

CLAIMS

1. A device (100; 200) for the sterilization of a gas, comprising:

- a sterilization chamber (110,110'; 210) with an inlet and an outlet and a flow direction between said inlet and said outlet;
- a ventilation system configured and adapted to let the gas flow from said inlet to said outlet;
- one or more sources (240) of at least one laser beam (115,115'; 215) positioned so that said at least one laser beam (115,115'; 215) passes through said sterilization chamber (110,110'; 210);

wherein:

- said at least one laser beam (115,115'; 215) has a wavelength alternatively in a range of $\pm 15\%$ around 1940nm, 2950nm, 9300nm, 10600, and a predetermined irradiance;
- the sterilization chamber (110,110'; 210) comprises a system of mirrors (112,113; 212,213) configured and adapted to create a network of laser segments inside the sterilization chamber;
- said laser segments are incident with respect to said flow direction; and
- said ventilation system is configured and adapted to let the gas flow with a speed which depends on the number of said laser segments, as well as on the wavelength and on said predetermined irradiance of said at least one laser beam;

the device being characterized in that:

- said at least one laser beam (115,115'; 215) is introduced in said sterilization chamber (110,110'; 210) with a first inclination (α) from 0.2 to 1° or from 1 to 15° with respect to a direction perpendicular to said flow direction;
- said at least one laser beam is introduced at a first end of the sterilization chamber (110,110'; 210) along said flow direction and is reflected by at least one respective mirror inclined at a second end of the sterilization chamber (110, 110'; 210) along said flow direction, opposite to said first end, with a second inclination (β) from 0.2 to 1° or from 1 to 15° with respect to said perpendicular direction, wherein said second inclination differs from said first inclination.

2. A device (100; 200) according to claim 1, wherein said gas is air.

3. A device (100; 200) according to claim 1 or 2, wherein said one or more laser sources(240) have an overall average power from 1 to 1000W CW, in particular between 1 and 30W CW.

4. A device (100; 200) according to one or more of claims 1 to 3, wherein said ventilation system is configured to let said gas flow between said inlet and said outlet at a speed between 0.5 and 5 m/s or between 5 and 10 m/s.

5. A device (100; 200) according to one or more of claims 1 to 4, wherein before said inlet and/or after said outlet an additional funnel-shaped chamber (360,370) is placed, which decreases the volume moving towards or away from said inlet and/or outlet respectively, in order to create a Venturi effect in said sterilization chamber (110,110'; 210) and a pressure increase in the volume in the additional chamber.

6. A device (100; 200) according to one or more of claims 1 to 5, wherein the system of mirrors (112,113; 212,213) is configured so that, after said first inclination (α), said at least one laser beam (115,115'; 215) is alternatively reflected with a path perpendicular to the flow direction and with an inclination between 1 and 15° with respect to said perpendicular direction again, and similarly after said second inclination (β).

7. A device (100; 200) according to one or more of claims 1 to 6, wherein said sterilization chamber (110,110'; 210) has a substantially parallelepiped shape, wherein the length is along said flow direction, the bases perpendicular to said flow direction include said inlet and said outlet, respectively, and the smaller sides along said flow direction have a predetermined thickness which is a function of a thickness of said at least one laser beam (115,115'; 215).

8. A device (100; 200) according to claim 7, wherein said predetermined thickness is a multiple of said thickness of said at least one laser beam (115,115'; 215).

9. A device (100; 200) according to claim 7 or 8, wherein said mirror system (112,113; 212,213) comprises at least one portion of surface reflecting said at least one laser beam (115,115'; 215), said at least one portion of the surface facing the interior of the sterilization chamber (110,110'; 210) and being positioned on said smaller sides.

10. A device (100; 200) according to one or more of claims 1 to 6, wherein said sterilization chamber (110,110'; 210) has a substantially cylinder shape, in which the height is along said flow direction, said inlet and said outlet are along the side wall, and the bases comprise said system of mirrors, said one or more sources of at least one laser beam being positioned so that said at least one laser beam passes through said sterilization chamber in the height direction.

11. A device (100; 200) according to one or more of claims 1 to 10, wherein after said one or more sources of at least one laser beam, at least one respective beam expander is placed, configured to reduce the divergence of the laser beam to a value between 0.3 and 1 mrad and increase the surface of the laser beam to a size comparable to that of the mirrors of said mirror system.

12. A device (100; 200) according to one or more of claims 1 to 11, wherein gas deflection means (116) are provided at said inlet, configured and adapted to convey the gas towards the center of said sterilization chamber (110,110'; 210) as viewed perpendicularly to said flow direction.

13. A device (100; 200) according to one or more of claims 1 to 12, wherein around at least one portion of an outer wall of said sterilization chamber (110,110'; 210), a collector (150) of said gas is assembled, fluidly connected to said inlet.

14. A device (100; 200) according to one or more of claims 1 to 13, wherein said first inclination (α) and/or said second inclination (β) is between 0.2 and 5 degrees.