June 5, 1934. O. J. MOEHLER 1,961,700

APPARATUS FOR STERILIZING ARTICLES BY ULTRAVIOLET RADIATION

Filed July 29, 1932 2 Sheets-Sheet 1

Fig. 1

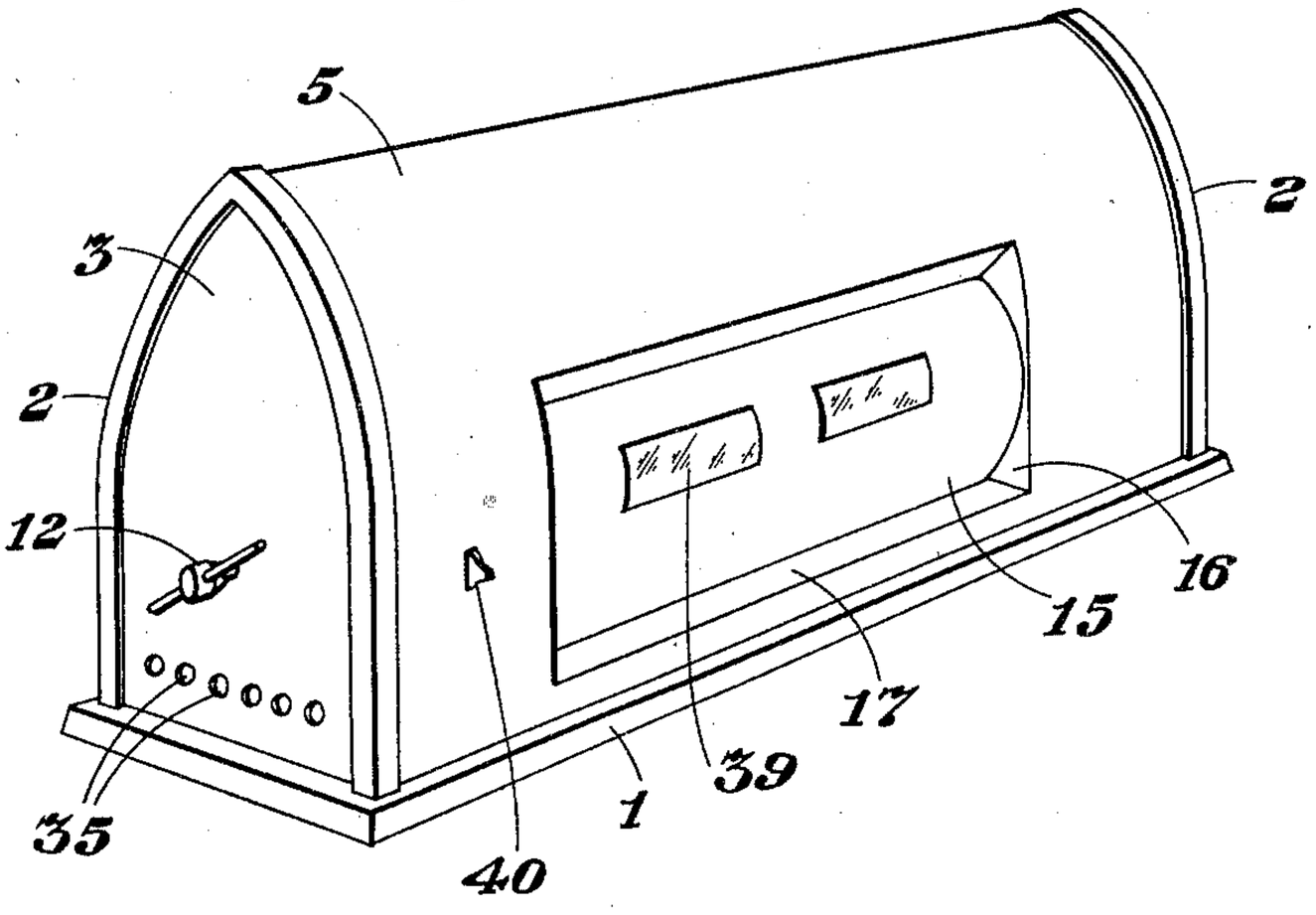

Fig. 2

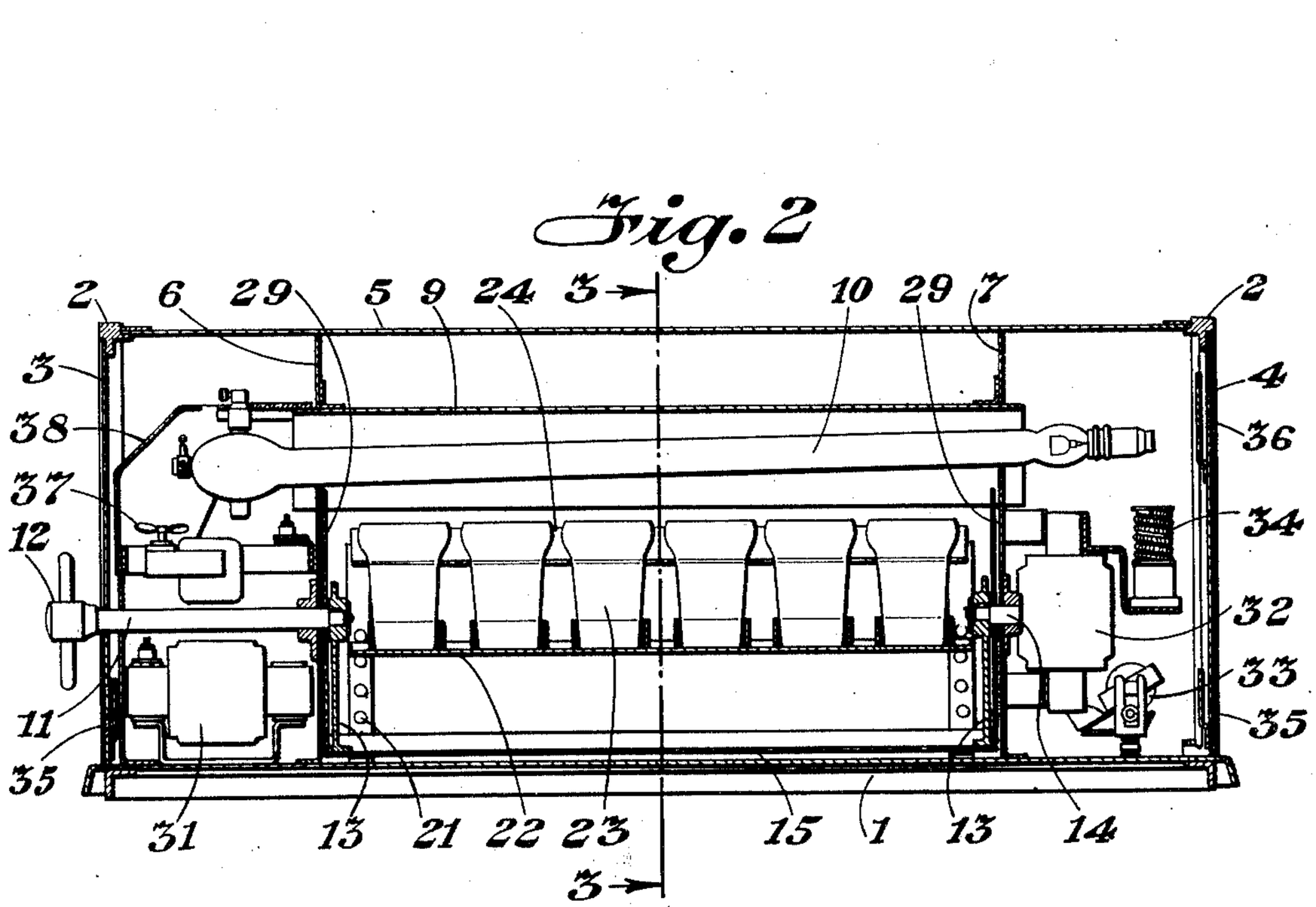

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Fig. 4

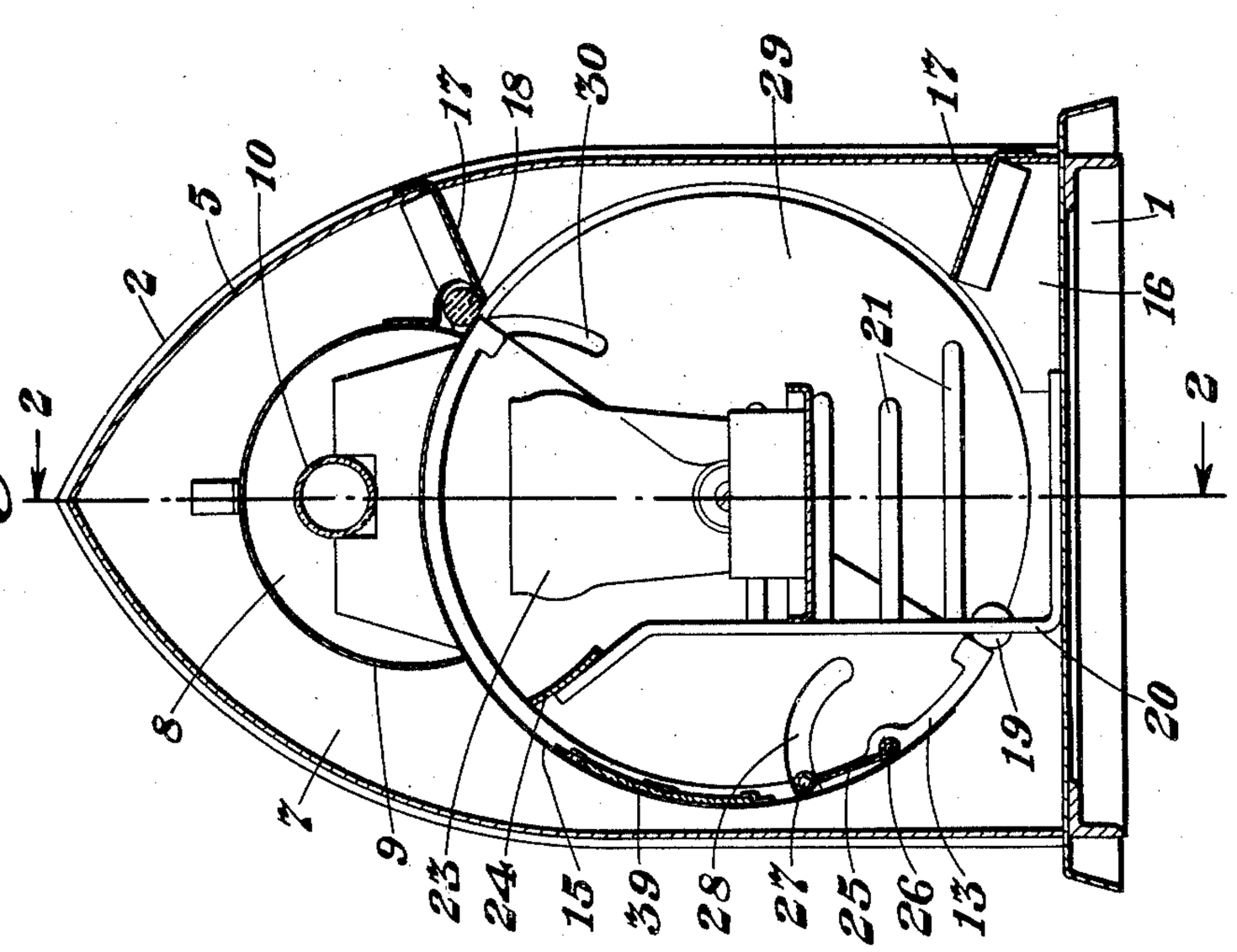
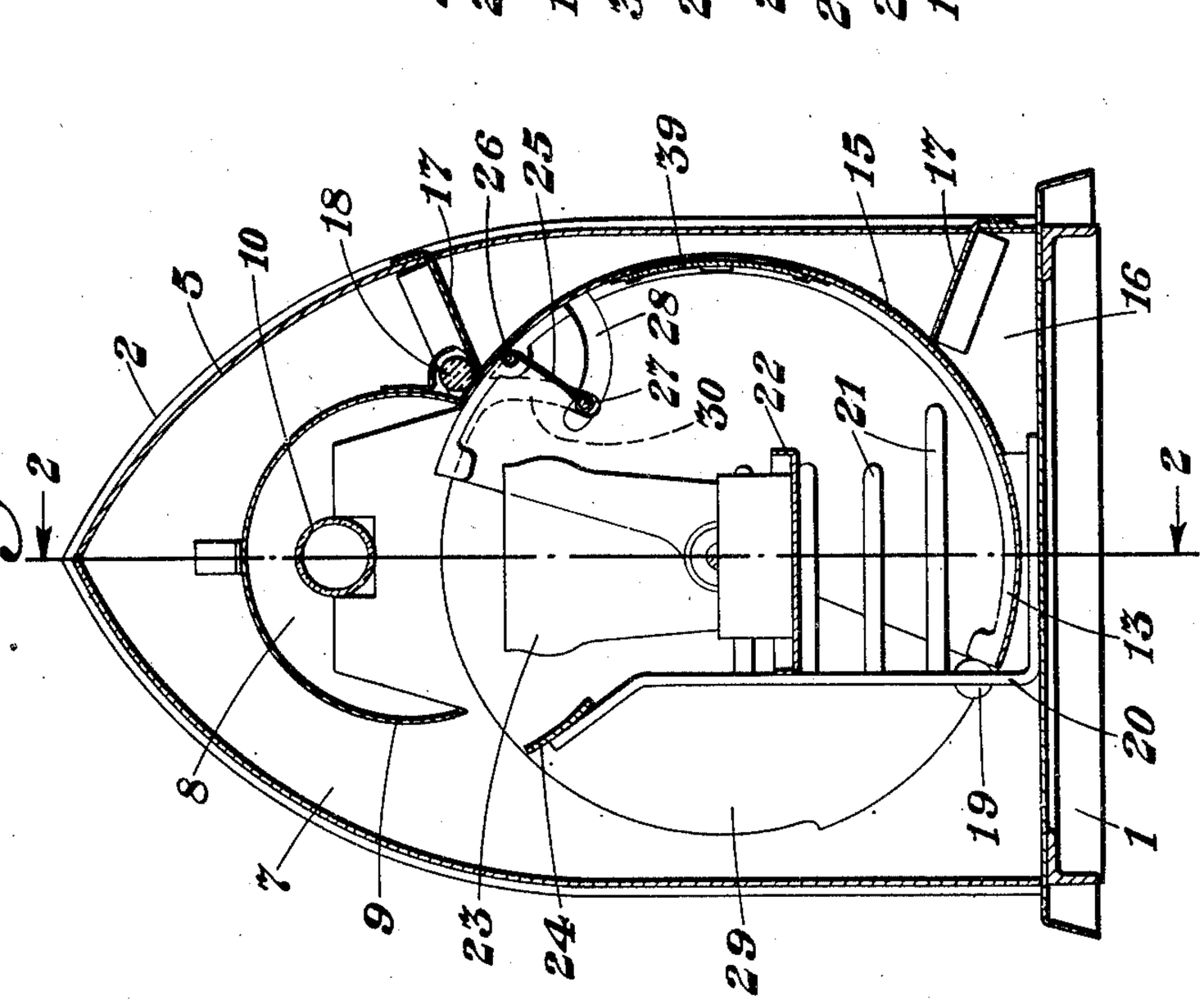


Fig. 3



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UNITED STATES PATENT OFFICE

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APPARATUS FOR STERILIZING ARTICLES BY ULTRAVIOLET RADIATION

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5 Claims. (Cl. 167—3)

The present invention relates to the sterilization of articles by ultraviolet irradiation.

A particular object of the invention is to provide a novel apparatus for irradiating objects, such as drinking glasses and the like, with ultraviolet radiations. Another object of the invention is to provide an apparatus which will permit insertion and removal of the objects to be sterilized without escape of any of the ultraviolet radiations. Still other objects and advantages of the invention will appear from the following detailed specification or from an inspection of the accompanying drawings.

The invention consists in the unique structure hereinafter set forth and claimed.

In the structures heretofore proposed for sterilizing articles, such as glasses or the like, with ultraviolet radiations no provision has been made to absolutely prevent the escape of stray radiations through the openings provided for insertion and removal of the objects to be sterilized. These stray radiations, in the amount likely to be received by any one individual, are probably beneficial rather than a source of any danger, but may lead some persons unfamiliar therewith to fancy that they have been injured. Hence it has been found advisable to provide some means to positively preclude the escape of stray radiations where these structures are to be operated in public places, as at soda fountains and the like. It is likewise desirable to provide a structure which is simple, and yet which can only be operated in the desired manner. I have discovered that these results can be effectively attained with a unique structure of my invention. In this novel structure a shutter is provided by means of which the ultraviolet source may be entirely shut off from the chamber in which the objects are irradiated, and a closure member is provided for said chamber, the movement of said shutter and of said closure member being so coordinated that the latter cannot be opened unless said shutter is fully in position. In the preferred embodiment of my invention the shutter and the closure member are made integral, so that any movement of the closure member automatically closes said shutter, although it is to be understood that this is not essential. Furthermore, in my preferred embodiment a portion of the reflector surface is moved in a novel manner along with the closure member, in order to provide free access to the irradiation chamber, and due to the novel motion of this reflector the separation between the ultraviolet source and the articles to be irradiated may be made very small.

For the purpose of illustrating my invention I have shown a preferred embodiment thereof in the accompanying drawings, in which

Fig. 1 is a perspective view of a novel structure especially designed for irradiating drinking glasses or the like,

Fig. 2 is a longitudinal sectional view of the apparatus of Fig. 1,

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1, and

Fig. 4 is a sectional view of the apparatus taken on the same line as Fig. 3, but with the shutter closed and the closure member open.

As shown in these drawings my novel sterilizing apparatus has a base 1 which carries a pair of spaced castings 2 of any desired shape, such as the Gothic arch illustrated. One of said castings has a sheet metal plate 3 attached thereto, while the other of said castings carries a similar plate 4, these plates forming the ends of a light tight housing which is completed by the sheet metal cover 5 which is likewise carried by the castings 2. A sheet metal partition 6 is positioned within said housing at some distance from the plate 3 and a similar partition 7 is positioned at a like distance from the plate 4. Each of said partitions has an opening 8 therein in each of which an end of the inverted trough reflector 9 is supported. The arc tube of a mercury vapor arc lamp 10 is supported in suitable notches in the openings 8 in said partitions, with the electrode chambers thereof overhanging said partitions. A shaft 11 which is journalled in the plate 3 and partition 6, has an operating handle 12 attached to the outer end thereof, while the inner end of said shaft carries a semi-circular casting 13. A similar casting 13 is carried by a stub shaft 14 which is journalled in the partition 7 at a point which is in axial alignment with the shaft 11. A metal drum 15 is carried by said castings 13, said drum extending over said castings at each end to a point in proximity to the partitions 6 and 7. The sides of the reflector 9 both extend downwardly to the path of travel of the drum 15 as it rotates on the shafts 11 and 14, said reflector and drum thus cooperating to enclose the mercury arc 10 when said drum is in one position.

The front of said cover 5 has an opening therein for the insertion of articles to be sterilized. This opening is made light tight by the sheet metal plates 16 which are supported by the partitions 6 and 7 at some distance therefrom, and which closely fit the curvature of the drum 15, and also

by the plates 17 which are attached to the cover 5 at the top and bottom of said opening and which extend inwardly to the path of said drum 15. A felt roller 18 or the like is positioned at the junction of the upper plate 17 and said drum 15, said roller serving to remove the possibility of any light escaping through the crack between said elements.

A stop 19 is affixed to the partition 7 to engage the casting 13, said stop being so positioned as to arrest movement of said casting whenever either edge of the drum 15 carried thereby just overlaps the front edge of the reflector 9. Said drum is of such a size as to simultaneously overlap the lower plate 17 and the back edge of the reflector 9, so that said drum inherently prevents the escape of radiations from the lamp 10 through the opening in the front of the cover 5.

A pair of supports 20 attached to the base 1 extend upwardly at a point opposite the stop 19, where they do not interfere with movement of the drum 15, and carry several pairs of horizontal pins 21 which are adapted to support a removable tray 22. Said tray, as shown, has retaining means for a plurality of drinking glasses 23. The various pairs of supporting pins 21 adapt the apparatus, of course, to glasses of various heights, the open mouths of said glasses thus being invariably positioned close to the mercury arc lamp 10, regardless of size. At the top said supports 20 carry a slightly concave reflector 24 which is adapted to redirect radiations from the lamp 10 to the rim of the glasses 23. A corresponding reflector 25 is carried by a pair of rods 26 and 27. The rod 26 is supported at each end by the castings 13 at a point near the rim thereof, while the rod 27 passes at each end through an arcuate slot 28 in said castings, the ends thereof resting on a pair of circular plates 29 which are supported by the partitions 6 and 7 at some distance therefrom. In front said plates 29 closely fit the drum 15, and serve as a light baffle, but along the top and a portion of the back said plates are cut away sufficiently to permit travel of said rod 27 between said plates and said drum. At its forward end said cut away portion ends in an arcuate slot 30 which extends downwardly into each plate, the curvature of said slot being such that as the drum 15 is rotated to close the front opening in the cover 5 the rod 27 can swing in the slots 28 to follow the slots 30. Thus said reflector 25 is automatically positioned to reflect ultraviolet radiations to the rims of the glasses 23 whenever the drum 15 is in the position to irradiate the glasses, but is removed whenever said drum is moved to permit removal of said glasses, so that said reflector does not hamper said removal.

The various elements of the usual auxiliary apparatus, including an autotransformer 31, inductance 32, shifter 33, and resistances 34, which are connected to the lamp 10 in a conventional manner, are conveniently disposed between the end plates 3 and 4 and the partitions 6 and 7, respectively. Air inlet ports 35 are provided in the lower portion of each of the plates 3 and 4, and outlet ports 36 are provided near the top of the plate 4. An electric fan or blower 37 is preferably provided below the cathode chamber of the lamp 10, and a hood 38 about said cathode chamber directs the air from said fan along the arc tube to said outlet ports. Suitable light baffles are placed inside of all of said ports to prevent escape of any stray radiation therethrough.

A pair of lead glass windows 39 are located in the drum 15 in such a position as to permit view of the glasses 23 while they are being irradiated, and materially add to the advertising value of the device, particularly as these windows can carry any desired legend which will be illuminated by the lamp 10. Since no harmful radiations are transmitted by lead glass no possible injury can result from the light which is transmitted by these windows. A toggle switch 40 in the front of the cover 5 controls both the lamp 10 and the motor of the fan 37.

In the use and operation of this apparatus, assuming the parts thereof to be in the position illustrated in Figs. 1–3, the mercury vapor arc lamp 10 is started in the conventional manner by the high voltage surge developed in the inductance 32 as a result of the opening of the shifter 33, and the fan 37 is started. The drum 15 is then rotated by means of the handle 12 in a counterclockwise direction, as viewed in Fig. 3. As said drum 15 revolves it first moves across the reflector 9, completely shutting off the irradiation chamber from the lamp 10. During this interval the opening in the cover 5 is still closed by said drum. Further movement of said drum then causes it to move out of said opening, but the lamp 10 is still shut off from the irradiation chamber thereby. During this movement of the drum the rod 27 follows the arcuate slots 30 and then rides along the rim of the plates 29, causing the reflector 25 to clear the glasses 23 and to assume the position shown in Fig. 4, so that there is ready access to the tray 22 and glasses 23. Said tray is then removed, and either the same or another tray full of fresh glasses is placed between the proper set of pins 21. The drum 15 is then rotated in the reverse direction to first close the opening in the cover 5 and then to open the lamp 10 to the irradiation chamber. During this movement of the drum the reflector 25 is moved back into the position shown in Fig. 3, where it serves to increase the irradiation of the rim of the glass. After an interval of the order of fifteen seconds, which has been found to be ample for complete sterilization when a low pressure mercury arc having a fused silica arc tube an inch in diameter is used, the drum is again rotated to close off the mercury arc and to open the front opening, as previously described, after which the sterilized glasses are removed, and a fresh trayful of glasses inserted, these operations being repeated at will.

With this novel construction it is obvious that a portion of the drum 15 serves as a shutter for the housing about the lamp 10, while another portion of said drum serves as a closure for the opening in the cover 5, these portions necessarily cooperating, due to their unitary structure, to prevent opening of the shutter when the closure portion is open, and to prevent opening of the closure member while the shutter member is open. This result may be obtained, of course, with other mechanism, either with or without suitable interlocks, but the structure illustrated and described is preferred because of its simplicity and dependability. As a result of this novel structure glasses, or other articles to be sterilized, may be placed in the irradiation chamber and irradiated without the possibility of any light escaping, and faulty operation of the device by an inexperienced or careless operator is absolutely precluded.

While I have described my invention by reference to a specific structure it is not limited thereto, as noted above, it being understood that various changes, omissions and substitutions, with-

in the scope of the appended claims, may be made therein without departing from the spirit of the invention.

I claim as my invention:—

1. In combination, a source of ultraviolet radiations, a housing surrounding said source, a shutter which is opaque to ultraviolet radiations by which a portion of the interior of said housing may be shut off from ultraviolet radiations from said source, an aperture in said housing through which articles to be irradiated may be inserted into said portion of said housing and a closure member for said aperture.

2. In combination, a source of ultraviolet radiations, a housing surrounding said source, a shutter by which a portion of the interior of said housing may be shut off from radiations from said source, an aperture in said housing through which articles to be irradiated may be inserted into said portion of said housing, a closure member for said aperture, and interlocking means to prevent the opening of said closure member when said shutter is open and to prevent opening of said shutter when said aperture is open.

3. In combination, a source of ultraviolet radiations, a housing surrounding said source, an aperture in said housing through which articles to be irradiated may be inserted, and a movable member which serves in one position as a closure for said aperture, in another position as a shutter to confine the radiations from said source to the portion of said housing immediately adjacent thereto, and in an intermediate position as both said closure and said shutter, whereby escape of ultraviolet radiations through said aperture is entirely avoided.

4. In combination, a source of ultraviolet radiations, a housing surrounding said source, a trough shaped reflector about said source, an aperture in said housing adjacent to an edge of said reflector, and a rotatable drum segment within said housing, the arc of movement of said drum passing close to the edges of said reflector and to the edges of said aperture whereby said drum serves in one position as a shutter to confine radiations from said source within said reflector and in another position as a closure for said aperture, the arc of said drum segment being such that in an intermediate position said drum segment serves as both said shutter and said closure.

5. In combination, a source of ultraviolet radiations, a housing surrounding said source, an aperture in said housing through which articles to be irradiated can be inserted, a movable reflector within said housing adjacent to said aperture, a closure for said aperture, and means responsive to movement of said closure to move said reflector away from said aperture.

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