CLAIMS

What is claimed is:

1. An automated wet masking system (60) for applying a maskant to a portion (16) of a workpiece (10), the system (60) comprising:

one or more pressurized mixing vessels (62, 64),

each of the mixing vessels including an agitator (66) for continuously blending the ingredients of the maskant and/or maintaining the maskant in the form of a slurry mixture in suspension,

a dispensing system (88) hydraulically connected to and downstream of the one or more pressurized mixing vessels (62, 64), and

the dispensing system (88) hydraulically connected to one or more injection valves (94, 96) and operable for supplying and dispensing metered volumes of the maskant to the injection valves (94, 96).

2. The automated wet masking system (60) of claim 1, further comprising an electronic controller (20) for controlling the masking system (60) to automatically coat the portion of a workpiece with the maskant.

3. The automated wet masking system (60) of claim 2, further comprising:

a fixture (30) for holding the workpiece (10) during the masking process with the portion (16) of the workpiece (10) inside a hollow interior or cavity (31) of the fixture (30),

a top opening (40) in the fixture (30) operable to place only the portion (16) of the workpiece (10) inside the cavity (31), and

one or more inlet ports (44, 46) in one or more sides (32, 34) of the fixture (30) are alignable with one or more injection ports (104, 106) of the one or more injection valves (94, 96) respectively for injecting the maskant into the cavity (31) for coating the portion (16) of the workpiece (10).

4. The automated wet masking system (60) of claim 3, further comprising one or more heaters (110, 112) operably positioned for drying or flash drying the maskant on the portion of the workpiece.

5. The automated wet masking system (60) of claim 3, further comprising one or more controllable recirculation lines (114, 116) hydraulically leading from the one or more injection valves (94, 96) to at least one of the mixing vessels (62, 64) and the controller (20) operable to flow the maskant through the recirculation lines (114, 116) after a period of time when no maskant is flowing through masking system (60).

6. The automated wet masking system (60) of claim 3, further comprising:

the one or more injection valves (94, 96) mounted on one or more powered slides (100, 102) respectively,

a rotary table (98) for supporting the workpiece (10) during the masking process at a first angular position of the rotary table (98),

the one or more heaters (110, 112) operably positioned for drying or flash drying the maskant on the portion of the workpiece at a second angular position of the rotary table (98), and

the one or more injection valves (94, 96) positioned ninety degrees apart from the one or more heaters (110, 112) respectively.

7. The automated wet masking system (60) of claim 6, further comprising:

one or more controllable recirculation lines (114, 116) hydraulically leading from the one or more injection valves (94, 96) to at least one of the mixing vessels (62, 64),

the controller (20) operable to flow the maskant through the recirculation lines (114, 116) after a period of time when no maskant is flowing through masking system (60), and

the maskant including an alcoholic binder material and/or metallic and metallic oxide powders.

8. An automated wet masking system (60) for applying a maskant to a root or dovetail (16) of gas turbine engine blade (10), the system (60) comprising:

at least hydraulically connected serially inline first and second pressurized mixing vessels (62, 64),

each of the mixing vessels including an agitator (66) for continuously blending the ingredients of the maskant and/or maintaining the maskant in the form of a slurry

mixture in suspension,

a dispensing system (88) hydraulically connected to and downstream of the second pressurized mixing vessel (64),

the dispensing system (88) hydraulically connected to first and second injection valves (94, 96) and hydraulically connected and operable for supplying and dispensing metered volumes of the maskant to the first and second injection valves (94, 96),

an electronic controller (20) for controlling the masking system (60) to automatically coat the root or dovetail (16) with the maskant,

a fixture (30) for holding the gas turbine engine blade (10) during the masking process with the root or dovetail (16) of gas turbine engine blade (10) inside a hollow interior or cavity (31) of the fixture (30),

a top opening (40) in the fixture (30) operable to place only the root or dovetail (16) of the blade (10) inside the hollow interior or cavity (31),

first and second inlet ports (44, 46) in first and second sides (32, 34) of the fixture (30) are alignable with first and second injection ports (104, 106) of the first and second injection valves (94, 96) respectively for injecting the maskant into the hollow interior or cavity (31) for coating the root or dovetail (16) of the blade (10),

first and second heaters (110, 112) operably positioned for drying or flash drying the maskant on the root or dovetail (16) of the blade (10).

9. The automated wet masking system (60) of claim 8, further comprising:

first and second more controllable recirculation lines (114, 116) hydraulically leading from the first and second injection valves (94, 96) to at least one of the first and second mixing vessels (62, 64),

the controller (20) operable to flow the maskant through the recirculation lines (114, 116) after a period of time when no maskant is flowing through masking system (60), and

the maskant including an alcoholic binder material and/or metallic and metallic oxide powders.

10. The automated wet masking system (60) of claim 8, further comprising:

the first and second injection valves (94, 96) mounted on first and second powered slides (100, 102) respectively,

a rotary table (98) for supporting the blade (10) during the masking process at a first angular position of the rotary table (98),

the first and second heaters (110, 112) operably positioned for drying or flash drying the maskant on the root or dovetail (16) of blade (10) at a second angular position of the rotary table (98),

the first and second injection valves (94, 96) positioned 180 degrees apart from each other and 90 degrees apart from the first and second heaters (110, 112) respectively, and

first and second controllable recirculation lines (114, 116) hydraulically leading from the first and second injection valves (94, 96) to at least one of the first and second mixing vessels (62, 64) and the controller (20) operable to flow the maskant through the recirculation lines (114, 116) after a period of time when no maskant is flowing through masking system (60).

11. A method for applying a maskant to a portion (16) of a workpiece (10) with an automated wet masking system (60), the method comprising:

loading maskant ingredients into a first one of one or more pressurized mixing vessels (62, 64),

continuously blending the ingredients of the maskant and/or maintaining the maskant in the form of a slurry mixture in suspension using an agitator (66) in each of the mixing vessels,

hydraulically flowing the maskant from the one or more pressurized mixing vessels (62, 64) to a dispensing system (88),

metering the maskant from the dispensing system (88) and hydraulically supplying the maskant from dispensing system (88) to one or more injection valves (94, 96),

coating the portion (16) of a workpiece (10) with the maskant injected by the one or more injection valves (94, 96),

drying or flash drying the maskant on the portion of the workpiece one or more heaters (110, 112) after the portion (16) of a workpiece (10) has been coated with the maskant, and

recirculating the maskant by opening one or more recirculation lines (114, 116) leading from the one or more valves (94, 96) respectively to the one of the mixing vessel

when the automated wet masking system (60) is running and not coating for a period of time.

12. A method for applying a maskant to a root or dovetail (16) of gas turbine engine blade (10), the method comprising:

loading maskant ingredients into first and second pressurized mixing vessels (62, 64),

continuously blending the ingredients of the maskant and/or maintaining the maskant in the form of a slurry mixture in suspension using an agitator (66) in each of the mixing vessels,

hydraulically flowing the maskant from the first and second pressurized mixing vessels (62, 64) to a dispensing system (88),

metering the maskant from dispensing system (88) and hydraulically supplying the maskant from dispensing system (88) to first and second injection valves (94, 96),

mounting the blade (10) in a fixture (30) for holding the blade (10) during the masking process with the root or dovetail (16) inside a hollow interior or cavity (31) of the fixture (30),

coating the root or dovetail (16) by injecting the maskant with the first and second injection valves (94, 96) into the hollow interior or cavity (31) of the fixture (30),

injecting the maskant through first and second injection ports (104, 106) of the first and second injection valves (94, 96) and into the hollow interior or cavity (31) through first and second inlet ports (44, 46) in first and second sides (32, 34) of the fixture (30) respectively,

drying or flash drying the maskant using first and second heaters (110, 112) after the root or dovetail (16) has been coated with the maskant and while the root or dovetail (16) is still inside the hollow interior or cavity (31), and

recirculating the maskant by opening first and second recirculation lines (114, 116) leading from the first and second valves (94, 96) respectively to the one of the mixing vessel when the automated wet masking system (60) is running and not coating for a period of time.

CLAIMS

1. An automated wet masking system for applying a wet maskant to a portion of a workpiece, the system comprising:

one or more pressurized mixing vessels,

the one or more pressurized mixing vessels containing ingredients of wet maskant and/or the maskant in a slurry mixture in suspension,

each of the one or more mixing vessels including an agitator for continuously blending the ingredients of the wet maskant and/or maintaining the wet maskant in the slurry mixture in suspension,

a dispensing system hydraulically connected to and downstream of the one or more pressurized mixing vessels,

the dispensing system hydraulically connected to one or more injection valves and operable for supplying and dispensing metered volumes of the wet maskant to the injection valves,

the one or more injection valves mounted on one or more powered slides operable to linearly move the one or more injection valves respectively,

a rotary table for supporting the workpiece at a first angular position of the rotary table, and

one or more heaters operably positioned for drying or flash drying the wet maskant on the portion of the workpiece at a second angular position of the rotary table.

2. The automated wet masking system of claim 1, further comprising an electronic controller for controlling the automated wet masking system to automatically coat the portion of a workpiece with the wet maskant.

3. The automated wet masking system of claim 2, further comprising:

a fixture for holding the workpiece during a masking process to automatically coat the portion of a workpiece with the wet maskant with the portion of the workpiece inside a hollow interior or cavity of the fixture,

a top opening in the fixture operable to place only the portion of the workpiece inside the cavity, and

one or more inlet ports in one or more sides of the fixture are alignable with one or more injection ports of the one or more injection valves respectively for injecting the wet maskant into the cavity for coating the portion of the workpiece.

4. The automated wet masking system of claim 3, further comprising one or more heaters operably positioned for drying or flash drying the wet maskant on the portion of the workpiece.

5. The automated wet masking system of claim 3, further comprising one or more controllable recirculation lines hydraulically leading from the one or more injection valves to at least one of the mixing vessels and the electronic controller operable to flow the wet maskant through the recirculation lines after a period of time when no maskant is flowing through the automated wet masking system.

6. An automated wet masking system for applying a maskant to a portion of a workpiece, the system comprising:

one or more pressurized mixing vessels,

each of the mixing vessels including an agitator for continuously blending ingredients of the maskant and/or maintaining the maskant in the form of a slurry mixture in suspension,

a dispensing system hydraulically connected to and downstream of the one or more pressurized mixing vessels,

the dispensing system hydraulically connected to one or more injection valves and operable for supplying and dispensing metered volumes of the maskant to the injection valves,

an electronic controller for controlling the automated wet masking system for automatically coating the portion of a workpiece with the maskant,

a fixture for holding the workpiece during the coating with the portion of the workpiece inside a hollow interior or cavity of the fixture,

a top opening in the fixture operable to place only the portion of the workpiece inside the cavity,

one or more inlet ports in one or more sides of the fixture are alignable with one or more injection ports of the one or more injection valves respectively for injecting the maskant into the cavity for the coating of the portion of the workpiece,

the one or more injection valves mounted on one or more powered slides operable to linearly move the one or more injection valves respectively,

a rotary table for supporting the workpiece during the coating of the portion of the workpiece at a first angular position of the rotary table, and

the one or more heaters operably positioned for drying or flash drying the maskant on the portion of the workpiece at a second angular position of the rotary table.

7. The automated wet masking system of claim 6, further comprising the one or more injection valves positioned ninety degrees apart from the one or more heaters respectively.

8. The automated wet masking system of claim 7, further comprising one or more controllable recirculation lines hydraulically leading from the one or more injection valves to at least one of the mixing vessels and the controller operable to flow the maskant through the recirculation lines after a period of time when no maskant is flowing through the automated wet masking system.

9. The automated wet masking system of claim 8, further comprising the maskant including an alcoholic binder material.

10. The automated wet masking system of claim 9, further comprising the maskant further including metallic and metallic oxide powders.

11. An automated wet masking system for applying a wet maskant to a root or dovetail of a gas turbine engine blade, the system comprising:

at least hydraulically connected serially inline first and second pressurized mixing vessels,

the one or more pressurized mixing vessels containing ingredients of the wet maskant and/or the wet maskant in a slurry mixture in suspension,

each of the pressurized mixing vessels including an agitator for continuously blending ingredients of the wet maskant and/or maintaining the wet maskant in the form of a slurry mixture in suspension,

a dispensing system hydraulically connected to and downstream of the second pressurized mixing vessel,

the dispensing system hydraulically connected to first and second injection valves and hydraulically connected and operable for supplying and dispensing metered volumes of the wet maskant to the first and second injection valves,

the first and second injection valves mounted on first and second powered slides operable to linearly move the one or more injection valves respectively,

the dispensing system and the first and second injection valves operable for applying the wet maskant to the root or dovetail of the gas turbine engine blade,

a rotary table for supporting the gas turbine engine blade at a first angular position of the rotary table,

one or more heaters operably positioned for drying or flash drying the wet maskant on the root or dovetail of the gas turbine engine blade at a second angular position of the rotary table, and

an electronic controller for controlling the automated wet masking system to automatically coat the root or dovetail with the wet maskant.

12. The automated wet masking system of claim 11, further comprising:

a fixture for holding the gas turbine engine blade during coating of the root or dovetail with the wet maskant with the root or dovetail of the gas turbine engine blade inside a hollow interior or cavity of the fixture,

a top opening in the fixture operable to place only the root or dovetail of the blade inside the hollow interior or cavity, and

first and second inlet ports in first and second sides of the fixture are alignable with first and second injection ports of the first and second injection valves respectively for injecting the wet maskant into the hollow interior or cavity for coating the root or dovetail of the gas turbine engine blade.

13. The automated wet masking system of claim 12, further comprising first and second heaters operably positioned for drying or flash drying the wet maskant on the root or dovetail of the gas turbine engine blade.

14. The automated wet masking system of claim 13, further comprising:

first and second more controllable recirculation lines hydraulically leading from the first and second injection valves to at least one of the first and second pressurized mixing vessels, and

the controller operable to flow the wet maskant through the recirculation lines after a period of time when no maskant is flowing through masking system.

15. The automated wet masking system of claim 14, further comprising the wet maskant including an alcoholic binder material.

16. The automated wet masking system of claim 15, further comprising the wet maskant further including metallic and metallic oxide powders.

17. An automated wet masking system for applying a maskant to a root or dovetail of gas turbine engine blade, the system comprising:

at least hydraulically connected serially inline first and second pressurized mixing vessels,

each of the mixing vessels including an agitator for continuously blending the ingredients of the maskant and/or maintaining the maskant in the form of a slurry mixture in suspension,

a dispensing system hydraulically connected to and downstream of the second pressurized mixing vessel,

the dispensing system hydraulically connected to first and second injection valves and hydraulically connected and operable for supplying and dispensing metered volumes of the maskant to the first and second injection valves, and

an electronic controller for controlling the masking system to automatically coat the root or dovetail with the maskant,

a fixture for holding the gas turbine engine blade during the masking process with the root or dovetail of gas turbine engine blade inside a hollow interior or cavity of the fixture,

a top opening in the fixture operable to place only the root or dovetail of the blade inside the hollow interior or cavity, and

first and second inlet ports in first and second sides of the fixture are alignable with first and second injection ports of the first and second injection valves respectively for injecting the maskant into the hollow interior or cavity for coating the root or dovetail of the blade,

first and second heaters operably positioned for drying or flash drying the maskant on the root or dovetail of the blade,

the first and second injection valves mounted on first and second powered slides operable to linearly move the first and second injection valves respectively,

a rotary table for supporting the gas turbine engine blade during the masking process at a first angular position of the rotary table, and

the first and second heaters operably positioned for drying or flash drying the maskant on the root or dovetail of the gas turbine engine blade at a second angular position of the rotary table.

18. The automated wet masking system of claim 17, further comprising:

the first and second injection valves positioned 180 degrees apart from each other and 90 degrees apart from the first and second heaters respectively, and

first and second controllable recirculation lines hydraulically leading from the first and second injection valves to at least one of the first and second mixing vessels and the electronic

controller operable to flow the maskant through the recirculation lines after a period of time when no maskant is flowing through the automated masking system.

19. The automated wet masking system of claim 18, further comprising the maskant including an alcoholic binder material.

20. The automated wet masking system of claim 19, further comprising the maskant further including metallic and metallic oxide powders.