Claims

1. A microfluidic device for mixing liquids, the microfluidic device comprising:

a plurality of device inlets, each device inlet for receiving a liquid;

a chamber assembly comprising:

a set of chamber inlets in fluid communication with the device inlets;

a mixing chamber for receiving the liquids through the chamber inlets, the chamber inlets comprising a first chamber inlet positioned at a centre area of the mixing chamber to direct the liquids into the centre area; and

a plurality of chamber outlets for communicating the liquids away from the mixing chamber; and

a set of device outlets in fluid communication with the chamber outlets,

wherein the chamber outlets are spaced around the mixing chamber such that the mixing chamber facilitates uniform mixing of the liquids communicating from the chamber inlets to the chamber outlets.

2. The microfluidic device according to claim 1, wherein the chamber assembly comprises:

a first layer comprising the chamber inlets and chamber outlets;

a second layer comprising vias respectively connecting each chamber inlet and chamber outlet to the mixing chamber; and

a third layer comprising the mixing chamber.

~~3. The microfluidic device according to claim 1 or 2, wherein the chamber inlets comprise a first chamber inlet positioned to direct the liquids into a centre area of the mixing chamber.~~

4~~3~~. The microfluidic device according to claim ~~3~~1 or 2, wherein the mixing chamber comprises an array of guiding elements for regulating communication of the liquids from the first chamber inlet to the chamber outlets.

~~54~~ The microfluidic device according to claim ~~43~~, wherein the guiding elements are concentrically arranged such that the liquids are communicated radially from the first chamber inlet to the chamber outlets.

~~65~~. The microfluidic device according to any one of claims ~~3~~ 1 to ~~54~~, wherein the chamber outlets are equidistantly spaced from the first chamber inlet.

~~76~~. The microfluidic device according to any one of claims 1 to ~~65~~, wherein the chamber outlets are equidistantly spaced from each other.

~~87~~. The microfluidic device according to any one of claims 1 to ~~76~~, wherein the chamber outlets are spaced around a periphery of the mixing chamber.

~~98~~. The microfluidic device according to any one of claims 1 to ~~87~~, further comprising a debubbling assembly disposed between the device inlets and the chamber assembly, the debubbling assembly configured for debubbling the liquids.

~~109~~. The microfluidic device according to claim ~~98~~, wherein the debubbling assembly comprises a set of bubble traps.

~~1110~~. The microfluidic device according to claim ~~109~~, wherein each bubble trap comprises a filter for debubbled liquids to pass through from the bubble trap.

~~1211~~. The microfluidic device according to any one of claims 1 to ~~1110~~, further comprising a plurality of reservoirs disposed between the device inlets and the chamber assembly.

~~1312~~. The microfluidic device according to claim ~~1211~~, further comprising a plurality of retention valves disposed between the device inlets and the reservoirs.

~~1413~~. The microfluidic device according to claim ~~1312~~, wherein each device inlet is associated with one reservoir and one retention valve.

~~15~~14. The microfluidic device according to claim ~~13~~ 12 or ~~14~~13, wherein each retention valve is a capillary valve.

~~16~~15. The microfluidic device according to any one of claims 1 to ~~15~~14, further comprising a measurement element for measuring the mixed liquids in the mixing chamber.

16. A liquid control system for controlling liquids in a microfluidic device according to any one of claims 1 to 15, wherein the liquid control system is configured to controllably communicate a gas to the device inlets of the microfluidic device, such that each device inlet selectably receives the gas to thereby control communication of a liquid in the respective device inlet.

17. ~~A~~ The liquid control system ~~for controlling liquids in a microfluidic device~~according to claim 16, the liquid control system comprising:

a pneumatic device for pumping ~~a~~ the gas;

a device connector for connecting to the microfluidic device, the device connector comprising a plurality of inlet connectors, each inlet connector for fluidically connecting to ~~a~~ the respective device inlet ~~of the microfluidic device~~;

a valve assembly comprising a plurality of valves for fluidically connecting between the pneumatic device and the device connector, each valve fluidically communicable with ~~a~~ the respective inlet connector to control communication of the gas from the pneumatic device through the respective valve to the respective inlet connector; and

a valve controller configured to independently control operation of each valve to, for each valve, controllably communicate the gas through the respective valve and respective inlet connector to the respective device inlet~~,~~.

~~wherein controlled communication of the gas to each device inlet thereby controls communication of a liquid in the respective device inlet.~~

18. The liquid control system according to claim 17, further comprising a manifold for fluidically connecting between the pneumatic device and the valve assembly for distributing the gas at substantially even pressure to each valve.

19. The liquid control system according to claim 17 or 18, wherein each valve is a solenoid valve.

20. The liquid control system according to any one of claims 17 to 19, wherein the operation of the pneumatic device and/or the valve controller is controllable by a control unit communicatively connected to the liquid control system.

21. A computer program comprising computer executable instructions that, when executed by a processor, cause the processor to control an additive manufacturing apparatus to manufacture a product comprising the microfluidic device according to any one of claims 1 to ~~16~~15.

22. A method of manufacturing a product via additive manufacturing, the method comprising:

obtaining an electronic file representing a geometry of the product wherein the product comprises the microfluidic device according to any one of claims 1 to ~~16~~15; and

controlling an additive manufacturing apparatus to manufacture, over one or more additive manufacturing steps, the product according to the geometry specified in the electronic file.