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Beauvais et al.

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[54] SURFACE STERILIZATION

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[51] Int. Cl. **A61l 1/00**, B05b 7/08

[58] Field of Search 21/56, 91, 58, 111, 117; 239/424, 425.5, 128, 549; 43/130; 134/11, 36; 431/190

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[57] ABSTRACT

A surface sterilization method and blowtorch or burner for used in connection therewith. Jets of an ignited combustible mixture and a sterilizing fluid are projected toward a surface to be sterilized. The sterilizing fluid is heated by the flame of the burner and then contacts the surface to be sterilized in order to achieve sterilization. In a preferred form, saturated steam is used as the sterilizing fluid. The saturated steam becomes superheated as it expands when it leaves the burner and as it is heated by the flame thereof. The amount of saturated steam which leaves the burner is controlled to effect at least partial condensation of the superheated steam on the surface to be sterilized and the condensate is then re-evaporated with the aid of the heat of the flame. The blowtorch or burner construction establishes jets of an ignited combustible mixture and the sterilizing fluid which are mixed exteriorly of the burner.

3 Claims, 4 Drawing Figures

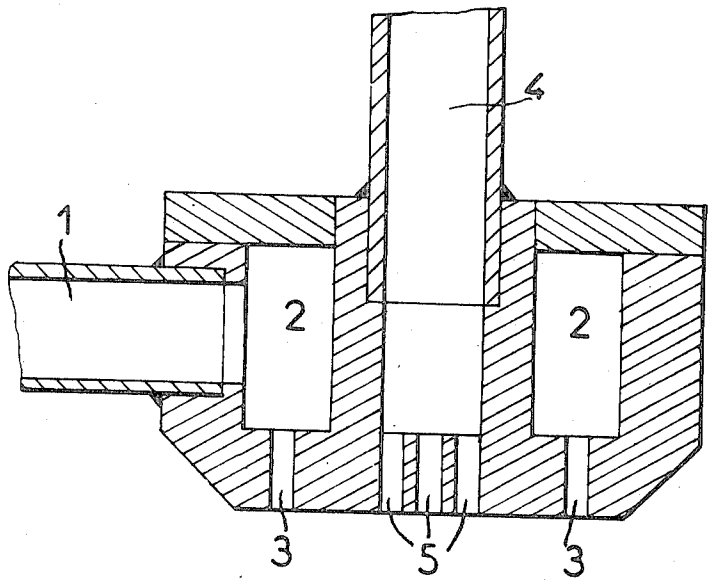


Fig.1.

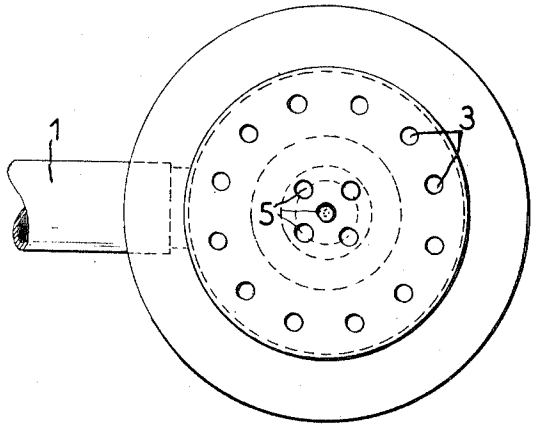


Fig.2.

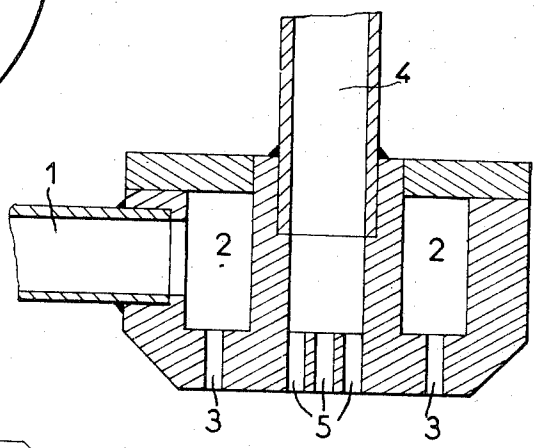


Fig.3.

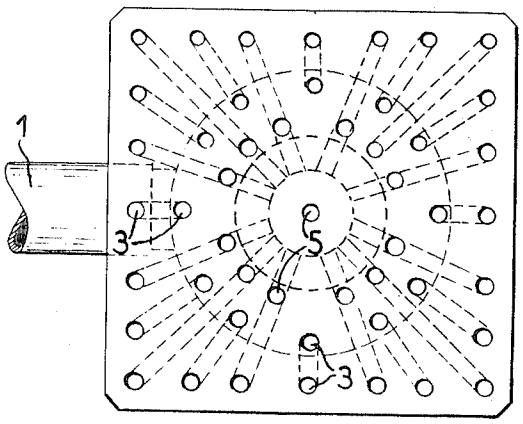
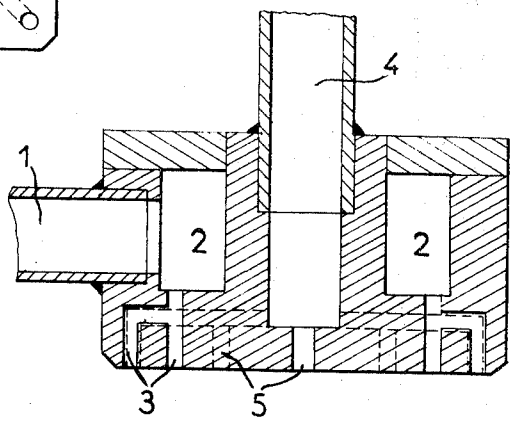


Fig.4.



SURFACE STERILIZATION

This invention relates to a method of surface sterilization and a burner construction for use therewith and, more particularly, to such a method which utilizes a sterilizing fluid which is heated by the flame of the burner.

It has been known heretofore to use a burner or blowtorch flame in order to effect surface sterilization solely by the burner flame. In such devices, the flame must be capable of raising the surface temperature sufficiently high in order to achieve sterilization. The nature of the surface constitutes a limiting factor on the use of flame heating and many surfaces are damaged or destroyed if the temperature exceeds a given threshold level for the particular surface.

It is also known that, for a given temperature, a greater sterilizing action takes place if the ambient or environmental conditions in which the surface is located contains a substantial amount of water or water vapor as contrasted with relatively dry ambient air with low relative humidity.

The present invention overcomes the disadvantages of previously known flame treatment devices by modifying the jet discharge of a blowtorch or burner to include a sterilizing fluid in addition to the flame itself. In a preferred form of the invention, saturated steam is introduced into the burner. The saturated steam becomes superheated as it is expanded and heated upon being discharged from the burner.

A further difficulty is experienced in using saturated steam because after it becomes superheated it also tends to condense in the environment of relatively cool room temperature and the temperature of the surface to be sterilized. As is well known, this condensation may cause or provoke a regrouping of bacteria on the surface and result in certain contaminated zones or pockets.

In accordance with the present invention, this further difficulty is obviated in a preferred form of the invention by controlling the amount of steam admitted vis-a-vis the amount of combustible gases burned to ensure that the condensate is re-evaporated under the influence of a sufficient temperature.

Accordingly, it becomes possible in a preferred form of the invention to project simultaneously toward the surface to be sterilized jets of an ignited combustible mixture and a sterilizing fluid. The sterilizing fluid is heated by diffusion with the ignited combustible mixture or flame of the burner and it contacts the surface to be sterilized in order to effect sterilization. Furthermore, it has been found that by projecting simultaneously toward the surface to be sterilized jets of an ignited combustible mixture and a sterilizing fluid at a temperature sufficient to sterilize the surface without destroying it and by effecting condensation and re-evaporation that maximum sterilization occurs at a minimum temperature.

The inherent advantages and improvements of the present invention will become more readily apparent upon considering the following detailed description of the invention and by reference to the drawings in which:

FIG. 1 is a fragmentary plan view of the underside of a burner construction illustrating one embodiment of the present invention;

FIG. 2 is an elevational view taken in vertical cross section substantially along a major axis of the burner shown in FIG. 1;

FIG. 3 is a fragmentary plan view of the underside of a burner construction illustrating another embodiment of the present invention; and,

FIG. 4 is an elevational view taken in vertical cross section substantially along a major axis of the burner shown in FIG. 3.

Referring now to FIGS. 1 and 2, a blowtorch or burner construction is illustrated to have an input 1 for a mixture of combustible gases. Input 1 is shown in the form of a pipe welded to the side of the burner and it communicates directly with a toroidal mixing chamber 2. A plurality of circularly arranged nozzles 3 extend outwardly from the mixing chamber 2 to the tip of the burner. Jets of flame issue directly out from nozzles 3 when the combustible gases, such as propane and oxygen, are ignited.

The blowtorch or burner is also illustrated to have an input 4 for a sterilizing fluid which is illustrated to consist of a pipe welded to the burner. Input 4 communicates with central diffuser means 5 whereby the sterilizing fluid is separated into a plurality of discrete jets. These jets are substantially parallel to the output of nozzles 3 which, as illustrated best in FIG. 1, are arranged around the outer periphery of the jets of sterilizing fluid. If desired, the arrangement could be reversed with the combustible mixture entering at the center and the jets of sterilizing fluid entering peripherally in a ring.

The apparatus is provided with suitable valve controls, not shown, for the inputs of both the combustible gases and the sterilizing fluid. These controls, which are standard for blowtorches or burners, make it possible to adjust the ratio of combustible gas mixture with respect to the sterilizing fluid which is introduced into the burner.

In a preferred form of the invention, saturated steam is used as the sterilizing fluid and any suitable combustible mixture, such as propane and oxygen, may be used. The saturated steam becomes superheated as it expands upon leaving the burner in discrete jets and is heated by the flame from the burner. Because the ambient air and surface to be sterilized, such as the inside surface of a container body, are at a substantially lower temperature, such as room temperature, condensation of the superheated steam occurs on the container body. By controlling the amount of steam projected in the heated jets, the condensate is re-evaporated, thereby avoiding the danger of a build-up of bacteria in the condensate. This method thus takes advantage of the heat of vaporization of the sterilizing fluid and results in maximum sterilization at a minimum temperature. This, of course, ensures that the process may be practiced on a large number of surfaces without destroying them.

Referring now to FIGS. 3 and 4, another embodiment of the blowtorch or burner is disclosed and wherein the same reference numerals are used to designate the same component parts. In this embodiment, the input 1 again communicates with a toroidal mixing chamber 2. However, in this embodiment the face of the burner is substantially square so as to conform to the outline of a substantially square surface to be treated. The jets from nozzles 3 alternate with the jets from the diffuser means 5 which again separate the sterilizing fluid intro-

duced at 4 into a plurality of discrete jets. In this form of the invention, the diffuser means 5 constitute a plurality of radially extending passageways (as viewed in FIG. 3) each of which communicates with the sterilizing fluid input 4. The alternating nozzle arrangement is also shown to be substantially radial in FIG. 3 but the passageways thereto communicate with the toroidal mixing chamber 2.

In an actual reduction to practice, saturated steam at a temperature maintained between 300°F. and 350°F. and having a boiler pressure of approximately 150 psi (pounds per square inch) was introduced into input 4 where it still had a pressure of from approximately 100–140 psi. Oxygen and propane constituted the combustible gas mixture and these gases were introduced at input 1 of a burner arrangement as shown in FIGS. 1 and 2. The oxygen was taken from a source at 15 psi and the propane was taken from a source at 10 psi. The quantity of steam was controlled through a valve so that a small but perceptible amount of condensation occurred on the surface to be sterilized which consisted of an open-top cup-shaped container. The diameter of the burner was approximately 1¼ inches. The amount of steam was varied until all condensate was re-evaporated on the surface of the container to be sterilized. At a distance of about 8 inches from the face of the burner, the temperature was measured to be approximately 800°F.

Other combustible gases, including natural gas, can be used as the combustible gases and other fluids, liquids or gases, can be used in place of steam. Also, the distribution or arrangement of jets of flames and sterilizing fluids may vary depending upon the surface to be treated. A plurality of burners may be used in series. Also, it is possible to use a large number of burners with small cross sections and a small number of sterilizing fluid diffusers of large diameter, or, conversely, large burners and many small diffusers.

While presently preferred embodiments of the invention have been illustrated and described, it will be recognized that the invention may be otherwise variously embodied and practiced within the scope of the claims which follow.

What is claimed is:

1. A method of sterilizing the surface of a container body utilizing a flame of a burner comprising the steps of (a) projecting jets of an ignited combustible mixture and jets of a sterilizing fluid from nozzles formed in a burner diffuser, (b) heating said sterilizing fluid with said ignited combustible mixture by mixing said jets externally of said burner diffuser, (c) and establishing contact between sterilizing fluid and said surface for a length of time sufficient to sterilize said surface without destroying said surface.

2. A method of sterilizing a surface as claimed in claim 1, wherein said sterilizing fluid comprises steam and said method includes the steps of super-heating said steam at the outlets of said burner diffuser.

3. A method of sterilizing a surface as claimed in claim 2, including the additional steps of controlling by means of a valve setting the amount of steam projected to effect at least partial condensation of said superheated steam on said surface to be sterilized and re-evaporating said condensate with the aid of heat from said ignited combustible mixture.

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