CLAIMS:

1. A device for heat treating a metal component, comprising:
at least one parabolic mirror formed in the axially extending cavity; and
at least one IR heat source for providing IR heat rays in a direction
toward the at least one parabolic mirror;
such that the at least one parabolic mirror is positioned to focus a
band of the IR heat rays onto the metal component.

2. The device of claim 1, wherein the metal part is at least one airfoil in an integrally bladed rotor.

3. The device of claim 2, wherein the IR heat source and parabolic mirror are sized to direct the IR heat rays along the junction between the airfoil and the integrally bladed rotor device.

4. The device of claim 3, which includes a pair of housings on opposite sides of the entire area of contact between the airfoil and the integrally bladed rotor device, with each housing having an IR heat source and a parabolic mirror formed in the housing for each IR heat source.

5. The device of claim 4, wherein each of the pair of IR heat sources are mounted to its respective housing with a clip.

6. The device of claim 5, wherein the parabolic mirror directs the IR heat rays to a region of the airfoil where it is joined to the integrally bladed rotor device.

7. The device of claim 1, wherein the IR heat rays are focused into an elongated band having a band width of from about 6 mm to about 18 mm.

8. The device of claim 2, which further includes a cooling element for each IR heat source for maintaining a desired temperature for the IR heat source.

9. The device of claim 8, wherein the cooling element is part of the housing having an axial passage adapted to transfer cooling liquid through the passage, and the housing extends along the airfoil.

10. The device of claim 9, wherein the housing includes a cavity forming a parabolic mirror and the IR heat source is mounted in the cavity to focus the IR heat rays on the junction of the airfoil where it is joined to the integrally bladed rotor device.

11. A system for heat treating at least one airfoil in an integrally bladed rotor device, the system comprising:

at least one IR heat source means mounted in a position for directing IR heat rays in a direction; and

at least one parabolic mirror means for reflecting the IR rays on to the at least one portion of an airfoil.

12. The system of claim 11, which includes a pair of housings each having an axially extending cavity, the cavity forming the parabolic mirror, the housings further each positioning an IR heat source, wherein the pair of IR heat sources are facing in opposite directions and each IR heat source is aligned with the parabolic mirror.

13. The system of claim 12, wherein the parabolic mirror directs the IR heat rays radially inward to the airfoil where it is joined to the integrally bladed rotor device.

14. The system of claim 13, which further includes a cooling element for each IR heat source for maintaining a desired temperature for the IR heat source.

15. The system of claim 14, wherein the cooling element is part of a housing having an axial passage adapted to transfer cooling liquid through the passage, and the housing extends along the width of the airfoil.

16. A method for heat treating at least one airfoil in an integrally bladed rotor device having a rotor and a plurality of blades, comprising:

providing a pair of housings each having an axially extending cavity, the cavity including a surface forming a parabolic mirror;

positioning an IR heat sources proximate each parabolic mirror, wherein the IR heat sources are facing in opposite directions and each IR heat source is aligned with its parabolic mirror to direct IR heat rays in a direction radially inward to the airfoil where it is joined to the integrally bladed rotor device; and

cooling each IR heat source to maintain a desired temperature for the IR heat source, the cooling element being part of the housing and having an axial passage adapted to transfer cooling liquid through the passage.

17. The method of claim 16, wherein the IR heat rays are focused into an elongated band having a band width of from about 6 mm to about 18 mm.

18. The method of claim 16, wherein the heat rays heat the metal component to a temperature of at least 1,300 °F (704 °C) and the cooling element maintains the adjacent areas adjacent areas of the metal component below 1,000 °F (538 °C).

CLAIMS

1. A method of heat treating an airfoil (11) in an integrally bladed rotor using two focused infrared heat lamps, wherein each heat lamp comprises:
a housing (13, 15) providing an axially extending cavity;
at least one parabolic mirror (17, 19) formed in the axially extending cavity; and
at least one IR heat source (27) for providing IR heat rays in a direction toward the at least one parabolic mirror;
the method comprising:
positioning the two heat lamps to face in opposite directions and such that the at least one parabolic mirror of each lamp is positioned to focus a band of the IR heat rays onto opposite sides of the airfoil.

2. The method of claim 1, wherein the IR heat source (27) and parabolic mirror (17, 19) are sized to direct the IR heat rays along the junction between the airfoil (11) and the integrally bladed rotor device.

3. The method of claim 2, wherein the pair of housings (13, 15) are on opposite sides of the entire area of contact between the airfoil (11) and the integrally bladed rotor device.

4. The method of claims 1, 2, or 3, wherein each of the pair of IR heat sources (27) are mounted to its respective housing (13, 15) with a clip (29).

5. The method of any preceding claim, wherein the IR heat rays are focused into an elongated band having a width of from about 6 mm to about 18 mm.

6. The method of any preceding claim, which further includes a cooling element for each IR heat source for maintaining a desired temperature for the IR heat source.

7. The method of claim 6, wherein the cooling element is part of the housing (13, 15) having an axial passage (33) adapted to transfer cooling liquid through the passage, and the housing extends along the airfoil (11).

8. The method of claim 7, wherein the cavity forms the parabolic mirror (17, 19) and the IR heat source (27) is mounted in the cavity to focus the IR heat rays on the junction of the airfoil (11) where it is joined to the integrally bladed rotor device.

9. The method of any preceding claim, wherein the parabolic mirror (17, 19) directs the IR heat rays radially inward to the airfoil (11) where it is joined to the integrally bladed rotor device.

10. The method of any preceding claim, the method comprising:
providing the pair of housings (13, 15) each having an axially extending cavity, the cavity including a surface forming the parabolic mirror (17, 19);
positioning the IR heat sources (27) proximate each parabolic mirror, wherein the IR heat sources are facing in opposite directions and each IR heat source is aligned with

its parabolic mirror to direct IR heat rays in a direction radially inward to the airfoil (11) where it is joined to the integrally bladed rotor device; and

cooling each IR heat source with a cooling element to maintain a desired temperature for the IR heat source.

11. The method of any preceding claim, wherein the heat rays heat the airfoil (11) to a temperature of at least 1,300 °F (704 °C) and the cooling element maintains the adjacent areas of the airfoil below 1,000 °F (538 °C).