April 1, 1947. K. EHRGOTT 2,418,339

GAS PURIFIER AND STERILIZER

Filed Feb. 28, 1942

Fig. 1.

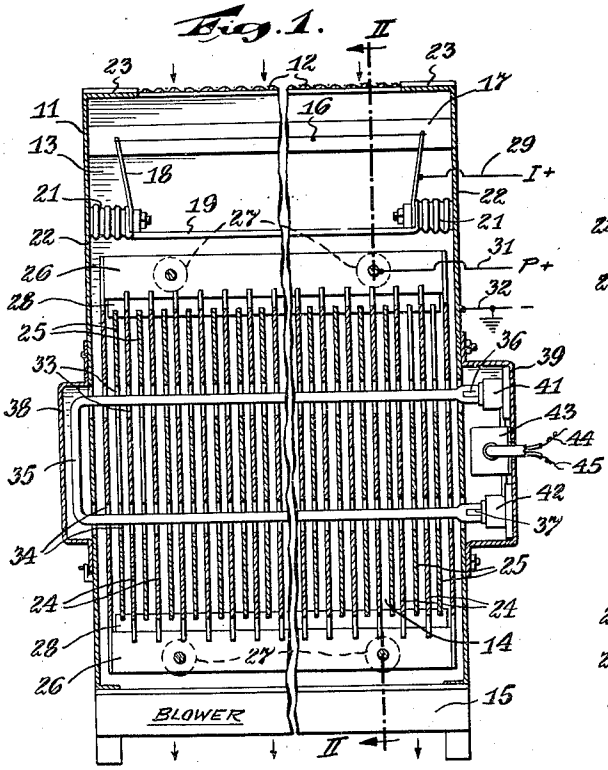
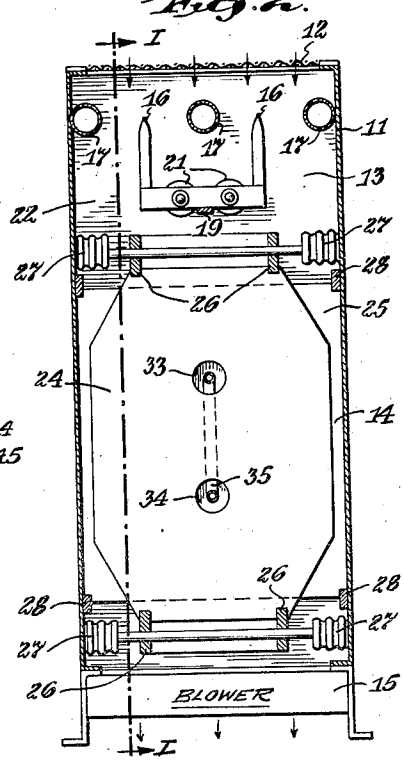


Fig. 2.



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GAS PURIFIER AND STERILIZER

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3 Claims. (Cl. 183—7)

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This invention relates to means for purifying and sterilizing gas and, more particularly, to removing atmospheric dust and other impurities from air as well as sterilizing the same by killing bacteria and the like, said means being particularly, although not necessarily, used in the conditioning of air which is to be breathed.

The present invention is an improvement over that described and claimed in the Penney patent, No. 2,129,783, of September 13, 1938, relating to a precipitator in which gas is blown, first through an ionizing chamber and then through a separate precipitating chamber, a significant feature of the precipitator being that the ionizing wire is of such small diameter that practically utilizable ionization of suspended particles in the gas may be obtained at a wire-charging voltage below the critical corona voltage, thereby limiting the ionizing current input, and ozone generation when the precipitator is used for cleaning air.

Such a precipitator utilizes an ionizing wire of less than 32 mils diameter, which is a somewhat critical value near the knee of the curve expressing the relation between critical corona voltage and wire diameter. The wire is preferably much finer than this upper limit and is desirably a tungsten wire approximately 5 mils or less in diameter. In order to insure against breakage and facilitate handling of the equipment, the end supports for such fine wire should be fairly rigid and strong, and if said wire is longer than about a foot, it should be supported at intervals along its length, say every 8 inches, in order to protect it against vibration, breakage and excessive sagging.

An object of my invention is to introduce bactericidal means into such a precipitator to sterilize the air passing therethrough, as by killing air-borne bacteria and the like.

Another object of my invention is to employ generators of ultraviolet radiation of bactericidal character, which intersect or are disposed adjacent the precipitating plates, so that they not only sterilize air passing between said plates, but also irradiate the surfaces thereof and maintain the same in sterile condition.

Other objects and advantages of the invention, relating to the particular arrangement and construction of the various parts, will become apparent as the description proceeds.

Referring to the drawing:

Fig. 1 is a vertical, longitudinal, sectional view of one form of my invention, the section plane being indicated at I—I in Fig. 2.

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Fig. 2 is a vertical, sectional view on the plane indicated by the line II—II of Fig. 1.

In the embodiment of my invention illustrated, air to be treated is drawn in through the top of the precipitator cabinet 11, through a protective screening 12, and passes downwardly through an ionizing chamber 13 in the top of the cabinet, after which it continues and passes through a precipitating chamber 14. A blower 15 is provided therebeneath for drawing the air through the apparatus. The outlet of the blower may either discharge the treated air near the floor, or the same might be led away in any desired manner.

The ionizing chamber 13, in the present embodiment, comprises a plurality of ionizing units disposed transversely with respect to the direction of the air flow, each unit consisting of a fine wire 16, which is desirably spaced midway between the relatively large electrodes 17, which are preferably tubular or curved in section so that they present convex surfaces toward the ionizing wire. As explained in the aforesaid Penney patent, the tubular electrodes 17 are grounded on the precipitator cabinet 11, and the ionizing wires 16 are suspended between rigid metal end supports 18 carried by a skeleton frame work 19 which is supported by insulators 21.

The end supports 18 must be adequately spaced from the end walls 22 of the cabinet in order to provide adequate insulation. It will thus be seen that the air in the space between the end walls 22 and the supports 18 is not adequately ionized, and suitable baffles designated by the reference character 23, are therefore provided for keeping the air stream from passing over these regions of poor ionization. Unless the wires 16 are very short it will be usually found desirable to steady them at one or more intermediate points.

The precipitating chamber 14 consists of a large number of spaced insulated plates 24 and grounded plates 25 disposed close together and parallel to the direction of air flow. The insulated precipitating plates 24 are supported by notched metal members 26 which are carried by insulators 27. The non-insulated plates 25 are supported and spaced by means of notched plates 28 carried by the cabinet 11.

As explained in the aforesaid Penney patent, the ionizing wires 16 and the insulated precipitator plates 24 are unidirectionally charged with respect to the uninsulated or grounded parts. Because of the greater spacing between each wire 16 and its associated tubular electrode 17, as com-

pared with the spacing between the alternate plates 24 and 25 of the precipitating chamber, the ionizing voltage is desirably higher than the precipitating voltage. I have indicated that unidirectional voltages are applied to the ionizing wires 16 and the precipitator plates 24, by showing leads 29 and 31 respectively marked on the drawing as being energized by the positive terminal of the unidirectional ionizing source of voltage I+, and by the positive terminal of the unidirectional precipitating source of voltage P+, the negative terminals (—) being grounded on the frame of the cabinet 11, as indicated at 32.

In order to effect sterilization of the gas or air passing through the cabinet 11, while the same is being freed of dust and other air-borne particles, I provide apertures 33 and 34 in the plates 24 and 25 for the reception of a desirably U-shaped generator 35 of ultraviolet radiations of bactericidal character. This generator, in the present embodiment, consists of elongated tube of vitreous material containing electrodes 36 and 37 in end chambers thereof, and an ionizable medium such as a mixture of neon and argon with mercury vapor. The vitreous material of the envelope is such that it transmits ultraviolet radiations of bactericidal character, that is those between 2500 and 2800 A. U., as well as some in the neighborhood of 1800 A. U. It is desirably constructed and operated generally as described in the James Patent, No. 2,258,765 of October 14, 1941, or corresponds with the ultraviolet discharge lamps or generators sold under the trademark "Sterilamp" by the Westinghouse Electric & Manufacturing Co., thereby cooperating with the ionizing means in avoiding the generation of an objectionable proportion of ozone.

For convenience in applying the generator 35, the end walls of the cabinet 11 are desirably apertured, similar to the precipitator plates, and after passing the arms of the U-shaped generator through the apertures 33 and 34, the side wall apertures are desirably closed by a relatively shallow pan-shaped cover plate 38 at one end and a deeper pan-shaped cover plate 39 at the other end. The cover plate 39 carries sockets 41 and 42 for the generator 35, as well as a transformer 43 to provide power at the proper voltage for operation thereof, power leads to said transformer being indicated at 44 and 45.

In operation, gas or air entering the top of the cabinet 11, as shown by the arrows, is first ionized in the chamber 13 so as to charge the particles which are suspended therein. The air then passes through the precipitating chamber 14 and over the arms of the U-shaped ultra-violet generating device 35, where charged suspended particles become attached to the oppositely charged precipitating plates, while it is at the same time treated by bactericidal ultraviolet radiations, whereby it is purified and sterilized. At the same time the surfaces of the precipitating plates and any collected particles are maintained in a sterile condition by the ultraviolet radiations impinging thereon. The conditioned air is withdrawn from the cabinet by the blower 15.

When the precipitator, and especially the precipitating means, becomes dirty by reason of foreign particles extracted from the air, the ultraviolet generating device 35 is desirably first removed and the remainder flushed out with a hose, after which it may be reassembled for use.

From the foregoing disclosure it will be seen that I have not only provided for removing particles of dust and foreign matter from gas or air,

but have also provided for the simultaneous sterilization of said air, as well as maintaining the precipitating plates and any coating thereon in sterile condition, whereby my apparatus may be employed for air conditioning purposes in which it is desired to reduce or eliminate bacterial air infection as well as remove dust and other solid foreign matter.

My present invention generally follows the practices explained in the aforesaid Penney patent, utilizing an ionization voltage considerably lower than the critical corona voltage, this practice being made possible by employing fine ionizing wire.

While I have described preferred embodiments of my invention, it will be understood that I am not limited thereto, as modifications may be made within the spirit and scope of the appended claims.

I claim:

1. A gas purifying and sterilizing device comprising an ionizing chamber, a precipitating chamber, means for causing gas to flow successively through first said ionizing chamber and then said precipitating chamber, said precipitating chamber consisting of a series of closely disposed, spaced plates, alternate ones of which are at a potential different from that of the ionization of the flowing gas, so as to attract solid particles in the gas passing therethrough, and means disposed in said precipitating chamber for generating ultraviolet radiations of a bactericidal character, said means including an elongated ultraviolet transmitting envelope, said plates being apertured and said envelope passing through said apertures so as to extend substantially perpendicular to the planes of said plates, in order to direct radiation on the plate surfaces to maintain the same in sterile condition, as well as sterilize the gas flowing therebetween.

2. A gas purifying an sterilizing device comprising an ionizing chamber, a precipitating chamber, means for causing gas to flow successively through first said ionizing chamber and then said precipitating chamber, said ionizing chamber being provided with one or more ionizing units each disposed transverse to the gas flow and comprising oppositely charged electrodes, one of said electrodes being a single fine wire spaced between relatively large electrodes, said precipitating chamber comprising spaced, oppositely-charged plates lying substantially parallel to the direction of the gas flow, alternate plates being at a potential different from that of the ionizing wire so as to collect charged particles from the gas passing therebetween, and means disposed in said precipitating chamber and passing through apertures in said plates for generating ultraviolet radiations of a bactericidal character in order to direct such radiations on the plate surfaces to maintain them in sterile condition and sterilize the gas passing therebetween.

3. A gas purifying and sterilizing device comprising an ionizing chamber, a precipitating chamber, means for causing gas to flow successively through first said ionizing chamber and then said precipitating chamber, said ionizing chamber being provided with one or more ionizing units, each disposed transverse to the gas flow and comprising oppositely charged electrodes, at least one of said electrodes being a single fine wire spaced between relatively large electrodes, said precipitating chamber comprising spaced, oppositely charged, generally flat electrodes lying substantially parallel to the direction of the gas

flow and one another, means associated with the ionizing chamber and the precipitating chamber for unidirectionally charging said electrodes, said wire being charged to a voltage which is below the critical corona voltage and of such fineness that practically utilizable ionization of the particles suspended in the gas is obtained, and means disposed in said precipitating chamber for generating ultraviolet radiations, a large portion of which lie between 2500 and 2800 A. U., in order that the same may be strongly bactericidal, said means consisting of an elongated ultraviolet transmitting envelope, said plates being apertured and said envelope passing through said apertures so as to extend substantially perpendicular to the planes of said plates, in order to direct radiation on the plate surfaces to maintain the same in sterile condition, as well as sterilize the gas flowing therebetween.

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