CLAIMS:

1. A component for a gas turbine engine, the component comprising:

a gas path wall having a first surface and a second surface; and

a cooling hole extending through the gas path wall from the first surface to the second surface, the cooling hole comprising an inlet portion having an inlet at the first surface, an outlet portion having an outlet at the second surface, and a transition defined between the inlet and the outlet;

wherein the inlet portion converges in a first direction from the inlet to the transition and diverges in a second direction from the inlet to the transition; and

wherein the outlet portion diverges at least in one of the first and second directions from the transition to the outlet.

2. The component of claim 1, wherein the inlet portion of the cooling hole has an oblong geometry.

3. The component of claim 1, wherein cross-sectional area of the cooling hole decreases or remains constant from the inlet to the transition.

4. The component of claim 3, wherein cross-sectional area of the cooling hole increases from the transition to the outlet.

5. The component of claim 1, wherein the first direction is a longitudinal direction with respect to gas flow along the second surface and the second direction is a transverse direction with respect to the gas flow along the second surface.

6. The component of claim 1, wherein the first direction is a transverse direction with respect to gas flow along the second surface and the second direction is a longitudinal direction with respect to the gas flow along the second surface.

7. The component of claim 1, wherein the cooling hole is inclined in a downstream direction with respect to gas flow along the second surface of the gas path wall.

8. The component of claim 7, wherein the cooling hole has a substantially straight upstream surface extending from the inlet through the transition to the outlet.

9. The component of claim 8, wherein the cooling hole has a convergent downstream surface extending from the inlet to the transition and a divergent downstream surface extending from the transition to the outlet.

10. The component of claim 1, further comprising:

a longitudinal ridge formed on a downstream surface of the outlet portion between the transition and the outlet, wherein the longitudinal ridge divides the outlet portion into lobes.

11. The component of claim 10, further comprising:

a transition region extending between the longitudinal ridge and a trailing edge of the outlet.

12. The component of claim 1, wherein the second surface forms a pressure surface, a suction surface or a platform surface of an airfoil.

13. An airfoil comprising:

a wall having a first surface and a second surface, wherein the second surface is exposed to hot working fluid flow; and

a cooling hole comprising a metering section having an inlet at the first surface, a diffusing section having an outlet at the second surface, and a transition defined between the inlet and the outlet;

wherein the metering section converges in a first direction from the inlet to the transition, and diverges in a second direction from the inlet to the transition; and

wherein the diffusing section diverges at least in one of the first and second directions from the transition to the outlet.

14. The airfoil of claim 13, wherein the first direction is a longitudinal direction with respect to the hot working fluid flow and the second direction is a transverse direction with respect to the hot working fluid flow.

15. The airfoil of claim 13, further comprising:

longitudinal ridges formed on a downstream wall of the diffusing section, the longitudinal ridges extending between the transition and the outlet and dividing the diffusing section into lobes.

16. A gas turbine engine component comprising:

a gas path wall having a first surface and a second surface;

a cooling hole extending through the gas path wall, the cooling hole having an inlet portion with an inlet in the first surface, an outlet portion with an outlet in the second surface, and a transition defined between the inlet portion and the outlet portion;

a first cooling hole surface extending along the cooling hole, wherein the first cooling hole surface is substantially straight from the inlet through the transition to the outlet; and

a second cooling hole surface extending along the cooling hole opposite the first cooling hole surface, wherein the second cooling hole surface converges toward the first cooling hole surface from the inlet to the transition and diverges away from the first cooling hole surface from the transition to the outlet.

17. The gas turbine engine component of claim 16, wherein flow area of the inlet portion decreases or remains constant between the inlet and the transition, and wherein flow area of the outlet portion increases between the transition and the outlet.

18. The gas turbine engine component of claim 16, wherein the first cooling hole surface is an upstream surface with respect to hot gas flow along the second surface of the gas path wall and the second cooling hole surface is a downstream surface with respect to the hot gas flow.

19. The gas turbine engine component of claim 18, further comprising:

a longitudinal ridge formed on the downstream surface between the transition and the outlet, wherein the longitudinal ridge divides the outlet portion into lobes.

20. A component for a gas turbine engine, the component comprising:

a flow path wall having a first surface and a second surface, wherein the first surface is exposed to cooling fluid and the second surface is exposed to hot working fluid;

a cooling hole comprising a metering section having an inlet at the first surface, a diffusing section having an outlet at the second surface, and a transition defined between the inlet and the outlet;

an upstream surface of the cooling hole, wherein the upstream surface is substantially straight from the inlet to the outlet; and

a downstream surface of the cooling hole, wherein the downstream surface converges toward the upstream surface from the inlet to the transition and diverges away from the upstream surface from the transition to the outlet.

21. The component of claim 20, further comprising:

first and second lateral side surfaces of the cooling hole, wherein the first and second lateral side surfaces of the cooling hole diverge from the inlet to the transition.

22. The component of claim 21, wherein divergence of the first and second lateral side surfaces is selected such that the cross sectional area of the metering section does not increase from the inlet to the transition.

23. The component of claim 21, wherein divergence of the first and second lateral side surfaces is selected such that cross sectional area of the metering section decreases from the inlet to the transition.

24. The component of claim 20, further comprising:

a ridge extending along the downstream surface of the cooling hole in the diffusing section, wherein the ridge divides the diffusing section of the cooling hole into lobes.

25. The component of claim 24, further comprising:

a transition region extending from the ridge to a trailing edge of the outlet.

CLAIMS

1. A component for a gas turbine engine, the component comprising:

a gas path wall having a first surface and a second surface; and

a cooling hole extending through the gas path wall from the first surface to the second surface, the cooling hole comprising an inlet portion having an inlet at the first surface, an outlet portion having an outlet at the second surface, and a transition defined between the inlet and the outlet;

wherein the inlet portion converges in a first direction from the inlet to the transition and diverges in a second direction from the inlet to the transition such that a flow area of the inlet portion decreases from the inlet to the transition or remains substantially constant; and

wherein the outlet portion diverges at least in one of the first and second directions from the transition to the outlet.

2. The component of claim 1, wherein the inlet portion of the cooling hole has an oblong geometry.

3. The component of claim 1, wherein cross-sectional area of the cooling hole increases from the transition to the outlet.

4. The component of claim 1, wherein the first direction is a longitudinal direction with respect to gas flow along the second surface and the second direction is a transverse direction with respect to the gas flow along the second surface.

5. The component of claim 1, wherein the first direction is a transverse direction with respect to gas flow along the second surface and the second direction is a longitudinal direction with respect to the gas flow along the second surface.

6. The component of claim 1, wherein the cooling hole is inclined in a downstream direction with respect to gas flow along the second surface of the gas path wall.

7. The component of claim 6, wherein the cooling hole has a substantially straight upstream surface extending from the inlet through the transition to the outlet.

8. The component of claim 7, wherein the cooling hole has a convergent downstream surface extending from the inlet to the transition and a divergent downstream surface extending from the transition to the outlet.

9. The component of claim 1, further comprising:

a longitudinal ridge formed on a downstream surface of the outlet portion between the transition and the outlet, wherein the longitudinal ridge divides the outlet portion into lobes.

10. The component of claim 9, further comprising:

a transition region extending between the longitudinal ridge and a trailing edge of the outlet.

11. The component of claim 1, wherein the second surface forms a pressure surface, a suction surface or a platform surface of an airfoil.

12. An airfoil comprising:

a wall having a first surface and a second surface, wherein the second surface is exposed to hot working fluid flow; and

a cooling hole comprising a metering section having an inlet at the first surface, a diffusing section having an outlet at the second surface, and a transition defined between the inlet and the outlet;

wherein the metering section converges in a first direction from the inlet to the transition, and diverges in a second direction from the inlet to the transition such that a flow area of the metering section decreases from the inlet to the transition or remains substantially constant; and

wherein the diffusing section diverges at least in one of the first and second directions from the transition to the outlet.

13. The airfoil of claim 12, wherein the first direction is a longitudinal direction with respect to the hot working fluid flow and the second direction is a transverse direction with respect to the hot working fluid flow.

14. The airfoil of claim 12, further comprising:

longitudinal ridges formed on a downstream wall of the diffusing section, the longitudinal ridges extending between the transition and the outlet and dividing the diffusing section into lobes.

15. A gas turbine engine component comprising:

a gas path wall having a first surface and a second surface;

a cooling hole extending through the gas path wall, the cooling hole having an inlet portion with an inlet in the first surface, an outlet portion with an outlet in the second surface, and a transition defined between the inlet portion and the outlet portion;

a first cooling hole surface extending along the cooling hole, wherein the first cooling hole surface is substantially straight from the inlet through the transition to the outlet;

a second cooling hole surface extending along the cooling hole opposite the first cooling hole surface, wherein the second cooling hole surface converges toward the first cooling hole surface from the inlet to the transition and diverges away from the first cooling hole surface from the transition to the outlet; and

third and fourth cooling hole surfaces extending along the cooling hole, wherein the third and fourth cooling hole surfaces diverge from one another as the first and second cooling hole surfaces converge such that a flow area of the inlet portion decreases from the inlet to the transition or remains substantially constant.

16. The gas turbine engine component of claim 15, wherein the first cooling hole surface is an upstream surface with respect to hot gas flow along the second surface of the gas path wall and the second cooling hole surface is a downstream surface with respect to the hot gas flow.

17. The gas turbine engine component of claim 16, further comprising:

a longitudinal ridge formed on the downstream surface between the transition and the outlet, wherein the longitudinal ridge divides the outlet portion into lobes.

18. A component for a gas turbine engine, the component comprising:

a flow path wall having a first surface and a second surface, wherein the first surface is exposed to cooling fluid and the second surface is exposed to hot working fluid;

a cooling hole comprising a metering section having an inlet at the first surface, a diffusing section having an outlet at the second surface, and a transition defined between the inlet and the outlet;

an upstream surface of the cooling hole, wherein the upstream surface is substantially straight from the inlet to the outlet; and

a downstream surface of the cooling hole, wherein the downstream surface converges toward the upstream surface from the inlet to the transition and diverges away from the upstream surface from the transition to the outlet; and

first and second lateral side surfaces of the cooling hole, wherein the first and second lateral side surfaces diverge from one another as the upstream surface and the downstream surface converge such that a flow area of the metering section decreases from the inlet to the transition or remains substantially constant.

19. The component of claim 18, wherein divergence of the first and second lateral side surfaces is selected such that cross sectional area of the metering section decreases from the inlet to the transition.

20. The component of claim 18, further comprising:

a ridge extending along the downstream surface of the cooling hole in the diffusing section, wherein the ridge divides the diffusing section of the cooling hole into lobes.

21. The component of claim 20, further comprising:

a transition region extending from the ridge to a trailing edge of the outlet.