

(No Model.)

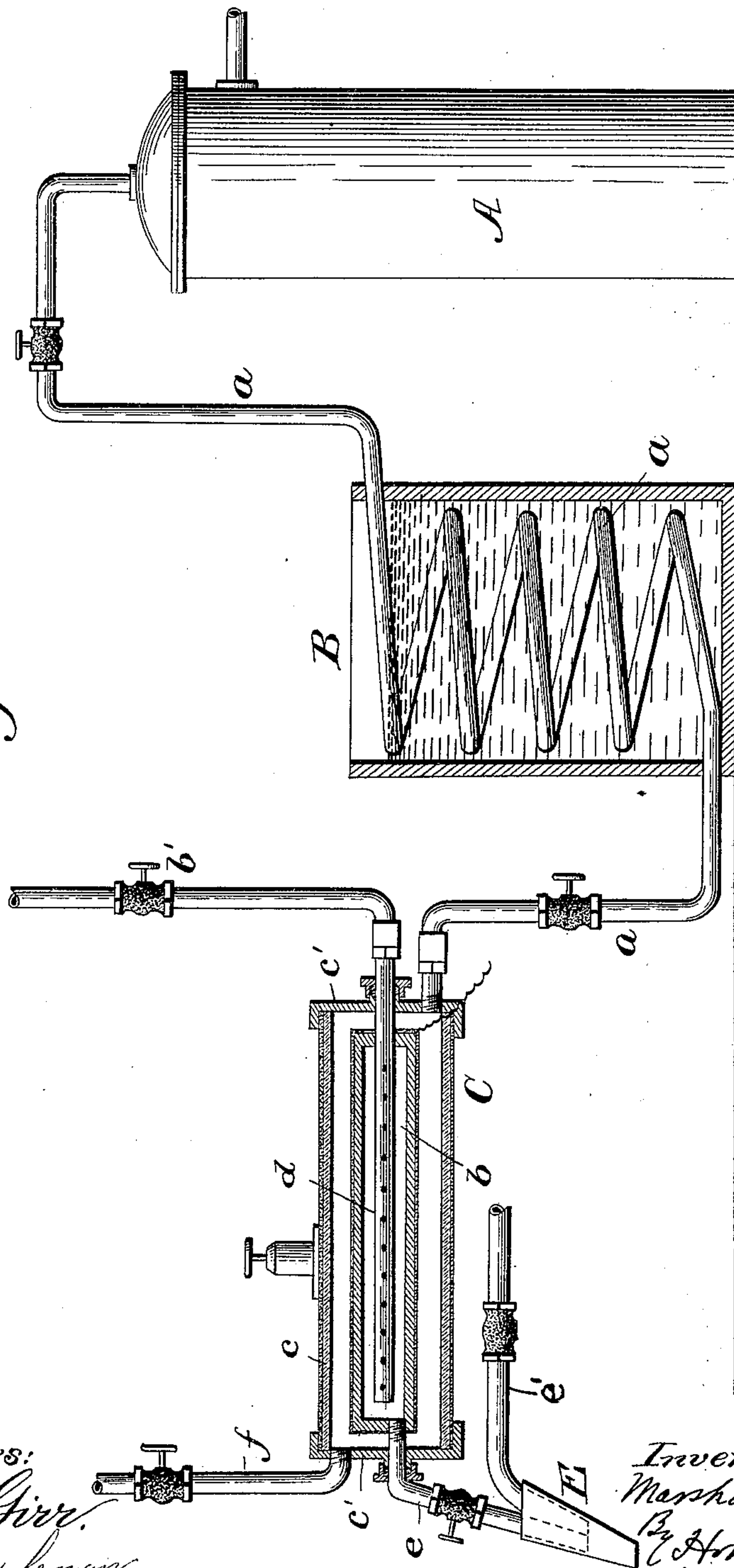
2 Sheets—Sheet 1.

M. PRIDHAM.  
APPARATUS FOR GENERATING OZONE.

No. 574,341.

Patented Dec. 29, 1896.

Fig. 1.



Witnesses:  
J. B. McGirr.  
J. P. Appleman.

Inventor.  
Marshall Pridham,  
By *Howson & Howson*  
his Attys.

(No Model.)

2 Sheets—Sheet 2.

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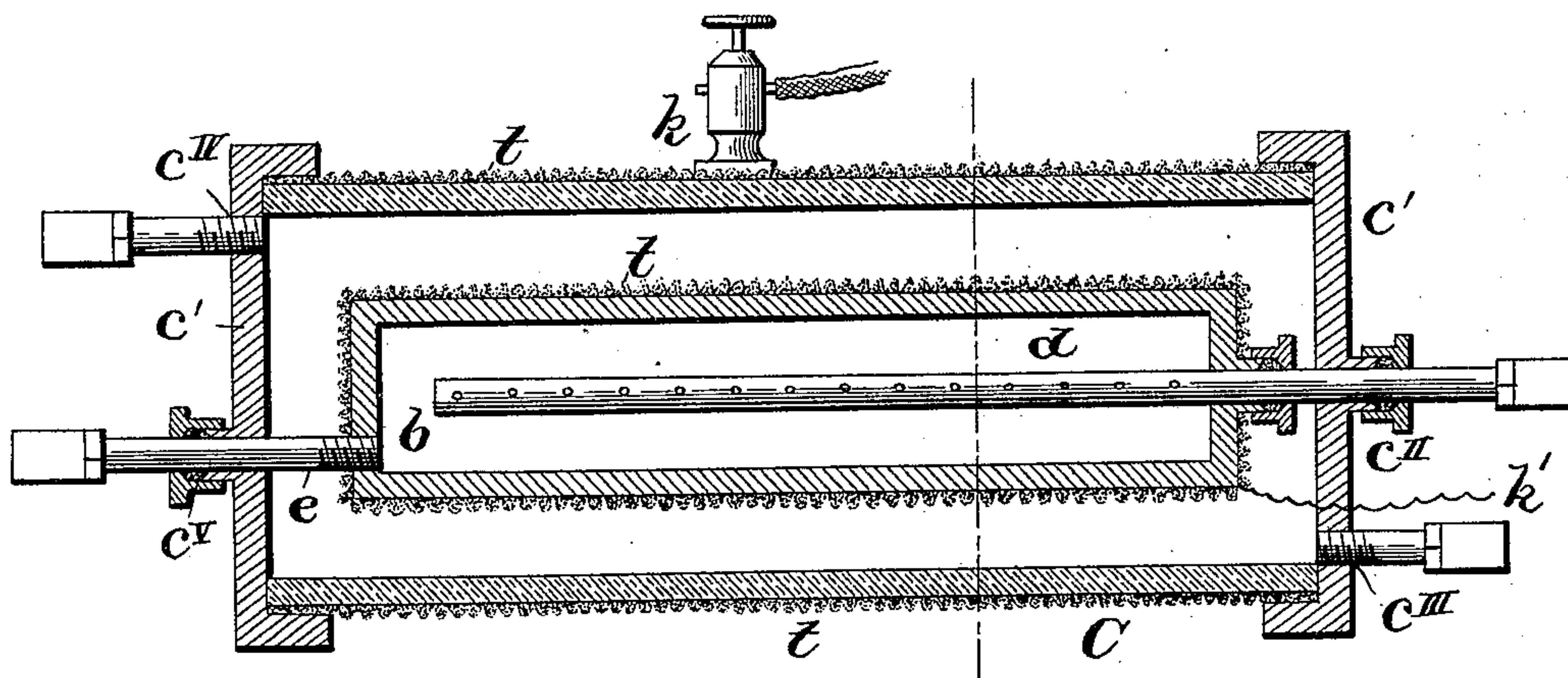


Fig. 2.

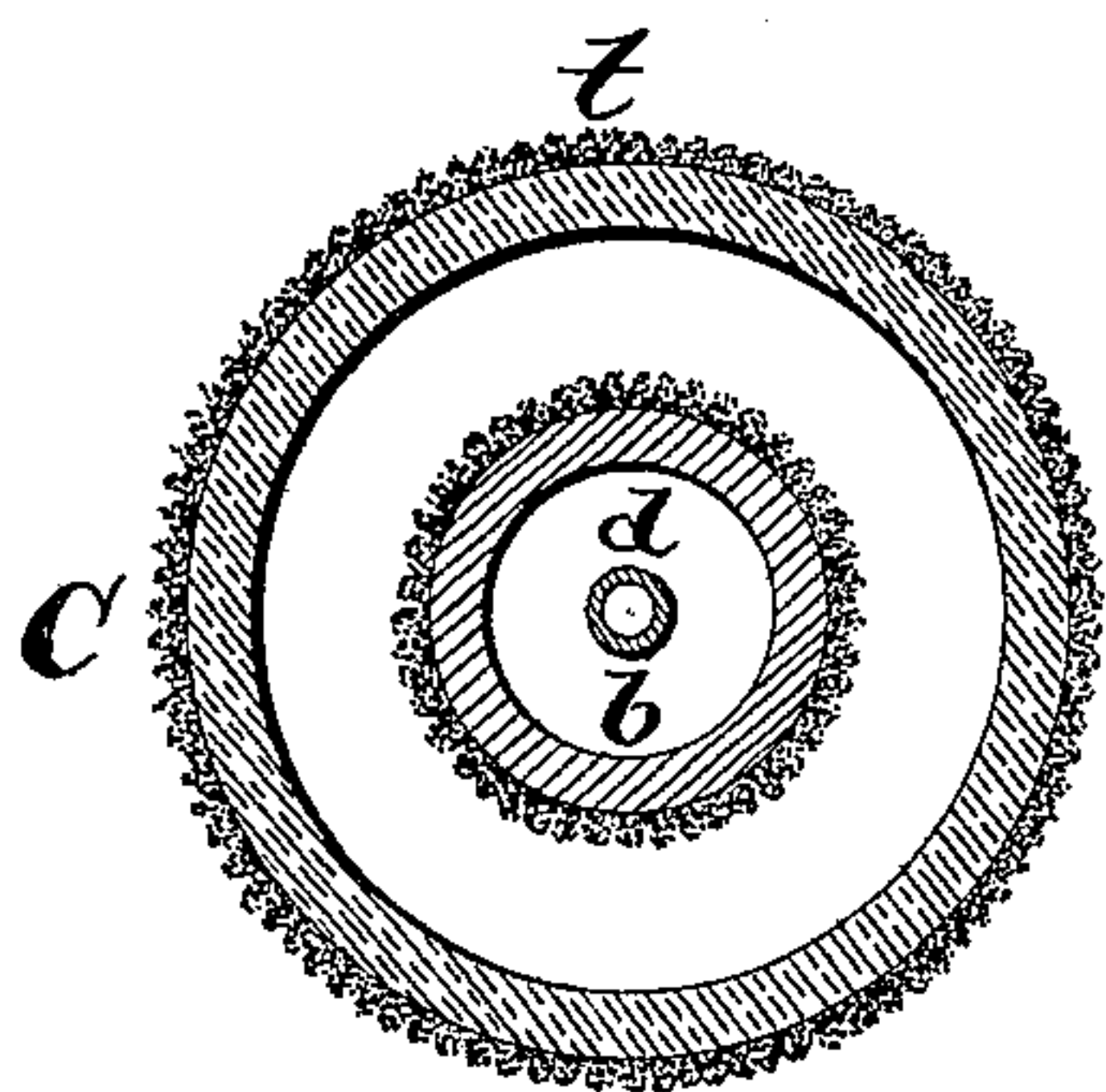


Fig. 3.

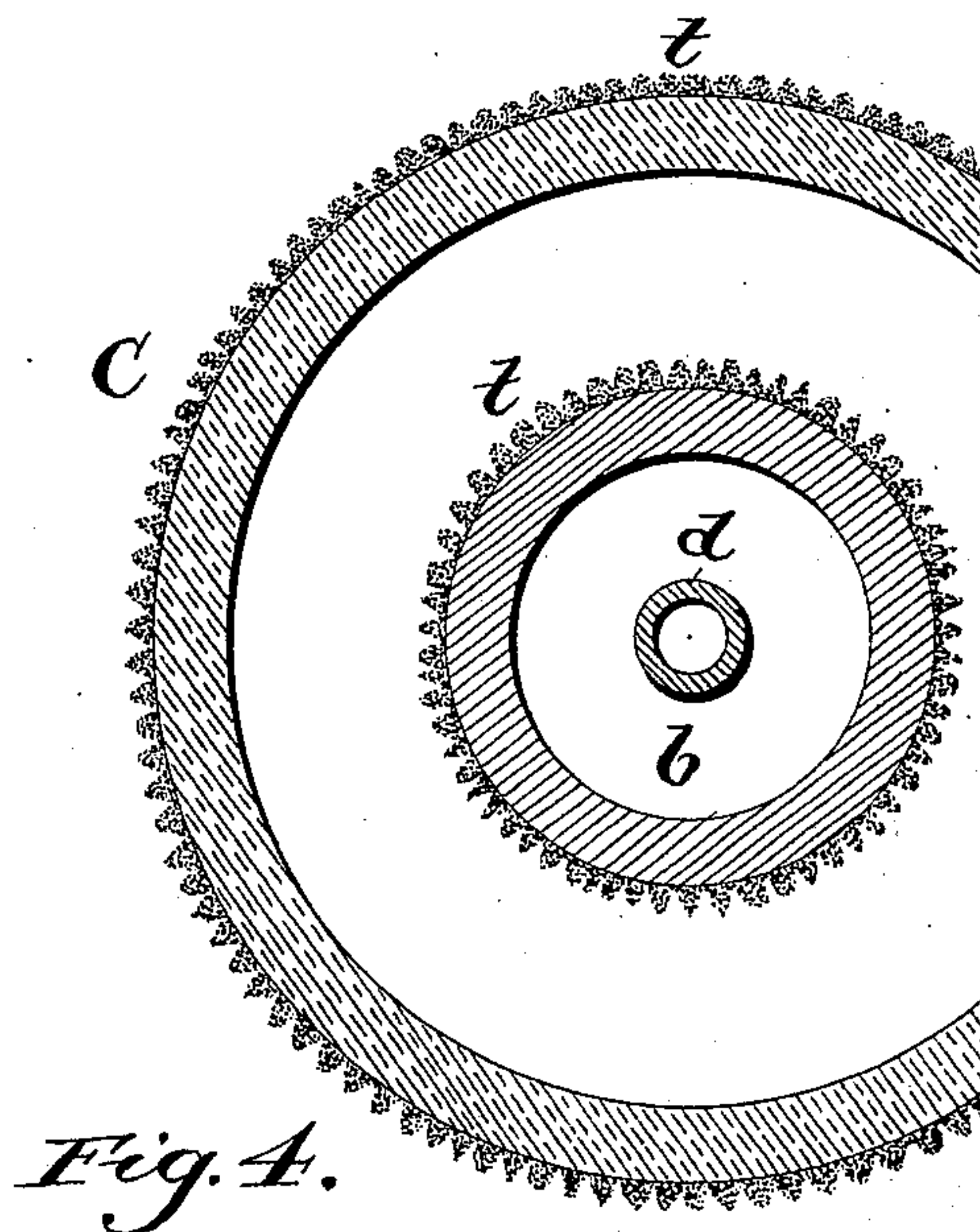


Fig. 4.

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# UNITED STATES PATENT OFFICE.

MARSHALL PRIDHAM, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO  
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NEW JERSEY.

## APPARATUS FOR GENERATING OZONE.

SPECIFICATION forming part of Letters Patent No. 574,341, dated December 29, 1896.

Original application filed September 12, 1896, Serial No. 605,632. Divided and this application filed October 15, 1896. Serial  
No. 608,987. (No model.)

*To all whom it may concern:*

Be it known that I, MARSHALL PRIDHAM, a citizen of the United States, residing at Philadelphia, county of Philadelphia, Pennsylvania, have invented certain new and useful Improvements in Apparatus for Generating Ozone, of which the following is a specification.

My invention consists of an apparatus for generating ozone gas, whereby the quantity of gas produced and the purity of the product are greater than with other processes with which I am familiar, the mode of operation consisting, essentially, in subjecting oxygen gas to an electric current in the form of a brush-discharge, the oxygen and gas being, by preference, at a low temperature while it is being subjected to the action of the current.

In the accompanying drawings, Figure 1 is a side view, partly in section, of apparatus constructed in accordance with my invention for the production of ozone. Fig. 2 is a longitudinal section, on a larger scale, of the generator proper. Fig. 3 is a transverse section of the same, and Fig. 4 is an exaggerated view illustrating more clearly than the other figures the character of the conducting-surfaces with which the generator is provided.

In the drawings, A represents a tank or reservoir for containing oxygen derived from any suitable source, this tank being connected by means of a pipe *a* to the ozone-generator C, between which and the tank A is a refrigerating or cooling tank B, through which the pipe *a* passes on its way to the generator C, a portion of said pipe *a* being preferably spirally coiled in the tank B and surrounded therein by a refrigerating liquid or cooling medium, such, for example, as ammonium nitrate and water.

Instead of passing the oxygen gas through a cooling medium I may compress the same, and after permitting the compressed gas to cool to any desired extent may then permit it to expand either directly into the ozone-generator or into a supply-chamber therefor, thereby greatly decreasing its temperature, and thus cooling it to the desired degree.

The generator C consists of a casing *c* of

dielectric material, preferably glass, and preferably also in the form of a tube or pipe closed at each end by suitable caps *c'*, that at one end of the casing being provided with apertures *c<sup>ii</sup>* and *c<sup>iii</sup>*, while that at the other end of the casing is provided with apertures *c<sup>iv</sup>* and *c<sup>v</sup>*. Within this outer casing is another casing or box *b*, preferably of metal and of smaller external diameter than the internal diameter of the outer casing, this inner casing being centrally supported within the outer casing, so as to provide a uniform width between the cylindrical portions of the two. Within the inner casing is a spraying device consisting, in the present instance, of a perforated metal tube *d*, closed at that end which is within the inner casing, but open at the outer end, the tube passing through the aperture *c<sup>ii</sup>* in the cap *c'*, which aperture is preferably provided with a suitable stuffing-box, the outer end of the tube being connected with any suitable supply of cooling liquid, which may be admitted to or cut off from the tube *d*, as desired, by means of a valve *b'*.

Connected to the inner casing *b*, preferably at one end, is a discharge-pipe *e*, which passes through the packed aperture *c<sup>v</sup>* into the chamber of a suitable ejector E, having a motive-fluid-supply pipe *e'*, and is intended to be used for draining the internal chamber of said casing *b* and thereby preventing the accumulation therein of fluid in such quantity as would interfere with the spraying action of the perforated tube *d*.

Communicating with the space between the inner and outer casings of the generator is a pipe *f*, which is fitted to the aperture *c<sup>iv</sup>* and serves to convey the ozone gas to any suitable reservoir or treating-chamber, the oxygen-gas-supply pipe *a* passing through the aperture *c<sup>iii</sup>* in the opposite head *c'* of the generator.

The outer surfaces of both the inner and outer casings of the generator are coated with a layer *t* of material suitable for producing a brush-discharge, such material, for instance, as powdered carbon, lead dust, or the like, which will produce a surface of roughened or granulated form, presenting a multiplicity of



points or protuberances. The layer or coating of granular or powdered material may be applied to the surface of the casings by coating the latter with an adhesive non-conductive material and sprinkling the said powdered or granular material thereon.

To the coatings of the inner and outer casings of the generator are connected the terminals of the secondary coil of a step-up transformer supplied with a suitable current of electricity, preferably an alternating current. The terminal  $k'$  is connected to the outer surface of the inner casing and the terminal  $k$  is connected to the outer surface of the outer casing. Hence when the current is turned on a brush-discharge takes place from the coating of the inner casing through the dielectric outer casing to the outer coating of the latter, and the oxygen gas passing through the annular space between the two casings is subjected to the action of this induced brush-discharge, the low temperature of the gas being maintained by the cooling fluid which is sprayed upon the inner casing from the tube  $d$ .

By subjecting oxygen gas to an electrical current in the form of a brush-discharge I find that ozone of a very high degree of strength can be economically and rapidly produced, and I find, further, that the process is facilitated by a low temperature of the ozone gas. Hence I prefer in all cases to cool the gas before it enters the generator and to maintain it at low temperature in said generator. This brush-discharge consists of a great number of sparks passing and repassing between the two coated casings and extending from the numerous protuberances or points formed by the granular or powdered coating.

In practice I have used temperatures below zero Fahrenheit, and I find that, as a rule, the lower the temperature the better the result.

I also prefer in carrying out my invention to use an oxygen gas of as pure a character as can be manufactured on a commercial scale within the necessary limit of cost, although my invention may be carried out successfully even if the oxygen gas is diluted or adulterated to some extent by admixture with air or with other gases.

I may state that while the process and apparatus for generating ozone are particularly adapted for use in connection with my improved process of purifying and decolorizing saccharine and other liquids, as disclosed in my application for Letters Patent, Serial No. 605,441, filed September 10, 1896, and Serial No. 605,631, filed September 12, 1896, and with my improved process of purifying, rectifying, decolorizing, and deodorizing alcoholic and other liquids, as disclosed in my application for Letters Patent, Serial No. 605,632, filed September 12, 1896, of which the present is a divisional application, my present invention is capable of general application wherever ozone gas is required. I should

also state that while it is necessary in all cases to make the outer casing dielectric the inner casing may or may not be dielectric, though I prefer to make the latter casing of metal or equivalent material, especially where the cooling medium is sprayed against it, in order that it may the better withstand the shocks of the streams of cooling fluid impinging said casing.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. In an apparatus for generating ozone gas, the combination of separated casings, one being dielectric, each provided with a thin-sprinkled coating of powdered or granular conducting material, suitable for producing an electrical brush-discharge, the dielectric being between the coatings, means for causing a flow of oxygen through the space between said casing, and means for conveying an electric current to one and away from the other of said coatings, substantially as specified.

2. In an apparatus for generating ozone gas, the combination of separated casings, one being dielectric, and each having a thin-sprinkled coating of powdered or granular conducting material suitable for producing an electrical brush-discharge, the dielectric being between the two coatings, means for conveying an electrical current to one and away from the other of said coatings, means for causing a flow of oxygen gas through the space between the casings, and means for reducing the temperature of said gas before it enters the generator, substantially as specified.

3. In an apparatus for generating ozone gas, the combination of separated casings, one being dielectric, and each having a thinly-sprinkled exterior coating of powdered or granular conducting material suitable for producing an electrical brush-discharge, means for conveying an electrical current to one and away from the other of said coatings, means for causing a flow of oxygen gas through the space between the casings, and means for maintaining said gas at a low temperature during its passage, substantially as specified.

4. In an apparatus for generating ozone gas, the combination of separated casings, one being dielectric, and each provided with a thinly-sprinkled exterior coating of powdered or granular conducting material suitable for producing an electrical brush-discharge, means for conveying an electric current to one and away from the other of said coatings, means for causing a flow of oxygen gas through the space between the casings, means for reducing the temperature of said gas before it enters the generator, and means for maintaining such low temperature of the gas while it is passing through the generator, substantially as specified.

5. In an apparatus for generating ozone gas, the combination of an inner and outer



casing separated from each other, the outer casing being dielectric, and each having a thinly-sprinkled exterior coating of powdered or granular conducting material suitable for  
5 producing an electrical brush-discharge, with an inlet for admitting oxygen gas to the space between the inner and outer casing, an outlet from said space, and connections between the conducting-coatings and a suitable generator of electricity, substantially as specified.  
10

6. In an apparatus for generating ozone gas, the combination of the inner and outer casing mounted so as to provide a space between them, the outer casing being dielectric, and each having a thinly-sprinkled exterior coating of granular or powdered conducting material suitable for producing an electrical brush-discharge, connections between said  
15 coatings and an electrical generator, a pipe for supplying oxygen gas to the space between the two casings, and a refrigerating-tank through which the oxygen-supply pipe passes on its way to the generator, substantially as specified.  
20  
25

7. In apparatus for generating ozone gas, the combination of inner and outer casings mounted so as to form a space between the two, the outer casing being dielectric and  
30 each having an external coating of material suitable for producing an electrical brush-

discharge, connections between said external coatings and a suitable source of electricity, a perforated pipe extending within the inner casing and having connection with a supply  
35 of cooling fluid, a pipe for withdrawing the cooling fluid from said inner casing, and means for causing a flow of oxygen gas through the space between the two casings, substantially as specified.  
40

8. In apparatus for generating ozone gas, the combination of inner and outer casings mounted so as to provide a space between the two, the outer casing being dielectric, and each provided with an external coating  
45 of material suitable for producing an electrical brush-discharge, connections between said coatings and a generator of electricity, a spraying device for introducing jets of cooling liquid within the inner casing, a suitable  
50 source of oxygen-supply, a pipe leading therefrom to the space between the two casings, and a refrigerating vessel through which said pipe passes on its way to the generator, substantially as specified.  
55

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

MARSHALL PRIDHAM.

Witnesses:

M. H. MILES,  
H. D. GORDON.