

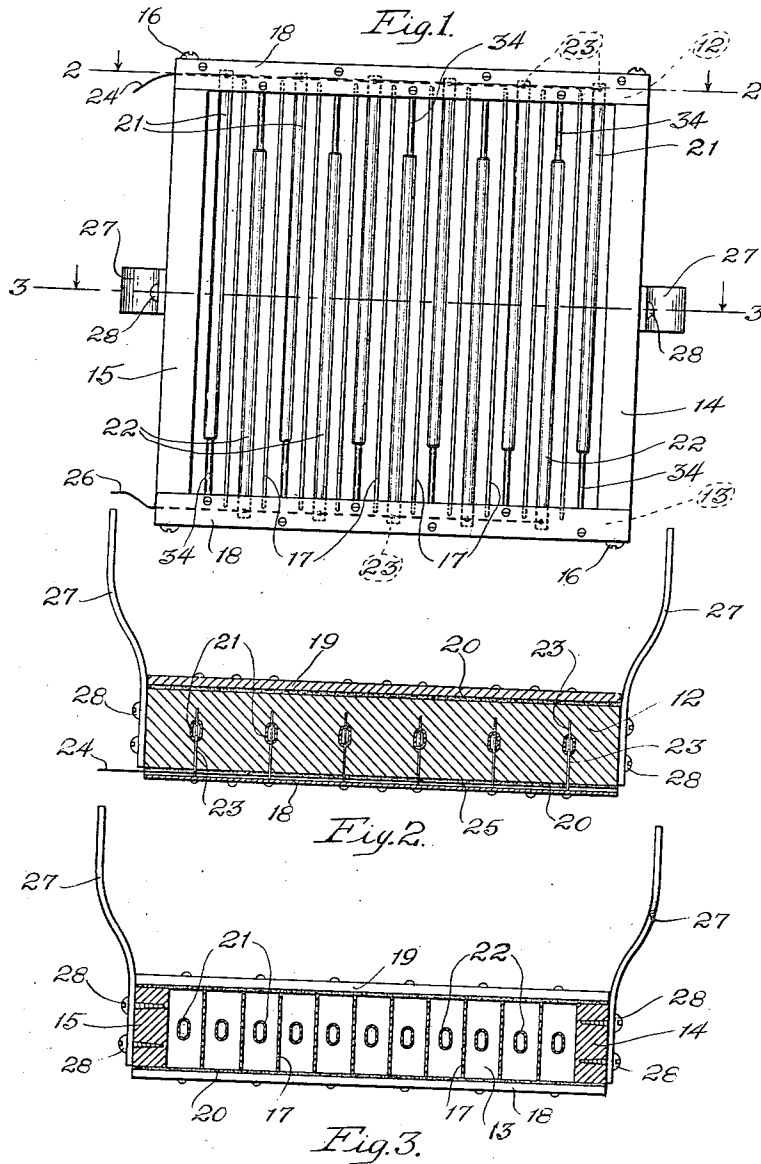
R. D. SMALL & O. LINDER.
OZONIZER.

APPLICATION FILED APR. 4, 1911. RENEWED APR. 11, 1912.

1,044,700.

Patented Nov. 19, 1912.

3 SHEETS—SHEET 1.



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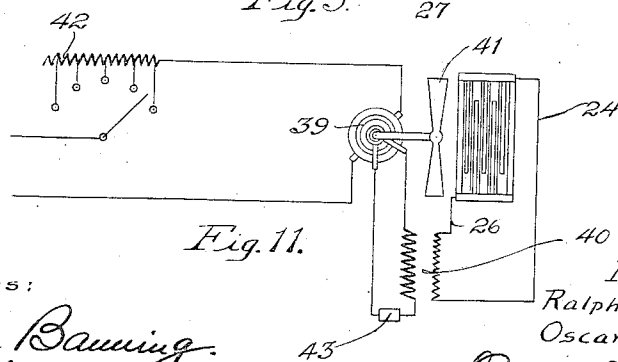
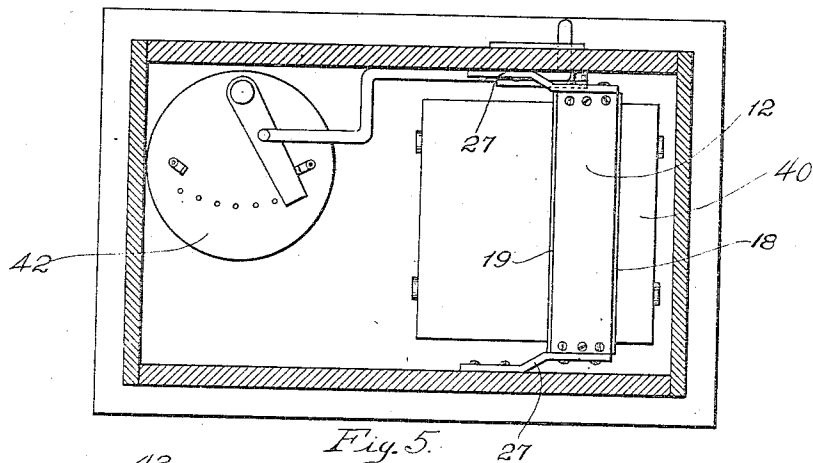
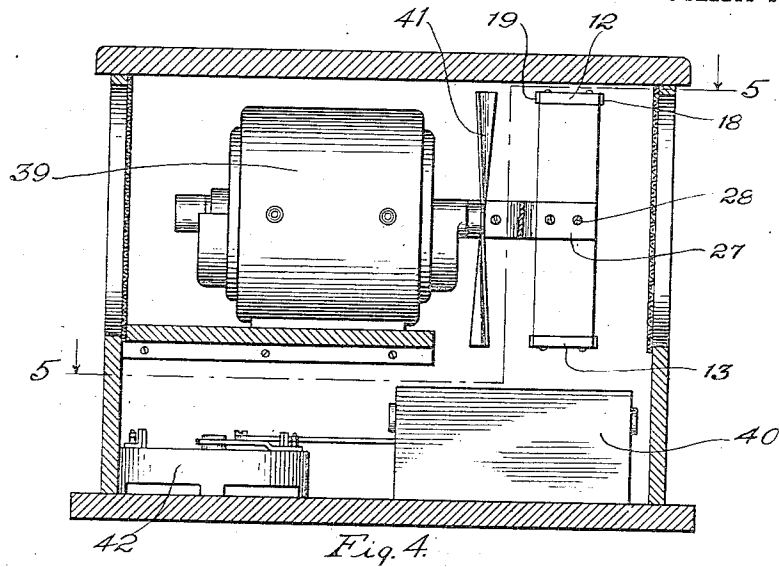
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3 SHEETS-SHEET 2.



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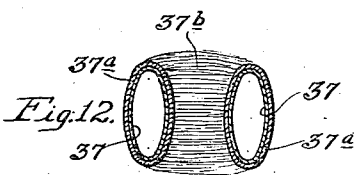
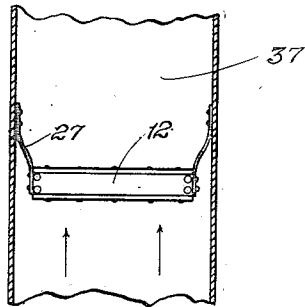
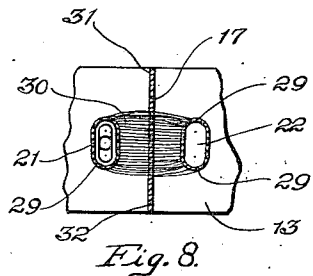
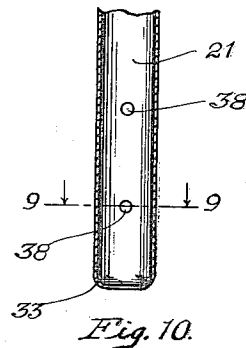
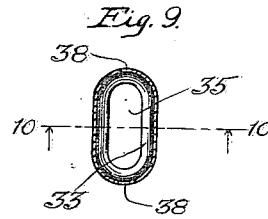
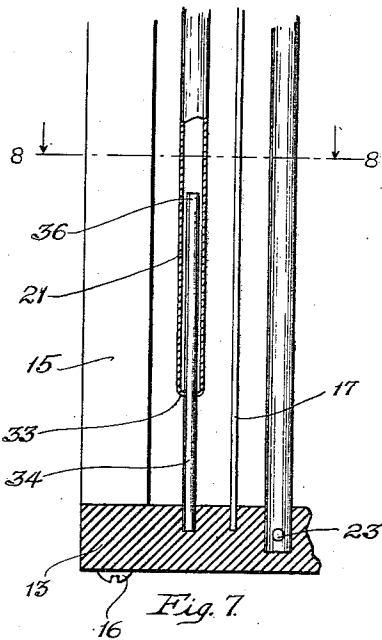
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

RALPH D. SMALL AND OSCAR LINDER, OF CHICAGO, ILLINOIS, ASSIGNORS, BY MESNE ASSIGNMENTS, TO VOHR OZONE ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

OZONIZER.

1,044,700.

Specification of Letters Patent. Patented Nov. 19, 1912.

Application filed April 4, 1911, Serial No. 618,831. Renewed April 11, 1912. Serial No. 690,043.

To all whom it may concern:

Be it known that we, RALPH D. SMALL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, and OSCAR LINDER, a citizen of the Republic of Switzerland, also residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Ozonizers, of which the following is a specification.

This invention relates to certain improvements which we have made in ozonizers or the like, especially intended for use in localities and under conditions where large amounts of air are to be ozonized. The devices herein set forth are also intended particularly to meet requirements for use in damp places, as, for example, in refrigerator or cold storage plants. It is also intended to produce a device which shall be peculiarly adapted for use in connection with ventilating systems, wherein large amounts of air are distributed from the common source to the different rooms of a building. In this case, our improved ozonizer is well adapted for use in conjunction with such a ventilating system, it being adapted for location in one of the air distribution ducts, thus ozonizing all of the air which is carried into the number of rooms.

It will be understood that in cold storage plants and in other similar locations, the air is moist, because cooling it tends to increase its humidity, and to precipitate its moisture. This being the case, the moisture rapidly collects on objects which are placed in such atmosphere. It will also be understood that a high voltage must be used in order to secure the proper electrical discharge for ozonizing the air. On account of this fact, considerable leakage will occur over moist surfaces of the ozonizer, unless the ozonizer is specially arranged and adapted to meet the particular requirements of such usage. The amount of electric leakage over the ozonizer surfaces may be reduced in a number of ways, among which are increasing the length of the path over which the leakage must occur, and using materials for the ozonizer which are practically non-hygroscopic. The discharge or ozonizing member to which the present invention relates is especially adapted to meet these requirements, among others.

Where an ozonizer is to be used for ozon-

izing large quantities of air, it must be of considerable capacity and capable of handling a considerable amount of electrical discharge. This amount of electrical discharge may be produced by using a comparatively high density of discharge across a small area, or, by using a low density of discharge across a large area. The discharge tends to heat the electrodes and dielectrics through which the discharge takes place, and this heating rapidly increases with the density of the discharge. The heat thus generated results in a deterioration of ozone, and may break the dielectric when the latter is of glass or similar vitreous material. The discharge member of the present invention is peculiarly adapted for securing a large amount of discharge surface within a small volume, and for distributing the heat generated by the discharge in such a manner that the danger of breaking the dielectrics is very greatly reduced.

The distribution of the electrical discharge between the electrodes depends very largely upon their shape and the distance between them. It is found that edges and corners, or sharp turns, become the chief points of discharge, so that by far the greater portion of the electricity is drawn to these portions, leaving the comparatively flat surfaces unused.

One of the main objects of this invention is to provide electrodes of such form that the distribution of the discharge is substantially uniform over the entire electric zone. When the discharge is distributed, as above, the entire electrode and discharge zone is used to the highest efficiency, a larger amount of discharge may be safely produced in a given zone, and the heating over said zone is substantially uniform, so that a higher discharge temperature may safely be used, because the strains set up in a vitreous dielectric which is evenly heated are not as dangerous and as difficult to control as those set up in an unevenly heated dielectric. This even heating which obtains from an even discharge results in another advantage, to wit: that we are enabled to use wider dielectrics than otherwise, thus obtaining a better insulation between the electrodes, and better encountering the difficulties which must be overcome in producing an ozonizer for use in damp places.

The main objects then of our invention

are, to provide a discharge member for an ozonizer which is peculiarly adapted for use in connection with an air duct of a ventilating system; to so form said discharge member that it will successfully meet the difficulties which exist in producing an ozonizer for use in damp places; to provide a form of electrode which will produce a substantially uniform electric discharge throughout the entire discharge zone; thus to produce a substantially uniform heating throughout the entire discharge zone whereby wider electrodes may be used and better insulation be secured; to provide a form of discharge member in which a large amount of discharge area may be obtained in a comparatively small volume; to so form the electrodes that they may be cooled to the best advantage, when the device is used in conjunction with a ventilating system; to provide a form of discharge member peculiarly well adapted for use in large sizes, by reason of the relative arrangements of the electrodes, dielectrics, and the frame which supports them; to provide nevertheless a form of discharge member which can be conveniently used in small sizes, thus adapting it for service in small ozonizers intended to be placed in the rooms of a building; to form the discharge member, in such a way that the electrodes and dielectrics may be conveniently and quickly taken out for replacement or repair; and in other ways and manners to generally provide an ozonizer well adapted to meet all of the foregoing as well as other conditions.

Other objects and uses will appear from a detailed description of the invention, which consists in the features of construction and combination of parts hereinafter described and claimed.

Referring now to the drawings, in Figure 1, we show a side elevation of our improved form of discharge member or rack; in Fig. 2, we show a cross section of the same taken on the line 2—2 of Fig. 1 looking in the direction of the arrows; in Fig. 3, we show a cross section on the line 3—3 of Fig. 1 looking in the direction of the arrows; in Fig. 4, we show a cross section through one form of ozonizer provided with our improved form of discharge rack, the same being suitably supported on the side walls of the ozonizer box; in Fig. 5, we show a cross section on the line 5—5 of Fig. 4, looking in the direction of the arrows; in Fig. 6, we show our improved form of rack as the same may be supported in an air duct of a ventilating system; in Fig. 7, we show an enlarged detail of a portion of a modified form of rack in which the electrodes are braced as they may be when made in large sizes; in Fig. 8, we show a cross section taken on the line 8—8 of Fig. 7 looking in the direction of the arrows; in Fig. 9, we show a detail cross

section of one of the electrodes taken on the line 9—9 of Fig. 10 looking in the direction of the arrows; in Fig. 10, we show a longitudinal section taken on the line 10—10 of Fig. 9 looking in the direction of the arrows; in Fig. 11, we show diagrammatically the connections of the ozonizer which is illustrated in Figs. 4 and 5; and in Fig. 12, we show a cross section through a modified form of electrode, the same being made from glass or other vitreous material of proper shape to secure the aforementioned even electrical discharge, and being faced on its inner surface with a conducting material.

As heretofore stated, the electric discharge tends to concentrate on sharp angles and corners, leaving the comparatively flat surfaces unused. In our present invention, we make the electrodes in the form of elongated cylinders and place the same side by side, so that the electrical discharge takes place between their elongated surfaces. The electrode cylinders have their adjacent surfaces of such curvature and form that the discharge between them is of substantially uniform density throughout the entire discharge zone. We then place between adjacent electrodes of opposite polarity any suitable dielectric. This may be in the form of plates of glass or the like, in which case the exterior surfaces of the metal of the electrodes may be exposed. In one embodiment of our invention, we provide an inclosure of dielectric, completely surrounding each electrode. For example, this may be in the form of a cylinder of glass completely inclosing the metallic electrode within. When using such a construction, the electrode itself might take the form of a layer or film of metal suitably deposited on the interior of the glass.

The cylinder electrodes may be mounted in any desired way, as, for example, in a "rack." In this case, all of the electrodes of one polarity should extend downwardly from one end of the rack, the opposite electrodes extending upwardly from the other end between the first mentioned electrodes. By forming the rack of proper width any number of electrodes may be accommodated, and by forming the rack of suitable length, the active portion of each electrode may be given any amount of surface desired, so that ultimately the total ozonizing capacity of the electrode may be made very large.

Referring now particularly to Figs. 1, 2, and 3, of the drawings, we will describe the preferred form of rack. The same comprises upper and lower rails 12 and 13 respectively, connected at their ends to cross bars 14 and 15; such connection may be formed in any desired manner as by means of screws 16. In the construction herein shown, rails are slotted across their adjacent faces at even distances to receive plates of

dielectric 17 which are of depth substantially equal to or slightly greater than the width of the rails. Bars 18 and 19 are secured across the outside of the rails, a layer
 5 of felt or the like 20 being interposed between each bar and the face of the rail for the purpose of securing an even and constant pressure against the edges of the dielectrics which, as heretofore stated, may be of width
 10 slightly greater than that of the rails, so that this pressure of the felt against their ends will be effective. All of the electrodes 21 of one polarity are socketed in the rail 12, and project downwardly in the alternate
 15 spaces between plates of dielectric, while the electrodes 22 of the other polarity are socketed in the opposite rail and extend upwardly into the unoccupied spaces between the dielectrics. In order to hold each elec-
 20 trode in position in its socket, we pass a pin 23 through it and through the rail. Each pin makes electrical contact with its electrode, so that a common wire 24 connected to the pins will give electrical con-
 25 nection to all of the electrodes of that polarity. The rail 18 may be provided with a groove 25 for the reception of the wire 24, should that be desirable. In like manner, the electrodes of opposite polarity are held
 30 securely in their sockets, a wire 26 delivering electric current to them. For purposes of supporting the rack, brackets 27 may be secured to the bars 14 and 15, the attachment shown being by means of screws 28. It will
 35 be understood that these brackets may be connected to any suitable structure, as, for example, to the sides of a metallic ventilating duct. Under these circumstances, they will be electrically connected together, and, there-
 40 fore, all of the screws 28 will be of the same electrical polarity. In order, therefore, to secure the best possible electrical insulation, we provide an uneven number of electrodes, so that both of the electrodes occupying the
 45 extreme side positions in the rack will be of the same polarity. This being the case, there will be no tendency for current to jump into the screws on one side of the rack, and then pass through the metallic structure to the screws on the other side of the rack, and
 50 thence to the other electrode. In other words, the electric strains in the bars and rails of the rack frame are thus reduced to the lowest possible limit, an important fea-
 55 ture when it is considered that very high potentials are used in such a structure.

Referring to Figs. 7-10 inclusive and Fig. 12, we will describe more in detail the preferred form of electrodes. These are
 60 tubular, and are preferably placed with their longer axes parallel to each other, as is well shown in Fig. 8. As heretofore stated, a tendency exists for the electric discharge to concentrate on sharp angles and curves of
 65 small radius. We, therefore, round the sides

29 of the electrodes in such a way that the electric discharge 30 is practically uniform throughout the entire electric zone. It will be understood the exact curvature and shape of the electrode will be determined, among
 70 other things, by its distance from the dielectric, when a plate dielectric is used, and from the adjacent electrode of opposite polarity, but we contemplate within the scope of our invention any form of electrode,
 75 which will produce a substantially uniform discharge across the electric zone. As heretofore stated, the amount of heat depends, among other things, upon the amount of electric discharge. In case an electrode were
 80 used of such form that there would exist a number of belts of heavy discharge alternating with belts of light discharge, it is evident that when a plate dielectric was used between the electrodes, it would be unevenly
 85 heated, and would, therefore, be unevenly strained. For this reason, it would be liable to breakage, and its permissible width between the edges 31 and 32 would be considerably reduced. It will be understood
 90 that when using plate dielectrics, the amount of insulation between the electrodes depends upon the distance to which the edges 31 and 32 of the dielectrics project beyond the elec-
 95 trodes, because these distances determine the length of the path which the electricity would have to jump in order to break down the insulation. By using a form of electrode which gives a substantially even discharge
 100 over the entire electric zone, we are enabled to use wider dielectrics without danger of breakage, due to uneven heating. We, therefore, secure better insulation than would otherwise be possible. In order to com-
 105 pletely carry out the idea of securing an even discharge, we round the ends 33 of the electrodes in the proper manner, so that no sharp edges or corners will exist at these points. When using long electrodes, means
 110 should be provided for bracing the same at their free ends, because they should be evenly spaced with respect to each other. In order to secure this bracing, we may provide an insulating rod 34 for each electrode, passing the same up through the open end
 115 35 of the electrode to a point 36 considerably above said open end. Any slight back and forth movement of the electrode will bring the end 36 into contact with the side of the electrode, and any further movement of the
 120 same will be resisted.

In order to secure the best insulation of the rack, all of the wooden parts thereof, when wood is used, may be impregnated with any suitable material, and preferably
 125 a material which will render the parts non-hygroscopic.

In Fig. 12 we show a cross section of a pair of electrodes of modified construction. In this case, each electrode comprises a con- 130

ducting cylinder or surface 37, completely surrounded by a layer of insulating material, as, for example, a cylinder of glass 37^a. Such a construction may be provided by lining the inner face of the glass cylinders with conducting material, as, for example, tin-foil, or by filling the cylinders with a conducting liquid, such as mercury. A number of important advantages are attained by this construction, chief among which is that each electrode is completely and absolutely insulated, so that all danger from electric shocks is eliminated, a very important consideration with the ozonizer to be used in certain classes of work. Another advantage is that the plate dielectrics may be dispensed with. In order to secure a uniform discharge across the entire zone 37^b the electrodes should be of proper shape, as has been heretofore pointed out.

As heretofore stated, it is intended particularly to provide a form of ozonizer which will be well adapted for use in connection with the ventilating system of a building. In Fig. 6, we show the rack as it may be supported in a ventilating duct, so that practically all of the air which passes through said duct will pass through the discharge zones, and will thus be ozonized. In order to better cool the electrodes, their sides 29 may be perforated by holes 38, as shown particularly in Fig. 10, so that a portion of the air will pass directly through the electrodes. This will also tend to reduce the resistance which the rack produces to the flow of air through the duct.

It will be seen from all of the above that a rack member, such as herein disclosed, is peculiarly well adapted for use in connection with a refrigerator system, or the like, because it is a construction which can be especially well insulated. Furthermore, by forming the parts of substantially non-hygroscopic material, the precipitation of moisture on them will be reduced to a minimum.

In Figs. 4 and 5, we show the manner in which our rack member may be used in connection with an ozonizer of comparatively small capacity, such as would be used for purifying the air of a single room. In this case, a rotary converter 39 may be used for supplying low potential alternating current to a transformer 40, which steps up the voltage to that suitable for use in the rack, the rotary converter driving a fan 41 which forces the air through the rack. A rheostat 42 serves to control the speed of the rotary converter as well as the direct current voltage on the same, thus also at the same time controlling the alternating current voltage, and, therefore, the electric discharge.

In Fig. 11, we show diagrammatically the connections of the apparatus of the form

shown in Figs. 4 and 5. It will be understood that the terminals of the low potential side of the transformer are constantly connected to the slip rings of the rotary converter. This being the case, there may be a tendency for a sudden rush of current through said low potential side when the rotary converter is first started, and in order to limit the same, a resistance 43 may be permanently connected in said circuit. This resistance, while of sufficient magnitude to prevent an abnormal rush of current, is so low that the loss of energy therein is comparatively insignificant when the apparatus is running.

While we are familiar with the fact that concentric surfaces of opposite polarity have been used, in a certain manner for producing an electric discharge, we are not familiar with any construction, in which a number of non-concentric cylinders have been used, placed side by side, and each made of proper shape to secure a uniform discharge across the entire electric zone.

We claim:

1. In an ozonizer, the combination of a suitable electrode mounting of insulating material, cylindrical electrodes of one polarity suitably socketed in one end of the mounting and projecting downwardly therein, cylindrical electrodes of opposite polarity suitably socketed in the other end of the mounting and projecting upwardly therein between the first mentioned electrodes, electrical conductor retainers for retaining the electrodes within their sockets and for providing electrical communication with them, an electrical conductor suitably connected to the retainers which secure the electrodes of one polarity within their sockets, and an electrical conductor suitably connected to the retainers which secure the remaining electrodes within their sockets, substantially as described.

2. In an ozonizer, the combination with an electrode mounting of a plurality of electrodes of one polarity socketed in one portion of the mounting and projecting downwardly therein, electrodes of opposite polarity socketed in an opposite portion of the mounting and projecting upwardly therein between the first mentioned electrodes, electrical conductor retainers securing the electrodes within their sockets and providing electrical connection with them, an electrical conductor connected to the retainers which secure the electrodes of one polarity within the mounting, and an electrical conductor connected to the retainers which secure the remaining electrodes within the mounting, substantially as described.

3. In an ozonizer, the combination of a plurality of cylindrical electrodes of alternating polarity, a mounting therefor, and plates of dielectric between consecutive pairs

of electrodes, the electrodes having their discharge surfaces of suitable contour to provide a substantially uniform electrical discharge between the pairs of electrodes, substantially as described.

4. In an ozonizer, the combination of an electrode mounting comprising a pair of oppositely disposed substantially parallel rails provided in their adjacent faces with alternating electrode sockets, and with transverse slots for the reception of plates of dielectric, electrodes secured within the sockets, plates of dielectric between adja-

cent electrodes and extending from the slots of one rail to the slots of the opposite rail, yielding substance on the sides of the rails, and bars for retaining the yielding substance firmly against the rails and across the ends of the slots for retaining the plates of dielectric in position, substantially as described.

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