I claim:

1. A method of at least partially filling at least one opening in a workpiece made of a metal, said at least one opening being at least partially defined by at least one opening wall having at least one opening wall surface, the method comprising the steps of:

(a) providing an insert comprising an insert material that is metallically bondable with the metal, the insert being formed to at least partially fit into said at least one opening, the insert having at least one insert engagement surface formed for engagement with said at least one opening wall surface;

(b) positioning at least one opening surface heating element proximal to said at least one opening wall surface;

(c) positioning at least one insert heating element proximal to said at least one insert engagement surface;

~~(b)~~ (d) with said at least one opening surface heating element, heating said at least one opening wall surface in a first non-oxidizing atmosphere to a hot working temperature, ~~at which~~to uniformly heat an opening wall heated layer of said at least one opening wall to a first distance from said at least one opening wall surface to the hot working temperature, at which said hot working temperature the opening heated layer is plastically deformable, the hot working temperature being less than a melting temperature of the metal;

~~(c)~~ (e) with said at least one insert heating element, heating said at least one insert engagement surface in a second non-oxidizing atmosphere to the hot working temperature, to uniformly heat an insert heated layer of said at least one insert to a second distance from the insert engagement surface to the hot working temperature, at which said ~~at least one~~hot working temperature the insert ~~engagement surface~~heated layer is plastically deformable;

(f) moving said at least one opening surface heating element away from said at least one opening wall surface, to permit engagement of said at least one insert engagement surface with said at least one opening wall surface;

(g) moving said at least one insert heating element away from said at least one insert engagement surface, to permit engagement of said at least one insert engagement surface with said at least one opening wall surface;

~~(d)~~ (h) subjecting the insert to an engagement motion, to move said at least one insert engagement surface relative to said at least one opening wall surface;

~~(e)~~ (i) while the insert is subjected to the engagement motion, and while ~~said at least one~~the insert ~~engagement surface~~heated layer and ~~said at least one~~the opening wall ~~surface~~heated layer are at the hot working temperature, subjecting the insert to a translocation motion to move the insert at least partially into said at least one opening, for engaging said at least one insert engagement surface with said at least one opening wall surface while the insert is subjected to the engagement motion, to cause plastic deformation of ~~said at least one~~the opening wall ~~surface~~heated layer and of ~~said at least one~~the insert ~~engagement surface~~heated layer as they engage each other, for at least partially creating a metallic bond between the insert and the workpiece; and

~~(f)~~ (j) allowing the insert and the workpiece to cool, to solidify the insert and the workpiece together.

~~2. A method according to claim 1 in which said at least one opening wall surface is uniformly heated to the hot working temperature, and said at least one opening wall is uniformly heated to the hot working temperature to a first distance from said at least one opening wall surface in said at least one opening wall.~~

~~3. A method according to claim 1 in which said at least one insert engagement surface is uniformly heated to the hot working temperature, and said at least one~~

~~insert is uniformly heated to the hot working temperature to a second distance from said at least one insert engagement surface in said at least one insert.~~

2. ~~4.~~ A method according to claim 1 in which the engagement motion is an oscillating motion relative to the workpiece.

3. ~~5.~~ A method according to claim ~~4~~2 in which the oscillating motion is a linear motion of the insert in which the insert is moved relative to the workpiece.

4. ~~6.~~ A method according to claim 1 in which the engagement motion is a rotation of the insert relative to the workpiece, about an axis of the insert.

5. ~~7.~~ A method according to claim 1 in which the engagement motion is a vibrating motion relative to the workpiece.

6. ~~8.~~ A method according to claim 1 in which said at least one opening wall surface is planar, and said at least one insert engagement surface is planar.

7. ~~9.~~ A method according to claim ~~8~~6 in which the translocation motion is in a predetermined linear direction into said at least one opening and said at least one opening wall surface is located at a predetermined angle relative to the predetermined linear direction.

8. ~~10.~~ A method according to claim 1 in which the translocation motion is in a predetermined linear direction, into said at least one opening.

9. ~~11.~~ A method according to claim 1 in which:

the insert extends between an inner end and an outer end thereof; and

the insert comprises at least one chamfered insert surface located proximal to said at least one insert engagement surface at one or more of the inner and outer ends.

10. ~~12.~~ A method according to claim ~~11~~9 in which:

said at least one opening wall surface extends between an internal end and an external end; and

the workpiece comprises at least one chamfered workpiece surface located proximal to said at least one opening wall surface at one or more of the internal and external ends.

11. A method according to claim 9 in which the insert comprises at least one notch formed at the inner end thereof in which the extruded material is partially receivable.

~~13. A system for at least partially filling at least one opening in a workpiece made of a metal, said at least one opening being at least partially defined by at least one opening wall having at least one opening wall surface, the system comprising:~~

~~at least one clamp subassembly, for holding the workpiece stationary;~~

~~an insert comprising an insert material that is bondable with the metal, the insert being formed to at least partially fit into said at least one opening, the insert having at least one insert engagement surface formed for engagement with said at least one opening wall surface;~~

~~at least one first heating element, for heating said at least one opening wall surface in a first non-oxidizing atmosphere to a hot working temperature at which said at least one opening wall surface is plastically deformable;~~

~~at least one second heating element, for heating said at least one insert engagement surface in a second non-oxidizing atmosphere to the hot working temperature, said at least one insert engagement surface being plastically deformable at the hot working temperature;~~

~~an insert movement subassembly, for simultaneously subjecting the insert (i) to an engagement motion in which said at least one insert engagement surface is moved relative to said at least one opening wall surface, and (ii) to a translocation motion, in which the insert is moved at least partially into~~

said at least one opening, for plastic deformation of said at least one engagement surface and said at least one opening wall surface as they engage each other, for metallic bonding of the insert and the workpiece;

said at least one first heating element and said at least one second heating element being removable upon said at least one opening wall being heated to the hot working temperature, to at least a first distance in said at least one opening wall from said at least one opening wall surface, and upon said at least one insert engagement surface being heated to the hot working temperature, to at least a second distance in the insert from said at least one insert engagement surface; and

the system being configured to permit the insert and the workpiece to cool after said at least one insert engagement surface and said at least one opening wall surface have engaged each other and plastically deformed, to metallically bond the insert and the workpiece.

14. A method of at least partially attaching a tube to a workpiece made of a metal, to at least partially align the tube with at least one opening in the workpiece, said at least one opening being at least partially defined by at least one opening wall having at least one opening wall surface, the method comprising the steps of:

(a) forming at least one tube engagement surface on the tube that is configured for engagement with said at least one opening wall surface;

(b) heating said at least one opening wall surface in a first non-oxidizing atmosphere to a hot working temperature, at which said at least one opening wall surface is plastically deformable;

(c) heating said at least one tube engagement surface in a second non-oxidizing atmosphere to the hot working temperature, at which said at least one tube engagement surface is plastically deformable;

(d) subjecting the tube to an engagement motion, to move said at least one tube engagement surface relative to said at least one opening wall surface;

(e) while the tube is subjected to the engagement motion, and while said at least one tube engagement surface and said at least one opening wall surface are at the hot working temperature, subjecting the tube to a translocation motion to move the tube at least partially into said at least one opening, for engaging said at least one tube engagement surface with said at least one opening wall surface while the tube is subjected to the engagement motion, to cause plastic deformation of said at least one opening wall surface and of said at least one tube engagement surface as they engage each other, for at least partially creating a metallic bond between the tube and the workpiece; and

(f) allowing the tube and the workpiece to cool, to solidify the tube and the workpiece together.

15. A method of repairing a workpiece comprising a defective region thereof, the method comprising the steps of:

(a) removing a portion of the workpiece comprising the defective region, to provide an opening in a remaining portion of the workpiece, the opening being defined by at least one opening wall having at least one opening wall surface on the remaining portion of the workpiece;

(b) providing a first insert comprising a first insert material that is metallically bondable with the metal, the first insert being formed to at least partially fit into at least a part of said at least one opening, the first insert having at least one first insert engagement surface formed for engagement with said at least one opening wall surface;

(c) heating said at least one opening wall surface in a first non-oxidizing atmosphere to a hot working temperature at which said at least one opening wall surface is plastically deformable;

(d) heating said at least one first insert engagement surface in a second non-oxidizing atmosphere to the hot working temperature at which said at least one first insert engagement surface is plastically deformable;

(e) subjecting the first insert to a first engagement motion, to move said at least one first insert engagement surface relative to said at least one opening wall surface;

(f) while the first insert is subjected to the first engagement motion, and while said at least one first insert engagement surface and said at least one opening wall surface are at the hot working temperature, subjecting the first insert to a first translocation motion to move the first insert at least partially into said at least one opening, for engaging said at least one first insert engagement surface with said at least one opening wall surface while the first insert is subjected to the engagement motion, to cause plastic deformation of said at least one opening wall surface and of said at least one first insert engagement surface as they engage each other, for at least partially creating a metallic bond between the first insert and the remaining portion of the workpiece; and

(g) permitting the first insert and the remaining portion of the workpiece to cool, to provide a partially-repaired workpiece comprising the first insert and the remaining portion of the workpiece metallically bonded together.

16. A method according to claim 15 additionally comprising the steps of:

(h) forming at least one supplementary opening in the partially-repaired workpiece, said at least one supplementary opening being defined by at least one supplementary opening wall that is at least partially located in the first insert, and at least partially located in the remaining portion of the workpiece, said at least one supplementary opening wall having at least one supplementary opening wall surface;

(i) providing at least one second insert comprising a second insert material that is metallically bondable with the metal, said at least one second insert being formed to at least partially fit into said at least one supplementary opening, said at least one second insert having at least one second insert engagement surface formed for engagement with said at least one supplementary opening wall surface;

(j) heating said at least one supplementary opening wall surface in the non-oxidizing atmosphere to the hot working temperature at which said at least one supplementary opening wall surface is plastically deformable;

(k) heating said at least one second insert engagement surface in the non-oxidizing atmosphere to the hot working temperature at which said at least one second insert engagement surface is plastically deformable;

(l) subjecting said at least one second insert to a second engagement motion, to move said at least one second insert engagement surface relative to said at least one supplementary opening wall surface;

(m) while said at least one second insert is subjected to the second engagement motion, and while said at least one second insert engagement surface and said at least one supplementary opening wall surface are at the hot working temperature, additionally subjecting said at least one second insert to a second translocation motion to move said at least one second insert at least partially into said at least one supplementary opening, for engaging said at least one second insert engagement surface with said at least one supplementary opening wall surface, to cause plastic deformation of said at least one supplementary opening wall surface and of said at least one second insert engagement surface as they engage each other, for at least partially creating a metallic bond between said at least one second insert and the partially-repaired workpiece; and

(n) allowing said at least one second insert and the partially-repaired workpiece to cool, to form a repaired workpiece comprising said at least one second insert and the partially-repaired workpiece.

17. A method according to claim 16 in which said at least one supplementary opening is round.

18. A method according to claim 17 in which said at least one second insert is a right circular cone.

19. A method according to claim 18 in which said at least one second insert is frustoconical.

20. A method of at least partially filling at least one opening in a workpiece, the workpiece comprising at least two layers, each of said at least two layers comprising respective metals, said at least one opening being at least partially defined by at least one opening wall surface, the method comprising the steps of:

(a) providing an insert comprising at least two insert materials that are metallically bondable with the respective metals of said at least two layers of the workpiece, the insert being formed to at least partially fit into said at least one opening, the insert having at least one insert engagement surface formed for engagement with said at least one opening wall surface;

(b) heating said at least one opening wall surface in a first non-oxidizing atmosphere to a hot working temperature, at which said at least one opening wall surface is plastically deformable;

(c) heating said at least one insert engagement surface in a second non-oxidizing atmosphere to the hot working temperature, at which said at least one insert engagement surface is plastically deformable;

(d) subjecting the insert to an engagement motion, to move said at least one insert engagement surface relative to said at least one opening wall surface;

(e) while the insert is subjected to the engagement motion, and while said at least one insert engagement surface and said at least one opening wall surface are at the hot working temperature, subjecting the insert to a translocation motion to move the insert at least partially into said at least one opening, for engaging said at least one insert engagement surface with said at least one opening wall surface while the insert is subjected to the engagement motion, to cause plastic deformation of said at least one opening wall surface and of said at least one insert engagement surface as they engage each other, for at least partially creating metallic bonds between the insert and the workpiece; and

(f) allowing the insert and the workpiece to cool, to solidify the insert and the workpiece together.