CLAIMS

1. A vent hole array that is incorporated into a mask body or gas path componentry that is directly connected to a mask, for venting exhaust gases from the mask body or gas path componentry, the vent hole array comprising:

a substrate having an inner surface and an outer surface,

at least one vent hole extending through the substrate and having a vent hole circumference, the vent hole comprising an exhaust gas inlet at the inner surface of the substrate and an exhaust gas outlet at an outer surface of the substrate, the vent hole further comprising a sidewall extending between the exhaust gas inlet and the exhaust gas outlet,

the exhaust gas inlet and the exhaust gas outlet having different diameters such that the sidewall of the vent hole is inclined at a taper angle between the exhaust gas inlet and the exhaust gas outlet; wherein

the taper angle of the inclined side wall of the vent hole varies around the vent hole circumference.

2. The vent hole array of claim 1 comprising a plurality of vent holes.

3. The vent hole array of claim 2 comprising ten or more vent holes.

4. The vent hole array of claim 2 or claim 3 wherein the vent holes have the same draw direction, the draw direction being the direction at which a mould tool is opened or removed relative to the vent during manufacture.

5. The vent hole array of claim 4 wherein the draw direction is substantially perpendicular to the inner surface of the vent, at a midpoint of the vent.

6. The vent hole array of claim 2 or claim 3 wherein at least one vent hole has a different draft direction from at least one other vent hole, the draft direction being the (resultant, average) direction that exhausted air flows out of the vent hole and defined by an axis that extends through the centre of the exhaust gas inlet and through the centre of the exhaust gas outlet of the vent hole.

7. The vent hole array of any one of claims 2 to 6 wherein the vent substrate comprises a substantially planar substrate portion, the vent holes being spaced apart on the planar substrate portion.

8. The vent hole array of any one of claims 2 to 6 wherein the vent substrate comprises a substantially arcuate substrate portion, the vent holes being spaced apart on the arcuate substrate portion.

9. The vent hole array of claim 8 wherein the curvature of the arcuate substrate portion increases away from a centre of the vent.

10. The vent hole array of claim 8 or claim 9 wherein the arcuate substrate portion is curved in two dimensions.

11. The vent hole array of any one of claims 8 to 10 wherein the arcuate substrate portion is curved transversely across the vent, that is, when the vent is viewed in transverse cross section.

12. The vent hole array of claim 11 wherein the vent holes are spaced transversely across the vent, with each vent hole having a different draft direction, when viewed in transverse cross section.

13. The vent hole array of claim 11 or claim 12 wherein the vent holes are spaced longitudinally along the vent, with each vent hole having the same draft direction, when viewed in longitudinal cross section.

14. The vent hole array of any one of claims 8 to 10 wherein the arcuate vent area is curved in three dimensions. that is, both when the vent is viewed in transverse cross section and in longitudinal cross section.

15. The vent hole array of any one of claims 6 to 14 wherein each vent hole has a different draft direction from each other vent hole.

16. The vent hole array of claim 15 wherein at least one vent hole has a draft direction which is inclined relative to the draw direction, the draw direction being the direction at which a mould tool is opened or removed relative to the vent during manufacture.

17. The vent hole array of claim 16 wherein the draft direction is inclined relative to the draw direction, when the vent hole is viewed in transverse cross section.

18. The vent hole array of claim 16 or claim 17 wherein the draft direction is inclined relative to the draw direction, when the vent hole is viewed in longitudinal cross section.

19. The vent hole array of claim 18 wherein the angle of inclination of the draft direction relative to the draw direction when the vent hole is viewed in transverse cross section is different from the angle of inclination of the draft direction relative to the draw direction when the vent hole is viewed in longitudinal cross section.

20. The vent hole array of claim 16 wherein the vent hole(s) further from the centre of the vent have a draft direction which is inclined at a greater angle from the draw direction relative to the vent hole(s) nearer the centre of the vent.

21. The vent hole array of any one of the preceding claims wherein the vent area is less than approximately 500mm^2.

22. The vent hole array of any one of the preceding claims wherein the vent area is less than approximately 450mm^2.

23. The vent hole array of any one of the preceding claims wherein the vent area is less than approximately 400mm^2.

24. The vent hole array of claim 2 wherein the taper angle of one vent hole is different from the taper angle of another vent hole.

25. The vent hole array of claim 24 wherein the taper angle of the vent hole(s) furthest from a centre of the vent is greater than the taper angle of the vent hole(s) nearer the centre of the vent.

26. The vent hole array of claim 24 wherein at least one vent hole has sidewalls which are asymmetric, when each vent hole is viewed in transverse cross section.

27. The vent hole array of claim 24 wherein, the taper angle of the sidewall of a vent hole that is furthest from the centre of the vent hole array when that vent hole is viewed in transverse cross section is greater that the taper angle of the sidewall of that vent hole that is closest to the centre of the vent hole array.

28. The vent hole array of any one of the preceding claims wherein the centre of the exhaust gas outlet is offset from the centre of the exhaust gas inlet, when the vent is viewed in plan.

29. The vent hole array of any one of the preceding claims wherein the exhaust gas outlet and the exhaust gas inlet are non-concentric.

30. The vent hole array of any one of the preceding claims wherein the exhaust gas inlet and/or the exhaust gas outlet of at least one vent hole is radiused.

31. The vent hole array of claim 30 wherein the radius is asymmetric, when that vent hole is viewed in transverse cross section.

32. The vent hole array of claim 30 or claim 31 wherein the exhaust gas outlet is radiused, such that the exhaust gas outlet is of larger diameter than the exhaust gas inlet.

33. The vent hole array of any one of claims 30 to 32 wherein the exhaust gas inlet is radiused, such that the exhaust gas inlet is of larger diameter than the exhaust gas outlet.

34. The vent hole array of claim 2 wherein the vent holes are arranged in a plurality of vent hole arrays, each array having at least one vent hole, the vent hole of one array having at least one characteristic which is different from a vent hole in at least another array.

35. The vent hole array of claim 34 wherein at least one array differs from at least another array in respect of one or more of the following:

a) vent hole having a different draw direction;

b) vent hole having a different draft direction;

c) vent hole having a different exhaust gas outlet shape and/or diameter;

d) vent hole having a different exhaust gas inlet shape and/or diameter;

e) vent hole side walls having differing taper angles;

f) vent hole having different radiusing/chamfering of the exhaust gas outlet and/or the exhaust gas inlet; and/or

g) different number of vents.

h) different spacing of vents;

i) different pattern of vents; and/or

j) different length of each vent hole.

36. A vent hole array that is incorporated into a mask body or gas path componentry that is directly connected to a mask, for venting exhaust gases from the mask body or gas path componentry of a respiratory therapy system, the vent hole array comprising:

a substrate having an inner surface and an outer surface,

at least one vent hole extending through the substrate, the vent hole comprising an exhaust gas inlet at the inner surface of the substrate and an exhaust gas outlet at an outer surface of the substrate, the exhaust gas inlet and the exhaust gas outlet each having a respective centre, the vent hole further comprising a sidewall extending between the exhaust gas inlet and the exhaust gas outlet,

the exhaust gas inlet and the exhaust gas outlet defining a draft direction being the direction that exhausted air flows out of the vent hole and which is defined by an axis that extends through the centre of the inlet and the centre of the outlet of the vent hole, wherein

the draft direction of the vent hole is not aligned with a draw direction, the draw direction being the direction at which a mould tool is opened or removed relative to the vent during manufacture, and wherein

the exhaust gas inlet and the exhaust gas outlet having different diameters such that the sidewall of the vent hole is inclined at a taper angle between the exhaust gas inlet and the exhaust gas outlet; wherein

the taper angle of the inclined side wall of the vent hole varies around the vent hole circumference.

37. A vent hole array that is incorporated into a mask body or gas path componentry that is directly connected to a mask, for venting exhaust gases from the mask body or gas path componentry of a respiratory therapy system, the vent hole array comprising:

a substrate having an inner surface and an outer surface,

at least one vent hole extending through the substrate, the vent hole comprising an exhaust gas inlet at the inner surface of the substrate and an exhaust gas outlet at an outer surface of the substrate, the exhaust gas inlet and the exhaust gas outlet each defining a respective centre, the vent hole further comprising a sidewall extending between the exhaust gas inlet and the exhaust gas outlet,

the centre of the exhaust gas inlet being offset from the centre of the exhaust gas outlet, when the vent is viewed from above

and wherein

the exhaust gas inlet and the exhaust gas outlet having different diameters such that the sidewall of the vent hole is inclined at a taper angle between the exhaust gas inlet and the exhaust gas outlet; wherein

the taper angle of the inclined side wall of the vent hole varies around the vent hole circumference.

38. A vent hole array that is incorporated into a mask body or gas path componentry that is directly connected to a mask, for venting exhaust gases from the mask body or gas path componentry of a respiratory therapy system, the vent hole array comprising:

a substrate having an inner surface and an outer surface,

at least two vent holes extending through the substrate and each having a circumference, an exhaust gas inlet at the inner surface of the substrate and an exhaust gas outlet at an outer surface of the substrate, a sidewall being defined between the exhaust gas inlet and the exhaust gas outlet of each vent hole,

the exhaust gas inlet of each vent hole having a different diameter to the diameter of the exhaust gas outlet of that vent hole such that the sidewall of each vent hole is inclined at a taper angle between the exhaust gas inlet and the exhaust gas outlet; wherein

the taper angle of the inclined side wall of one vent hole is different from the taper angle of the side wall of another vent hole, and wherein the taper angle of the inclined side wall of each vent hole varies around the vent hole circumference.

39. A vent hole array that is incorporated into a mask body or gas path componentry that is directly connected to a mask, for venting exhaust gases from the mask body or gas path componentry of a respiratory therapy system, the vent hole array comprising:

a substrate having an inner surface and an outer surface,

at least two vent holes extending through the substrate, each vent hole comprising a bore extending through the substrate, the bore comprising an exhaust gas inlet at the inner surface of the substrate and an exhaust gas outlet at an outer surface of the substrate, the exhaust gas inlet and the exhaust gas outlet each defining a respective centre, each vent hole further comprising a sidewall extending between the exhaust gas inlet and the exhaust gas outlet

the exhaust gas inlet and the exhaust gas outlet of each vent hole defining a draft direction being the direction that exhausted air flows out of that vent hole and defined by an axis that extends through the centre of the inlet and through the centre of the outlet of that vent hole, wherein

the draft direction of one vent hole is different to the draft direction of the other vent hole, and wherein

for each vent hole, the exhaust gas inlet and the exhaust gas outlet having different diameters such that the sidewall of each vent hole is inclined at a taper angle between the exhaust gas inlet and the exhaust gas outlet; wherein

the taper angle of the inclined side wall of each vent hole varies around the vent hole circumference.

40. A vent hole array that is incorporated into a mask body or gas path componentry that is directly connected to a mask, for venting exhaust gases from the mask body or gas path componentry of a respiratory therapy system, the vent hole array comprising:

a substrate having an inner surface and an outer surface,

at least one vent hole extending through the substrate and having a circumference, the vent hole comprising an exhaust gas inlet at the inner surface of the substrate and an exhaust gas outlet at an outer surface of the substrate, a sidewall being defined between the exhaust gas inlet and the exhaust gas outlet,

the exhaust gas inlet having a different diameter to the diameter of the exhaust gas outlet such that the sidewall of the vent hole is inclined at a taper angle between the exhaust gas inlet and the exhaust gas outlet; wherein

the taper angle of the inclined side wall of the vent hole varies with respect to a draw direction, the draw direction being the direction in which a mould tool is opened or removed during manufacture of the vent hole, and the taper angle of the inclined side wall of each vent hole varies around the vent hole circumference.

41. A patient interface comprising the vent hole array of any one of claims 1 to 40.

42. The patient interface of claim 41, wherein the patient interface is any one of:

a) a nasal interface configured to seal around the nares or nose of the patient;

b) an oral mask configured to seal around the mouth of the patient; or

c) a full face mask configured to seal around both the mouth and nose of the patient.

43. A mask body or gas path componentry of a respiratory therapy system comprising the vent hole array of any one of claims 1 to 40.

44. The mask body or gas path componentry of claim 43 comprising any one of:

a) an elbow connector configured to connect a gas delivery conduit to a patient interface;
b) a gas delivery conduit;
c) a gas delivery conduit connector configured to connect a gas delivery conduit to another mask body or gas path componentry of the respiratory therapy system.

45. A respiratory therapy system comprising the vent hole array of any one of claims 1 to 40 and any one or more of:

a) a breathing gas flow generator;
b) a breathing gas humidifier;
c) a gas delivery conduit, which may or may not be heated; and/or
d) a patient interface.