Claims

1. A device for providing respiratory gases, the device comprising:
(a) a blower configured to receive a first gas from a first gas flow path and generate a flow of a first gas provided through a first gases outlet of the blower;
(b) a second gas flow path configured to receive a flow of a second gas and provide the flow of the second gas through a second gases outlet; and
(c) a mixing chamber configured to receive a flow of the first gas from the first gases outlet and a flow of the second gas from the second gases outlet, the received gases configured to mix in the mixing chamber to form a mixed gas, the received gases configured to travel in a mixing flow direction in the mixing chamber towards a mixed gases inlet, wherein mixed gas exits the mixing chamber via the mixed gases inlet providing flow to a mixed gas flow path.

2. The device according to claim 1, wherein the mixing chamber receives the flow of gases from the second gases outlet upstream of the first gases outlet in the mixing flow direction.

3. The device according to claim 1 or claim 2, wherein one or both of the first gases outlet and the second gases outlet are arranged to achieve flow of the first gas and/or the second gas substantially tangentially along a wall of the mixing chamber.

4. The device according to any one of the preceding claims, wherein the first gases outlet and the second gases outlet are arranged relative to the mixing chamber such that the first gases outlet is arranged to direct the first gas entering the mixing chamber away from the second gases outlet.

5. The device according to any one of the preceding claims, wherein the first gases outlet and the second gases outlet are arranged such that the first gas in the first gases outlet is directed in a first flow direction between a direction that is substantially parallel to a second flow direction of the second gas in the second gases outlet, and a direction that is substantially perpendicular to the second flow direction and optionally wherein the first flow direction relative to the second flow direction is at an angle of about 0º to less than about 90º.

6. The device according to claim 5, wherein the mixed gases inlet is arranged such that the mixed gas flow in the mixed gas flow path is directed in a mixed flow direction between a direction substantially perpendicular to one or both of the first and second flow directions and a direction anti-parallel to one or both of the first and second flow directions.

7. The device according to claim 6, wherein the first flow direction and the second flow direction are in a common plane, or wherein the mixed flow direction, the first flow direction and the second flow direction are in a common plane.

8. The device according to claim 6 or claim 7, wherein the mixed flow direction is substantially anti-parallel to the second flow direction.

9. The device according to any one of the preceding claims, wherein the mixing chamber is substantially cylindrical and/or wherein the mixing chamber is substantially circular in cross section.

10. The device according to any one of the preceding claims, wherein the mixing flow direction in the mixing chamber is around a central shaft and optionally wherein the central shaft comprises a portion of the blower.

11. The device according to any one of the preceding claims, wherein the mixing chamber is comprised of a plurality of adjacent sectors, and wherein the first gases outlet and the second gases outlet are arranged in adjacent sectors of the mixing chamber, and optionally wherein the plurality of sectors comprises four quadrants.

12. The device according to claim 11, wherein the mixed gases inlet is arranged in a non-adjacent sector to the first gases outlet; and/or wherein the mixed gases inlet is provided in a sector that achieves optimal uniformity of flow within the mixed gases flow path.

13. The device according to any one of the preceding claims, wherein arrangement of the second gases outlet permits flow of gases from the mixing chamber into the second gas flow path.

14. The device according to any one of the preceding claims, wherein the second gases outlet comprises a lead-in portion and optionally wherein the lead in portion

comprises a taper configured to direct flow of the second gas into the mixing chamber.

15. The device according to any one of the preceding claims, wherein the second gas flow path comprises one or more of:

a flow conditioner at the second gases outlet which is configured to increase resistance to flow of gases from the mixing chamber;

one or more nozzles configured to provide the flow of the second gas to the mixing chamber through a nozzle diameter which is less than a diameter of the second gas flow path; and

a non-return valve.

16. The device according to any one of the preceding claims, wherein the device comprises one or more of:

a first flow sensor for sensing flow rate of gases in the first gas flow path;

a second flow sensor for sensing flow rate of gases in the second gas flow path; and

a third flow sensor for sensing flow rate of the mixed gas in the mixed gas flow path.

17. The device according to any one of the preceding claims, wherein the second gas flow path comprises a proportional valve, and optionally, wherein a or the second flow sensor senses flow rate of gases in the second gas flow path downstream of the proportional valve.

18. The device according to claim 16 or claim 17, wherein the mixed gas flow path comprises a mixed flow conditioner upstream of the third flow sensor; and optionally wherein the mixed flow conditioner is located at or proximal to the mixed gases inlet.

19. The device according to claim 18, comprising one or more of:

wherein the mixed flow conditioner has an inlet end that is shaped to be continuous with an internal wall of the mixing chamber;

wherein the mixed flow conditioner comprises a plurality of substantially parallel flow channels; and

wherein the mixed flow conditioner is integral with the mixed gases inlet.

20. The device according to any one of the preceding claims, wherein one or more of the first gas, second gas and mixed gas flows comprise a flow rate of 0 L/min or greater, optionally the mixed gas flow comprises a flow rate of about 20 L/min to about 90 L/min, optionally the mixed gas flow comprises a flow rate of about 40 L/min to about 70 L/min.

21. The device according to any one of the preceding claims, comprising a plurality of cooperating components through which bores have been formed which cooperate to define a plurality of gas flow paths, and into which cooperating cavities have been formed to define a cavity for receiving the blower and a mixing chamber.

22. The device according to any one of the preceding claims, comprising a pneumatic block having three or more cooperating components, wherein:
(a) a first component comprises a first opening defining a first gases inlet, a second opening defining a second gases inlet, and a first cavity for receiving a first part of the blower;
(b) a second component comprises three parallel through-bores defining part of each of the first gas flow path, the second gas flow path and the mixed gas flow path, and a third opening defining a device outlet; and
(c) the third component comprises three parallel through-bores defining part of each of the first gas flow path, the second gas flow path and the mixed gas flow path, and a second cavity for receiving a second part of the blower and defining the mixing chamber;
wherein the bores in the second component align with the bores in the third component to define colinear parts of the first gas flow path, second gas flow path and mixed gas flow path.

23. The device according to any one of the preceding claims, wherein the first gas flow path is an oxygen flow path.