

5 **Claims:**

1. A hookah device for use with a hookah having an elongate stem and a water chamber with a first end of the stem attached to the water chamber, wherein the hookah device comprises:

10 **a plurality of mist generator devices;**

a manifold having a manifold pipe and a plurality of apertures, wherein each aperture of the plurality of apertures is in fluid communication with the manifold pipe and is configured to receive a mist outlet port of a respective ultrasonic mist generator device, wherein each
15 aperture of the plurality of apertures is formed in a respective side wall of the manifold and the manifold pipe is provided on an end wall of the manifold, **and wherein the plurality of mist generator devices are releasably coupled to the manifold;**

a driver device which is configured to connect electrically to each
20 of the mist generator devices and configured to activate the mist generator devices; and

a hookah attachment arrangement which is configured to attach the hookah device to a second end of the stem of the hookah, the hookah attachment arrangement having a hookah outlet port which is in
25 fluid communication with the manifold pipe and provides a fluid flow path out of the hookah device such that, when at least one of the mist generator devices is activated by the driver device, mist generated by each activated mist generator device combines in the manifold and flows through the manifold pipe and the hookah outlet port and out of the
30 hookah device to the hookah.

2. The hookah device of claim 1, wherein the end wall is perpendicular to each side wall.

5 3. The hookah device of claim 1 or claim 2, wherein the hookah device is configured to receive four mist generator devices which are releasably coupled to the manifold at 90° relative to one another.

~~4. wherein the hookah device further comprises a plurality of mist generator devices, wherein the plurality of mist generator devices are releasably coupled to the manifold.~~

~~45.~~ The hookah device of **any one of the preceding claims**~~claim 4~~, wherein each mist generator device comprises:

15 a mist generator housing which is elongate and comprises an air inlet port and the said mist outlet port;

a liquid chamber provided within the mist generator housing, the liquid chamber containing a liquid to be atomized;

a sonication chamber provided within the mist generator housing;

20 a capillary element extending between the liquid chamber and the sonication chamber such that a first portion of the capillary element is within the liquid chamber and a second portion of the capillary element is within the sonication chamber;

25 an ultrasonic transducer having a generally planar atomization surface which is provided within the sonication chamber, the ultrasonic transducer being mounted within the mist generator housing such that the plane of the atomization surface is substantially parallel with a longitudinal length of the mist generator housing, wherein part of the second portion of the capillary element is superimposed on part of the atomization surface, and wherein the ultrasonic transducer is configured to vibrate the atomization surface to atomize a liquid carried by the second portion of the capillary element to generate a mist comprising the atomized liquid and air within the sonication chamber; and

30 an airflow arrangement which provides an air flow path between the air inlet port, the sonication chamber and the air outlet port.

- 5 **56.** The hookah device of claim **45**, wherein each mist generator device further comprises:
- a transducer holder which is held within the mist generator housing, wherein the transducer element holds the ultrasonic transducer and retains the second portion of the capillary element superimposed on part of the
 - 10 atomization surface; and
 - a divider portion which provides a barrier between the liquid chamber and the sonication chamber, wherein the divider portion comprises a capillary aperture through which part of the first portion of the capillary element extends.
- 15 **67.** The hookah device of claim **45** or claim **56**, wherein the capillary element is 100% bamboo fiber.
- 78.** The hookah device of any one of claims **45** to **67**, wherein the airflow arrangement is configured to change the direction of a flow of air along the air
- 20 flow path such that the flow of air is substantially perpendicular to the atomization surface of the ultrasonic transducer as the flow of air passes into the sonication chamber.
- 89.** The hookah device of any one of claims **45** to **78**, wherein the liquid
- 25 chamber contains a liquid having a kinematic viscosity between 1.05 Pa•s and 1.412 Pa•s and a liquid density between 1.1 g/ml and 1.3 g/ml.
- 910.** The hookah device of any one of claims **45** to **89**, wherein the liquid
- 30 chamber contains a liquid comprising approximately a 2:1 molar ratio of levulinic acid to nicotine.
- 1014.** The hookah device of any one of the preceding claims, wherein the driver device comprises:
- an AC driver which is configured to generate an AC drive signal at a
 - 35 predetermined frequency to drive a respective ultrasonic transducer in each mist generator device;

- 5 an active power monitoring arrangement which is configured to monitor the active power used by the ultrasonic transducer when the ultrasonic transducer is driven by the AC drive signal, wherein the active power monitoring arrangement is configured to provide a monitoring signal which is indicative of an active power used by the ultrasonic transducer;
- 10 a processor which is configured to control the AC driver and to receive the monitoring signal drive from the active power monitoring arrangement; and
a memory storing instructions which, when executed by the processor, cause the processor to:
- 15 A. control the AC driver to output an AC drive signal to the ultrasonic transducer at a predetermined sweep frequency;
 - B. calculate the active power being used by the ultrasonic transducer based on the monitoring signal;
 - C. control the AC driver to modulate the AC drive signal to maximize the active power being used by the ultrasonic transducer;
 - 20 D. store a record in the memory of the maximum active power used by the ultrasonic transducer and the sweep frequency of the AC drive signal;
 - E. repeat steps A-D for a predetermined number of iterations with the sweep frequency incrementing with each iteration such that, after the
25 predetermined number of iterations has occurred, the sweep frequency has been incremented from a start sweep frequency to an end sweep frequency;
 - F. identify from the records stored in the memory the optimum frequency for the AC drive signal which is the sweep frequency of the
30 AC drive signal at which a maximum active power is used by the ultrasonic transducer; and
 - G. control the AC driver to output an AC drive signal to the ultrasonic transducer at the optimum frequency to drive the ultrasonic transducer to atomize a liquid.

5 **1112**. The hookah device of claim **1011**, wherein the active power monitoring arrangement comprises:

a current sensing arrangement which is configured to sense a drive current of the AC drive signal driving the ultrasonic transducer, wherein the active power monitoring arrangement is configured to provide a monitoring
10 signal which is indicative of the sensed drive current.

1213. The hookah device of claim **1011** or claim **1112**, wherein the memory stores instructions which, when executed by the processor, cause the processor to:

15 repeat steps A-D with the sweep frequency being incremented from a start sweep frequency of 2900kHz to an end sweep frequency of 2960kHz.

1314. The hookah device of claim **910** or claim **1112**, wherein the memory stores instructions which, when executed by the processor, cause the
20 processor to:

repeat steps A-D with the sweep frequency being incremented from a start sweep frequency of 2900kHz to an end sweep frequency of 3100kHz.

1415. The hookah device of any one of claims **1011** to **1314**, wherein the AC
25 driver is configured to modulate the AC drive signal by pulse width modulation to maximize the active power being used by the ultrasonic transducer.

1516. A hookah comprising:

a water chamber;
30 an elongate stem having a first end which is attached to the water chamber, the stem comprising a mist flow path which extends from a second end of the stem, through the stem, to the first end; and

a hookah device according to any one of the preceding claims, wherein the hookah attachment arrangement of the hookah device is attached to the
35 stem of the hookah at the second end of the stem.