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OZONE GENERATOR.

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951,789.

Patented Mar. 15, 1910.

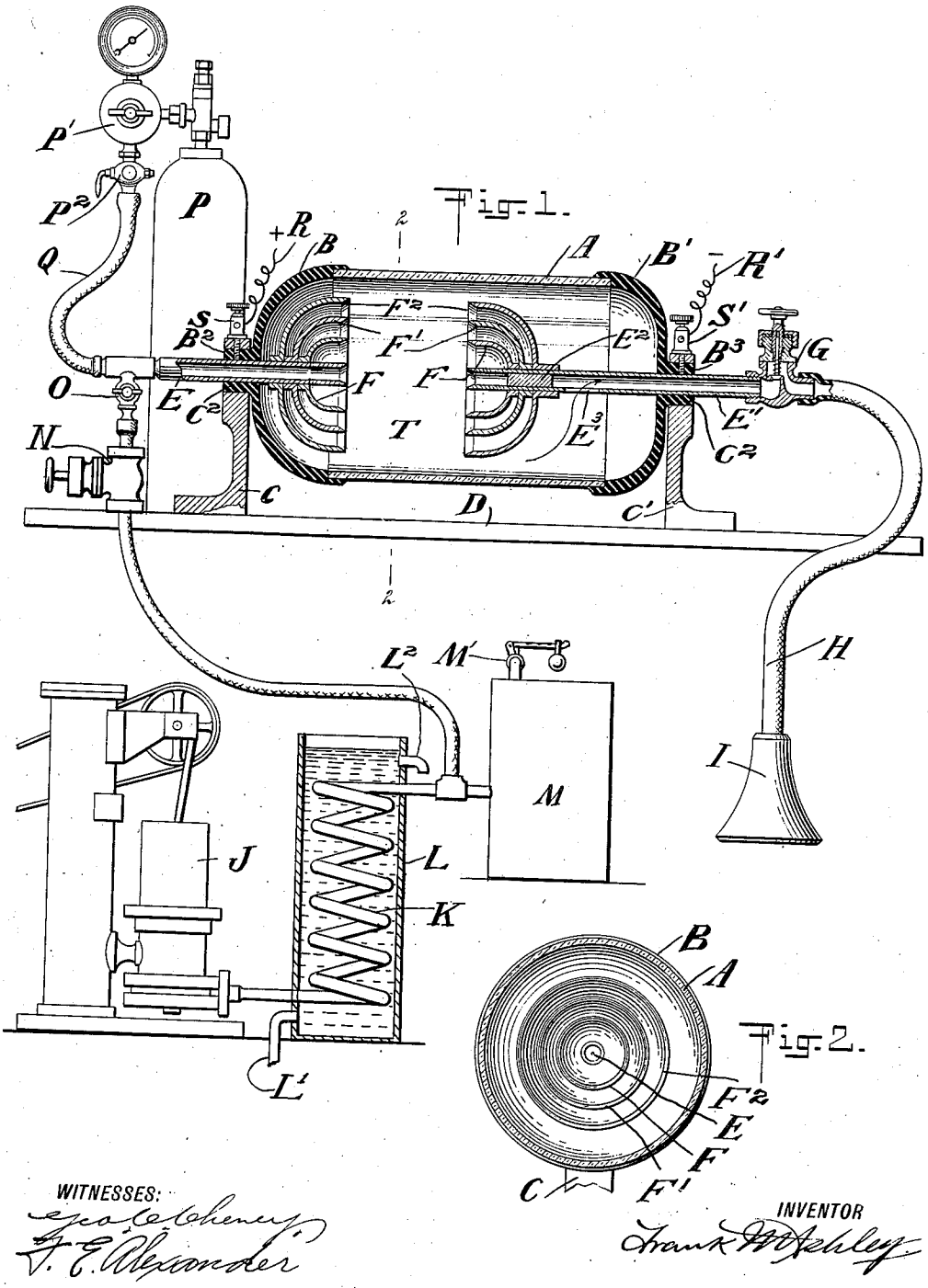

Fig. 1.

Fig. 2.

WITNESSES:

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OZONE-GENERATOR.

951,789. Specification of Letters Patent. Patented Mar. 15, 1910.

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To all whom it may concern:

Be it known that I, FRANK M. ASHLEY, a citizen of the United States, and resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Ozone-Generators, of which the following is a specification.

My invention relates to ozone generators, and the object of my invention is to provide a method of and means for generating ozone gas in a cheap and rapid manner, and by means that may be relied upon to operate continuously without short circuiting or otherwise breaking down in operation.

A further object is to provide a machine in which the process of generating the gas may be observed within the generator, and to provide means for properly adjusting the distance between the electrodes according to the voltage of the electric current used.

A further object is to produce the ozone in a cool condition so that rooms or inclosures into which the gas may flow after being converted into ozone, may be cooled as well as ventilated.

I have found also that my ozonator may be used to reduce the amperes flowing in a shunt circuit, to a sufficient degree to permit a portion of the secondary circuit to be used for therapeutic work, with fairly large coils having a capacity far above that which a man can stand if all of the secondary circuit was delivered to his person.

Referring to the drawings which form part of this specification, Figure 1 discloses a longitudinal sectional view through my ozonator, together with gas tanks for holding oxygen or air under pressure, and a pump for compressing gas, and a tank for cooling the gas as it is compressed and a reservoir for holding the gas after it is cooled. Fig. 2 is a cross sectional view through the ozonator on line 2—2, of Fig. 1, disclosing an end view of one of the gangs of multiple electrodes.

A, indicates a glass cylinder which is held between two end caps B and B′ respectively, which are duplicates of each other, and preferably made of non-conducting material. The end caps are mounted on brackets C and C′ respectively which are duplicates of each other and are preferably made of non-conducting material, and which in turn are secured to a base strip D which is also made of non-conducting material such as wood or hard rubber. The said brackets are provided with openings C^2, in which rest cap projections B^2 and B^3 respectively, which projections have openings, through which project metal tubes E and E′ respectively, of the same diameter. Mounted on the end of each tube is an electrode comprising a bell shaped metal conductor F, and similar shaped conductors of larger diameter, indicated by F′ and F^2, the inner edges of which are brought in longitudinal alinement with each other, and are preferably sharpened to facilitate the action of a silent brush discharge between the edges of the opposite electrodes. A plug E^2, is inserted in tube E′ as shown, and an opening E^3 is made in the tube just behind the plug.

Mounted on the tube E′ is a relief pressure valve G, and connected to the outlet of said valve is a flexible tube H which terminates in a cone shaped exhaust nozzle I.

J, indicates a power driven gas compressor, and K, a pipe which is submerged in water for a part of its length, in tank L, cold water entering at L′ and escaping at L^2. Connected with pipe K is a gas storage reservoir M, provided with a safety valve M′.

N, indicates a relief valve similar in construction to that indicated by G, the outlet communicating with pipe E and controlled by stop valve O.

P, indicates a tank containing pure oxygen under pressure, and provided with a reducing valve P′, of the usual construction furnished with such tanks, and P^2 is a cock valve for controlling the passage communicating with tank P on one side and that in pipe Q on the other, said last named passage being in open communication with the passage in tube E.

R, and R′, indicate wires connected with the positive and negative poles of a high tension alternating or interrupted electric current, such as the secondary circuit of an electric spark coil or transformer, at one end, and S and S′ indicate binding posts, the lower projecting ends of which are in electrical contact with tubes E and E′ respectively, and the opposite ends of said wires R and R′. These binding posts serve also to hold the tubes E and E′ in their adjusted positions.

The operation of the mechanism is as follows:—Assuming an electric current to be flowing through wire R to tube E and thence to electrodes F, F′ and F^2, and flowing

across the gap to the opposite electrodes respectively, in the form of a brush discharge, and thence through tube to binding post S′ and wire R′ to the negative pole of the source of generation. Should incandescent sparks jump across the gap between the electrodes, the electrodes may be separated further by sliding either tube E or E′, or both, in opposite directions until a perfect brush discharge is obtained, as will be readily understood. By closing valve O and opening valve P^2, the oxygen in tank P will flow therefrom to and through tube E into the ozonizing chamber T and will pass through the brush discharge flowing between the electrodes and through opening E^3 and tube E′ to the relief valve G, which will automatically open when the gas pressure exceeds the pressure at which said valve is set, as will be readily understood, and the gas will then flow to the atmosphere. Since the gas in tank P is compressed to a considerable degree above atmospheric pressure, and the sensible heat caused by such compression has been withdrawn, the expansion of the gas as it drops in pressure and flows into the ozonating chamber, becomes very cold and thereby materially assists in converting a large percentage of the oxygen into ozone and maintaining it in the form of ozone, since heat causes ozone to change back into oxygen, and it is therefore important to keep the oxygen and ozone at as low a temperature as possible. The higher the pressure of gas is within the ozonizing chamber, the greater the electrical pressure must be, to force the brush discharge across the gap. Now assuming the valve P^2 to be closed and valve O, open, and pump J started, air or gas may be compressed to any pressure up to that at which relief valve N, is set, valve M′ being always set at a higher pressure than valve N, and the sensible heat generated by the compression, is absorbed by the water in tank L and the air stored in tank M, which is in open communication with chamber T when valve N is open, and may be expanded in said chamber as previously described. It is evident that one kind of gas could be used from tank P, such as pure oxygen, and another kind, such as air, from the pump J, the two gases being combined in the ozonating chamber in any desired proportions.

The operation of the ozonator may be viewed through the glass tube A, the discharge being clearly visible when the ozonator is operated in a dark room.

I have found that a plurality of electrodes at each end operate with less heat than a single one at each end, and converts a greater percentage of the oxygen into ozone, and by spacing the electrodes as shown, and making the discharging terminals sharp, as indicated, a fine discharge is effected, and the gas is forced to pass successively through the different streams of electrical discharge which are passing between the opposite electrodes, and the oxygen is almost entirely converted into ozone.

Care should be taken when air is being treated, to prevent disruptive incandescent discharges, as such discharges act on the nitrogen and generate nitrous acid gas, which would be injurious when the gases are used for therapeutic purposes.

It is obvious that ozone can be generated regardless of the casing A, the ozone flowing into the atmosphere direct.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is,

1. In an ozone generating machine, two tubular electrodes the ends of which are disposed opposite to each other and at a distance apart greater than the sparking distance therebetween, one of which serves as a conduit for gas.

2. In an ozone generating machine, two tubular electrodes the axes of which are in alinement with each other and the ends of which are separated at a distance apart greater than the sparking distance therebetween, one of which serves as a conduit for gas.

3. In an ozone generating machine, two tubular electrodes the axes of which are in alinement with each other and the ends of which are separated a distance apart greater than the sparking distance therebetween but at a distance through which a brush discharge will flow, one of which serves as a conduit for gas.

4. In an ozone generating machine, two tubular electrodes the ends of which are disposed opposite to each other and at a distance apart greater than the sparking distance therebetween, one of which serves as a conduit for gas, and a casing inclosing said electrodes.

5. In an ozone generating machine, two tubular electrodes the ends of which are separated at a predetermined distance apart and less than the discharge distance therebetween, and one of which has a passage therein through which a gas may be conducted to the space between the ends of said electrodes.

6. In an ozone generating machine, two electrodes arranged end to end, one of which has a passage therein and at a predetermined distance from each other and less than a brush discharge will flow, a casing for said electrodes, and means for forcing a gas through said passage to within said casing.

7. In an ozone generating machine, two electrodes arranged end to end and at a distance from each other less than that through which a brush discharge will flow, and one of which has a passage therethrough, a

source of electrical supply, conductors adapted to connect said supply with said electrodes, means for compressing gas, a pipe connecting said means with said passage in said electrodes, and a casing in which said gas may be inclosed and treated by electricity flowing between said electrodes.

8. In an ozone generating machine, two electrodes, one of which has a passage therethrough, and arranged opposite to each other at a proper distance for the purpose set forth, each of said electrodes comprising a plurality of rings or disks arranged concentrically.

9. In an ozone generating machine, two electrodes, one of which has a passage therethrough, and arranged opposite to each other at a proper distance for the purpose set forth, each of said electrodes comprising a plurality of rings or disks arranged concentrically, and means for supporting said electrodes in adjustable relation to each other.

10. In an ozone generating machine, two electrodes arranged opposite to each other at a distance adapted to effect a brush discharge between them, and one of which has a passage therethrough, a casing inclosing said electrodes, and means for forcing gas through said passage in said electrode to the space between said electrodes.

11. In an ozone generating machine, two electrodes arranged opposite to each other at a distance adapted to effect a brush discharge between them, and one of which has a passage therethrough, a casing inclosing said electrodes, means for forcing gas through said passage in said electrode to the space between said electrodes, and provision for treating said gas electrically to convert a portion of same into ozone.

12. In an ozone generating machine, two electrodes arranged opposite to each other and one of which has a passage therein, a casing inclosing said electrodes, a valve controlled outlet from said casing, means for forcing gas into said casing by way of said passage, and treating same electrically therein.

13. In an ozone generating machine, two electrodes arranged with their ends opposite to each other, one of which has a passage therein, a casing for said electrodes, means for compressing gas, means for leading said gas within said casing and for maintaining a predetermined pressure of same therein, and for treating said gas electrically to convert a portion of same into ozone.

14. In an ozone generating machine, two electrodes arranged with their ends opposite to each other and one of which has a passage therein, a casing for said electrodes, means for compressing gas, means for reducing the pressure of said gas located between said first named means and said casing, and means for treating said gas electrically and under pressure in said casing.

15. In an ozone generating machine, a closed chamber, means for compressing a gas, means for reducing the temperature of said gas, means for reducing the pressure of said gas, and means for treating said gas electrically in said chamber to convert a portion of same into ozone.

16. In an ozone generating machine, a closed chamber, means for compressing a gas, means for reducing the temperature of said gas, means for storing said gas after cooling, means for reducing the pressure of said gas, and means for treating said gas electrically in said chamber to convert a portion of same into ozone.

17. In an ozone generating machine, a closed chamber, means for compressing gas, means for reducing the temperature of said gas, means for reducing the pressure of said gas, and means for treating said gas electrically under pressure in said chamber to convert a portion of same into ozone.

18. In an ozone generating machine, a casing having a closed chamber, means for compressing a gas and leading same to said chamber, and means for treating said gas electrically and means for maintaining same under a constant pressure therein to convert a portion of same into ozone while gas is forming through said chamber.

19. In an ozone generating machine, a casing having a chamber, means for compressing a gas and means for leading said gas into said chamber and for treating same by electricity under a constant pre-determined pressure automatically maintained therein by electricity to convert a portion of same into ozone while said gas is being forced from said compressing means through an outlet in said casing.

20. In an ozone generating machine, a casing having a chamber, means for compressing a gas, means for reducing the temperature of said gas, means for reducing the pressure, means for leading said gas into said chamber and for treating same electrically therein to convert a portion into ozone, and an automatic relief valve controlling the outlet from said chamber.

21. In an ozone generating machine, a casing having a transparent chamber, means for compressing a gas, means for reducing the temperature of said gas, means for reducing the pressure, means for leading said gas into said chamber and for treating same electrically therein to convert a portion into ozone, and an automatic relief valve controlling the outlet from said chamber.

22. In an ozone generating machine, a transparent casing having a closed chamber, means for compressing a gas and leading same to said chamber, and means for treating said gas electrically and automatically

maintaining same under a constant determined pressure therein to convert a portion of same into ozone.

23. In an ozone generating machine, two tubular electrodes the ends of which are disposed opposite to each other at a distance apart greater than the sparking distance therebetween, one of which serves as a conduit for the gas after treatment.

24. In an ozone generating machine, a casing comprising two end caps and a transparent member held between the same, an electrode supported by one of said caps and provided with a passage therethrough, and an outlet from said casing through the opposite cap.

25. In an ozone generating machine, a casing comprising two end caps and a tubular member held between the same, an electrode supported by one of said caps and provided with a passage therethrough, and an outlet from said casing through the opposite cap.

26. In an ozone generating machine, an electrode comprising a tube presenting a sharp edge adapted to assist in discharging a brush discharge therefrom.

27. In an ozone generating machine, an electrode comprising a tube having a conducting member encircling said tube and provided with a discharging surface adapted to effect a discharge of current entirely around the end of said tube.

28. In an ozone generating machine, an electrode comprising a tube having a concentric conducting ring mounted thereon substantially as described.

29. In an ozone generating machine, two tubular electrodes arranged with their ends opposite to each other, means for causing a brush discharge to flow between said electrodes to form an envelop, and means for forcing a fluid through one of said tubes and through said brush discharge.

30. In an ozone generating machine, two tubular electrodes arranged with their ends opposite to each other, a casing, means for causing a brush discharge to flow between them to form an envelop, means for forcing a fluid through one of said tubes and through said brush discharge and out of said casing through the opposite tube.

31. In an ozone generating machine, a casing having a chamber therein, and two tubular electrodes supported by said casing, the ends of which are oppositely disposed at a distance apart greater than the sparking distance therebetween, one of which serves as an inlet for gas and the other as an outlet therefor.

32. In an ozone generating machine, a transparent casing having a chamber therein, and two tubular electrodes supported by said casing, the ends of which are oppositely disposed, one of which serves as an inlet for gas and the other as an outlet therefor.

Signed at New York in the county of New York and State of New York this 17th day of February A. D. 1909.

FRANK M. ASHLEY.

Witnesses:
E. F. MURDOCK,
DANIEL DE V. HARNED.