

Dec. 14, 1954

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2,697,173

ELECTRIC STERILIZER FOR TELEPHONES

Filed Nov. 7, 1952

3 Sheets-Sheet 1

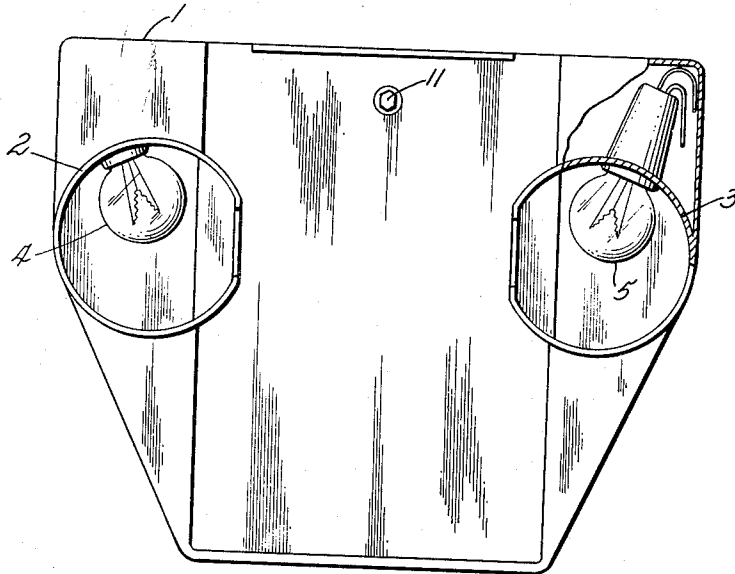


FIG. 1.

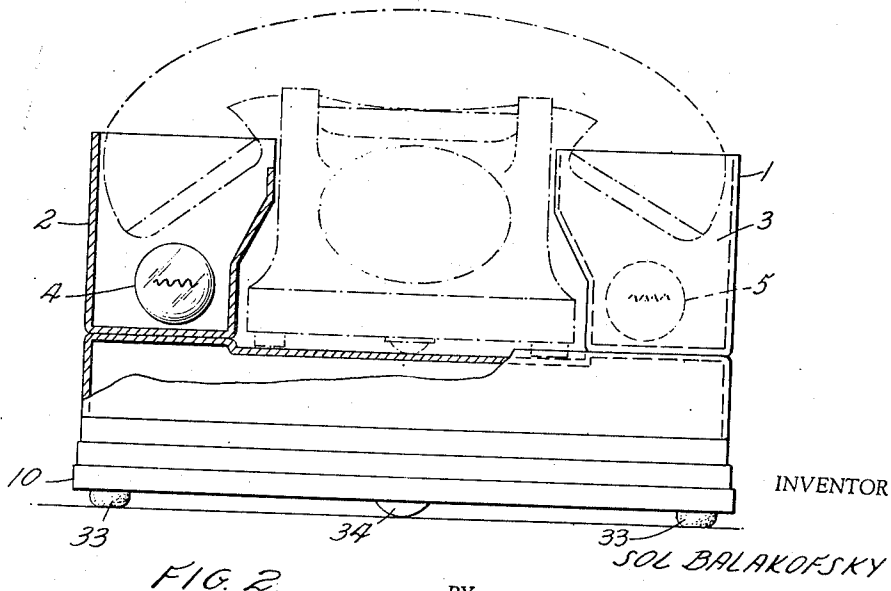


FIG. 2.

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3 Sheets-Sheet 2

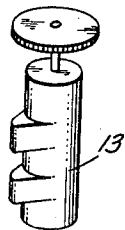


FIG. 7.

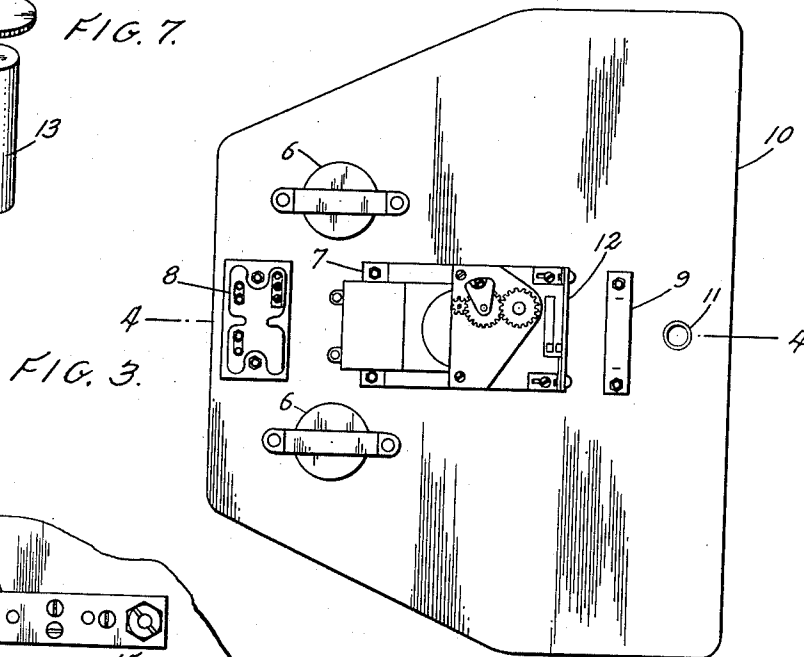


FIG. 3.

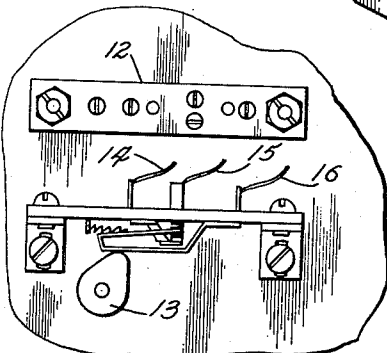


FIG. 6.

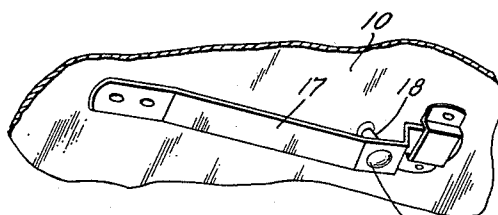


FIG. 5.

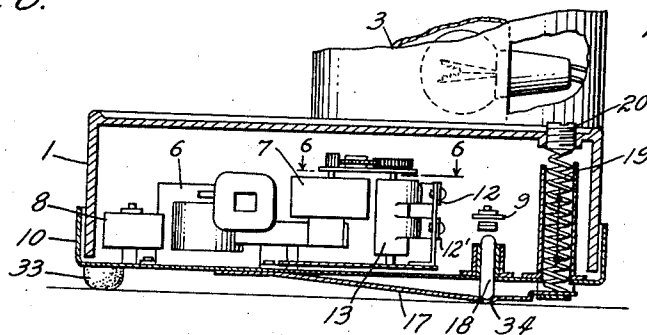


FIG. 4

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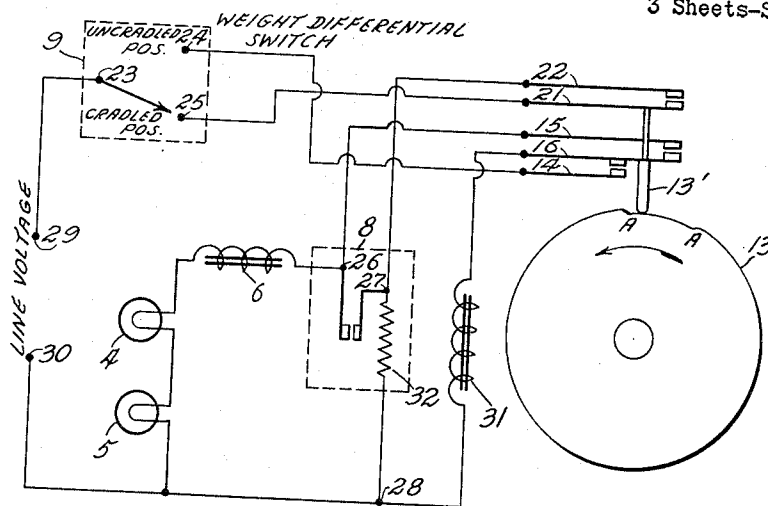


FIG. 8.

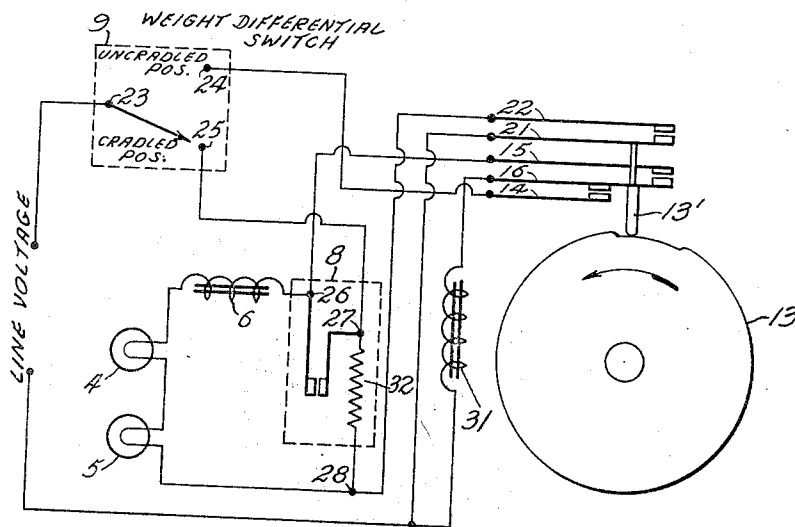


FIG. 9.

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ELECTRIC STERILIZER FOR TELEPHONES

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Application November 7, 1952, Serial No. 319,319

6 Claims. (Cl. 250—51)

The present invention is directed to the class of manufactures which includes devices for sterilizing articles which are handled successively by the public and which presently constitute a medium for the undesired transmission of disease organisms from one person to another.

Although not limited to a specific application in its field, the invention is particularly well adapted to the task of sterilizing hand-sets and/or dictation machine apparatus and the like.

Of the many known schemes for sterilizing apparatus of the type indicated, the most effective arrangements have been found to be those which include as the principal sterilizing agency, one or more electric ray lamps of the type which are operated in a state of very high wave agitation so that they radiate germicidal rays in the region of 10 to 2000 Angstroms. These lamps are fitted with vacuum retaining envelopes of quartz or the like so that these very high frequency waves are able to penetrate the lamp wall and are released into the atmosphere. At the time of these writings one of the most convenient forms of this lamp is that marketed by the proprietors under the trade-mark "Sterilamp." For convenience in manufacture, these lamps are at present made in a similar physical form to that which characterizes high efficiency tungsten lamps of the type used on automobiles. They typically employ a coiled wishbone filament and in operation radiate more germicidal rays in a region broadside to the wishbone than in any other direction.

Sterilizers of the prior art which employ germicidal ray lamps have been notably successful in achieving the primary object for which they were devised, but they suffer from certain serious disadvantages when considered in their broader aspect of service to the public.

Some of these prior art devices are actually dangerous to public health for the reason that the ray emanations are not adequately controlled in their application. The germicidal ray is no respecter of organisms and will act destructively upon any biological particle with which it can collide. There are many important biological particles within the human anatomy which must not be exposed to germicidal rays and unless the action of a ray lamp is rigidly supervised, preferably by automatic means, these invisible destroyers will make undesired contact with human organisms while the apparatus is being handled by the public. Prior art germicidal-ray sterilizers do not provide "fool-proof" or adequate protection against this risk.

It is an object of this invention to provide a germicidal ray sterilizer of the type indicated characterized by means for preventing the rays from being set free while a human agency is handling the apparatus which requires sterilization.

It is a further object to provide a germicidal ray sterilizer characterized by means for projecting a higher density beam of rays upon the subject parts than has heretofore been contemplated in connection with ray lamps of practical design.

It is a still further object to provide a germicidal ray sterilizer wherein the means for preventing accidental human contact with the rays is positive in action and functions independently of wide variations in human behavior while handling the subject apparatus.

In its broad aspect, the invention contemplates a germicidal ray sterilizer comprising one or more germicidal ray sources, means for positioning the said ray sources so that their respective centres of radiation lie broadside to the respective surfaces to be sterilized, electric power

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means for energizing said ray sources, first electric switching means co-acting with predetermined physical attitudes of said surfaces to be sterilized for directing the said electric power means into one or other of two channels, second electric switching means co-acting selectively with both said channels for controlling the application of said power to said ray sources, timer means for predetermining the interval during which the said second switching means co-acts with one or other of said channels, and delay means co-acting with at least one of said channels to independently determine an interval during which one said channel is prevented from functioning in the manner selected by the said second switching means.

One of the most needed applications of these teachings is in connection with the sterilization of telephone hand sets of the type commonly used successively by a large number of persons as in offices, public telephone pay stations and the like, and it is in this connection that the teachings of the invention will now be more intimately elucidated by the following description of a telephone sterilizer the said description being aided by reference to the accompanying drawings wherein:

Figs. 1 and 2 depict somewhat schematically two views of an adapter containing the elements of the invention and associated with a standard telephone set of current vintage.

Fig. 3 depicts more or less pictorially an arrangement of control apparatus mounted on a chassis forming the bottom plate of the adapter housing.

Fig. 4 depicts an elevational section along lines 4—4 of Fig. 3.

Fig. 5 is a perspective view of a weight-sensitive switching device.

Fig. 6 depicts a cam operated switch forming part of a timing system.

Fig. 7 is a perspective view of a timer-cam.

Fig. 8 discloses schematically the electrical and mechanical combinations which are characteristic of one example of construction, and

Fig. 9 shows a variation of the circuit of Fig. 8.

Referring now to these figures, 1 is a housing and 2 and 3 are cavities or chambers designed and positioned to receive the respective active agencies of a telephone hand-set, and to confine the germicidal rays from lamps 4, 5 to the areas which it is particularly desired to sterilize. The housing is contoured to provide a nesting platform for the standard telephone set which is intended to rest permanently in association with said housing but without requiring any screwed fixings, switch arms or other devices which might be regarded as "interfering" with telephone property. When the telephone is in the cradled attitude, the hand-set rests with its principal germ collecting components nested more or less closely coupled to the rays from lamps 4 and/or 5. This arrangement, up to this point, is similar, except as regards one feature to be later discussed, to other known constructions designed for the same purpose. When the hand set is removed from its cradle, the radiation path of the lamps 4 and 5 is no longer confined and it is evident that these agencies, in the interest of public safety, must not be allowed to radiate while the hand set is in use. It is here that prior art arrangements fail in that they lack suitable control means capable of preventing the ray sources from being accidentally energized when the user is dialing or otherwise handling the body member of the telephone set.

In prior art arrangements which somewhat resemble the present invention in a pictorial sense, it is customary to employ a weight sensitive switch which controls the power supply to the ray sources. In some arrangements this switch comes in contact with the weight pressure of a specified part of the hand set when it is cradled and in others, the weight sensitive actuating member of the switch is influenced by a change in weight of the whole apparatus, the weight which sets the switch in one condition being the whole weight, and that which sets the switch in another condition being the difference in weight which occurs when the hand-set is uncradled. Without exception these weight sensitive switches require to be set to such a high degree of torque sensitivity that actions other than that of removing the hand set

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from its cradle will actuate the switch causing undesired operation of the ray sources, and subject the telephone user to undesired exposure to germicidal rays.

In a known attempt to lessen this evil, thermal switches have been associated with the weight-sensitive switch in an effort to delay its action, but these efforts have been foredoomed to failure for the reason that any such agency, used solely per se and timed to maintain a minimum interval of unsafe radiation, is unable to provide a suitable interval of germicidal bombardment of the infected hand set when it is cradled.

To overcome these objections referable to prior art arrangements, the weight sensitive switch according to the present invention is interlocked with two other switching devices one of which comprises a positive timer, preferably controlled by an electric motor, and the other a delayed action contactor which may conveniently be of the normally open thermally closed type.

Fig. 8 discloses a suitable circuit arrangement according to the invention in its exemplified form. Switch arm 23 shifts or oscillates between contacts 24, 25 which selectively provide two channels for the transmission of electrical energy from mains terminals 29, 30 into the lamp and control system. Channel 24 leads to a double throw single pole switch 14, 15, 16 and channel 25 leads to a single pole single throw switch 21, 22. Both of these switches are simultaneously shifted in a fixed relationship from a first to a second condition by timer cam and push rod assembly 13, 13'. The cam is geared to a timing motor whose exciting coil 31 is connected at one end to terminal 30 of the mains supply and at the other end to the swinging blade 16 of the double throw switch. In an exemplary case the timer cam is designed to close contacts 15, 16 for 55 seconds and then to open these and close contacts 14, 16 for 5 seconds.

When the telephone hand set is in use (uncradled) terminals 23, 24 of weight sensitive switch 9 are closed, energizing channel 24 to contact 14. If the cam is in the short interval position the timer will be energized for some portion of 5 seconds and will then open contacts 14, 16 to stop the timing motor, holding contacts 14, 16 open. In this position contacts 15, 16 close as do also contacts 21, 22. As long as switch 9 remains open at contact 24 the lamp energizing circuit and the timer motor remain shut down.

When the hand set is cradled channel 25—21 is energized and if the cam is in the long interval position contacts 15, 16 and 21, 22 will be closed. Contacts 21, 22 close the energy circuit through a heating element 32 in thermal (normally open) switch 8 which after a delay of about 12 seconds closes contacts 26, 27 and energizes the lamp circuits through ballast 6 and ray sources 4, 5, thereby applying germicidal rays to specified regions of the hand set. When 26, 27 close, energy is also made available to terminal 15 which is closed to 16 thereby energizing motor exciter coil 31 to drive cam 13 over any balance of its 55 second phase and on into the 5 second phase which shifts all the contacts on the double gang switch back to their other condition. This de-energizes the lamp circuit instantly and also shuts down the timer motor thereby causing cam 13 to dwell somewhere in the timer cam interval A—A so long as the hand set remains cradled.

When the hand set is subsequently uncradled and later cradled again the above two cycles of control activity are repeated.

This complex switching arrangement could be simplified if one were not concerned about any problem other than that of removing and cradling the hand set. This circuit arrangement provides by its specified complexity a novel means for preventing unwanted operation of the ray sources when the uncradled telephone set is dialed roughly, pushed, tapped or leaned upon while in use. All such actions occur in the practical use of the telephone and cannot be controlled or avoided. These departures from normal behaviour of the telephone set, on its stand, cause any weight sensitive switch of practical design to oscillate between its two operating conditions. In prior art constructions the weight switch is usually of the simple off-on type, and lamps are frequently excited by the persistent oscillation of this switch.

In the present construction, the unwanted operation of the ray lamps is prevented even if the weight sensitive switch 9 does oscillate. Consider what happens in the circuit of Fig. 8 when the contacts 23—24, and

23—25 are alternated at any rate from a fast oscillation down to a slow back and forth motion, as slow as 4 changes per minute (much slower than would normally occur in dialing or as a result of a person "doodling" on the telephone body while using the instrument). When the hand set is uncradled preparatory to making a call, contacts 23—24 close and cam 13 immediately shifts over to the long interval position closing 21—22 and 15—16 and opening 14—16. If contacts 23—25 are now closed for an interval less than the time delay of thermal switch 8, only the heating element 32 is energized, the lamps and timer being disconnected at open terminals 26—27. If the dwell interval of contacts 23—25 were longer than the 12 seconds necessary to close contacts 26—27 (an unlikely event which could be provided for if necessary by lengthening the time delay of switch 8) the lamps would come on but the incidental visible light from the ray lamps would startle the user causing the latter to recoil from the instrument, thus restoring contacts 23—24 and, in some interval less than 55 seconds, the timer would throw into the A—A region and shut the lamps down. This action would eventuate even if the contacts at 23—24 and 23—25 continued to oscillate during and after the said shut-down.

It is evident, therefore, that the present complex switching arrangement provides a greatly enhanced safety factor in connection with the use of germicidal ray sterilizers of the type indicated and also provides positive and error-proof switching of the system by virtue of the two-channel switching arrangement and its ancillary thermal relay and positively timed channel distributor.

Fig. 9 shows a variation in wiring of the system of Fig. 8. In this case the contacts 21—22 are on the other side of the mains supply, the lamps being switched at both ends instead of at only one end of their supply.

Figs. 3 to 7 inclusive depict a practical arrangement of the control agencies described with reference to Fig. 8.

A chassis 10, forming also the bottom plate of the apparatus housing, supports a pair of ballast chokes 6, a timer 7 comprising an electric motor of the general type used to operate electric clocks (a motor supplied by the proprietors of the trade-mark "Telechron" has proven very satisfactory for this purpose), actuating a cam 13 which in turn actuates a pair of single pole double throw switches 12, 12' (one pole of one switch is not used), and a plunger actuated switch 9 which is rendered weight sensitive by spring 19, detent bar 17 and sensitivity adjusting screw 20. Spring 19 is shown as constrained against sidewise movement by a tubular guide 11.

The housing 1 and base 10 of the apparatus rests 3-point fashion upon rubber feet 33 and on a dimple 34 on detent bar 17 (see Figs. 2 and 4). The detent bar is resilient and under pressure normally applied upward upon dimple 34 (by weight of the apparatus) urges plunger 18 to throw switch 9 from one of two conditions to the other. A coil spring 19 urges downwardly upon the outer end of detent bar 17 tending to urge the plunger actuated switch from the other said condition to the one said condition. The sensitivity of this switching to a change in weight of the ensemble is adjusted by altering the tension on spring 19 by a thrust screw 20: when this screw is suitably adjusted, removal of the hand set from a telephone instrument residing upon housing 1 will throw switch 9 from one condition to the other, that is referring to the exemplification typified by Fig. 8, it will open contacts 23—24 and close contacts 23—25.

The cam arrangements depicted in Figs. 8 and 9 are purely schematic. A practical form of cam of compact design and suited for use with a conventional "clock-timer" such as a Telechron has been selected for exemplification in the form indicated in Figs. 4 and 6 and by the perspective view thereof in Fig. 7. With a cam of this type the contact arrangement exemplified in Figs. 8 and 9 are, of course, required to be reversed, the A—A position of cam 13 in Fig. 8 being characterized by the point of the cam 13 depicted in Figs. 6 and 7. The cambering of the cams generically depicted as 13 in Figs. 6 and 8 are reversed in phase, respectively.

The cams and switches shown in the various figures can be made the subject of variation as expediency may dictate so long as the principal circuit functions are not altered thereby. The construction depicted in Figs. 3 to 7 was arranged to incorporate readily available materials and devices of known type adapted to be associated together in the present novel combination.

An important feature of the present construction which

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was mentioned earlier in the description concerns the manner of mounting the germicidal ray lamps in the sterilizing chambers 2 and 3. As noted, these lamps are usually characterized by a coiled filament arranged like a wishbone or hair-pin within the ray transmissive envelope. To obtain the highest possible germicidal ray concentration upon the target, these lamps should be arranged to reside with their hair-pin locus lying on a plane substantially parallel to the average value of the contour of the surface to be sterilized. Whereas it is not difficult to beam the visible rays from an incandescent filament by means of a polished reflector, the very short wave rays of the germicidal range cannot be reflected by conventional reflectors such as silvered parabolas and the like, so that the positioning of the lamps should be, desirably, arranged to provide the greatest possible concentration of direct radiation as occurs when the ray sources are positioned as now suggested. Heretofore it has not been advisable to position these lamps in this manner for the reason that, should the lamps come into operation accidentally as a result of the behaviours mentioned, the germicidal rays would be beamed in great strength directly into the face of the telephone user, subjecting the latter to the destructive effect of such rays on organic tissue. Frequent or lengthy exposure (beyond a few seconds) to these rays could cause unpleasant and harmful effects such as conjunctivitis of the eye system. This risk is present to a high degree in all prior art arrangements of the type indicated and known to the applicant, but this risk would be much greater if prior art devices for sterilizing by germicidal rays were to be arranged with the lamps oriented as now contemplated. With the positive control arrangement of the present invention, risk of unwanted ray bombardment of human tissue is eliminated, so the full capabilities of modern simplified ray lamps can now be fully realized.

It is now evident that the present invention provides not only a safer sterilizing means, but also a more efficient one, than any previously proposed.

The foregoing description has elucidated an example of construction in accordance with the teachings of the invention, and in various applications and under the urge of expediencies many modifications which lie within the broad spirit of these teachings will occur to those skilled in the art. All such are to be regarded as lying within the ambit of the appended claims.

What I claim is:

1. A germicidal-ray sterilizer comprising a germicidal ray source, chamber means enclosing said ray source but including an aperture coacting with a surface to be sterilized, means for positioning the said ray source so that one region of greatest ray concentration lies face toward face with the said surface to be sterilized when the latter is in one of two selective physical attitudes, electric power means for energizing said ray source, first electric switching means having two selective positions corresponding respectively to said two selective attitudes, each said position affording access by said electric power means to one of two channels, second electric switching means including two separate circuit distributors one for each channel, electric motor actuated timer means for successively determining two respective intervals of time during which said two separate circuit distributors are simultaneously caused to dwell in one and then in the other of two conditions, a switch having a predetermined delay-closing characteristic, connections over a first said channel and a first said distributor corresponding to a first position of said first switching means and a first condition of said second switching means for energizing said delayed-closing switch to enable the said electric power means to energize said ray source, connections over a second said channel corresponding to a second position of said first switching means and to a second condition of said second switching means for disabling the said power

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means from energizing said ray-source, connections common to the load terminal of said delayed switch and a switch connection of said second distributor for enabling said power means to actuate said timer and after a predetermined dwell to change the said second switching means from its first to its second condition when the said ray sources are energized, and connections from said power means over said second position of said first switching means and over said second condition of said second distributor for energizing said timer to change the said second switching means after a predetermined dwell back from its second to its first condition.

2. A germicidal ray sterilizer of the kind defined by claim 6 wherein the delay in closure of the said delayed-closing switch is predetermined to be greater than the average dwell of the said switching means upon a specified position during any specified interval of oscillation of the switch between its two positions.

3. A germicidal-ray sterilizer comprising a germicidal ray source, chamber means enclosing said ray source but including an aperture coacting with a surface to be sterilized to concentrate thereupon rays from said source when the said surface lies in one of two selective physical attitudes, electric power means for energizing said ray source, first electric switching means having two selective positions corresponding respectively to said two selective attitudes, each said position affording access by said electric power means to one of two channels, second electric switching means including circuit distributors one for each channel, timer means for sequentially positioning said distributors in one and then in another of two conditions, a switch having a predetermined delay-closing characteristic, connections over a first said channel and one distributor corresponding to a first position of said first switching means and a first condition of said second switching means for energizing said delayed closing switch enabling said electric power means to energize said ray source, connections over a second channel corresponding to a second position of said first switching means and to a second condition of said second switching means for disabling said power means from energizing said ray source, interlocking electric circuit means between said delayed switch and said second distributor for enabling the said power means to actuate said timer and after a dwell to change the said second switching means from its first to a second condition when the said ray sources are energized, and circuit connections interlocking said first position of said switching means and said second condition of said second distributor for energizing said timer to change the second switching means slowly back from its second to its first condition.

4. A construction as defined in claim 3, wherein the said first electric switching means comprises a weight sensitive spring loaded contactor which changes to its second position when a weight corresponding to the mass associated with the said surface to be sterilized is removed from the mass which normally restrains the said switch in its first position.

5. A construction in accordance with claim 3, wherein the said timer comprises a motor driven cam-switch, the various delays in circuit change being determined by the positions of detents upon the cam face and upon a predetermined speed of rotation of said cam.

6. A construction as defined by claim 3, wherein the delay in the closing of said delayed-closing switch is predetermined to be greater than a specified interval between changes in the condition of said first switching means.

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