APPARATUS FOR PURIFYING AND STERILIZING PREMISES

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3 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus which can be used alternatively to purify or to both purify and sterilize premises such as an operating theatre. A casing in which forced circulation of the atmosphere of the premises can be produced by a fan contains a hot-cathode ultra-violet ray tube and a cold-cathode ultra-violet ray tube. When the premises are to be purified, only the hot-cathode tube is operated but when the premises are to be sterilized also both the hot-cathode tube and the cold cathode tube are operated. Means such as dihedral reflector are provided to delay the passage of the atmosphere over the tubes. A reflector to provide direct irradiation when desired is incorporated in a door of the casing.

This invention is concerned with purifying and sterilizing premises.

The germicidal effect of ultra-violet ray tubes, due to their emitting radiation centered on the 2537 A. line, is well-known. It has already been proposed that they should be used in premises such as operating theatres in order to purify the atmosphere, even while these premises are occupied.

However, since ultra-violet radiation has a direct, injurious effect on living creatures, apparatus emitting this radiation must operate by means of indirect radiation if installed in premises where people are working. It has therefore been proposed that it should be placed in an enclosure with a cover, the cover being removed when the premises are unoccupied.

This type of apparatus is generally equipped with an ultra-violet ray tube known as a hot-cathode UV tube.

This type of tube emits not only radiation centered on the 2537 A. line but also radiation centered on the 1850 A. line, which is that corresponding to ozone, another disinfectant and freshener which is powerful but harmful to humans. However, since the quantity of ozone released by this type of tube is very slight, it can be used with practically no risk in occupied premises, for example operating theatres.

When such premises are unoccupied, however, it is often necessary not only to purify the atmosphere, but to sterilize the atmosphere and most of the articles in it.

To this end, the invention proposes apparatus by means of which premises, for example operating theatres, can be purified when occupied and sterilized when unoccupied.

The apparatus according to the invention is essentially characterized in that it comprises a case in which forced circulation of the atmosphere of the premises in which the apparatus is situated can be produced, for example, by means of a fan, and this case contains a hot-cathode ultra-violet ray tube and a cold-cathode ultra-violet ray tube.

When the hot-cathode tube only is operating, the radiation emitted purifies the stream of air entering the case and disinfects the atmosphere of the premises. When the premises are unoccupied, on the other hand, simultaneous operation of both the tubes in the stream of air passing through the case leads not only to better and faster purification of the atmosphere, which flows over both tubes at once, but very thorough sterilization due to the ozone produced during operation of the hot-cathode tube.

According to a preferred embodiment, the ventilating case is in the form of an elongated box, defining an elongated air flow path, with a suction inlet, near which the fan is situated, and a delivery outlet between which the two tubes are mounted extending axially the length of the flow path, so that all the air drawn in flows correctly along both tubes to be purified and/or sterilized.

Advantageously, the back of the case is provided with a reflector, preferably in the form of aluminum sheeting crimped and deformed to make successive dihedrons or undulations of which ridges are in a plane close to the two tubes. The undulations have a triangular cross section and an edge thereof forms the apex of each triangle. It is these edges that are close to the tubes. With a reflector of this type, the stream of air passing into the case is mixed and agitated between the inlet and the outlet, so that its period of contact with the two tubes is increased and the purifying effect is improved.

To increase this effect still further, the two tubes are situated in a plane parallel to the back of the case thus equipped with its retarding reflector, and, to prevent any bombardment of one tube by the other, a metal screen, preferably detachable, is provided between the two tubes.

In order to derive the maximum benefit from the radiation emitted by the two tubes in unoccupied premises, that wall of the case opposite the back of the case is in the form of a door which, when open, permits direct radiation into the premises. The inside surface of this wall may be provided with a reflector.

Lastly, this door has a window obfuscated with a transparent or translucent sheet, through which one can see whether the apparatus is operating.

It should be noted that the combination in a single case of a hot-cathode tube and a cold-cathode tube allows interaction between these two tubes, more particularly the powerful "in situ" action of the ozone produced by the cold-cathode tube on the air purified by the hot-cathode tube.

One embodiment of apparatus according to the invention is described below, by way of example, and shown in the accompanying drawings in which

FIG. 1 is a perspective front view, with the cover open;
FIG. 2 is a section through the apparatus shown in FIG. 1, along a horizontal plane passing between the two tubes; and
FIG. 3 is a cross-section along a plane passing in front of the fan, on a small scale.

In the previous figures of the drawings, reference 1 designates an oblong casing, with casings 2, 3 at each end. Each of the casings 2, 3 has an oblique, slotted front face 4 or 5 respectively.

The casing 2 is separated from the oblong casing 1 by a wall 6, which contains an aperture 7 and to which two brackets 8, 9 attach a motor 10 for driving a fan 11.

The casing 3, which is separated from the oblong box 1 by a wall element 12, contains the ignition circuit elements 13, 14 for two ultra-violet rays tubes 15, 16, the said circuits not being described in detail.

The two tubes 15, 16 are mounted in the elongated box 1 by way of sockets such as 17, 18, mounted respectively on brackets 20 and on the wall element 12. The two tubes are parallel to one another and on the axis of the elongated or oblong casing 1, and are in a plane parallel to the back 21 of the casing. This back is provided with a reflector 22 made from metal sheeting deformed to give successive dihedrons, of which alternate ridges 23, 24 are in the vicinity of the two tubes 15, 16.
A metal screen 25, impervious to the radiation of the tubes, situated between the two tubes is mounted on a plate 26 with four clips 27, 28, by means of which the screen is held between the two tubes to prevent bombardment of one by the other.

The front wall of the oblong casing 1 is formed by a door 29, with hinges 30, 31. The inside surface of this door 29 is lined with an undulating reflector 32, and it contains a slot or window 33 covered with a strip 34 of transparent or translucent material.

When the apparatus is in operation the occupied premises where it is situated, the door 29 is closed and only the tube 15 (which is the hot-cathode tube) and fan unit 10, 11 are connected to the mains. The air draws in through the slotted wall 4 and delivers it into the casing 1 in the direction of the outlet formed by the slotted wall 5. As it flows along the casing, the air sweeps over the tube 15 and is purified while in contact with this tube by the ultra-violet radiation emitted by the tube. This contact between the air and the tube 15 is improved by the eddies produced in the air-stream by the reflector 22 with the dihedrons 23, 24. The window 33, 34 makes it possible to see whether the apparatus is operating.

If the apparatus is to be used in occupied premises, the tube 16 (the cold-cathode tube) is also switched on, and this both emits ultra-violet radiation and produces ozone. The air stream which passes through the apparatus as before flows over not only the tube 15, which purifies it, but also the tube 16 which causes thorough sterilisation of the air purified by the tube 15, this sterilisation being particularly effective because it takes place at the actual site of ozone production. The period during which the two tubes act on the air-stream is increased by the reflector 22 with the dihedrons 23, 24, as in the preceding case, so that the air discharged through the slotted plate 5 has the very purest ozonised air.

If the premises in which the apparatus embodying the invention are mounted are unoccupied and direct radiation is also desired, the door may be pivoted into the position shown in FIG. 1. The reflector 32 then reflects some of the radiation onto the ceiling, if the apparatus is a ceiling fitting.

However, the apparatus may be mounted as a wall fitting or be mobile in the premises which are to be purified, while still retaining its advantages connected with the “in situ” action of the ozone on the air purified by the hot-cathode tube 15.

Obviously, the embodiment illustrated is not restrictive, and the invention also covers any other embodiment which combines in a single case combinations of hot-cathode and cold-cathode UV lamps with the advantage of permitting the ozone to act where it is produced on the air-stream already purified by means of a hot-cathode tube.

I claim:

1. Apparatus for purifying the air in a space and sterilizing said space comprising, means comprising a casing defining an elongated, axially confined flow path for air, means to positively flow air into said casing at an inlet end of said flow path and out of said casing at an opposite outlet end of said flow path, an elongated hot-cathode ultraviolet ray tube in said flow path disposed longitudinally extending in the same general direction of said flow path and having a length substantially the length of said flow path between the inlet end and outlet end thereof, said tube emitting ultraviolet radiation of a germicidal wavelength in operation, an elongated cold-cathode ultraviolet ray tube disposed in said flow path generally parallel to said hot-cathode tube and of substantially the same length and selectively energizable to emit germicidal radiation and for developing ozone in said flow path, common means providing electrical sockets for both tubes for joint or individual energization thereof, a radiation reflector disposed adjacent one sidewall of said casing and spaced laterally from said tubes and extending the length of said tubes for receiving ultraviolet radiation from said tubes and reflecting said radiation toward said tubes into said flow path, said reflector having a plurality of undulations thereon axially spaced from each other and extending into said flow path to retard air flow axially along said flow path, said undulations defining reflector surfaces having a triangular cross section with an edge defining the apex of each triangular undulation, said reflector and edges extending substantially the height of said flow path, and a divider between the two tubes impervious to the radiation of said tubes disposed in a plane parallel to said tubes normal to the sides of said casing and extending towards the sides of said flow path, but terminating short of said sides of said flow path.

2. Apparatus for purifying the air in a space and sterilizing said space according to claim 1, including a pivotally mounted elongated door constituting a second sidewall of said casing extending the axial length of said flow path between the inlet end and outlet end of said flow path, and a second radiation reflector on the inner side of said door disposed extending substantially the full length of said door and the height of said flow path, said second sidewall being disposed to said one sidewall of said casing, and said tubes being disposed extending between both radiation reflectors.

3. Apparatus for purifying the air in a space and sterilizing said space according to claim 2, in which the edges defining the apexes of said undulations are close adjacent said tubes.

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