C. S. BRADLEY.

PROCESS FOR OZONIFYING.

APPLICATION FILED AUG. 6, 1910.

1,041,421.

Patented Oct. 15, 1912.

3 SHEETS—SHEET 1.

FIG. 1.

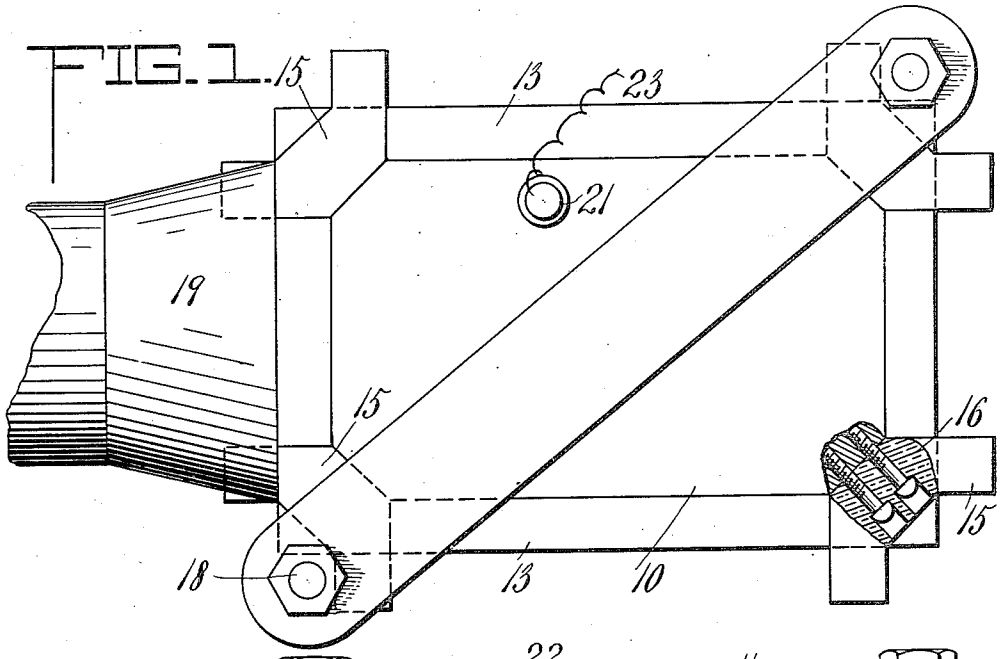

FIG. 2.

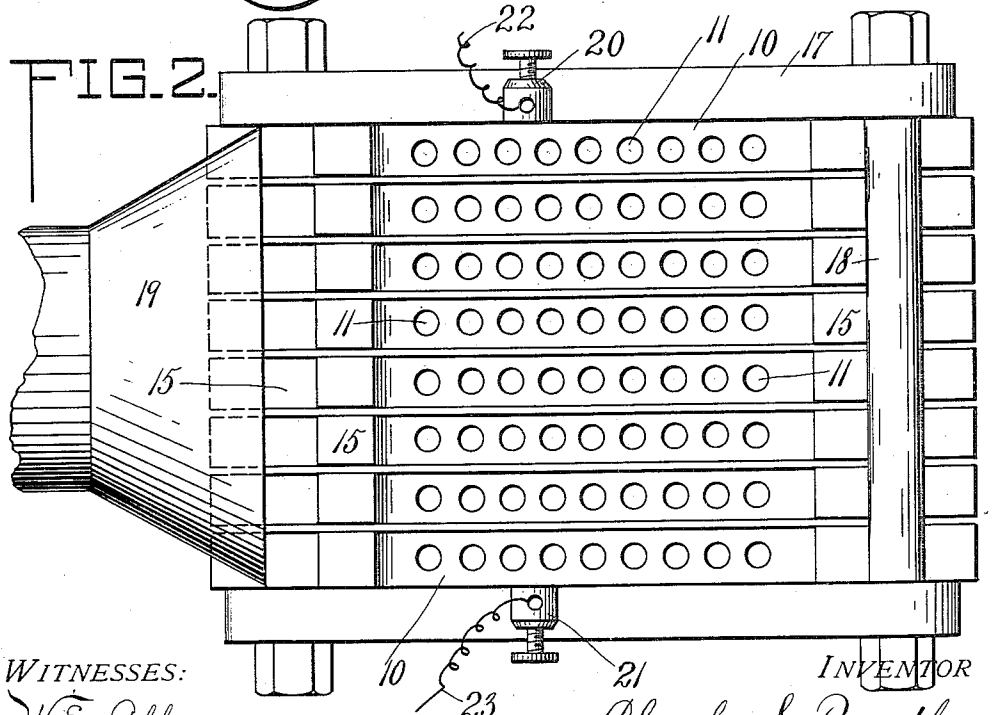

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FIG. 3.

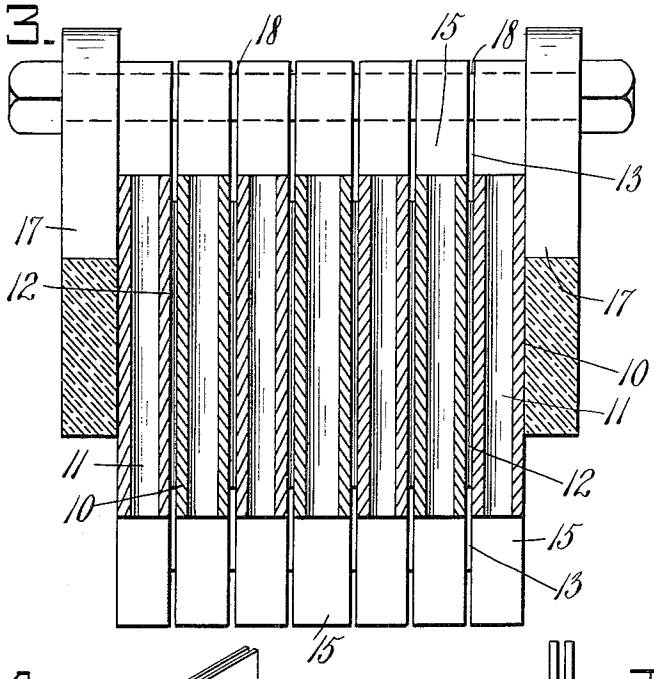


FIG. 4.

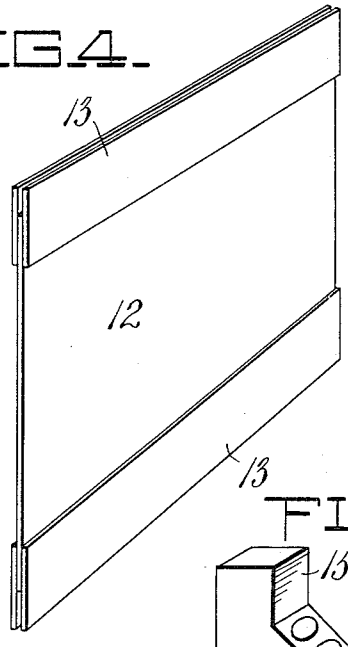


FIG. 5.

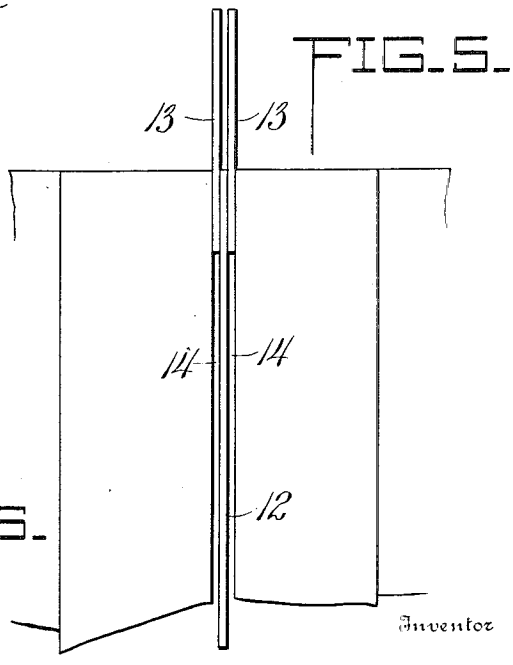
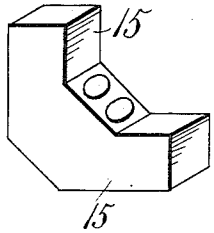


FIG. 6.



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3 SHEETS—SHEET 3.

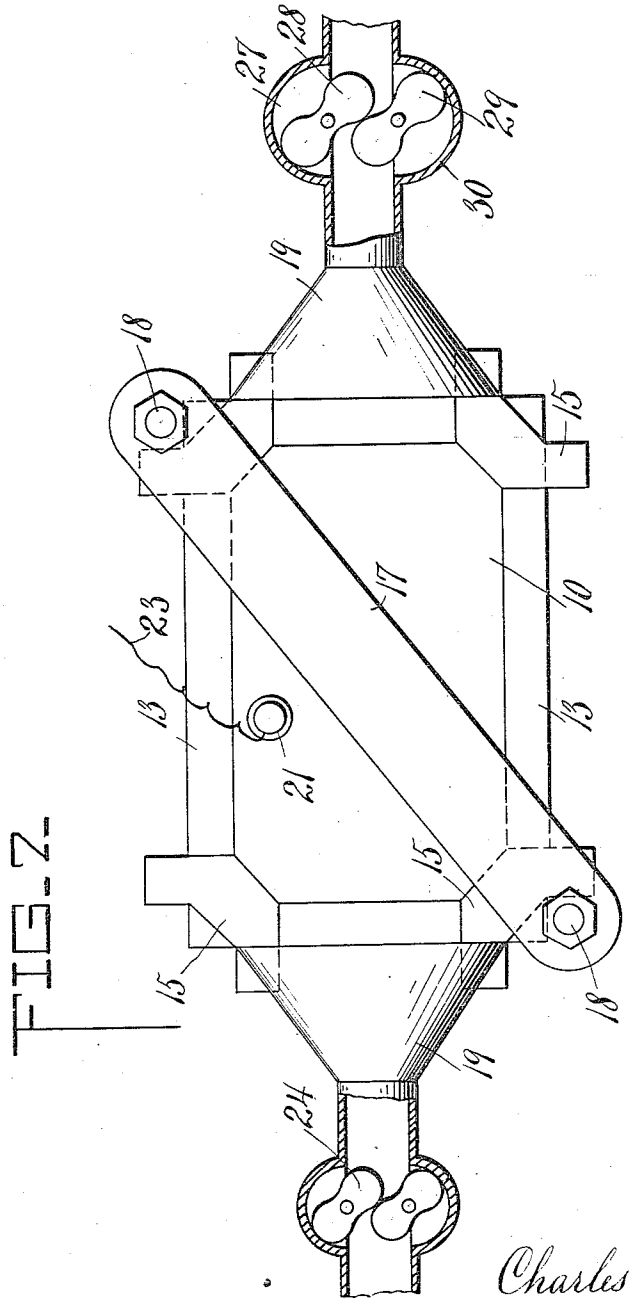

FIG. 7.

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UNITED STATES PATENT OFFICE.

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PROCESS FOR OZONIFYING.

1,041,421. Specification of Letters Patent. Patented Oct. 15, 1912.

Original application filed October 29, 1906, Serial No. 341,120. Divided and this application filed August 6, 1910. Serial No. 575,987.

To all whom it may concern:

Be it known that I, CHARLES S. BRADLEY, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Processes for Ozonifying, of which the following is a specification.

My present application is a division of my application entitled "Process and apparatus for ozonifying," Serial No. 341120, filed October 29th, 1906.

My invention relates to the production of ozone, and is especially concerned with an improved process for converting oxygen into ozone.

Experiments made by me have led me to believe that the conversion of oxygen into ozone is a surface action; that is, the conversion takes places at the surface of the plates confining the space in which the gas is treated, and is due to the impact of bombardment of the charged molecule against the surface. Any means for increasing the bombardment will therefore induce an increased efficiency. This increase in bombardment may be accomplished by placing the confining plates closer together than heretofore, so that the charged molecule has less distance to travel. Furthermore the velocity of the molecule may be increased by reducing the pressure of the gas which is treated, and the bombardment in this way increased. Another method of increasing the velocity of the molecule and consequently the bombardment is to employ a higher electromotive force. When this electromotive force is increased, however, the current density tends to increase, and since increased current density brings increased heat which impairs the efficiency as is well known, the dielectric sheets must be made thicker to permit the higher electromotive force to be used without lowering the efficiency. A still further consideration which must be borne in mind in the construction of ozonifying apparatus is, that the rise in temperature due to the treatment of the gas must be prevented or kept within a comparatively low range. For the purpose of preventing as far as possible the detrimental rise in temperature, it is well to make the electrodes of such thickness that perforations may be made in them through which air or other cooling medium may be forced or permitted to circulate so as to cool the electrodes.

In accordance with the observations made in my experiments, I have constructed an ozonifying apparatus to carry out my process, the principles of which may be seen from the accompanying drawings, in which,

Figure 1 is a side elevation of one form of apparatus constructed in accordance with my invention, Fig. 2 is a top plan of the same, Fig. 3 is a central vertical section thereof, Fig. 4 is a perspective view of one of the dielectric sheets in position, between the spacing strips hereinafter referred to, Fig. 5 is a detail view showing the disposition of the dielectric sheet with its spacing strips between a pair of the electrodes, Fig. 6 is a perspective view of one of the corner blocks hereinafter referred to, and Fig. 7 is a side elevation of the apparatus provided with pressure reducing means.

Referring now specifically to said drawings, 10 indicates the electrode plates which are preferably of aluminium, and of sufficient thickness to permit of vertical perforations 11 through which cooling air may be allowed or forced to pass. The dielectrics are preferably in the form of sheets of mica 12, which may be substantially the same length and height as the electrode plates 10. Spacing strips 13 (see especially Figs. 4 and 5) inclose the upper and lower edges of the dielectric sheets 12, and are held between the electrode plates 10. The spacing strips 13 are also preferably of mica and are extended some distance beyond the upper and lower edges of the electrodes, as clearly shown in Fig. 5, to prevent sparks from jumping around the dielectric from one electrode over to the other. I prefer to use mica for the dielectric sheets and spacing strips rather than glass, for the reason that it is less apt to become fractured and may stand a much higher strain when the elements of the ozonifier are drawn tightly together, in the manner hereinafter described. It will be seen that narrow ozonifying spaces 14 closed above and below but open at the two ends are formed between each pair of electrodes and the dielectric sheet. The electrode plate is therefore not protected from the oxidizing effect of the ozone, and it is for this reason that I prefer to make the

electrode of aluminium since this metal is not attacked by ozone. In this construction it will be seen that four surfaces are present in the spaces between each pair of electrodes, two electrode surfaces and two dielectric surfaces. There is thus a much greater bombardment area than in forms of ozonifying apparatus in which the electrodes are secured upon the outer surfaces of the dielectrics and bombardment can only take place between the two surfaces of the dielectric sheets. A further advantage in making the electrode plates 10 of considerable thickness is to enable me to secure corner blocks 15 of insulating material, preferably of fiber, (Fig. 6) to their corners for securing the inlet and outlet funnels, at the ends of the ozonifying spaces 14. As shown in Fig. 1, the corner blocks 15 are secured to the beveled corners of electrode plates 10 by screws 16 countersunk in the corner blocks 15, the corner blocks being of the same thickness as the electrode plates 10, thus fitting between the projecting pairs of spacing strips 13.

For the purpose of clamping together the elements of the apparatus, I provide clamping plates 17 of insulating material, preferably fiber, and bolt these together diagonally across the outer electrode plates by insulating bolts 18 also preferably of fiber. On each end of the apparatus I then place suitable inlet and outlet funnels or hoods 19 each in communication with one end of the ozonifying spaces above referred to. These funnels are so formed as to permit of air-tight connection being made with the projecting ends of the corner blocks, so that there is then a tight passageway from the supply pipe into the inlet funnel through the ozonifying spaces and out by the outlet funnel.

Binding posts 20 and 21 of any suitable form may be secured to the outer electrodes for connecting the electric conductors 22 and 23 to the apparatus. The series of electrodes and dielectrics thus forms a plurality of condensers in series, in each of which a pair of ozonifying spaces 14 is provided for the passage of air or other gas to be treated. The number of electrode plates may of course be varied to suit the particular condition under which the apparatus is to be operated.

In order to obtain the desired reduction in pressure in the gas which is in the ozonifying spaces 14, I insert a suitable engine in the inlet funnel or hood 19 and in the outlet funnel or hood 19 I provide a suitable form of air pump. This portion of the apparatus is illustrated in Fig. 7. Referring to said figure it will be seen that in the inlet funnel 19 an engine 24 is placed. In the outlet funnel 19 is then placed the air pump 27. The engine 24 and pump 27 may be of any suitable form but preferably in the form shown, which comprises a pair of revolving blades 28 and 29 operating in a casing 30. Any suitable form of driving mechanism may be employed to actuate the air pump, and the engine which is driven by atmospheric pressure is made of smaller capacity and suitably connected with the pump so as to have the same velocity and thus the reduction of pressure is obtained.

While I have shown specific details and described a specific form of the apparatus, this form has been shown and described merely as an example of my invention, and not as an indication of the full scope of the same. Various details of construction may be modified to suit the conditions of operation.

In constructing the apparatus, the ozonifying spaces should have as small a volume with respect to the electrode surface as the conditions of operation will permit, or in other words, the electrodes should be at the minimum permissible distance apart and thus leave a space having minimum cross-section and volume. In this way the electromotive force used can be materially reduced without lowering the yield and thus the efficiency increased.

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

The process of ozonifying, which comprises effecting an ozonifying electric discharge in a gas at a pressure materially below atmospheric, whereby the impedance to the travel of the charged particles of the gas is diminished.

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Witnesses:
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