Oct. 11, 1938. F. S. SMITH 2,132,708

METHOD FOR TREATING MATERIALS AND ELECTRICAL TREATING APPARATUS, ESPECIALLY FOR STERILIZATION

Filed Oct. 8, 1934 2 Sheets-Sheet 1

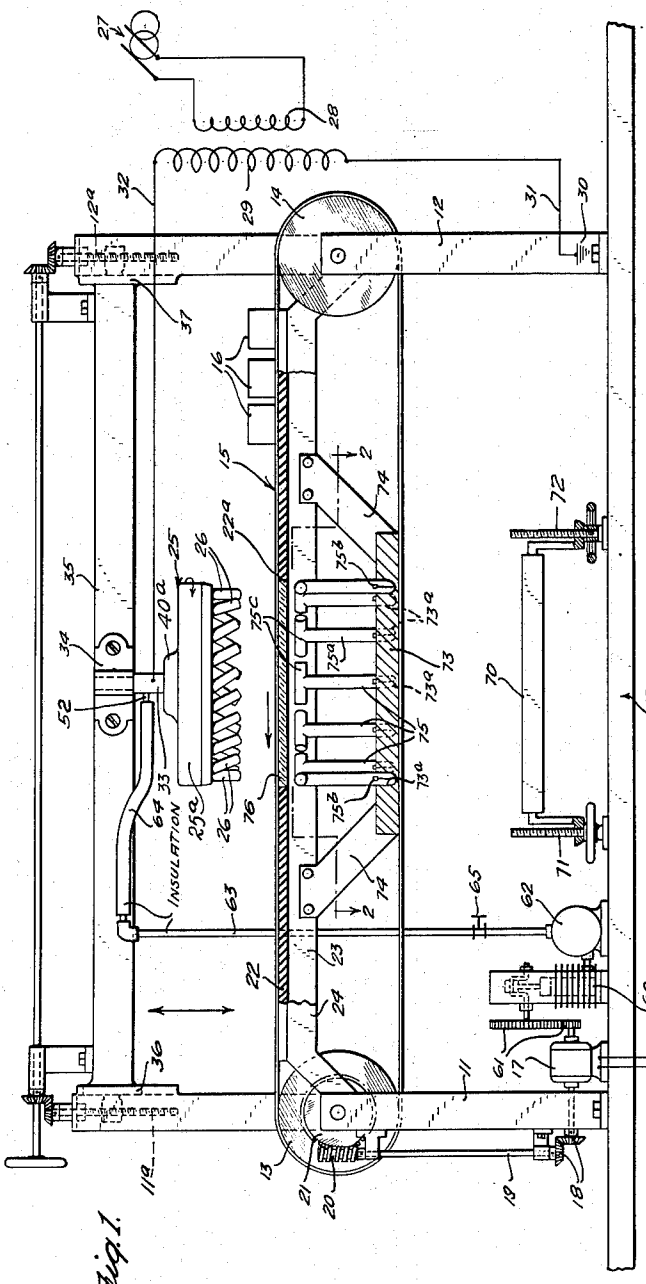


Fig. 1.

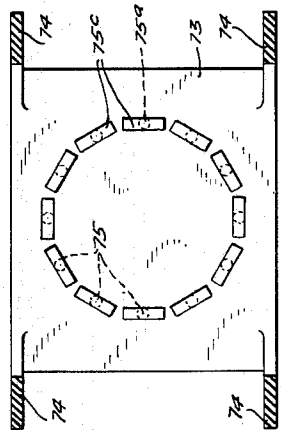


Fig. 2.

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Fig. 3.

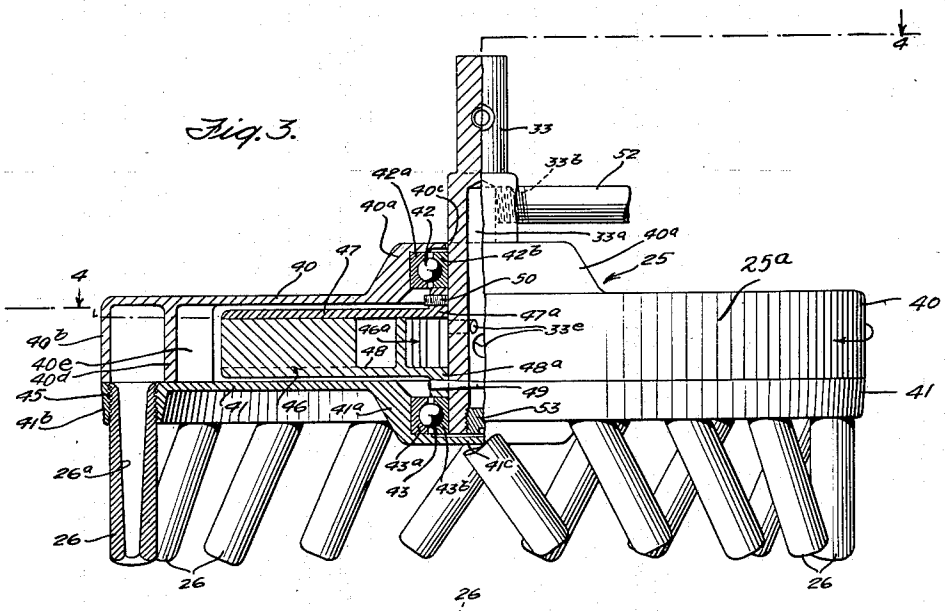
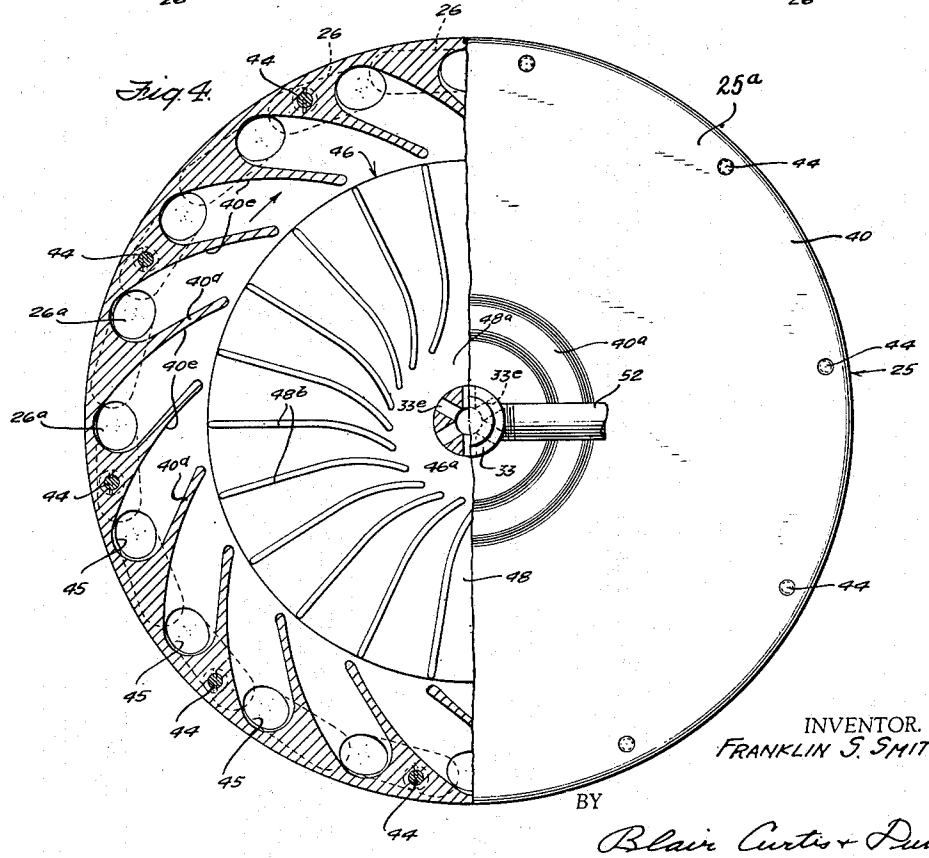


Fig. 4.



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'atented Oct. 11, 1938 2,132,708

UNITED STATES PATENT OFFICE

2,132,708

METHOD FOR TREATING MATERIALS AND ELECTRICAL TREATING APPARATUS, ESPECIALLY FOR STERILIZATION

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Application October 8, 1934, Serial No. 747,442

25 Claims. (Cl. 21—54)

This invention relates to apparatus which is articularly adapted for electrically sterilizing roducts, such as food products or the like.

One of the objects of this invention is to prode a practical and inexpensive apparatus for se among other things in destroying insect life, ich as eggs, pupae, larvae, and the like, conined in products such as food products, illusatively cereals, flour, and the like. Another obct is to provide an apparatus of the above-menoned character in which insulation problems id the like are overcome in a dependable and iexpensive way. Another object is to provide an ectrical sterilizing apparatus in which the elecical discharge is dependably controlled and, ioreover, by way of means that is compact and iexpensive and dependable in action. Another)ject is to provide apparatus of the above-menoned character in which the conditions under hich certain discharge electrodes operate are eatly improved and in which also superior elecode or discharge action is achieved. Other obcts will be in part obvious or in part pointed it hereinafter.

The invention accordingly consists in the feaires of construction, combinations of elements, id arrangements of parts and in the several eps and relation and order of each of the same one or more of the others, all as will be illusatively described herein, and the scope of the pplication of which will be indicated in the folwing claims.

In the accompanying drawings in which is iown one of the various possible embodiments the electrical and mechanical features of my vention,

Figure 1 is a front elevation of a complete apiratus, certain parts being diagrammatically incated;

Figure 2 is a plan view as seen along the line —2 of Figure 1;

Figure 3 is a view on an enlarged scale, partly elevation and partly in vertical section, of an ectrode structure and driving means therefor id which forms part of the apparatus of Figure and

Figure 4 is a view, partially in plan and partialin horizontal section, of the apparatus of Fige 3, as seen along the line 4—4 of Figure 3.

Similar reference characters refer to similar irts throughout the several views in the drawgs.

Referring now to the drawings and more parcularly to Figure 1, I have there shown a main ame 10 having, at its ends, pairs of uprights or standards 11 and 12 in the upper ends of which, in suitable bearings, are rotatably supported drums 13 and 14, respectively, the latter having extending thereover a conveyor belt 15 made of a suitable material, preferably non-conductive, such as cotton, or the like. The upper side of the belt 15 functions to carry and move the product to be sterilized, illustratively packaged food products 16, in a direction from the right to the left, through a treatment zone to be hereinafter more clearly described. Any other suitable means may be provided for feeding the product 16 to one end of the conveyor and for removing the treated product from the apparatus at the other end.

The conveyor 15 may be driven in any suitable manner, illustratively by a motor 17, preferably mounted in the base of the machine, suitably geared or connected to the drum 13, as by the bevel gears 18, by which a vertical shaft 19, supported in suitable bearings carried by the standard 11, is driven, suitable gearing such as a worm 20 and a worm wheel 21 connected to the shaft 19 and the drum 13, respectively, completing the drive of the drum 13 and hence of the conveyor 15.

The upper side of the belt 15 supported against sagging by a table-like structure which, illustratively, may comprise a plate-like member 22 extending from the drum 13 to the drum 14 and underneath the upper side of the belt 15; plate member 22 is of insulating material, such as laminated "bakelite". It may be supported in position in any suitable manner, illustratively by two side beams 23 and 24, also made of solid dielectric material and supported at their ends in any suitable manner, illustratively by the pairs of standards 11—12.

Intermediate of the drums 13—14 I provide a suitable treatment zone, the latter being achieved by certain coacting parts, certain of which are underneath the product-carrying side of the belt and certain of which are above, and for convenience the latter may be considered first. Accordingly, I position, above the belt 15 an electrode means generally indicated at 25 which includes the rotatable electrode proper 25^a provided with a suitable number of downwardly directed electrode elements or discharge points 26, preferably arranged in a circle in the rotatable carrier portion of the electrode 25^a and driven in a manner about to be described, and with their lower ends in a plane spaced upwardly from and preferably parallel to the plane of the product-carrying side of the belt 15. The products are moved by the belt through the space between these two

planes. The electrode elements 26 are maintained at a relatively high potential, a potential of the order of 150,000 volts, and preferably an alternating one, preferably of a relatively high frequency, such as, for example, 640 cycles per second.

This energizing potential may be derived from any appropriate source and illustratively I may provide an alternator 27 of the appropriate frequency and of low voltage connected to the low voltage winding 28 of a step-up transformer 28—29 whose high voltage winding 29, yielding a voltage on the order of 150,000 volts, has its one side grounded, preferably to the frame 10, as at 30, by conductor 31, and has its other side or terminal connected, as by conductor 32, to the electrode 25a which, with its electrode elements 26, is thus maintained at this high potential relative to the base frame 10, to achieve certain electrical actions, certain of which are described later hereinafter.

The high voltage electrode structure 25a is provided with a shaft-like stud 33 rigidly mounted in a bracket 34 which in turn is secured to an insulating support 35, illustratively in the form of a beam or beams of solid dielectric material and in turn mounted for movement vertically and hence toward or away from the conveyor 15. Any suitable means may be provided for thus mounting the insulating frame 35 and illustratively its ends may be provided with suitable devices 36 and 37 which may be adjustably positioned along upward extensions of the main frame 10, illustratively indicated at 11a and 12a, respectively. The insulating beam structure 35 positioned to hold its bracket 34, positions the rotating electrode elements 26 relatively centrally over and with respect to the belt 15, and is suitably shaped and dimensioned adequately to insulate the high voltage electrode 25a from the metal parts of the supporting frame.

As above indicated the electrode 25a is rotated; for reasons and advantages, certain of which are later pointed out, I achieve this rotation or movement of the electrode 25a by means of a fluid motor operating, in coaction with other parts, under a non-conductive fluid under pressure, illustratively suitably dried air under a suitable pressure.

The fluid motor may, as in the form illustratively shown in Figures 3 and 4, be an integral part of the electrode 25a. Reference may first be made to Figure 3, in which the stud 33, nonrotatably secured to and depending from the bracket 34 (of Figure 1) rotatably supports a two-part housing 40—41; housing 40 has a hub-like portion 40a suitably counterbored to have tightly fitted therein the outer race 42a of a combined thrust and radial anti-friction bearing 42 whose inner race 42b is tightly fitted or otherwise secured to the stud 33.

The housing 40, otherwise generally disk-like in shape, is provided with a downwardly extending peripheral cylindrical portion 40b, with which the outer upper face of the disk-like housing member 41 mates, the two members 40—41 thereby enclosing an appropriate space therein and therebetween.

Housing member 41 also has a hub-like portion 41a suitably counterbored to tightly receive or have otherwise secured thereto the outer race 43a of a suitable combined radial and thrust anti-friction bearing, generally indicated at 43, whose inner race 43b is tightly fitted or otherwise secured to the lower end of the stud 33. With the housing parts 40—41 secured together, as by screws 44 (Figure 4) and assembled, after interposing therebetween certain parts about to be described the housing 40—41 is thus carried by the stud 33 for free rotation thereof about the axis of the stud itself.

The hub portion 40a of the upper housing member is provided with an aperture 40c through which the stud 33 emerges from the housing whereas the hub portion 41a of the housing member 41 is closed by a wall portion 41c adjacent the upper face of which the stud 33 terminates.

Now the outer part of the housing member 41 is provided with an annular rib 41b through which extends a series of preferably equally spaced threaded holes 45 (see also Figure 4) but the axes of these holes are inclined to the general plane in which the housing 40—41 rotates so that when the electrode elements 26, the latter being generally tubular (see Figure 3) and having their upper ends threaded, are threaded into the holes 45, the electrode elements 26 are inclined away from the direction in which they, with the housing 40—41, rotate about the stud 33, the upper ends of the electrode elements 26 therefore being the leading ends and the lower ends thereof being the trailing ends.

When the electrode elements 26 are arranged about a single circle, the diameter of the latter is preferably somewhat less than the width of the conveyor belt 15 above mentioned in connection with Figure 1.

Interposed between the housing members 40—41 (Figure 3) and non-rotatably secured to the stud 33 is a vane structure generally indicated at 46 in Figure 3, and preferably made of two parts 47 and 48, each substantially disk-like in shape. The disk part 48 is provided with a hub portion 48a secured to the stud 33 as by the taper pin 49. The coacting disk part 47 is provided with a hub portion 47a secured to the stud 33 as by the set screw 50. As better appears in Figure 3, the disk parts 47—48 are spaced apart and adequate clearances are provided between them and the respectively adjacent housing parts 40—41. Extending between the thus spaced disk parts 47 and 48 and preferably formed integrally with one of them, e. g. the part 48, is a plurality of vanes 48b shaped and positioned substantially as shown; see Figure 4. They extend in a generally radial direction but at their inner ends are curved as shown and terminate in a circle concentric with the axis of the stationary stud 33, forming a central or annular-like chamber 46a about the stud 33 (see Figure 4) closed at its upper and lower sides (see Figure 3) by the inner portions of the disk parts 47—48 and/or their hub portions 47a—48a.

To this annular chamber 46a, fluid under pressure is supplied preferably by passages or channels provided in the stud 33 itself. For this purpose, the stud 33 is tube-like throughout a substantial portion of its length, being provided with a passage 33a formed, for example, as by drilling axially of the stud 33 (in a vertical direction, as viewed in Figure 3) to a sufficient extent to carry the upper end of the channel 33a beyond the upper part of the rotatable housing member 40; at that point a horizontal passage 33b is formed as by drilling and is then tapped or threaded to receive a nipple or piece of tubing 52 which is supplied with fluid under pressure in a manner hereinafter described. The extreme lower end of the passage 33a is closed or sealed, as by a threaded plug 53 (Figure 3); and throughout that

portion of the stud 33 that is exposed to the above-mentioned annular chamber 46a, the walls of the stud 33 are provided with a suitable number of apertures 33e, whereby the fluid under pressure emerges from the channel 33a (Figure 3) into the annular chamber 46a (Figures 3 and 4) and thus expands and moves at a suitable velocity, under the guidance of the vanes 48b (Figure 4) in a generally radial direction between the disk parts 47—48 of the stationary vane structure 46, from which the still expanding fluid emerges in a general radial direction to impinge upon blades 40d carried by the rotatable housing 40—41.

The blades 40d (see Figure 3) may be integrally formed with one of the housing members, such as the member 40 and they extend between the planes of the disk-like horizontal wall portions 40—41. In horizontal section they are shaped as is better shown in Figure 4, from which it will be seen that their inner ends terminate adjacent the periphery of the stationary vane structure 46, the blades 40d extending at suitable angles or curvatures to form therebetween horizontal passages 40e closed at their outermost ends excepting for the passages 26a (Figure 3) through the electrode elements 26, through which the expanded fluid escapes. Accordingly, and illustratively, I provide as many blades 40d (see Figure 4) as there are threaded holes 45 and hence electrode elements 26, and with the shaping of the parts as above described and as is better shown in Figures 3 and 4, the housing 40—41, with its circular row of electrode elements 26, is rotated in clockwise direction, as viewed in Figure 4, at a suitable speed, illustratively 1200 R. P. M.

As is better seen from Figure 3, the passages 26a in the electrode elements 26 are nozzle-shaped, and this shape and the resultant action thereof on the finally discharged fluid, in conjunction with the inclination of the electrode elements 26 and hence of the nozzles (see Figures 3 and 4) act also to contribute toward the driving force or energy of rotation, thus supplementing the coactions and effects of the above-described stationary vanes and moving blades. But, as will be better seen when the electrical actions of the apparatus are considered, this nozzle action of the electrode elements 26 coacts also to achieve other results and advantages.

The fluid motor above described and thus embodied into the electrode means 25, is supplied with operating fluid that is preferably a dry gas under pressure, such as dried air under pressure. Accordingly, I provide a suitable air compressor 60 (Figure 1) driven in any suitable manner, illustratively by the motor 17, through suitable gearing 61. From the compressor 60 the compressed air passes through a separator 62 of any suitable construction and in that separator foreign matter and particularly moisture are removed from the air. Compressor and air conditioning apparatus may conveniently and preferably be positioned underneath the conveyor and carried by the base frame 10 of the apparatus.

Extending upwardly from separator 62 to a point adjacent electrode means 25 is rigid conduit 63. Attached to the upper end of rigid conduit 63 and extending to nipple 52 upon electrode means 25 is flexible conduit 64. Nipple 52 is connected through passages 33b, 33a and 33e to fixed vane 46. A valve 65 is provided in conduit 63 for control purposes. Due to the fact that conduits 63 and 64 are made of insulating material and the air passing through them is dry, electrode means 25 is efficiently insulated from separator 62. This makes it possible to maintain a high voltage potential upon electrode means 25 and, at the same time, maintain separator 62 at ground potential.

The length or lengths of insulating conduit employed is such that appropriate insulation, with a suitable safety factor, is achieved between the high voltage electrode structure and the other parts, such as the compressor 60 and air conditioner 62. At the same time the flexibility of conduit 64 gives adequate range of change of vertical position of the electrode means 25 to meet the varied requirements of practical use. Thus the electrode elements 26 are effectively maintained at the high potential, are caused to move at a suitable linear rate of movement above the conveyor 15, and as they move or rotate dried air is discharged in a general downward direction through the nozzles on the electrode elements.

Juxtaposed to the electrode means 25, and spaced downwardly therefrom, is a condenser plate 70 made of any suitable sheet metal. Plate 70 preferably extends horizontally and is adjustably mounted in any suitable manner relative to the base frame 10, as by the manually operable screws 71 and 72, whereby the plate 70 may be raised or lowered as desired. Plate 70, being thus mounted on the base frame 10, is at ground potential and coacts with the rotating high potential electrode 25a.

With this relation of parts, the air space or region between the plane of the lower ends of the electrode elements 26 and the plane of the product-carrying side of the belt 15 is electrically stressed and breaks down. With an appropriate spacing between the plane of the belt and the condenser plate 70, the above-mentioned region of breakdown becomes a region of corona-like discharge emanating from the discharge electrode elements 26. Because of the large number of electrode elements 26 and particularly because of the relatively high speed of movement thereof, in conjunction with the relatively high frequency of the potential applied by the transformer 28—29, this corona-like discharge is made up of such a multitude of discharge or corona-like streamers, as to give the appearance, to the naked eye, of a highly dense or solid annular-like mass of corona discharge. The products 16 are moved through this discharge by the conveyor 15 so as to be subjected to the discharge which seeks out the various possible forms of insect life in the product. Such forms of insect life have a substantially infinite permittivity and being in effect electrically conducting are thus destroyed.

Preferably complete rupture does not take place due to the fact that I maintain the air space between the products in the treatment zone and the condenser plate 70 (the two forming in effect a capacity) large enough safely to withstand the maximum voltage applied by the transformer. In a similar manner and by appropriate relative adjustment of the parts, I am enabled also to preclude puncturing of pasteboard or other wrappings or enclosures where the products undergoing treatment are packaged.

Preferably, I provide means for coacting with the moving electrode elements 26 for preventing straying of the dielectric flux and hence the discharge emanating from the electrode elements and thus make the above-mentioned region of discharge still more concentrated or more dense. Accordingly, underneath the product-carrying

side of the belt 15, I provide a support 73, preferably in the form of a metallic plate or casting spaced downwardly from the product-carrying side of the belt and supported from the side beams 23—24 in any suitable manner, as by brackets 74—74 made preferably of insulating material. Plate-like member 73 may thus be made to extend substantially parallel to the condenser plate 70, and the return side of the belt 15 may pass between these two parts.

In the member 73 I provide a series of pockets or sockets 73a preferably arranged in a circle of a diameter substantially the same as the diameter of the circle of the rotating electrode elements 26 and, for reasons about to be noted, I lessen the number of such sockets and hence of the parts which they are to receive.

Seated in each of these sockets is an electronic conduction device 75. These devices 75 are preferably made in the form of T-shaped glass or quartz tubes, the lower end of the vertical portion 75a of which is an electrode 75b suitably grounded or connected to the plate member 73. The cross-bar or upper horizontal portion 75c of each tube 75 may be of any suitable length, and may even be arcuate (see Figure 2) and if so the radius of curvature is substantially that of the circle of the sockets 73a in which the tubes 75 are mounted. When arranged as shown in Figures 1 and 2, therefore, the cross-bar portions 75c of these tubes 75 virtually abut end to end and do so in a circle commensurate in diameter with that of the rotating electrode elements 26.

The interior of the tubes 75 is filled with a suitable gas at appropriate pressure such as, for example, neon at a pressure of five or six millimeters and, being positioned in the highly stressed dielectric field between the metallic electrode structure 25 and the condenser plate 70, the tubes 75 become conductive, their gaseous contents becoming ionized and breaking down under this stress. The conductive gaseous content, due to the configuration of the tubes 75, and particularly immediately underneath that portion of the belt 15 that is in the treatment zone, is given the effective shape of a substantially continuous or uninterrupted circle (see Figure 2) coaxial with and directly juxtaposed to the circle of rotating electrode 25a.

Accordingly, the above described annulus of discharge of corona streamers, otherwise tending to stray or spread out as it impinges upon the belt 15, is concentrated by this circular shape of the effective portions of the conduction tubes 75 and is caused to be directed toward and confined within the effective circle of the tubes 75. This counteracts the tendency to stray or spread out and thus insures highly concentrated and uniform action throughout the mass or thickness of the products to be sterilized. With the tubes 75 thus in action, complete rupture or breakdown of the capacity circuit of the transformer 28—29 may be prevented by the effect of the parts 70 and 73 which, by appropriate adjustment of the part 70, form an air condenser whose proportions are such that breakdown therebetween at the maximum voltage of the transformer does not take place.

A circular aperture 22a is provided in plate 22 directly below and the same size as electrode 25a. Fitted in this aperture, and having its upper face flush with the upper face of plate 22, is a quartz disc 76. Quartz disc 76 acts as a support means for the portion of belt 15 which is under electrode 25a. The use of quartz disc 76 reduces the stress upon tubes 75 and they may, therefore, be made of glass.

During operation, electrode elements 26 are continually cooled by the dried air passing from the driving motor. This cooling prevents deterioration of electrode elements 26, and specifically prevents particles of metal from flying from the tips thereof. At the same time, the treatment zone below the ends of the electrode elements 26 is kept free from small particles of material, such as metal, by the passage of the air. This avoids any possibility of an arc which might be caused by a particle of metal remaining within the treatment zone.

Should any adjustments be necessary for any reasons, such adjustments may readily be made. For example, if it is desired to raise or lower the electrode means 25, the adjustable connection of the supporting beam structure 35 to the frame extensions 11a and 12a is appropriately manipulated or set. This will raise or lower the fluid motor with its electrode elements 26, the flexible conduit section 64 permitting freedom of such change in position of the structure 25—26, while maintaining dependable electrical isolation of the fluid motor and electrode elements from the other parts of the apparatus. Also, the raising or lowering of the condenser plate 70 may be readily achieved. Either of these adjustments or both in conjunction with each other may be utilized to accommodate the apparatus to various electrical and mechanical requirements or conditions as well as to the particular characteristics of the material or product undergoing sterilization.

Furthermore, the apparatus will be seen to be mechanically and electrically simple, compact and reliable in action. The fluid motor, for example, is of simple and dependable construction, is of a character such that it does not easily get out of running order, and is in these and other respects well adapted for coaction with the other parts of the apparatus. Moreover, it will be seen that insulation difficulties are dependably and inexpensively overcome, without sacrifice of dependability and efficiency of sterilizing action. And it will thus be seen that there has been provided in this invention an apparatus in which the objects hereinbefore noted together with many thoroughly practical advantages are successfully achieved.

As many possible embodiments may be made of the mechanical features of the above invention, and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawings, is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In electrical treating apparatus, in combination, an electric discharge circuit comprising a source of suitable potential, spaced means between which electric discharge takes place, one of said means comprising electrode means connected to the high potential side of said source, and condenser means incapable of breakdown at the voltage of said source, said high potential means being mounted to move along a certain path, fluid-driven motive means operable by a non-conductive fluid for moving said movable electrode means, means for supplying non-conductive operating fluid to said motive means, and means including solid dielectric conduit means

connecting said fluid-supplying means to said fluid-driven motive means.

2. An apparatus like that of claim 1 in which the means for supplying operating fluid is a means providing air under pressure, there being moisture-removing means interposed between the fluid supplying means and the fluid-driven motive means.

3. An apparatus like that of claim 1 in which the means for supplying operating fluid is a pump for maintaining the fluid under pressure.

4. An apparatus like that of claim 1 in which the means for supplying operating fluid is a pump, there being an electric motor driving said pump, said motor and its circuit of energy supply being insulated from said high potential electrode by said solid dielectric conduit means and the fluid passing therethrough.

5. An apparatus like that of claim 1 in which the means for supplying operating fluid is a driven air pump, there being a cleansing and moisture-removing means interposed between the pump and said fluid-driven motive means.

6. In electrical treating apparatus, in combination, an electric discharge circuit comprising a source of suitable potential, spaced electrode means between which electric discharge takes place, one of said spaced electrode means comprising a rotatable support having a vented electrode element directed toward the other spaced electrode means, and an air motor related to said rotatable support for rotating the latter, said air motor exhausting through said vented electrode element.

7. In an electrical treating apparatus, in combination, an electrical discharge circuit comprising a source of potential and spaced electrode means between which discharge takes place, and means for carrying material to be treated between the electrodes in the path of the discharge, in which one of said electrode means comprises an insulating support member, a movable electrode, fluid pressure motor means supported from the insulating support and connected to the movable electrode to drive the same, and conduit means for supplying non-conductive fluid under pressure to said motor means and comprising a substantial length of solid dielectric conduit whereby said motor means may be kept at the potential of the electrode.

8. In an electrical treating apparatus, in combination, an electrical discharge circuit comprising a source of potential and spaced electrode means between which discharge takes place, and means for carrying material to be treated between the electrodes in the path of the discharge, in which one of said electrode means comprises a movable carrier having electrode elements projecting therefrom for concentrating the discharge, fluid-pressure motor means comprising a stationary element and a driven element to which the carrier is connected, and exhaust connections from said fluid-pressure motor means to exhaust a blast of fluid into the discharge space.

9. In an electrical treating apparatus, in combination, an electrical discharge circuit comprising a source of potential and spaced electrode means between which discharge takes place, and means for carrying material to be treated between the electrodes in the path of the discharge, in which one of said electrode means comprises a movable carrier having electrode elements projecting therefrom, each of said electrode elements having a tubular passage extending longitudinally therethrough from the interior of the carrier to the tip thereof, fluid pressure motor means within and adapted to drive said carrier and exhausting into said passages whereby the exhaust fluid discharges from the tips of the electrode elements into the discharge space.

10. In an electrical treating apparatus, in combination, an electrical discharge circuit comprising a source of potential and spaced electrode means between which discharge takes place, and means for carrying material to be treated between the electrodes in the path of the discharge, in which one of said electrode means comprises a rotatable carrier having electrode elements projecting therefrom for concentrating the discharge, said elements having longitudinal passages therethrough, fluid jet means on which the carrier is rotatably mounted and a turbine-like rotor integrally connected to the carrier and having spaced vanes adapted to cooperate with the jets to utilize the fluid pressure for rotation of the carrier, and said vanes forming channels which at their ends communicate with said passages in the electrode elements, whereby fluid from between the vanes is exhausted through said electrode elements into the discharge space.

11. An apparatus like that of claim 6 in which there is a source of air under pressure connected to said air motor through non-conductive conduit means.

12. In electrical treating apparatus, in combination, an electric discharge circuit comprising a source of suitable potential, spaced means between which electric discharge takes place and between which a product to be treated is subjected to said discharge, means for holding a product in the space between said spaced means thereby to be subjected to said discharge, one of said spaced means comprising discharge electrode means, and means directing a blast of air into the discharge region to deionize the air therein or to displace ionized air.

13. An apparatus like that of claim 12 in which the air blast means includes a source of air under pressure, and orifice means associated with the discharge electrode means for discharging air from said air source.

14. An apparatus like that of claim 12 in which the air blast means includes an air turbine for effecting movement of the discharge electrode means, the air expended in said turbine being directed through said air blast means.

15. In electrical treating apparatus, in combination, a source of high potential, capacity-forming means connected thereto and including a movable electrode structure and means juxtaposed thereto for coaction therewith for producing an electric discharge, means for subjecting a product to be treated to said discharge, said electrode structure having a tube-like discharge electrode, and means for causing an air current to flow therethrough.

16. In electrical treating apparatus, in combination, a source of high potential, capacity-forming means connected thereto and including a movable electrode structure and means juxtaposed thereto for coaction therewith for producing an electric discharge, means for subjecting a product to be treated to said discharge, said electrode structure having a discharge electrode with an aperture therein, and means causing the flow of air current out of said aperture.

17. An electrical treating apparatus comprising an electrical circuit including a source of potential and spaced electrode means between

which discharge takes place and means for carrying material to be treated between the electrodes in the path of the discharge, which is characterized by one of said electrode means comprising projecting electrode elements having longitudinal passages therethrough for passage of fluid and means for passing a stream of fluid through said electrodes whereby to carry ionized air from the discharge space.

18. In an electrical treating apparatus, in combination, an electrical discharge circuit comprising a source of potential and spaced electrode means between which discharge takes place, and means for carrying material to be treated between the electrodes in the path of the discharge, in which one of said electrode means comprises electrode elements movable in a predetermined path, and another of said electrode means comprises electronic conduction tubes serving as electrode elements, said tubes extending in a direction substantially at right angles to the path of movement of said movable electrode elements, but there being portions upon the ends of said tubes which extend in a direction substantially parallel to said path.

19. In electrical treating apparatus, in combination, means for holding a product to be treated, electrode means spaced to one side of said first-mentioned means, T-shaped electronic conduction means on the other side of said first-mentioned means, a source of relatively high potential, and means for completing a circuit including said electrode means and said electronic conduction means and including means forming an electrical capacity.

20. An apparatus like that of claim 19 in which the electrode means is effective throughout a region juxtaposed to the cross-bar of the T-shaped electronic conduction means.

21. An apparatus like that of claim 19 in which the electrode means is movable along a certain path, means for so moving said electrode means, said T-shaped electronic conduction means having their horizontal portions alined in juxtaposition to and substantially parallel to the path of movement of said electrode means.

22. An apparatus like that of claim 19 in which the electrode means is rotatable, means is provided for rotating said electrode means, and said T-shaped conduction means are in sufficient number and with their top portions alined to form substantially a circle commensurate with the circle defined by the rotating electrode means.

23. The method of treating materials by electrical discharges which comprises producing an electric discharge by a pulsating potential, subjecting a product to be treated to said electric discharge, and deionizing air in the discharge space by an air blast directed into the latter, thereby displacing ionized air to effect discharge at a higher point in the instantaneous voltage characteristic upon the succeeding pulsation.

24. In electrical treating apparatus, in combination, a source of high potential, capacity-forming means connected thereto and including a movable electrode structure and means juxtaposed thereto for coaction therewith for producing an electric discharge within a treatment zone, means for moving a product through said treatment zone, said electrode structure having a tube-like discharge electrode, and means for causing an air current to flow therethrough.

25. In electrical treating apparatus, in combination, a source of high potential, capacity-forming means connected thereto and including a movable electrode structure and means juxtaposed thereto for coaction therewith for producing an electric discharge within a treatment zone, means for moving a product through said treatment zone, said electrode structure having a discharge electrode with an aperture therein, and means causing the flow of air current out of said aperture.

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