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APPARATUS FOR STERILIZING CONTAINER PARTS

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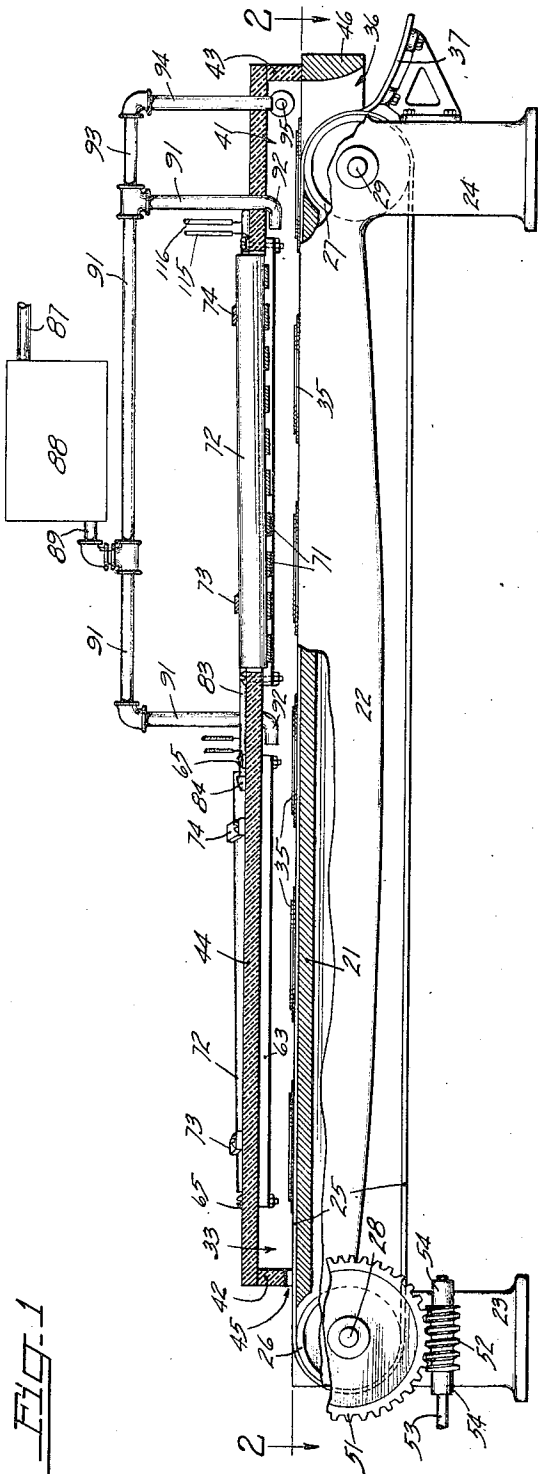
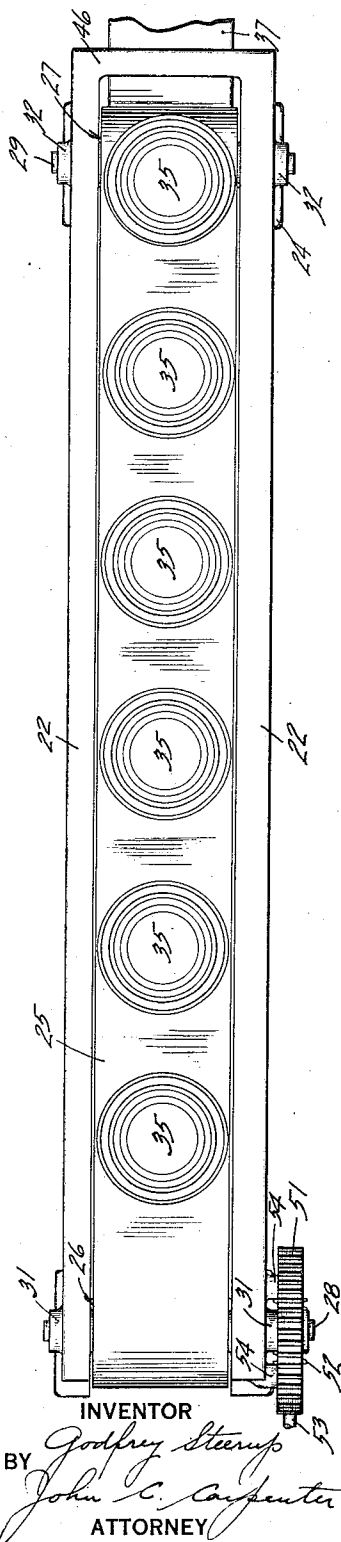


FIG. 2



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APPARATUS FOR STERILIZING
CONTAINER PARTS

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20 Claims. (Cl. 250—34)

The present invention relates to an apparatus for electrically sterilizing container parts and has more particular reference to such an improved apparatus utilizing an improved form of electrical arc having increased penetrating and bactericidal characteristics. The apparatus disclosed as an embodiment of the present invention is an improvement upon the apparatus of my Patent No. 1,958,449, issued May 15, 1934 for Apparatus for sterilizing container parts, which was filed in the United States Patent Office, September 8th, 1930.

The principal object of the present invention is the provision of an improved apparatus for automatically subjecting objects, such as container parts, to the influence of electrical disruptive discharges possessing highly accentuated bactericidal characteristics and utilizing such discharges for sterilizing treatment.

An important object of the invention is the provision of an apparatus for effecting a new form of electrical discharge which is first manifested at one end of a restricted zone and which then spreads over a considerable area permitting increased bombardment of electrical discharges on container parts being sterilized.

An important object of the invention is the provision, in an electrical sterilizing apparatus, of improved leakage paths for electrical discharges which are of different lengths and which provide varying limits in the resulting arcs.

The invention contemplates the maintenance of favorable arcing conditions in an apparatus which continually and automatically treats container parts by subjecting them to the bactericidal action of improved sterilizing electrical discharges of increased intensity having highly penetrating light rays and short wave lengths of the ultra violet region and even short wave lengths approaching the X-ray region.

A further important object of the invention is the provision of an apparatus of the character described, wherein a series of electrical discharges are created which are manifested in definite succession and throughout various zones within the sterilizing apparatus.

Numerous other objects of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a side elevation, partly broken away of an improved sterilizing apparatus exemplifying the present invention;

Fig. 2 is a plan of the lower part of the apparatus, as viewed substantially along the line 2—2 in Fig. 1;

Fig. 3 is a top plan view of the apparatus partly broken away, together with a wiring diagram embodying the electrical circuits used therewith;

Fig. 4 is an enlarged transverse sectional detail taken substantially along the line 4—4 in Fig. 3; and

Fig. 5 is a view similar to Fig. 4, taken substantially along the line 5—5 in Fig. 3.

The apparatus disclosed in the drawings, comprises a continuously moving conveyor for advancing a container part or similar object, herein illustrated as a container cover, beneath two pairs of spaced electrodes located in a sterilizing chamber and connected in suitable electrical circuits for producing electrical arcs. Associated members of each pair of electrodes are arranged at an angle to each other and provide arcing zones of varying lengths wherein electrical discharges between the electrodes begin as short length arcs and successively increase in length as they travel throughout the longitudinal extent of the electrodes. This produces arcs or sparks of increased spacial limits and of improved bactericidal characteristics which impinge upon the container covers passing beneath upon the moving conveyor and sterilization of these covers results.

Provision is made for forming leakage paths of moisture vapor between the electrodes which produce electrical discharges of intense eruptive quality. These discharges are further spread out or increased in spacial limits by the use of sterile air projected across the leakage paths. The resulting discharges possess highly accentuated penetration characteristics of great value in sterilizing operations.

The electrodes are connected in an electrical transformer circuit, the secondary of which is used to obtain the proper succession of electrical disruptive discharges. A circuit transfer device is also utilized in the secondary circuit to feed electrical energy to the different electrode units. The proper amount of moisture for the leakage paths is automatically and constantly applied to compensate for evaporation and other forms of dispersions of the moisture caused by the arcing operations. The container parts after passing through the sterilizing chamber of the apparatus are discharged in sterile condition, the discharge opening of the apparatus being constantly swept clear of any contaminating bac-

teria by heated and filtered or sterile air issuing with the sterilized container parts. Such container parts may then be used for the packaging of food products or for other purposes.

5 The apparatus disclosed in the drawings as a preferred form, comprises a horizontal bed 21 having supporting side walls 22 and carried on legs 23, 24. A conveyor, comprising an endless belt 25, moves over pulleys 26, 27 carried on respective shafts 28, 29 journaled in bearings 31, 32 formed in the legs 23, 24.

10 The upper run of the belt 25 passes over the upper surface of the table 21 and within a sterilizing chamber 33. This conveyor advances container parts, herein illustrated as can ends or covers 35, along its upper run and from pulley 26 to pulley 27. After passing over the pulley 27, the cover falls through a discharge opening 36, where it may be suitably conveyed out of the machine, a bracket 37 carried by the leg 24 being used to suggest subsequent handling of the sterile cover.

15 The sterilizing chamber 33 is enclosed between side walls 41 (Fig. 1) and end walls 42, 43. The conveyor 25 provides the floor or lower part of the chamber 33, the top of the chamber being closed by a cover plate 44 (Figs. 1 and 3). The walls 41, 42, 43 and top plate 44 are of insulating material preferably sheet asbestos. The walls 30 41 rest directly upon the side walls 22 and support the top plate 44. Wall 42 rests on the side walls 22 and is cut away along its lower edge to provide a clearance opening 45 through which the container parts 35 are introduced into the sterilizing chamber. The wall 43 rests upon a connecting transverse wall 46 formed integrally with the side walls 22.

35 The conveyor belt 25 is continually moved by rotation of the pulley 26 and its shaft 28, the latter (Figs. 1, 2 and 3) carrying a worm gear 51 for this purpose. The gear 51 meshes with a worm 52 formed on a horizontal drive shaft 53 journaled in bearings 54 carried by the leg 23. This shaft 53 may be driven in any suitable manner whereby the pulley 26 is rotated and the upper run of the belt 25 caused to advance through the sterilizing chamber.

40 In the drawings, there are disclosed two sets or pairs of electrodes, one set or pair being disposed beneath an opening 61 cut through the cover plate 44, the other set being similarly located adjacent an opening 62, also cut through the cover plate. The openings 61, 62 are located adjacent opposite sides of the apparatus and the 45 electrode sets are similarly located, this staggered condition providing sterilization for relatively large sized container covers 35 with minimum sized electrode units.

50 The electrical discharges which take place between the pairs of electrodes are thus confined to different areas of the sterilizing chamber and the container parts 35 moving with the conveyor 25 through the chamber are subjected to the bombardment of the electrical discharges 55 throughout different zones of their exposed area, the combined results of sterilizing operation covering the full surface of the container covers.

60 The electrodes of each set comprise spaced bars 63, 64 (Figs. 3, 4 and 5) which are carried on the under side of the cover plate 44, being secured in position by screws 65. The inner face of the electrode 63 of each set, indicated by the numeral 66, is disposed non-parallel or at an angle to the opposed inner face 67 of the electrode 64. There is, therefore, a relatively small 65

space of distance between the electrode faces 66, 67 at one end thereof and a greater space or distance between these faces at the opposite end. This difference will be clearly seen by a comparison between Figs. 4 and 5 and is for a purpose hereinafter more fully described. 5

A series of bridging members 71 are associated with each electrode set, being positioned within the opening 61 or the opening 62 as the case may be. These bridges are preferably of sheet mica or other suitable insulating material. The bridge members of each electrode unit are disposed alongside one another and spaced apart, as illustrated in Fig. 3, the bridge members resting upon the upper surfaces of the electrodes 15 63, 64 and spanning the spaces between their adjacent faces 66, 67.

The effective bridging function of each member 71 depends upon the space or distance between the faces 66, 67 at that position on the 20 electrodes and, therefore, the bridge member adjacent the narrow space (Fig. 4) is relatively short. The next adjacent bridge is longer and succeeding bridge lengths increase up to the maximum (Fig. 5) opposite the widest space. 25 These bridging members are utilized in starting and continuing the electrical discharges between the electrodes of each unit.

A moisture distributing member 72 is provided for each pair of electrodes 63, 64 and is longitudinally disposed thereof and within the slot 30 61 or the slot 62 as the case may be. This member 72 is preferably of heat resisting glass such as pyrex and engages and rests upon all of the bridging members 71 associated with the particular electrode set to which it is related. Holding 35 straps 73, 74 secured to the top plate 44 by screws 75, 76, press the bar 72 downwardly against the bridging members so that one end of the bar (the end adjacent the wide space 40 between the electrode faces 66, 67) is disposed below the upper surface of the electrodes as illustrated in Fig. 5, the other bridging members being correspondingly depressed in varying degrees. This places the longitudinal axis of the 45 members 72 at a slight angle to the line of travel of the conveyor belt 25 and the can covers 35.

A moisture spray for supplying a film of moisture to each of the members 72 is provided, the moisture being preferably applied along one side 50 of the bar. Capillary action and gravity causes the moisture to pass on to the several bridging members 71. This moisture provides an electrical leakage path for electrical discharges which pass between the electrodes 63, 64, as will be 55 hereinafter fully described.

The moisture spray referred to may be water or other suitable liquid which is preferably atomized by suitable air mixture. For this purpose there is provided a water and air line 81 (Fig. 60 3) leading into a pipe T 82 with which service pipes 83 are joined. Each pipe 83 terminates in an atomizing nozzle 84 located alongside and at one end of the member 72. This nozzle 84 is preferably located at the higher end of the 65 bar 72, this being the end adjacent the short space between the electrode faces. Under the action of the air and water, a fine spray or mist is thus projected against each glass bar 72 along which it flows under both capillary action and gravity throughout the entire length, distributing the moisture on the bridge members 71, as previously described.

Provision is made for introducing filtered air 75

into the apparatus for the combined purposes of maintaining sterile conditions in the sterilizing chamber and for accentuating the electrical discharges so as to produce improved arcs having increased bactericidal characteristics. This air may be received under sufficient pressure to cause it to flow freely from any suitable source of supply and through a supply pipe 87 which passes it through a filter box 88 and thence through a pipe 89 into lateral lead pipes 91, connecting with discharge nozzles 92.

Each nozzle 92 is preferably disposed adjacent the narrow space ends of the electrodes 63, 64, the air in issuing from the nozzle being projected longitudinally along the space and between the electrode walls 66, 67. The air thus flows laterally across the bridge members 71 and affects the arcs passing along the bridge leakage paths and between the electrodes by spreading out or increasing the spacial limits thereof.

An auxiliary pipe 93 is connected to one of the pipes 91 and terminates in a vertical discharge pipe 94 projecting through the plate 44 and into the sterilizing chamber 33 adjacent its discharge end. The sterile air passing from the discharge pipe 94 is preferably heated to further increase its sterilizing action in sweeping out the discharge opening 36 and in further preventing the entrance of unfiltered air. For this purpose a glow bar element 95 (Figs. 1 and 3) of suitable construction is carried in one of the side walls 41 of the sterilizing chamber and projects across and above the discharge opening 36 and directly beneath the end of the pipe 94. This bar 95 is in a suitable electrical heating circuit as will be pointed out in connection with the description of the wiring of the apparatus which follows.

Electrical energy for providing the proper disruptive discharges in the sterilizing apparatus may be produced in any suitable manner, as by a generator 100 (Fig. 3) indicated in diagram in that figure. Generator 100 supplies electric current to a transformer 101, the primary circuit including a wire 102 leading from one side of the generator and connecting, through a service switch 103, with a primary winding 104 of the transformer, a wire 105 leading back to the opposite side of the generator. The secondary winding of the transformer, designated by the numeral 106, is connected with a wire 107 which leads to a brush 108 operating in connection with a circuit interrupter and transfer device for supplying current alternately to the two electrode sets or units.

This transfer device, indicated generally by the numeral 109, may be of any suitable construction to provide timed alternations in the circuit flowing from the secondary side of the transformer. A rotating element 111 thereof comprises a continuous disc and an interrupted disc as is commonly used in devices of this character, the brush 108 maintaining continuous engagement with the continuous disc. Electrical contact brushes 112, 113 connecting with wires 114, 115 are alternately engaged by the interrupted disc and current flowing through the wire 107 is lead first into the wire 114 and then into the wire 115.

Wires 114, 115 are connected to the end of one electrode 64 in the different electrode sets. One end of the electrode 63 of each set is connected by a wire 116 to a wire 117 leading back to the opposite end of the secondary winding 106 of the transformer 101. This arrangement provides a

series of alternative electrical surges first in one electrode set and then in the other.

The space between the electrodes 63, 64 of a set is too great to permit an air jump electrical discharge and no discharge takes place until the proper moisture collects on the bridge members 71 to provide the desired leakage paths. When this is done electrical current passes between the electrodes of a set in a disruptive discharge, first along the shortest leakage path, which is the bridge member 71 adjacent the narrow end space. This electrical discharge vaporizes or otherwise dissipates the moisture on that bridge and the adjacent bridging member thereupon forms the leakage path for the next succeeding disruptive discharge. This continues until all of the leakage paths, provided by the bridging members 71, have been utilized and traversed by electrical discharges. By that time moisture has again collected in the shorter bridges and the action is repeated. The result is a succession of electrical discharges traversing the entire length of the electrodes. It will be understood that this discharge succession is very rapid and occurs in a very short period of time and that practically a continuous arcing effect is produced. While the action of the different electrode units is alternative, this action is so rapid as to appear simultaneous.

The sparks or arcs so produced are accentuated by the blasts of air issuing from the nozzles 92, as previously described and this spreads the individual energy in the sterilizing chamber. These arcs or sparks have greatly improved bactericidal characteristics of a highly accentuated character. Having such increased spacial limits they are peculiarly effective for sterilization, being composed of swiftly moving or high velocity streams of electrons with increased quantities of effective energy and high actinic light rays of different wave lengths. Furthermore, they are not attended with the intense heat ordinarily present in an electrical spark or arc.

The container parts 35 during their passage through the sterilizing chamber 33, are passed through the effective zones of energy and are subjected to a great number of electrical bombardments. All of the exposed surfaces of the container parts are thus sterilized and are discharged from the apparatus in that condition after which they may be further handled as desired.

The glow bar 95 may be suitably connected to the generator circuit of the apparatus. As disclosed in Fig. 3, this may be done by utilizing connecting wires 118, 119 leading from the generator 100 and connected electrically with the glow bar.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. A sterilizing apparatus, comprising in combination, a pair of elongated, coextensive electrodes arranged at an angle to each other and in the same plane, an electrical circuit including said electrodes, means for creating leakage paths between said electrodes, and a circuit breaker in said circuit, whereby a succession of

electrical discharges are passed along said leakage paths beginning at the proximate ends of said electrodes and advancing toward the opposite ends.

2. A sterilizing apparatus, comprising in combination, a pair of elongated, coextensive electrodes arranged at an angle to each other and in the same plane, an electrical circuit including said electrodes, means for interposing moisture vapor and thereby creating leakage paths between said electrodes, and means for interrupting said circuit and causing a succession of electrical discharges to pass along said moisture vapor leakage paths beginning at the proximate ends of said electrodes and advancing toward the opposite ends.

3. A sterilizing apparatus, comprising in combination, a pair of elongated, coextensive electrodes arranged at an angle to each other and in the same plane, an electrical circuit including said electrodes, means for creating leakage paths between said electrodes, means in said circuit for closing and opening the same, whereby a succession of electrical discharges are passed along said leakage paths beginning at the proximate ends of said electrodes and advancing toward the opposite ends, and means for laterally spreading the arcs of said electrical discharges.

4. A sterilizing apparatus, comprising in combination, a pair of elongated coextensive electrodes arranged at an angle to each other and in the same plane, an electrical circuit including said electrodes, means for creating leakage paths between said electrodes, means in said circuit for closing and opening the same, whereby a succession of electrical discharges are passed along said leakage paths beginning at the proximate ends of said electrodes and advancing toward the opposite ends, and means for projecting a stream of air against the arcs of said electrical discharges to increase their spacial limits.

5. A sterilizing apparatus, comprising in combination, a pair of elongated, coextensive electrodes arranged at an angle to each other and in the same plane, an electrical circuit including said electrodes, a series of spaced, insulated bridge members connecting said electrodes, means for creating leakage paths along said bridge members, and means in said circuit for closing and opening the same, whereby successive electrical discharges are passed consecutively along adjacent leakage paths beginning with the bridge members at the proximate ends of said electrodes.

6. A sterilizing apparatus, comprising in combination, a pair of elongated, coextensive electrodes arranged at an angle to each other and in the same plane, an electrical circuit including said electrodes, a series of spaced, insulated bridge members connecting said electrodes, means for applying moisture to said bridge members and creating moisture vapor leakage paths therealong, and means in said circuit for opening and closing the same, whereby electrical discharges are successively passed between said electrodes and along said leakage paths.

7. A sterilizing apparatus, comprising in combination, a pair of elongated, coextensive electrodes arranged at an angle to each other and in the same plane, an electrical circuit including said electrodes, a series of spaced, mica bridge members connecting said electrodes, means for applying moisture to said bridge members and creating moisture vapor leakage paths therealong, and means in said circuit for closing and

opening the same, whereby electrical discharges are successively passed between said electrodes and along said leakage paths.

8. An apparatus for sterilizing container parts, comprising in combination, a conveyor for advancing the container parts, a pair of elongated spaced electrodes mounted adjacent the path of travel of said container parts, an electrical circuit including said electrodes, the opposed faces of said electrodes being relatively near at one of their ends and spreading to a greater distance at the opposite ends, and means for creating leakage paths between said electrodes whereby electrical energy passes from one electrode to the other beginning at their proximate ends and spreading along the lengths of said electrodes to the opposite ends, the arcs produced therein impinging on said container parts as they are carried adjacent.

9. An apparatus for sterilizing container parts, comprising in combination, a conveyor for advancing the container parts, a pair of elongated spaced electrodes mounted adjacent the path of travel of said container parts, an electrical circuit including said electrodes, the opposed faces of said electrodes being relatively near at one of their ends and spreading to a greater distance at the opposite ends, and means for providing moisture vapor between said electrodes to produce leakage paths, whereby electrical energy passes from one electrode to the other beginning at their proximate ends and spreading along the lengths of said electrodes to the opposite ends, the arcs produced therein impinging on said container parts as they are carried adjacent.

10. A sterilizing apparatus, comprising in combination, a conveyor for advancing the container parts, a plurality of pairs of elongated, coextensive electrodes, a member of each pair arranged at an angle to its associated member and in the same plane, each pair of the electrodes being connected in an electrical circuit and positioned above the said conveyor with alternate pairs of electrodes staggered so as to cover different areas of said container parts as they move beneath, means for providing leakage paths between the electrodes, and means for causing electrical discharges to alternately pass between associated electrodes of each pair of electrodes and to alternately impinge on those exposed portions of said passing container parts in the zone of said discharges.

11. An apparatus for sterilizing container parts, comprising in combination, a sterilizing chamber, a conveyor for advancing the container parts through the sterilizing chamber, spaced electrodes connected in a transformer secondary circuit and mounted in said chamber adjacent the path of said container parts, means for creating leakage paths between said electrodes, and means including electric current producing means and a circuit breaker in the said secondary transformer circuit for closing and opening said circuit, whereby a succession of electrical discharges are passed along said leakage paths and between said electrodes to impinge on said passing container parts in said chamber to sterilize the same.

12. An apparatus for sterilizing container parts, comprising in combination, a sterilizing chamber, a conveyor for advancing the container parts through the sterilizing chamber and out of a discharge end thereof, spaced electrodes connected in an electrical circuit and mounted in said chamber adjacent the path of said container

parts, means in said circuit for closing and opening the same, whereby a succession of electrical discharges are passed between said electrodes to impinge on said passing container parts in said chamber to sterilize the same, and means for supplying a sterile medium in said chamber and for sweeping it out through said discharge end to prevent contamination of the sterilized container parts during their discharge.

13. An apparatus for sterilizing container parts, comprising in combination with a sterilizing chamber, a conveyor for advancing the container parts through said sterilizing chamber and out of a discharge end thereof, spaced electrodes connected in an electrical circuit and mounted in said chamber adjacent the path of said container parts, means for causing an electric current in said circuit and a succession of electrical discharges to pass between said electrodes and to impinge on said passing container parts in said chamber to sterilize the same, means for supplying a sterile medium in said chamber and for sweeping it out through said discharge end to prevent contamination of the sterilized container parts during their discharge, and means for heating said sterile medium.

14. A sterilizing apparatus, comprising in combination, a pair of spaced, elongated, coextensive electrodes arranged in the same plane and connected in an electrical circuit, a plurality of spaced, insulated bridge members connecting said electrodes, a moisture distributing member resting on said bridge members and extending longitudinally of said electrodes, means for supplying moisture to said distributing member and thence to said bridge members thus providing leakage paths between said electrodes, and means in said circuit for closing and opening the same, whereby electrical discharges are passed along said leakage paths and between said electrodes.

15. A sterilizing apparatus, comprising in combination, a pair of elongated, coextensive electrodes arranged at an angle to each other and in the same plane and connected in an electrical circuit, a plurality of spaced, insulated bridge members connecting said electrodes, the effective length of the bridge members varying as the adjacent space between the electrodes, a moisture distributing member resting on said bridge members and extending longitudinally of said electrodes, means for supplying moisture to said distributing member and thence to said bridge members thus providing leakage paths of different lengths between said electrodes, and means in said circuit for closing and opening the same, whereby electrical discharges are passed along said leakage paths and between said electrodes beginning with the short leakage paths and passing consecutively to the longer paths.

16. A sterilizing apparatus, comprising in combination, a pair of elongated coextensive electrodes arranged at an angle to each other and in the same plane, circuit opening and closing means, a circuit including said electrodes and means, means operatively associated with said electrodes for creating leakage paths therebe-

tween, said circuit upon closure and opening thereof by the circuit opening and closing means causing a succession of electrical discharges to be passed along said leakage paths beginning at the proximate ends of said electrodes and advancing toward the opposite ends.

17. An apparatus for electrically sterilizing articles, comprising in combination, a sterilizing chamber, means for presenting articles to be sterilized to said chamber, an electrical circuit, a set of electrodes in said chamber and included in said circuit, means for supplying an electric current to said circuit, vapor means for establishing a leakage path between said electrodes, said electrodes, electric circuit and vapor means cooperating to set up a succession of electric disruptive discharges of high bactericidal effect about said presented articles to thoroughly sterilize the same.

18. An apparatus for electrically sterilizing articles, comprising in combination, a sterilizing chamber, means for presenting articles to be sterilized to said chamber, an electrical circuit, a set of electrodes in said chamber and included in said circuit, means for supplying an electric current to said circuit, moisture means for establishing a leakage path between said electrodes, said electrodes, electric circuit and moisture means cooperating to set up a succession of electric disruptive discharges producing arcs of highly penetrating bactericidal light rays about said presented articles to thoroughly sterilize the same.

19. An apparatus for electrically sterilizing articles, comprising in combination, a sterilizing chamber, means for presenting articles to be sterilized to said chamber, an electrical circuit, a set of electrodes in said chamber and included in said circuit, means for supplying an electric current to said circuit, moisture and air supplying means for establishing a leakage path between said electrodes, said electrodes, electric circuit and moisture and air supplying means cooperating to set up a succession of electric disruptive discharges producing arcs of extended spacial limits which emit highly penetrating bactericidal light rays about said presented articles to thoroughly sterilize the same.

20. A sterilizing apparatus, comprising in combination, a conveyor for advancing the container parts, a plurality of pairs of elongated, coextensive electrodes, a member of each pair arranged at an angle to its associated member and in the same plane, the electrodes of each pair being connected in an electrical circuit and positioned above the said conveyor with alternate pairs of electrodes staggered so as to cover different areas of said container parts as they move beneath, means for providing leakage paths between the electrodes, means for causing electric currents in said circuits, and means for making and breaking said circuits and causing electrical discharges to pass between associated electrodes and to impinge on those exposed portions of said passing container parts in the zone of said discharges.

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