of the casting core 196 where the casting dies 202A, 202B abut each other. In some examples, the parting line 204 defines a reference plane extending generally in the radial and chordwise directions C, R to separate a pressure side 206 and a suction side 207 of the casting core 196. The parting line 204 or reference plane can be planar or curvilinear, for example. Casting die 202A defines a pull direction P_A perpendicular to a corresponding pull plane 208_A, and casting die 202B can define a pull direction P_B perpendicular to a corresponding pull plane 208_B (shown in Figure 4B).

Surface protrusions 210 extending from one or more cavities of the casting dies 202A, 202B are configured such that one or more grooves 212 (shown in Figure 4A) corresponding to trip strips 195 are defined in the first portion 197 and/or the second portion 198. As shown, at least some of the grooves 212 are spaced from the parting line 204 to permit removal of material or flash from the casting core 196 at a predetermined keep-out area adjacent the parting line 204.

The grooves 212 can be arranged relative to the reference plane defined by the parting line 204. Each of the grooves 212 defines a respective groove axis 214 (shown in Figure 4A and also indicated at Figure 4B for corresponding surface protrusions 210A). As shown, a first set of grooves 212A are distributed along a first side 215A (shown in Figure 4B) of the reference plane defined by parting line 204 such that one or more of the groove axes 214A of the first set of grooves 212A is oriented with respect to a pull direction P of at least one of the casting dies 202A, 202B. In further examples, one or more, or each, of the groove axes 214A of the first set of grooves 212A is parallel to the pull direction P of at least one of the casting dies 202A, 202B, and in yet further examples, one or more, or each, of the groove axes 214A is substantially horizontal or parallel to a reference plane extending in the thickness and chordwise directions T, C. Parallel can be within ±10 degrees, more narrowly within ±5 degrees, or evenly more narrowly exactly parallel. The first side 215A can correspond to the pressure side 174 and a second side 215B can correspond to the suction side 175 of the blade 161, for example.

The arrangement of the first set of grooves 212A relative to the parting line 204 reduces a likelihood of backlock of the casting core 196 during separation of the casting dies 202A, 202B, and also reduces the need for additional die pulls and parting lines during formation of the grooves 212, thereby simplifying the

CLAIMS

What is claimed is:

1. A casting core for an airfoil, comprising:

a first portion extending in a first direction and corresponding to a first cavity of an airfoil, the first portion defining a reference plane along a parting line formed by a casting die; and

the first portion defines a plurality of grooves corresponding to a plurality of trip strips of the airfoil, each of the plurality of grooves defines a respective groove axis, and the plurality of grooves are distributed in the first direction along a first side of the reference plane such that one or more of the groove axes are oriented with respect to a pull direction of the casting die.

2. The casting core for an airfoil as recited in claim 1, wherein one or more of the groove axes is parallel to the pull direction.

3. The casting core for an airfoil as recited in claim 1, wherein at least some grooves of the plurality of grooves extend a length along the groove axis such that the at least some grooves are substantially straight.

4. The casting core for an airfoil as recited in claim 3, wherein the groove axis of each of the plurality of grooves is arranged at a radial angle relative to the reference plane such that the radial angle of each of the first set of grooves is the same in the first direction.

5. The casting core for an airfoil as recited in claim 1, wherein the plurality of grooves includes a first set of grooves oriented with respect to the pull direction and a second set of grooves, the second set of grooves corresponding to a second set of trip strips of the airfoil, and the second set of grooves are distributed in the first direction such that each of the second set of grooves defines a respective second groove axis transverse to the pull direction of the casting die.

6. The casting core for an airfoil as recited in claim 5, wherein at least some grooves of the second set of grooves extend from at least some grooves of the first set of grooves.

7. The casting core for an airfoil as recited in claim 1, comprising:

a second portion extending in the first direction and corresponding to a feeding cavity of the airfoil, the second portion defined by the casting die; and

wherein the first cavity is an impingement cavity located at a leading edge of the airfoil and in communication with the feeding cavity.

8. The casting core for an airfoil as recited in claim 1, wherein the parting line is curvilinear.

9. A gas turbine engine, comprising:

a rotor and a vane spaced axially from the rotor;

a blade outer air seal spaced radially from the rotor; and

wherein at least one of the rotor and the vane includes an airfoil section extending from a platform, at least one of the airfoil section, the platform and the blade outer air seal comprising:

a first cavity extending in a first direction, the first cavity defining a reference plane along a parting line formed by a casting die; and

a first set of trip strips distributed in the first direction along a surface of the first cavity and on a first side of the reference plane, each of the first set of trip strips defining a respective groove axis, the groove axes being oriented with respect to a pull direction of the casting die.

10. The gas turbine engine as recited in claim 9, wherein the first cavity is an impingement cavity bounded by an external wall of the airfoil section.

11. The gas turbine engine as recited in claim 9, wherein the external wall defines a leading edge of the airfoil section.

12. The gas turbine engine as recited in claim 11, wherein the platform section defines at least one of the first set of trip strips.

13. The gas turbine engine as recited in claim 9, wherein one or more of the groove axes of the first set of trip strips is parallel to the pull direction.

14. The gas turbine engine as recited in claim 9, comprising a second set of trip strips distributed in the first direction along surfaces of the first cavity such that each of the second set of trip strips defines a respective second axis transverse to the pull direction.

15. The gas turbine engine as recited in claim 14, wherein at least some trip strips of the second set of trip strips are connected to at least one trip strip of the first set of trip strips.

16. A method for fabricating a gas turbine engine component, comprising:

arranging a first die half adjacent to a second die half to define a parting line;

forming a first portion between the first die half and the second die half, the parting line extending in a first direction along the first portion, and the first portion corresponding to a first cavity of an airfoil; and

wherein the first portion defines a first set of grooves corresponding to first set of trip strips of the airfoil, each of the first set of grooves defines a respective groove axis, and the first set of grooves are distributed in the first direction such that one or more of the groove axes is oriented with respect to a pull direction of at least one of the first die half and the second die half.

17. The method as recited in claim 16, comprising removing material from the first portion along the parting line, and wherein the first cavity is an impingement cavity located at a leading edge of the airfoil.

18. The method as recited in claim 16, wherein one or more of the groove axes is parallel to the pull direction.

19. The method as recited in claim 18, wherein at least some grooves of the first set of grooves are substantially straight along the groove axis.

20. The method as recited in claim 16, wherein the first portion defines a second set of grooves corresponding to a second set of trip strips of the airfoil, and the second set of grooves are distributed such that each of the second set of grooves defines a respective second groove axis transverse to the pull direction of the at least one of the first die half and the second die half, and at least some grooves of the second set of grooves are connected to at least some grooves of the first set of grooves.

of the casting core 196 where the casting dies 202A, 202B abut each other. In some examples, the parting line 204 defines a reference plane extending generally in the radial and chordwise directions R, C to separate a pressure side 206 and a suction side 207 of the casting core 196. The parting line 204 or reference plane can be planar or curvilinear, for example. Casting die 202A defines a pull direction P_A perpendicular to a corresponding pull plane 208_A, and casting die 202B can define a pull direction P_B perpendicular to a corresponding pull plane 208_B (shown in Figure 4B).

Surface protrusions 210 extending from one or more cavities of the casting dies 202A, 202B are configured such that one or more grooves 212 (shown in Figure 4A) corresponding to trip strips 195 are defined in the first portion 197 and/or the second portion 198. As shown, at least some of the grooves 212 are spaced from the parting line 204 to permit removal of material or flash from the casting core 196 at a predetermined keep-out area adjacent the parting line 204.

The grooves 212 can be arranged relative to the reference plane defined by the parting line 204. Each of the grooves 212 defines a respective groove axis 214 (shown in Figure 4A and also indicated at Figure 4B for corresponding surface protrusions 210A). As shown, a first set of grooves 212A are distributed along a first side 215A (shown in Figure 4B) of the reference plane defined by parting line 204 such that one or more of the groove axes 214A of the first set of grooves 212A is oriented with respect to a pull direction P of at least one of the casting dies 202A, 202B. In further examples, one or more, or each, of the groove axes 214A of the first set of grooves 212A is parallel to the pull direction P of at least one of the casting dies 202A, 202B, and in yet further examples, one or more, or each, of the groove axes 214A is substantially horizontal or parallel to a reference plane extending in the thickness and chordwise directions T, C. Parallel can be within ±10 degrees, more narrowly within ±5 degrees, or evenly more narrowly exactly parallel. The first side 215A can correspond to the pressure side 175 and a second side 215B can correspond to the suction side 174 of the blade 161, for example.

The arrangement of the first set of grooves 212A relative to the parting line 204 reduces a likelihood of backlock of the casting core 196 during separation of the casting dies 202A, 202B, and also reduces the need for additional die pulls and parting lines during formation of the grooves 212, thereby simplifying the

CLAIMS

What is claimed is:

1. A casting core for an airfoil, comprising:

a first portion extending in a first direction and corresponding to a first cavity of an airfoil, the first portion defining a reference plane along a parting line formed by a casting die; and

the first portion defines a plurality of grooves corresponding to a plurality of trip strips of the airfoil, each of the plurality of grooves defines a respective groove axis, and the plurality of grooves are distributed in the first direction along a first side of the reference plane such that one or more of the groove axes are oriented with respect to a pull direction of the casting die.

2. The casting core for an airfoil as recited in claim 1, wherein one or more of the groove axes is parallel to the pull direction.

3. The casting core for an airfoil as recited in claim 1, wherein at least some grooves of the plurality of grooves extend a length along the groove axis such that the at least some grooves are substantially straight.

4. The casting core for an airfoil as recited in claim 3, wherein the groove axis of each of the plurality of grooves is arranged at a radial angle relative to the reference plane such that the radial angle of each of the plurality of grooves is the same in the first direction.

5. The casting core for an airfoil as recited in claim 1, wherein the plurality of grooves includes a first set of grooves oriented with respect to the pull direction and a second set of grooves, the second set of grooves corresponding to a second set of trip strips of the airfoil, and the second set of grooves are distributed in the first direction such that each of the second set of grooves defines a respective second groove axis transverse to the pull direction of the casting die.

6. The casting core for an airfoil as recited in claim 5, wherein at least some grooves of the second set of grooves extend from at least some grooves of the first set of grooves.

7. The casting core for an airfoil as recited in claim 1, comprising:

a second portion extending in the first direction and corresponding to a feeding cavity of the airfoil, the second portion defined by the casting die; and

wherein the first cavity is an impingement cavity located at a leading edge of the airfoil and in communication with the feeding cavity.

8. The casting core for an airfoil as recited in claim 1, wherein the parting line is curvilinear.

9. A gas turbine engine, comprising:

a rotor and a vane spaced axially from the rotor;

a blade outer air seal spaced radially from the rotor; and

wherein at least one of the rotor and the vane includes an airfoil section extending from a platform, at least one of the airfoil section, the platform and the blade outer air seal comprising:

a first cavity extending in a first direction, the first cavity defining a reference plane along a parting line formed by a casting die; and

a first set of trip strips distributed in the first direction along a surface of the first cavity and on a first side of the reference plane, each of the first set of trip strips defining a respective groove axis, the groove axes being oriented with respect to a pull direction of the casting die.

10. The gas turbine engine as recited in claim 9, wherein the first cavity is an impingement cavity bounded by an external wall of the airfoil section.

11. The gas turbine engine as recited in claim 10, wherein the external wall defines a leading edge of the airfoil section.

12. The gas turbine engine as recited in claim 11, wherein the platform section defines at least one of the first set of trip strips.

13. The gas turbine engine as recited in claim 9, wherein one or more of the groove axes of the first set of trip strips is parallel to the pull direction.

14. The gas turbine engine as recited in claim 9, comprising a second set of trip strips distributed in the first direction along surfaces of the first cavity such that each of the second set of trip strips defines a respective second axis transverse to the pull direction.

15. The gas turbine engine as recited in claim 14, wherein at least some trip strips of the second set of trip strips are connected to at least one trip strip of the first set of trip strips.

16. A method for fabricating a gas turbine engine component, comprising:

arranging a first die half adjacent to a second die half to define a parting line;

forming a first portion between the first die half and the second die half, the parting line extending in a first direction along the first portion, and the first portion corresponding to a first cavity of an airfoil; and

wherein the first portion defines a first set of grooves corresponding to first set of trip strips of the airfoil, each of the first set of grooves defines a respective groove axis, and the first set of grooves are distributed in the first direction such that one or more of the groove axes is oriented with respect to a pull direction of at least one of the first die half and the second die half.

17. The method as recited in claim 16, comprising removing flash of a casting core from the first portion along the parting line, and wherein the first cavity is an impingement cavity located at a leading edge of the airfoil.

18. The method as recited in claim 16, wherein one or more of the groove axes is parallel to the pull direction.

19. The method as recited in claim 18, wherein at least some grooves of the first set of grooves are substantially straight along the groove axis.

20. The method as recited in claim 16, wherein the first portion defines a second set of grooves corresponding to a second set of trip strips of the airfoil, and the second set of grooves are distributed such that each of the second set of grooves defines a respective second groove axis transverse to the pull direction of the at least one of the first die half and the second die half, and at least some grooves of the second set of grooves are connected to at least some grooves of the first set of grooves.