

A DISINFECTION SYSTEM

Field of the Invention

The invention relates to systems used for disinfection of high concentration zones of virus, bacteria, fungus and spores, such as refuse areas, abattoirs, food markets, sanitation facilities
5 and toilets. The invention may further have application for those areas where virus, bacteria, fungus and spores may have the greatest adverse impact to humans, such as hospitals, aged care homes, etc.

Background

10 Whilst the general need for disinfection in large spaces is a demonstrable requirement, the disinfection of articles is typically relegated to wiping of open surfaces. This can be a wholly unsatisfactory way of treating potential sources of infection. Whilst arbitrary wiping of relatively clean articles is inadequate, there is the further problem of those articles that are considered to difficult, to wipe, having too many crevices to completely disinfect and others
15 that are neglected entirely. For instance, a viral cluster in New Zealand during the Covid-19 pandemic of 2020 was identified to have centred on a rubbish tin.

Other systems use UV light to disinfect articles, however, these have the clear disadvantage of having shadows where diffusion is insufficient to contact virus growth sites in crevasses, gaps and cracks.

20 Automation and regulated, routine processes to disinfect all objects is therefore a desirable means of mitigating the spread of virus and bacteria.

Summary of Invention

- In a first aspect, the invention provides a disinfection system for disinfecting an article, the system comprising: a disinfection device having a circulation fan in communication with a circulation outlet, a distribution fan in communication with a distribution outlet, a vent for receiving an inflow of air to recirculate through the distribution outlet, and a register for
- 5 receiving a canister of biocide; an aerosolization system in fluid communication with the canister, and arranged to direct a flow of biocide mist to the at least one circulation fan; wherein the circulation outlet is arranged to circulate the biocide mist with the mist recirculated through the vent and the circulation outlet arranged to distribute the biocide mist towards the article.
- 10 In a second aspect, the invention provides a method of disinfecting an article, the method comprising the steps of: aerosolizing a biocide; directing a flow of biocide mist to a circulation outlet; circulating the biocide mist; recirculating the mist through a vent, and; distributing the recirculated biocide mist towards the article using at least one distribution outlet.

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Brief Description of Drawings

- It will be convenient to further describe the present invention with respect to the accompanying drawings that illustrate possible arrangements of the invention. Other arrangements of the invention are possible and consequently, the particularity of the
- 20 accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

Figure 1 is a front elevation view of a disinfection device according to one embodiment of the present invention;

Figure 2 is an isometric view of the disinfection device of Figure 1;

Figure 3 is a side elevation view of a disinfection system according to one embodiment of the present invention;

Figure 4 is an isometric view of a disinfection chamber according to one embodiment of the present invention, and

Figure 5 is an isometric view of the disinfection chamber of Figure 4.

Detailed Description

The invention provides rapid disinfection of high-touch objects found in healthcare settings including: wheelchairs, patient beds, side tables, tray tables, gurneys and stretchers.

In one embodiment, the disinfection device is portable and may be used in conjunction with a selectively erectable disinfection chamber.

Alternatively, the disinfection device may be fixed, with the disinfection chamber provided by a fixed structure sized to fit the above articles, and so not large enough for human habitation.

The type of disinfectant usable with the disinfection device may vary, and may include, for instance a water-based non-toxic biocide to produce a dry-mist. One such biocide is BioCair BC-65.

Figures 1 and 2 show one embodiment of the disinfection device 5 having a case housing outlets 15A to 15E, fans connected to each outlet (not shown), internal pump (not shown),

aerosolization system (not shown) and a register 70 which is arranged to receive a canister 55 of the biocide. The case may also include a storage area 60, having a door 75 for housing extra canisters of the biocide 65A, 65B.

- 5 The disinfection device includes a system (not shown) for aerosolization of the biocide received from the canister, converting this to a dry-mist. Such aerosolization may rely upon an ultrasonic transducer or other such means to generate the mist.

The aerosol biocide is then vented through a circulation outlet 15C a to circulate the
10 disinfecting dry-mist.

The disinfection device may utilise at least one circulation outlet 15C to circulate the mist, with the remaining outlets used to distribute the mist in the desired direction. A particular advantage of the disinfection device according to the present invention, is the ability of the
15 device to direct the mist to particular locations in order to distribute the biocide throughout the article being disinfected. To this end, each outlet 15A to 15E may be independently controlled to distribute said mist.

In summary, the outlet 15C is connected to aerosolization system generating the mist. A fan
20 associated with the circulation outlet 15C will blow the mist inside the chamber. The mist will be drawn into the vent 20 and re-directed by fans through distribution outlets 15A, 15B, 15D, 15E to distribute the mist back inside the chamber.

Each outlet may be independently controlled by a control system to adjust direction, fan
25 speed, with the fan associated with the circulation outlet 15C also being controllable to adjust

flow rate of the mist. Flow rate may be controlled by operation of a pump (not shown) in the device for delivering the biocide to the aerosolization device, a circulation fan (not shown) to accelerate the mist through the device and/or the speed of the circulation outlet 15E.

- 5 The control system may be remotely controlled through normal remote communication systems, including Wi-Fi, Bluetooth etc. This may be particularly useful where multiple disinfection systems are being operated simultaneously. Each disinfection device may also permit direct operator control.
- 10 In the embodiment of Figures 1 and 2, a touch screen 45 is provided to allow operator control, as well as provide data on the operation of the fans, and quantity of biocide remaining in the canister 55. The screen may also provide the time remaining on the disinfection cycle. It will be noted that the disinfection time may be automatically implemented, or input by the operator. Some or all of the above information may also be
- 15 provided remotely to a central operator.

Disinfection cycles may be establish for different items, and may be in terms of number of minutes, or number of cycles. For instance, disinfection cycles may be in the range 10 to 20 minutes, depending on the expected contamination, with a wheel chair requiring one cycle

20 and a bed requiring 1 or more cycles depending upon use (e.g. a ward bed compared to an ICU bed).

Further, the fans may not operate all at the same time. As well as total period of time, a cycle may also include a sequence for the distribution fans for outlets 15A to 15E. For instance, for

25 a wheel chair, each wheel may have one outlet 15A, 15B directed to it. Each distribution fan

may then be operating at one time, and so each wheel is separately is disinfected. Such a sequence may ensure that the distribution outlets 15A, 15B, 15D, 15E do not work against each other for the mist, but instead each having a turn.

- 5 Further, during such a sequence of distribution fans, the circulation fan may be directed to the operational fan to direct mist to that fan for distribution. Alternatively, the circulation fan may be directed to the same location as the operational distribution fan. Thus, the control system may automatically operate the direction of the circulation outlets during the cycle. In a further embodiment, the control system may also vary the flow rate of the biocide and/or
- 10 fan speed subject to the stage of the cycle and/or sequence.

As a further example, the distribution outlets 15A, 15B, 15D, 15E may work together to direct the mist, with two or more distribution outlets 15A, 15B, 15D, 15E directed in the same direction, or in a direction that facilitates better distribution of the mist.

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The disinfection device 5 may include a vent 20 for receiving the mist from the chamber and re-circulating the mist through the distribution outlets 15A, 15B, 15D, 15E to a sealed disinfection chamber.

- 20 The disinfection device 5 may include barriers 25A, 25B to prevent the mist drifting laterally away from the device during operation.

Portability of the disinfection device may be a further advantage of the present invention. To this end, the embodiment of Figures 1 and 2 may include casters 40 and base 35, with handles

12, 50 for moving the device 5 into position. The device 5 may also be able to swivel about a pivot 30 for better alignment of the outlets 15A to 15E.

- Figure 3 shows a further embodiment of the present invention, having a disinfection system 48 comprising a disinfection device 44 coupled to a disinfection chamber 52. The disinfection chamber 52 may receive an article for disinfection, then sealed. Such articles may include wheelchairs, patient beds, side tables, tray tables, gurneys and stretchers and other articles subject to infection. The disinfection device may then be operated through control panel 46.
- 10 Figures 4 and 5 show one embodiment of the disinfection chamber 80. The chamber may be a permanent structure, or may be selectively erectable. The selectively erectable embodiment, may comprise panels or frame 85 supporting an impermeable material, providing smooth internal surfaces. The material of the chamber 80 maybe a canvas made from PVC, or other such impermeable material so it will not absorb the mist and get wet after several cycles.
- 15 Various olefin materials may also be useful including LDPE etc.

- The chamber 80 may have one or more doors 100, 105 which can be opened to receive the article. For instance, the embodiment of Figures 4 and 5 show two doors, with a larger door 105 for receiving one or more wheel chairs and a smaller door 100 to roll in a hospital bed.
- 20 The doors may be fixed by Velcro and or magnetic strips. The canvas may also include a window 110 to look inside the chamber during misting.

Alternatively, the chamber may be erected around an article. This embodiment may be useful in a highly infectious situation whereby the article is not to be transported or touched. The

chamber can be seal the article, with the disinfection device coupled to the chamber without any human contact of the article.

In the embodiment of Figure 4 and 5, a device receiving end 90 may include an aperture 95
5 sized to allow insertion of the disinfection device (not shown), whereupon the device may be coupled to the chamber 80 through sealing the aperture about the device, ready for the cycle to commence

The chamber 80 may include wheels (not shown) to facilitate movement to the correct
10 location, or with standard legs.