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WHAT IS CLAIMED IS:

1. A casing bit, comprising:

a mandrel;

a bit body bonded to the mandrel, the bit body having an inner surface and an outer surface opposite the inner surface, the bit body consisting essentially of a matrix material of crystalline tungsten and a binder material; and

wherein the bit body includes at least one blade having a blade thickness measured from the outer surface of the bit body to a top surface of the blade, the blade including a blade channel radially following the blade and ~~and the blade includes at least one channel~~ having a channel depth less than the blade thickness, the bit body configured to facilitate fragmentation of the bit body upon drill out.~~a thickness of the blade.~~

~~2. The casing bit of claim 1 wherein the at least one channel is a blade channel radially following the blade.~~

~~3~~2. The casing bit of claim 1 further comprising~~wherein the blade includes~~ a plurality of cutters, each cutter being bonded to the blade.

43. The casing bit of claim ~~3~~2 wherein each cutter is a polycrystalline diamond cutter.

~~5~~4. The casing bit of claim ~~3~~2 wherein each cutter comprises a diamond table mounted to a substrate of a first material.

65. The casing bit of claim 32 wherein the blade further includes a plurality of cutter channels, each cutter channel running circumferentially and having a depth less than the blade thickness.

76. The casing bit of claim 65 wherein the blade further comprises a plurality of cutter backup structures, and wherein one of the cutter channels is formed between adjacent ones of the cutter backup structures.

87. The casing bit of claim 65 further including a cap mounted to the substrate of the first material, wherein the cap at least partially overlies, but is not attached to, the diamond table.

98. The casing bit of claim 87 wherein the cap is made of or tipped with tungsten carbide.

109. The casing bit of claim 1 further including a plurality of blind openings formed in either the inner surface or the outer surface.

110. The casing bit of claim 1 wherein the binder material comprises brass.

121. The casing bit of claim 110 wherein the binder material comprises a nickel-brass alloy.

132. The casing bit of claim 1 wherein the inner surface includes a plurality of non-axisymmetric regions defined by raised portions of the inner surface.

143. The casing bit of claim 132 wherein the raised portions comprise a raised boss structure or a raised land structure.

154. The casing bit of claim 143 wherein the inner surface is configured such that during a drill out operation, drill out forces on the inner surface are first received by the raised boss structure or the raised land structure.

165. A casing end tool, comprising:

a tool body bonded to a mandrel, the tool body including a face portion having an inner surface, the face portion comprising a crystalline tungsten matrix material; and

a plurality of blades, each blade supporting a plurality of cutter elements and further including a blade channel radially following the blade and ~~at least one cutter channel~~ having a depth less than a thickness of the blade, the blade thickness measured from an outer surface of the face portion to a top surface of the blade; and

wherein the tool body is configured to facilitate fragmentation of the tool body upon drill out.

~~17. The tool of claim 16 wherein the tool body includes a plurality of blades.~~

168. The tool of claim 165 wherein the inner surface includes a plurality of non-axisymmetric regions defined by raised portions of the inner surface.

197. The tool of claim 186 wherein the raised portions comprise a raised boss structure or a raised land structure.

2018. The tool of claim 197 wherein the inner surface is configured such that during a drill out operation, drill out forces on the inner surface are first received by the raised boss structure or the raised land structure.

~~21. The tool of claim 16 wherein one of the blades further comprises a plurality of cutter backup structures, and wherein the cutter channel is formed between adjacent ones of the cutter backup structures.~~

19. The tool of claim 15 wherein one of the blades further comprises a plurality of cutter backup structures.

220. The tool of claim 165 wherein the tool is one of a casing bit or a casing reamer.

231. A casing end tool, comprising:

a body bonded to a mandrel, the body having a plurality of blades, each blade having a blade channel radially following the blade and having a channel depth less than a thickness of the blade, the blade thickness measured from an outer surface of the body to a top surface of the

blade, the body configured to facilitate fragmentation of the body upon drill out. ~~at least one channel having a channel depth less than a thickness of the blade.~~

224. The tool of claim 231 wherein each blade supports a plurality of cutter elements~~,~~ ~~and the at least one channel running circumferentially along the blade~~.

253. The tool of claim 231 wherein the body includes an inner surface and an outer surface opposite the inner surface, the inner surface having a non-axisymmetric region being defined by a raised region of the inner surface.

264. The tool of claim 231 wherein the raised region comprises a raised boss or raised land structure.

275. The tool of claim 231 wherein the body further comprises:

a wall defining an inner surface and an outer surface opposite the inner surface; and

a plurality of ports formed through the inner surface and the outer surface, each port having a surrounding thicker region of the wall interior to the bit body.

286. The tool of claim 257 further including a port sleeve for each port, the port sleeve extending above the surrounding thicker region.

~~29. The tool of claim 23 wherein the at least one channel is a blade channel radially following the blade.~~

~~30~~27. The tool of claim ~~23~~1 wherein the body includes a face portion formed of a crystalline tungsten matrix material.

28. The casing bit of claim 1 wherein the channel depth is approximately equal to one half the blade thickness.

29. The casing end tool of claim 15 wherein the depth of the blade channel is approximately equal to one half the blade thickness.

30. The casing end tool of claim 21 wherein the channel depth is approximately equal to one half the blade thickness.

WHAT IS CLAIMED IS:

1. A casing bit, comprising:

a mandrel;

a bit body bonded to the mandrel, the bit body having an inner surface and an outer surface opposite the inner surface, the bit body consisting essentially of a matrix material of crystalline tungsten and a binder material; and

wherein the bit body includes at least one blade and the blade includes at least one channel having a channel depth less than a thickness of the blade.

2. The casing bit of claim 1 wherein the at least one channel is a blade channel radially following the blade.

3. The casing bit of claim 1 wherein the blade includes a plurality of cutters, each cutter being bonded to the blade.

4. The casing bit of claim 3 wherein each cutter is a polycrystalline diamond cutter.

5. The casing bit of claim 3 wherein each cutter comprises a diamond table mounted to a substrate of a first material.

6. The casing bit of claim 3 wherein the blade further includes a plurality of cutter channels, each cutter channel running circumferentially and having a depth less than the blade thickness.

7. The casing bit of claim 6 wherein the blade further comprises a plurality of cutter backup structures, and wherein one of the cutter channels is formed between adjacent ones of the cutter backup structures.

8. The casing bit of claim 6 further including a cap mounted to the substrate of the first material, wherein the cap at least partially overlies, but is not attached to, the diamond table.

9. The casing bit of claim 8 wherein the cap is made of or tipped with tungsten carbide.

10. The casing bit of claim 1 further including a plurality of blind openings formed in either the inner surface or the outer surface.

11. The casing bit of claim 1 wherein the binder material comprises brass.

12. The casing bit of claim 11 wherein the binder material comprises a nickel-brass alloy.

13. The casing bit of claim 1 wherein the inner surface includes a plurality of non-axisymmetric regions defined by raised portions of the inner surface.

14. The casing bit of claim 13 wherein the raised portions comprise a raised boss structure or a raised land structure.

15. The casing bit of claim 14 wherein the inner surface is configured such that during a drill out operation, drill out forces on the inner surface are first received by the raised boss structure or the raised land structure.

16. A casing end tool, comprising:

a tool body bonded to a mandrel, the tool body including a face portion having an inner surface, the face portion comprising a crystalline tungsten matrix material; and

a plurality of blades, each blade supporting a plurality of cutter elements and further including at least one cutter channel having a depth less than a thickness of the blade.

17. The tool of claim 16 wherein the tool body includes a plurality of blades.

18. The tool of claim 16 wherein the inner surface includes a plurality of non-axisymmetric regions defined by raised portions of the inner surface.

19. The tool of claim 18 wherein the raised portions comprise a raised boss structure or a raised land structure.

20. The tool of claim 19 wherein the inner surface is configured such that during a drill out operation, drill out forces on the inner surface are first received by the raised boss structure or the raised land structure.

21. The tool of claim 16 wherein one of the blades further comprises a plurality of cutter backup structures, and wherein the cutter channel is formed between adjacent ones of the cutter backup structures.

22. The tool of claim 16 wherein the tool is one of a casing bit or a casing reamer.

23. A casing end tool, comprising:

a body bonded to a mandrel, the body having a plurality of blades, each blade having at least one channel having a channel depth less than a thickness of the blade.

24. The tool of claim 23 wherein each blade supports a plurality of cutter elements, and the at least one channel running circumferentially along the blade.

25. The tool of claim 23 wherein the body includes an inner surface and an outer surface opposite the inner surface, the inner surface having a non-axisymmetric region being defined by a raised region of the inner surface.

26. The tool of claim 23 wherein the raised region comprises a raised boss or raised land structure.

27. The tool of claim 23 wherein the body further comprises:

a wall defining an inner surface and an outer surface opposite the inner surface; and

a plurality of ports formed through the inner surface and the outer surface, each port having a surrounding thicker region of the wall interior to the bit body.

28. The tool of claim 27 further including a port sleeve for each port, the port sleeve extending above the surrounding thicker region.

29. The tool of claim 23 wherein the at least one channel is a blade channel radially following the blade.

30. The tool of claim 23 wherein the body includes a face portion formed of a crystalline tungsten matrix material.

Claims

WHAT IS CLAIMED IS:

1. A casing bit, comprising:

a mandrel;

a bit body bonded to the mandrel, the bit body having an inner surface and an outer surface opposite the inner surface, the bit body consisting essentially of a matrix material of crystalline tungsten and a binder material; and

wherein the bit body includes at least one blade having a blade thickness measured from the outer surface of the bit body to a top surface of the blade, the blade including a blade channel radially following the blade and having a channel depth less than the blade thickness, the bit body configured to facilitate fragmentation of the bit body upon drill out.

2. The casing bit of claim 1 further comprising a plurality of cutters, each cutter being bonded to the blade.

3. The casing bit of claim 2 wherein each cutter is a polycrystalline diamond cutter.

4. The casing bit of claim 2 wherein each cutter comprises a diamond table mounted to a substrate of a first material.

5. The casing bit of claim 2 wherein the blade further includes a plurality of cutter channels, each cutter channel running circumferentially and having a depth less than the blade thickness.

6. The casing bit of claim 5 wherein the blade further comprises a plurality of cutter backup structures, and wherein one of the cutter channels is formed between adjacent ones of the cutter backup structures.

7. The casing bit of claim 5 further including a cap mounted to the substrate of the first material, wherein the cap at least partially overlies, but is not attached to, the diamond table.

8. The casing bit of claim 7 wherein the cap is made of or tipped with tungsten carbide.

9. The casing bit of claim 1 further including a plurality of blind openings formed in either the inner surface or the outer surface.

10. The casing bit of claim 1 wherein the binder material comprises brass.

11. The casing bit of claim 10 wherein the binder material comprises a nickel-brass alloy.

12. The casing bit of claim 1 wherein the inner surface includes a plurality of non-axisymmetric regions defined by raised portions of the inner surface.

13. The casing bit of claim 12 wherein the raised portions comprise a raised boss structure or a raised land structure.

14. The casing bit of claim 13 wherein the inner surface is configured such that during a drill out operation, drill out forces on the inner surface are first received by the raised boss structure or the raised land structure.

15. A casing end tool, comprising:

a tool body bonded to a mandrel, the tool body including a face portion having an inner surface, the face portion comprising a crystalline tungsten matrix material; and

a plurality of blades, each blade supporting a plurality of cutter elements and further including a blade channel radially following the blade and having a depth less than a thickness of the blade, the blade thickness measured from an outer surface of the face portion to a top surface of the blade; and

wherein the tool body is configured to facilitate fragmentation of the tool body upon drill out.

16. The tool of claim 15 wherein the inner surface includes a plurality of non-axisymmetric regions defined by raised portions of the inner surface.

17. The tool of claim 16 wherein the raised portions comprise a raised boss structure or a raised land structure.

18. The tool of claim 17 wherein the inner surface is configured such that during a drill out operation, drill out forces on the inner surface are first received by the raised boss structure or the raised land structure.

19. The tool of claim 15 wherein one of the blades further comprises a plurality of cutter backup structures.

20. The tool of claim 15 wherein the tool is one of a casing bit or a casing reamer.

21. A casing end tool, comprising:

a body bonded to a mandrel, the body having a plurality of blades, each blade having a blade channel radially following the blade and having a channel depth less than a thickness of the blade, the blade thickness measured from an outer surface of the body to a top surface of the blade, the body configured to facilitate fragmentation of the body upon drill out.

22. The tool of claim 21 wherein each blade supports a plurality of cutter elements.

23. The tool of claim 21 wherein the body includes an inner surface and an outer surface opposite the inner surface, the inner surface having a non-axisymmetric region being defined by a raised region of the inner surface.

24. The tool of claim 21 wherein the raised region comprises a raised boss or raised land structure.

25. The tool of claim 21 wherein the body further comprises:

a wall defining an inner surface and an outer surface opposite the inner surface; and

a plurality of ports formed through the inner surface and the outer surface, each port having a surrounding thicker region of the wall interior to the bit body.

26. The tool of claim 25 further including a port sleeve for each port, the port sleeve extending above the surrounding thicker region.

27. The tool of claim 21 wherein the body includes a face portion formed of a crystalline tungsten matrix material.

28. The casing bit of claim 1 wherein the channel depth is approximately equal to one half the blade thickness.

29. The casing end tool of claim 15 wherein the depth of the blade channel is approximately equal to one half the blade thickness.

30. The casing end tool of claim 21 wherein the channel depth is approximately equal to one half the blade thickness.