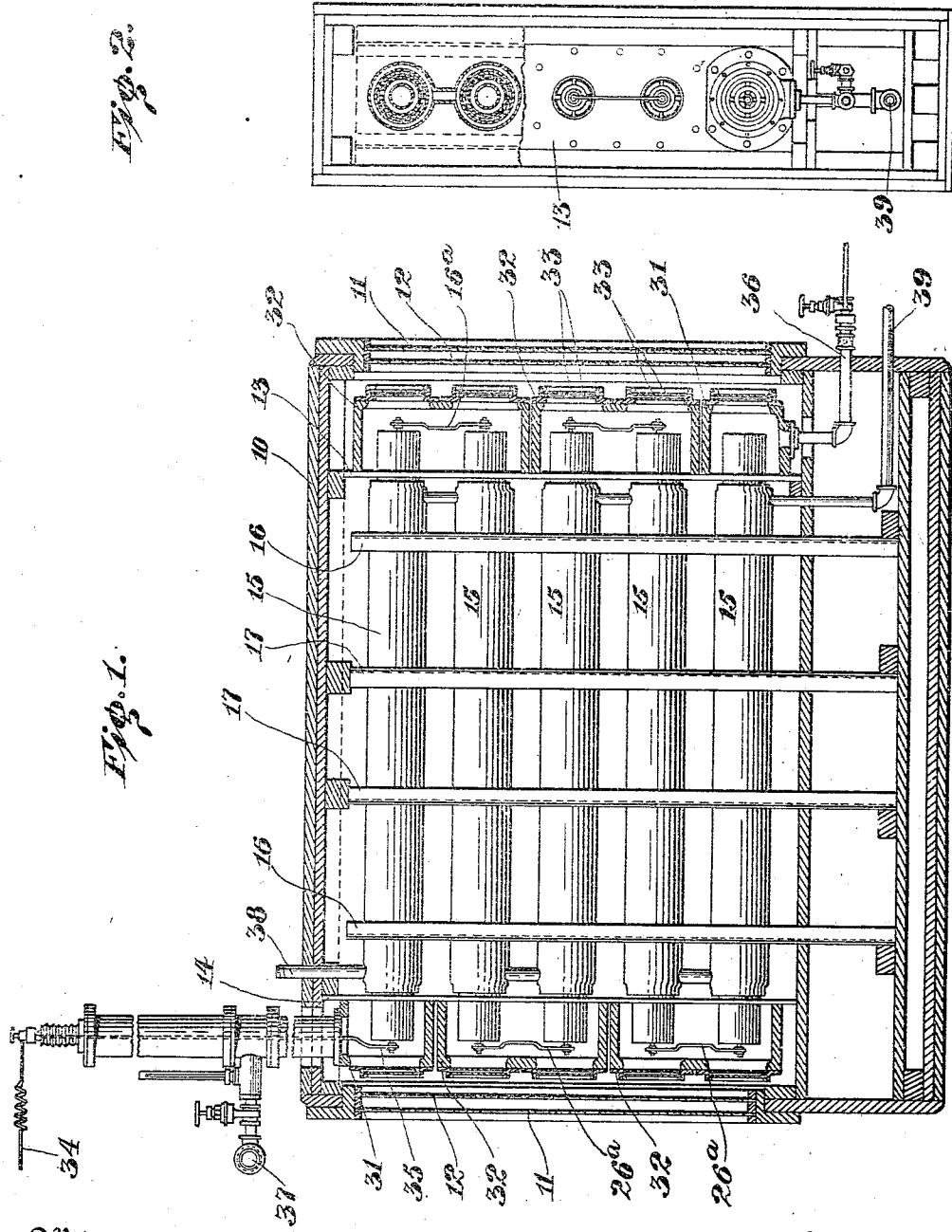
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APPARATUS FOR THE PRODUCTION OF OZONE.

APPLICATION FILED MAR. 9, 1915.

Patented Oct. 17, 1916.

2 SHEETS—SHEET 1.



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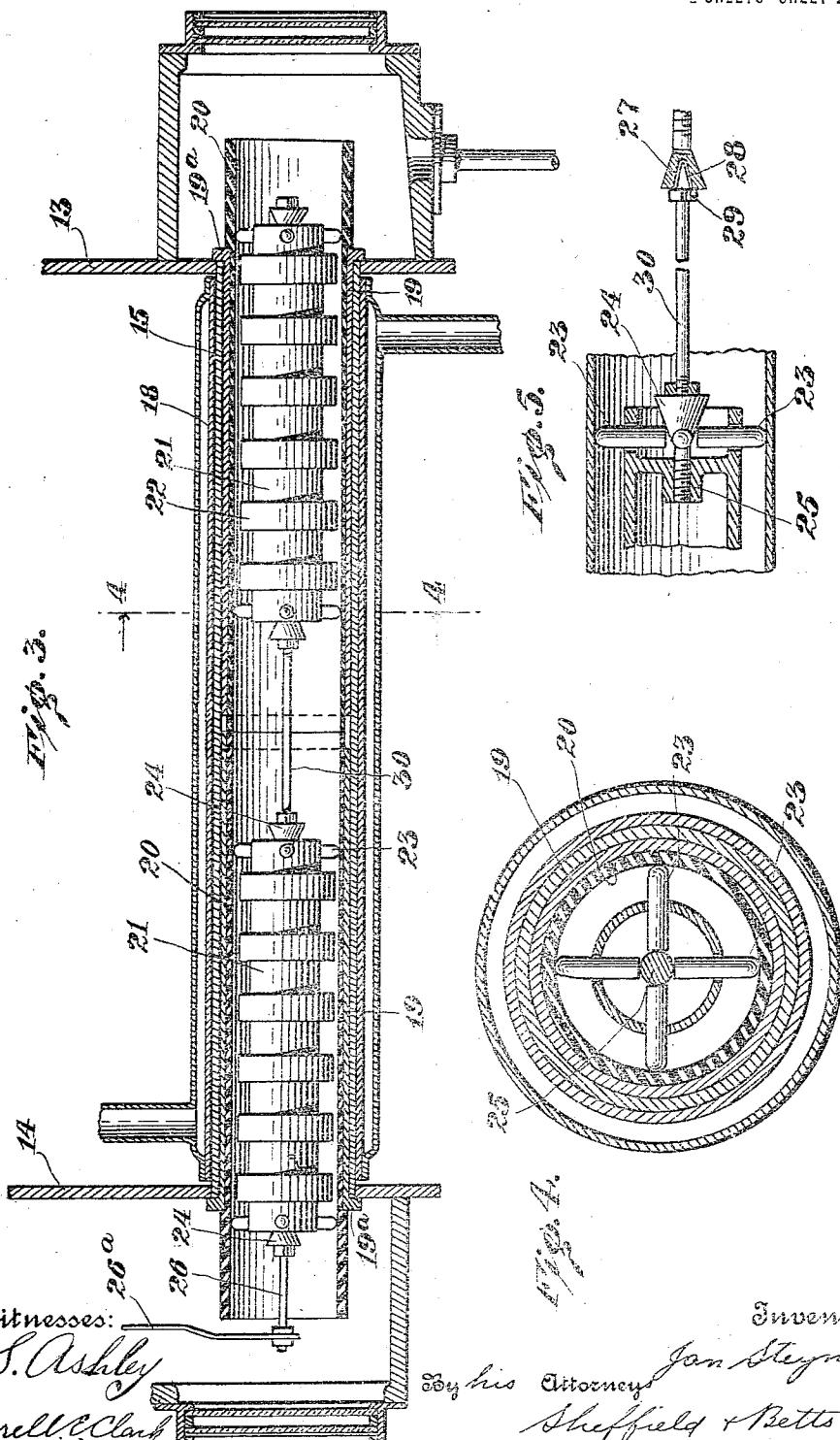
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2 SHEETS-SHEET 2.



# UNITED STATES PATENT OFFICE.

JAN STEYNIS, OF BAY SHORE, NEW YORK, ASSIGNOR TO STEYNIS OZONE COMPANY  
A CORPORATION OF NEW YORK.

## APPARATUS FOR THE PRODUCTION OF OZONE.

1,201,379.

Specification of Letters Patent.

Patented Oct. 17, 1916.

Application filed March 9, 1915. Serial No. 13,269.

*To all whom it may concern:*

Be it known that I, JAN STEYNIS, a subject of the Queen of the Netherlands, residing at Bay Shore, county of Suffolk, State of New York, have invented certain new and useful Improvements in Apparatus for the Production of Ozone, of which the following is a description.

My invention relates to apparatus for the production of ozone and particularly to such apparatus which accomplishes its function by means of electrical discharges which act upon air to produce ozone therefrom.

The object of my invention is to provide such an apparatus, which shall be simple in construction, efficient in operation and which may be easily disassembled and cleaned or repaired when necessary.

With these and other ends, which will hereinafter appear, in view, I have provided an apparatus consisting of a casing or support of any suitable character, in which are positioned a number of ozone generating tubes containing inner and outer electrodes separated by dielectric tubes. The outer electrodes may be connected to one terminal of a suitable source of current in any desired manner, as by being grounded through the supporting casing. The inner electrodes are connected in series to the other terminal of the current source. As current is applied to the electrodes, streaming electrical discharges take place and the air which is passed through the tubes, is thereby ozonized. Suitable means may also be provided for cooling the generating tubes.

With such an apparatus as I have described above, it sometimes happens that the dielectric between the inner and outer electrodes breaks down or a short circuit occurs through the presence of moisture, or for some other reason it becomes necessary to withdraw the electrodes from the supporting tubes for cleaning or repairing purposes.

My invention is especially concerned with providing an arrangement whereby this removal of the electrodes may be easily accomplished when desired. The particular means whereby this is effected will be fully described herein, but in general it may be said that the electrodes and dielectrics in each tube are parted at the middle, so that one set may be withdrawn from either end.

In the drawings, Figure 1 is a longitudinal sectional view of my improved appa-

ratus. Fig. 2 is an end elevation partly in section, showing the apparatus with one of the air chambers or casings removed. Fig. 3 is a longitudinal sectional view of a single tube and its contents on an enlarged scale; 60 Fig. 4 is a section taken on the line 4—4 of Fig. 3; and Fig. 5 is a fragmentary sectional view of the device shown in Fig. 3 and is intended to show the details of connection between the inner ends of the two 65 inner electrodes.

Referring to Fig. 1, 10 indicates the support or casing for the generating tubes. This casing is provided at either end with means for supporting plates of glass 11, 12, 70 so that the ozone generating apparatus may be entirely inclosed, but may still be open to view from without. Near the ends of the casing 10 are the plates 13, 14 in which the generating tubes 15 are supported. The 75 members 16, 17 positioned between the plates 13, 14 also assist in the support of these tubes.

Referring now particularly to Fig. 3, it is seen that each of the tubes 15 is surrounded by a jacket 18 for some suitable cooling medium, such as ammonia gas. If desired, these jackets may be packed in some such material as powdered cork. The outer tubular electrodes 19 may be inserted into a 85 tube 15 from either end. Each electrode 19 is provided at one end with a flange or collar 19<sup>a</sup> for limiting its movement into the tube, and if desired, some suitable means may be applied to these collars for retaining 90 the electrodes within the tubes 15. Fitting into the outer electrodes 19 are the dielectric tubes 20 which are also insertible from either end of any generating tube. These dielectric tubes may be made of any 95 suitable insulating material. The inner electrodes 21 are located within the dielectric tubes 20 and are provided with suitable enlargements or flanges 22 along their length, as is customary.

Some suitable means is provided for centering and retaining the inner electrodes within their respective dielectric tubes. As shown herein these means comprise a plurality of radially movable rods of porcelain 105 or other insulating material, which are adapted to slide in slots formed in the ends of the inner electrodes and when moved radially outward to contact with the inner surface of the dielectric tubes. I have pro- 110

vided means for moving these rods radially outward, which means comprises a cone-shaped member 24 which is screw threaded at 25 in the end of the inner electrode. It is obvious that by screwing the cone-shaped member 24 toward the center of the inner electrode, the rods 23 which contact with the cone-shaped member will all be forced an equal distance radially outward until they contact with the dielectric tube, thus centering and retaining the electrode therein.

The cone-shaped expanding members are also utilized as means for supporting the rods 26 to which the electrical conductors 26<sup>a</sup> are connected to connect in series the inner electrodes in the different generating tubes. One of the cone-shaped members used upon an inner end of one of the electrodes within each tube is formed somewhat differently from the remaining cone-shaped members, as shown in Fig. 5. Here the cone-shaped member 27 is seen to be provided with an internal cone-shaped recess 28, in which the cone-shaped end 29 of the rod 30 is adapted to fit. This rod 30 may be connected to the cone-shaped member 24 in any suitable way, as by being screw threaded therein and serves when the parts are in position to electrically connect the two inner electrodes within the same tube. The purpose of providing the corresponding cone-shaped surfaces 28 and 29 is in order that when the two inner electrodes are inserted within the tube from opposite ends the end 29 of the rod 30 will automatically position itself within the recess in the member 27 to effect the desired electrical connection.

From the foregoing, it is seen that the different members in each of the generating tubes may be first assembled in sets outside of the apparatus, that is, a dielectric tube may be placed within an outer electrode and an inner electrode may then be centered and retained within the dielectric tube by the manipulation of the members 24 at either end of the inner electrode. The two sets so assembled may then be inserted from opposite ends of the generating tube and as previously pointed out, they will be automatically electrically connected by the rod 30.

Bolted or otherwise secured to the plates 13, 14 at the ends of the generating tubes, are the casings 31, 32, the former being two in number and located at the point of entrance and the point of exit of the air to be ozonized and the latter being herein shown as four in number and each serving to form a passage for air from one tube to an adjacent tube. The particular arrangement of these casings or chambers is not important. These chambers are provided with openings opposite the ends of the various tubes and with glass plates 33 removably covering these openings. If it is desired to remove the members from within one of the gen-

erating tubes, it may be easily done, by removing the proper glass plates 11, 12 and 33, and disconnecting the proper conductor 26<sup>a</sup>.

In Fig. 1, 34 represents a conductor leading from one terminal of any suitable source of current. This conductor as shown is connected at 35 with one end of one of the inner electrodes, the other inner electrodes being electrically connected in series therewith by means of the rods 30 and conductors 26<sup>a</sup> as above indicated. The outer electrodes are connected to the other terminal of the source of current in any suitable manner, but it has been found simple and advantageous to ground the other terminal of the source of current and to connect the outer electrodes thereto by grounding through the supporting frame or casing 10.

The operation of my improved device is as follows: Current having been applied to the electrodes from its source, the air to be ozonized is introduced into the apparatus through the pipe or conduit 36. This air passes through the various generating tubes successively and is emitted from the conduit 37 in the form of ozone or ozonized air. In order to keep the temperature of the electrodes as low as possible, in spite of the streaming discharges which occur between them, ammonia gas or another suitable cooling medium is applied through the pipe or conduit 38 to the jackets 18, which are connected in series and after passing through these jackets flows off through the pipe 39. It is to be noted that it is preferable that the cooling medium be introduced near the point of exit of the ozonized air, in order that the cooling medium may be most effective where it is most needed.

The various advantages of my improved construction will be obvious to one skilled in the art from the above description. Attention is directed particularly, however, to the fact that the various members of the ozonizing devices may be removed in sets from either end of the generating tubes, without the slightest difficulty whenever it becomes necessary for the purpose of cleaning or repairing.

While I have disclosed herein an apparatus embodying my invention, I do not wish to limit myself to any particular embodiment thereof, since obviously many changes may be made without departing from the spirit of my invention.

What I claim is:

1. In an apparatus of the character described, a support provided with a tubular opening and a complete self-contained ozone generator, removably mounted in each end of said opening.
2. In an apparatus of the character described, a support provided with a tubular opening, an ozone generating device remov-

ably mounted in each end of said opening, each device comprising an outer electrode, a dielectric tube positioned therein and an inner electrode positioned within said dielectric tube. 5

3. In an apparatus of the character described, a support provided with a tubular opening, an ozone generating device removably mounted in each end of said opening, 10 each device comprising an outer electrode, a dielectric tube positioned therein, an inner electrode positioned within said dielectric tube, and means at either end of each inner electrode for centering it and retaining it 15 within the dielectric tube.

4. In an apparatus of the character described, a support provided with a tubular opening, an ozone generating device removably mounted in each end of said opening, 20 each device comprising an outer electrode, a dielectric tube positioned therein, an inner electrode positioned within said dielectric tube, and an expansion device at either end of each inner electrode for centering it and 25 retaining it within the dielectric tube.

5. In an apparatus of the character described, a support provided with a tubular opening, an ozone generating device removably mounted in each end of said opening, 30 each device comprising an outer electrode, a dielectric tube positioned therein, an inner electrode positioned within said dielectric tube, and means at either end of each inner electrode for centering it and retaining it 35 within the dielectric tube, said means comprising a plurality of radially movable members and means for moving said members into contact with the dielectric tube.

6. In apparatus of the character described, 40 a support provided with a tubular opening, an ozone generating device removably mounted in each end of said opening, each device comprising an outer electrode, a dielectric tube positioned therein, an inner electrode positioned within said dielectric tube, and means at either end of each inner electrode for centering it and retaining it 45 within a dielectric tube, said means comprising a plurality of radially movable members and a cone-shaped member screw threaded in the end of said electrode and adapted when rotated to move said members into contact with the dielectric tube. 50

7. In an apparatus of the character described, a support provided with a tubular opening, an ozone generating device removably mounted in each end of said opening, each device comprising an outer electrode, a dielectric tube positioned therein, an in- 55

ner electrode positioned within said dielectric tube, and means at the inner ends of said inner electrodes for electrically connecting them together. 60

8. In an ozone generating device, an outer tubular electrode, a dielectric tube positioned therein, an inner electrode positioned within said dielectric tube, and means at either end of the inner electrode for centering it and retaining it within the dielectric tube. 65

9. In an ozone generating device, an outer tubular electrode, a dielectric tube positioned therein, an inner electrode positioned within said dielectric tube, and an expansion device at either end of the inner electrode for centering it and retaining it within the dielectric tube. 70

10. In an ozone generating device, an outer tubular electrode, a dielectric tube positioned therein, an inner electrode positioned within said dielectric tube, and means at either end of the inner electrode for centering it and retaining it within the dielectric tube, said means comprising a plurality of radially movable members and means for moving said members into contact with the dielectric tube. 75

11. In an ozone generating device, an outer tubular electrode, a dielectric tube positioned therein, an inner electrode positioned within said dielectric tube, and means at either end of the inner electrode for centering it and retaining it within the dielectric tube, said means comprising a plurality of radially movable members and a cone-shaped member screw threaded in the end of said electrode and adapted when rotated to move said members into contact with the dielectric tube. 80

12. In an apparatus of the character described, a plurality of outer electrodes connected to one terminal of a source of current, a plurality of dielectric tubes positioned therein, a plurality of inner electrodes positioned within said dielectric tubes, means for centering and retaining the inner electrodes within the dielectric tubes, and means connected with said last-mentioned means for electrically connecting said inner electrodes to the other terminal of the source of current and to each other. 100

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JAN STEYNIS.

Witnesses:

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WALTER S. JONES.