CLAIMS:

1. A cold metal transfer (CMT) welding apparatus, comprising:

a CMT contact tip having a contact surface that is a substantially copper-free metal;

a weld wire in physical contact with the contact surface; and

a CMT wire feeder constructed and arranged to feed the weld wire through the CMT contact tip with an axially oscillating motion with respect to a centerline axis of the CMT contact tip.

2. The CMT welding apparatus of claim 1, wherein the weld wire is cobalt or a cobalt alloy.

3. The CMT welding apparatus of claim 1, wherein the weld wire is substantially the same copper-free metal as that selected for the contact surface.

4. The CMT welding apparatus of claim 1, wherein the contact surface is aluminum or an aluminum alloy.

5. The CMT welding apparatus of claim 1, wherein the contact surface is stainless steel.

6. The CMT welding apparatus of claim 1, wherein the contact surface is titanium or a titanium alloy.

7. The CMT welding apparatus of claim 1, wherein the contact surface is cobalt or a cobalt alloy.

8. A cold metal transfer (CMT) contact tip for use with a CMT welding apparatus, the CMT welding apparatus a wire feeder for feeding and oscillating a weld wire forward and

backward through and sharing a concentric axis with a wire passage in the CMT contact tip, the CMT contact tip comprising:

a substantially copper-free contact surface defining the wire passage.

9. The CMT contact tip of claim 8, wherein the CMT contact tip is a homogeneous, single-piece, metal body.

10. The CMT contact tip of claim 8, comprising the contact surface being stainless steel.

11. The CMT contact tip of claim 8, comprising the contact surface being aluminum or an aluminum alloy.

12. The CMT contact tip of claim 8, comprising the contact surface being titanium or a titanium alloy.

13. The CMT contact tip of claim 8, comprising the contact surface being nickel or a nickel alloy.

14. The CMT contact tip of claim 8, comprising the contact surface being cobalt or a cobalt alloy.

15. A method for welding a workpiece, the method comprising the steps of:

installing a cold metal transfer (CMT) contact tip having a substantially copper-free metal contact surface into a CMT welding device;

feeding a weld wire through the CMT contact tip such that the weld wire axially oscillates along a centerline axis of the CMT contact tip and in contact with the contact surface; and

depositing material from the weld wire on the workpiece to form a substantially copper-free weld.

16. The method of claim 15, wherein the weld wire is a metal selected from the group consisting of cobalt and cobalt alloys.

17. The method of claim 15, wherein the workpiece is a damaged turbine blade for a gas turbine engine.

18. The method of claim 15, wherein the workpiece is cobalt, a cobalt alloy, or a nickel alloy.

19. The method of claim 15, wherein the weld wire oscillates with respect to the CMT contact tip without the CMT contact tip depositing copper on the weld wire.

20. The method of claim 19, wherein the weld wire oscillates axially with respect to the CMT contact tip about 70 times per second during feeding.

CLAIMS

1. A cold metal transfer (CMT) welding apparatus (10), comprising:

a CMT contact tip (32) having a contact surface (74);

a weld wire (40) in physical contact with the contact surface; and

a CMT wire feeder (20) constructed and arranged to feed the weld wire through the CMT contact tip with an axially oscillating motion with respect to a centerline axis of the CMT contact tip,

characterized by:

the contact surface being a copper-free metal; and wherein the weld wire (40) is the same copper-free metal as that selected for the contact surface (74).

2. The CMT welding apparatus of claim 1 wherein the CMT contact tip is a homogeneous, single-piece, metal body (60).

3. The CMT welding apparatus of claim 1 or 2, wherein the weld wire (40) is cobalt or a cobalt alloy.

4. The CMT welding apparatus of claim 1, 2, or 3 wherein the contact surface (74) is stainless steel; or wherein the contact surface is aluminum or an aluminum alloy; or the contact surface is titanium or a titanium alloy, or wherein contact surface (74) is nickel or a nickel alloy, or wherein the contact surface (74) is cobalt or a cobalt alloy.

5. A method for welding a workpiece (50), the method comprising the steps of:

installing a cold metal transfer (CMT) contact tip (32) having a contact surface (74) into a CMT welding device (10);

feeding a weld wire (40) through the CMT contact tip such that the weld wire axially oscillates along a centerline axis of the CMT contact tip and in contact with the contact surface; and

depositing material from the weld wire on the workpiece to form a copper-free weld,

characterized by:

the contact surface being a copper-free metal; and wherein the weld wire (40) is the same copper-free metal as that selected for the contact surface (74).

6. The method of claim 5, wherein the weld wire (40) is a metal selected from the group consisting of cobalt and cobalt alloys.

7. The method of claim 5 or 6, wherein the workpiece (50) is a damaged turbine blade for a gas turbine engine.

8. The method of claim 5, 6 or 7, wherein the workpiece (50) is cobalt, a cobalt alloy, or a nickel alloy.

9. The method of claim 5, 6, 7 or 8, wherein the weld wire oscillates with respect to the CMT contact tip without the CMT contact tip depositing copper on the weld wire; and preferably wherein the weld wire oscillates axially with respect to the CMT contact tip about 70 times per second during feeding.