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IN THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF UTAH, CENTRAL DIVISION

BAKER HUGHES OILFIELD OPERATIONS, INC., Plaintiff, vs. REEDHYCALOG UK, LTD., REEDHYCALOG, LP, Defendants.	**COMPLAINT** **DEMAND FOR JURY TRIAL** Judge Ted Stewart DECK TYPE: Civil DATE STAMP: 11/09/2005 @ 16:44:46 CASE NUMBER: 2:05CV00931 TS

Plaintiff Baker Hughes Oilfield Operations, Inc. alleges:

PARTIES

1. Plaintiff Baker Hughes Oilfield Operations, Inc. is a California corporation with its principal place of business in Houston, Texas. Baker Hughes Oilfield Operations, Inc. provides technology, products, and services to oil and gas producers, including providing products and services used for drilling purposes, to enable such producers to find, develop, produce, and manage petroleum reservoirs.

2. Hughes Christensen Company ("HCC") is an operating division of Baker Hughes Oilfield Operations, Inc. (Baker Hughes Oilfield Operations, Inc. and HCC are collectively referred to as "Baker Hughes.") HCC was formed in 1990 when Baker Hughes bought Christensen Diamond Products Company, a Utah company founded in the 1940s. HCC manufactures fixed cutter, or so-called "drag," rotary drill bits as well as "roller cone" rotary drill bits and provides drilling-related products and services to its customers. HCC has a principal place of business at 1645 East 1500 South, Vernal, Utah 84078.

3. On information and belief, defendant ReedHycalog UK, Ltd., is a United Kingdom company with its principal place of business in Stonehouse, Gloucestershire, England. On information and belief, defendant ReedHycalog, L.P., is a Delaware limited partnership. ReedHycalog, L.P. is registered to do business in the State of Utah, has on office in Provo, Utah, and regularly and continuously conducts business in the State of Utah. ReedHycalog, UK, Ltd. and ReedHycalog, L.P. (collectively referred to as "RHL") are affiliated entities and are owned and/or controlled by Grant Prideco, Inc.

JURISDICTION AND VENUE

4. This court has jurisdiction of this case pursuant to 28 U.S.C. §§ 1331, 1332(a)(2) and 1338(a).

5. This is an action by Baker Hughes for declaratory judgment of non-infringement of patents owned and/or controlled by RHL and of invalidity and unenforceability of those patents. This action is brought pursuant to 28 U.S.C. §§ 2201 and 2202 and Federal Rule of Civil Procedure 57.

6. Venue is proper in this district pursuant to 28 U.S.C. § 1391(b), (c), and (d).

GENERAL ALLEGATIONS

7. As part of its business of providing technology, products, and services to oil and gas producers, Baker Hughes through its HCC division manufactures drill bits which employ polycrystalline diamond compact ("PDC") cutters and inserts (individually and collectively, "PDCs"). PDCs, in different configurations, are used by drill bit manufacturers as the "cutters" for so-called "drag" bits or "teeth" for roller cone drill bits used for subterranean drilling in the oil and gas industry. Baker Hughes manufactures and sells drill bits that contain PDCs made by other companies.

8. RHL manufactures PDCs that are used by RHL to manufacture drill bits that contain PDCs as components. As such, RHL is a direct competitor of Baker Hughes.

9. PDCs are made of a material such as graphite that is subjected to ultra-high pressure and temperature to form diamond particles or crystals. A common PDC is formed by using a catalyzing material or "binder," such as cobalt or other ferrous metal, to stimulate bonding of the individual diamond particles together under ultra-high pressure and temperature to create a polycrystalline diamond matrix or "table" having diamond-to-diamond bonds, and to bond that matrix to a hard alloy substrate, such as tungsten carbide. The catalyzing material remains in the polycrystalline diamond matrix of the PDC in interstices or voids between the mutually bonded diamond particles after the PDC is formed. While the catalyzing material speeds and enhances the diamond-to-diamond bonding, its presence after the PDC is made causes degradation of the diamond table of the PDC at high temperatures which may be encountered when the PDC is used on a drill bit for drilling subterranean formations, such as

may be encountered during oil and gas well drilling. Accordingly, when subjected to a high temperature above a certain limit during a drilling operation, the PDC will fail rapidly.

10. The process of "leaching" or otherwise removing the catalyzing material from a polycrystalline diamond matrix in PDCs has been well-known technology for many years. Leaching involves the application of chemicals to the diamond cutting surface of the PDC to remove some, most, nearly all, or virtually all materials from between the individual, mutually bonded diamond particles and from their surfaces in the polycrystalline diamond matrix and to some prescribed depth in that matrix. Leaching can result in a PDC being less susceptible to failure under high temperatures that may be encountered during use, and thus can be used to make a PDC more heat, abrasion, and wear resistant.

The Sumitomo Published Patent Application

11. Japanese Patent Application No. S58-91691 was filed on May 24, 1983, in the Japanese patent office by Sumitomo Electric Industries Co., Ltd. and inventor Shuji Yatsu. The application was published on December 10, 1984, with the publication no. S59-219500 (the "Sumitomo Published Patent Application"). A copy of the English translation of the Sumitomo Published Patent Application as created by RHL's predecessor in interest, Camco International, Ltd. ("Camco"), and as provided to the United States Patent Office ("USPTO"), along with the original application, are attached as Exhibit A.

12. The Sumitomo Published Patent Application discloses methods for processing diamond particles to create a PDC in the form of a diamond layer bonded to a rigid base material. The application states that the resulting sintered diamond object can be used to make rock cutting tools and machine tools, among other described applications.

13. The Sumitomo Published Patent Application states that the rigid base material can be made of an ultra-hard alloy, such as tungsten carbide. It also discloses that the diamond layer can be made by sintering diamond particles or granules under ultra-high pressure and high temperature in the presence of a ferrous metal, such as cobalt, that acts as a binder for the diamond particles. Once the diamond layer has been made, the diamond layer is composed of diamond particles bonded together with diamond-to-diamond bonds and with a "binder phase" of the ferrous metal filling at least some of the spaces between the mutually bonded diamond particles.

14. The Sumitomo Published Patent Application discloses that the heat resistance and wear resistance of the diamond layer can be improved by removing all, nearly all, or a majority of the ferrous metal binder from the diamond layer to a depth of at least 0.2 mm in general, and to a depth of 0.5 mm in one specific example, from the surface of the diamond layer. It discloses that the binder may, for example, be removed electrolytically by applying aqueous hydrochloric acid to the surface of the diamond layer and applying voltage.

15. The Sumitomo Published Patent Application also specifically discloses that such removal of the ferrous metal binder improves the heat resistance of the cutting element. The application states that the diamond surface or tip of the cutting element is the part of the element that becomes the hottest and that the temperature in the cutting element drops off quickly and considerably as one moves away from the surface and deeper into the element. It further discloses that the surface of a diamond sintered with a ferrous metal binder in the atmosphere turns to graphite at temperatures of 900°C or more, and that inferior tool performance begins to occur at 750°C in diamond sintered with such a binder. The application then discloses that, as a

consequence, with much or all of the binder removed from the surface of the diamond layer, the surface layer is composed entirely of diamond or nearly entirely of diamond, and thus has higher heat resistance than the diamond combined with the binder. The surface layer will be and can be at a much higher temperature than the lower layer of the cutting element that contains the ferrous metal binder. As a result, even when that lower layer experiences temperatures of about 750°C, the surface layer can be at a much higher temperature.

The RHL Patents

16. Beginning with provisional application No. 60/234,075, filed with the USPTO on September 20, 2000, and provisional application No. 60/281,054, filed with the USPTO on April 2, 2001, RHL or its predecessor Camco filed in the USPTO a family of related patent applications concerning PDCs and the cutting surfaces on these PDCs. As a result of these applications, the USPTO eventually issued the following patents: U.S. Patent No. 6,544,308 issued April 8, 2003; U.S. Patent No. 6,562,462 issued May 13, 2003; U.S. Patent No. 6,585,064 issued July 1, 2003; U.S. Patent No. 6,589,640 issued July 8, 2003; U.S. Patent No. 6,592,985 issued July 15, 2003; U.S. Patent No. 6,601,662 issued August 5, 2003; U. S. Patent No. 6,739,214 issued May 25, 2004; U.S. Patent No. 6,749,033 issued July 15, 2004; U.S. Patent No. 6,797,326 issued September 28, 2004; U.S. Patent No. 6,861,098 issued March 1, 2005; U.S. Patent No. 6,861,137 issued March 1, 2005; and U.S. Patent No. 6,878,447 issued April 12, 2005 (collectively, "RHL's Patents" or "the Patents").

17. Like the disclosure in the Sumitomo Published Patent Application published almost sixteen years earlier, many of RHL's Patents concern and claim an object having a bonded layer of polycrystalline diamond particles that is, in turn, bonded to a rigid base material

in which a portion of the diamond particle layer is substantially free of the bonding or catalyzing material to a depth of at least about 0.1 mm from the working surface of the diamond layer to improve the thermal and mechanical resistance of the object. Those claims in RHL's Patents that do not expressly claim such an object effectively concern and claim characteristics of, or results obtained from, such an object. Such characteristics and results are likewise disclosed in the Sumitomo Published Patent Application.

18. ReedHycalog UK, Ltd. is the assignee of all the Patents.

FIRST CLAIM FOR RELIEF

(Declaratory Action for Determination of Non-Infringement)

19. Baker Hughes incorporates by reference, as if fully set forth herein, all preceding paragraphs of this Complaint.

20. Through written and oral statements made by RHL's officers, employees, and/or authorized agents to Baker Hughes' officers and employees, and to Baker Hughes' customers and prospective customers, RHL has asserted that Baker Hughes' products infringe RHL's Patents, and that RHL intends to file a patent infringement action based on those patents against Baker Hughes. RHL's conduct has created the reasonable apprehension by Baker Hughes that RHL will file suit against Baker Hughes for patent infringement of RHL's Patents.

21. Specifically, on November 5, 2004, John Deane, President of ReedHycalog, L.P., sent a letter to HCC regarding several of the RHL Patents, some of which had issued and some of which had not yet issued as patents at the time, but have since issued.

22. Thereafter, Mr. Deane told HCC that ReedHycalog had collected PDCs made by various PDC manufacturers from the field, and that Mr. Deane was upset because ReedHycalog believed that those manufacturers were infringing on ReedHycalog's PDC patents.

23. In particular, Mr. Deane stated that ReedHycalog believed that PDCs made by U.S. Synthetics Corporation infringed the ReedHycalog's patents. He also stated that ReedHycalog believed that U.S. Synthetics had supplied HCC with the majority of the PDCs that HCC used to make drill bits. Mr. Deane further stated that Reed Hycalog intended to pursue U.S. Synthetics and other PDC manufacturers for patent infringement..

24. Mr. Deane's statements concerned HCC because HCC had purchased some of its PDCs from U.S. Synthetics to make drill bits.

25. Because of Mr. Deane's statements regarding infringement, and because HCC had used and/or sold some drill bits with PDCs manufactured by U.S. Synthetic Corporation, Baker Hughes believed that RHL would sue Baker Hughes for patent infringement in the near future.

26. Based on Mr. Deane's statements regarding infringement, Baker Hughes began preparing in anticipation of a patent infringement suit by RHL in accord with what Baker Hughes would have done if RHL had sued.

27. Baker Hughes' apprehension that RHL would soon sue for patent infringement was heightened and supported by statements RHL made to a Baker Hughes' customer that RHL is planning to sue Baker Hughes for patent infringement. On or about August 1, 2005, RHL told a customer of Baker Hughes—the Kuwait Oil Company—that RHL planned to sue HCC for patent infringement because of HCC's drill bits. Before that date, the Kuwait Oil company had purchased from HCC drill bits containing PDCs. As a competitor of HCC, RHL has attempted

to sell its own drill bits containing PDCs to the Kuwait Oil Company. In connection with offering to sell RHL products, a RHL drill bit sales person communicated with a drilling and workover engineer from the Kuwait Oil Company, Mr. Fayez Abdulrhman Al-Fayez. The RHL sales person told Mr. Fayez that RHL was planning to sue HCC for selling drill bits copied from, or similar to, RHL's abrasive-resistant drill bits.

28. Baker Hughes' products do not infringe the Patents and Baker Hughes has not induced or contributed to infringement of the Patents.

29. As a result of RHL's letter and statements, an actual controversy between the parties exists whether the devices manufactured, offered for sale, and sold by Baker Hughes through its HCC division infringe RHL's Patents.

30. Baker Hughes is entitled to judgment declaring that none of its products infringe the Patents and that Baker Hughes has not induced or contributed to infringement of the Patents.

31. Baker Hughes has suffered irreparable damage, injury, and harm from RHL's conduct, and will suffer further irreparable damage, injury, and harm unless the court adjudicates the controversy between the parties and issues a declaratory judgment of non-infringement of RHL's Patents.

SECOND CLAIM FOR RELIEF

(Declaratory Action for Determination of Patent Invalidity)

32. Baker Hughes incorporates by reference, as if fully set forth herein, all preceding paragraphs of this Complaint.

33. An actual and present controversy exists between Baker Hughes and RHL with respect to the validity of RHL's Patents.

34. The claims of RHL's Patents, individually or collectively, are invalid for failure to comply with the requirements of the United States patent laws, and in particular for failure to comply with 35 U.S.C. §§ 101, 102, 103, and/or 112.

35. Baker Hughes is entitled to judgment declaring that the Patents are invalid.

36. Baker Hughes has suffered irreparable damage, injury, and harm from RHL's conduct, and will suffer further irreparable damage, injury, and harm unless the court adjudicates the controversy between the parties and issues a declaratory judgment of invalidity of RHL's Patents.

THIRD CLAIM FOR RELIEF

(Declaratory Action for Determination of Patent Unenforceability)

37. Baker Hughes incorporates by reference, as if fully set forth herein, all preceding paragraphs of this Complaint.

38. During the prosecution of nearly all of the RHL Patents, among other misrepresentations, Camco misrepresented that the prior art, including the Sumitomo Published Patent Application, did not disclose a PCD Insert, or a method for producing or making a PCD Insert, in which the diamond layer is substantially free of the catalyzing material (also known as the ferrous metal binder phase) to a depth of at least 0.1 mm from the working surface of the diamond layer. Camco also failed to disclose facts relating to prior art PCDs made by U.S. Synthetics that were disclosed and sold to Camco (including at least one of the named inventors on the RHL patents) that likely would have precluded some or all of the patent claims from issuing.

Prosecution of the '985 Patent, the '640 Patent, the '214 Patent, the '033 Patent, the '064 Patent, the '447 Patent, and the '098 Patent

39. On July 13, 2001, RHL's predecessor-in-interest, Camco, filed Application No. 09/682,042 ("the '042 Application"), which eventually led to the issuance of U.S. Patent No. 6,592,985 (the '985 Patent). During the prosecution of the '042 Application, Camco disclosed the Sumitomo Published Patent Application to the USPTO as relevant prior art, and Camco also filed an English translation of that application in the USPTO.

40. The USPTO issued an office action rejecting all pending claims of the '042 Application as being anticipated by the Sumitomo Published Patent Application, among other references. On June 19, 2002, in response to that rejection of the claims, Camco, by and through its patent lawyer Jeffery E. Daly, abandoned all previously asserted claims and added new claims 112 through 128. Remarking about the prior art, including the Sumitomo Published Patent Application, Camco stated:

> *In order to clearly distinguish the claims of the present invention from the coatings shown in the prior art*, new independent claims 112, 118, 122 and 126 include the limitation that *the portion of the body that is free of catalyzing material extends to a depth of at least about 0.1 mm from the working surface.* ... JP 59219500 [the Sumitomo Published Patent Application] is generally drawn to a polycrystalline diamond member, and is similar in many respects to Oles '149 at the intermediate step prior to the CVD coating. None [of the references, including] JP59219500 [the Sumitomo Published Patent Application] ... individually show or describe the specific limitations of new independent claims 112 and 122. *Specifically, all the references [including the Sumitomo Published Patent Application] are silent about the nature of the catalyzing material that remains in the regions of the body that are substantially free of the catalyzing material.*

(Emphasis added.)

41. Camco's June 19, 2002, representations to the USPTO about the Sumitomo Published Patent Application were misleading and/or false.

(a) Contrary to Camco's representation that "the portion of the body that is free of catalyzing material extends to a depth of at least about 0.1 mm from the working surface" "clearly distinguish[ed] the claims from the prior art," Camco and its patent lawyer, Mr. Daly, knew, should have known, and/or failed to disclose that the Sumitomo Published Patent Application described an embodiment of a PCD Insert in which the polycrystalline diamond surface was substantially free of catalyzing material or binder to a depth equal to or in excess of 0.1 mm from the working surface. The Sumitomo Published Patent Application, in the English translation supplied by Camco to the USPTO, expressly states that "[t]he majority of a ferrous metal binder phase [catalyzing material] that is already contained in the surface layer section at least 0.2 mm from the surface layer of the diamond sintered layer is removed electrolytically." Ex. A at 1; see also id. at 3 ("The majority of the ferrous metal binder phase is removed from an area that is at least 0.2 mm of the surface layer of the sintered diamond layer.") The Sumitomo Published Patent Application also discusses an embodiment in which "nearly all of the metal [cobalt] binder phase in an area 0.5 mm from the surface of the sintered diamond object had been removed electrolytically," and that the application allows for the creation of "a composite sintered diamond layer[] from which the binder phase has been removed from the surface layer." Id. at 2, 3.

(b) Contrary to Camco's representation that "all the references are silent about the nature of the catalyzing material that remains in the regions of the body that are substantially free of the catalyzing material," Camco and its patent lawyer, Mr. Daly, knew, should have known, and/or failed to disclose that the Sumitomo Published Patent

Application described the nature of catalyzing materials that remains in the area leached from the diamond surface. The Sumitomo Published Patent Application , in the English translation as supplied by Camco to the USPTO, expressly states that "[t]he majority of a ferrous metal binder phase [catalyzing material] that is already contained in the surface layer section at least 0.2 mm from the surface layer of the diamond sintered layer is removed electrolytically." Ex. A at 1; see also id. at 3 ("The majority of the ferrous metal binder phase is removed from an area that is at least 0.2 mm of the surface layer of the sintered diamond layer.") The Sumitomo Published Patent Application also discusses an embodiment in which "nearly all of the metal [cobalt] binder phase in an area 0.5 mm from the surface of the sintered diamond object had been removed electrolytically," and that the application allows for the creation of "a composite sintered diamond layer[] from which the binder phase has been removed from the surface layer." Id. at 2, 3.

42. Camco's and its patent lawyer's misrepresentations relating to the Sumitomo Published Patent Application were material because they concerned the very limitations that Camco claimed distinguished its inventions over the prior art. Camco knew, should have known, and/or failed to disclose that the Sumitomo Published Patent Application claimed a diamond layer made from diamond particles and a catalyzing material (the ferrous metal binder phase) that are attached to an ultra-hard alloy base material to form a hybrid sintered object, and that all, nearly all, or a majority of the catalyzing material phase contained in the diamond layer is removed to a depth of at least 0.2 mm from the working surface. Despite this fact, Camco stated that none of the references, including the Sumitomo Published Patent Application, disclosed a

diamond body that is substantially free of catalyzing material to a depth of at least about 0.1 mm from the working surface.

43. On information and belief, Camco's and its patent lawyer's misrepresentations about the Sumitomo Published Patent Application were made with the intent to deceive the USPTO so that the '985 Patent and all patent applications derived form the '042 Application would issue.

44. In the same office action, the USPTO also rejected all pending claims of the '042 Application based on U.S. Patent No. 6,344,149 to Oles ("the Oles patent") on the basis that the Oles patent "disclosed the claimed coating on a substrate of cemented tungsten carbide."

45. In its June 19, 2002 response, Camco stated that the Oles patent did not anticipate the claims of the '042 Application. Specifically, Camco represented the following:

> [The] Oles [patent] discloses a polycrystalline diamond member with a chemical vapor deposition ["CVD"] applied hard material (preferably diamond) coating surrounding and mechanically adhering to exterior diamond particles which are exposed by removing the catalyst from near the surface of a typical polycrystalline diamond cutting element.
>
> The CVD applied hard material of [the] Oles [patent] does not form bonds with the exterior diamond particles that it surrounds, rather it simply fills the voids left after the catalyst is removed. The CVD applied hard material must be able to move among the bonded diamond crystals to be deposited as indicated.

46. Camco's June 19, 2002, representations to the USPTO about the Oles patent were misleading and/or false. Contrary to Camco's representation that "[t]he CVD applied hard material of [the] Oles [patent] does not form bonds with the exterior diamond particles that it surrounds, rather it simply fills the voids left after the catalyst is removed," the Oles patent expressly teaches that the CVD-applied hard material adheres to, or bonds, the diamond particles. The Oles patent specifically discloses:

> [D]epositing via CVD techniques beginning at the portion of the surface of the polycrystalline diamond layer a volume of hard material (e.g. diamond) whereby the rate of deposition is sufficiently slow as to permit the CVD hard material to infiltrate between (*and mechanically adhere to*) the bridged together diamond particles in the exterior region whereby the exterior region comprises exterior diamond particles bridged together with the hard material surrounding the bridged-together diamond particles."

(Emphasis added).

47. Camco's and its patent lawyer's misrepresentations relating to the Oles patent were material because they concerned the very limitations that Camco claimed distinguished its inventions over the prior art. On information and belief, Camco's and its patent lawyer's misrepresentations about the Oles patent were made with the intent to deceive the USPTO so that the '985 Patent and all patent applications derived form the '042 Application would issue.

48. Additionally, over ten years before the '042 Application was filed, on July 25, 1989, Louis Pope of U.S. Synthetics met with representatives of RHL's predecessor in interest Camco, including Terry R. Matthias and Nigel Dennis Griffin, a named inventor on the '985, '640, '214, '033, '064, '447, and '098 Patents. The topic of the meeting was to discuss twenty (20) cutters named "TC220" (or otherwise known as "TERRACUT 220") that Camco had previously purchased from U.S. Synthetics. Subsequently, in October and November 1990, Camco purchased at least 125 additional TC220 cutters from U.S. Synthetics. In Purchase Order 10629, transmitted by Terry R. Matthias of Camco to U.S. Synthetics, Camco ordered 100 of the TC220 cutters, while in Purchase Order 7640, Camco ordered 25 of the TC220 cutters.

49. The prior art TC220 cutters that Camco purchased from U.S. Synthetics included a diamond layer made from diamond particles attached to a tungsten carbide base material to form a hybrid sintered cutter. The diamond layer in at least the first twenty (20) TC220 cutters

that Camco purchased from U.S. Synthetics were composed of diamond grains of roughly 60 microns in size. On information and belief, the diamond layer was characterized by at least two different parts. The upper part of the diamond layer from the working surface to at least about 0.1 mm of depth in the diamond layer contained no or very little cobalt or other catalyzing material (a ferrous metal binder). The lower part of the diamond layer underneath contained cobalt or other catalyzing material. Because of the absence or almost complete absence of catalyzing material in the upper part of the diamond layer, the TC220 cutters demonstrated greater wear resistance and thermal resistance than either polycrystalline diamond cutters that did not contain catalyzing material throughout the diamond layer or that contained catalyzing material throughout the diamond layer.

50. On information and belief, Nigel Dennis Griffin, Camco, and/or others substantively involved in the prosecution of the '985, '640, '214, '033, '064, '447, and/or '098 Patents knew and/or should have known about all or most of the characteristics of the TC220 cutters described in paragraph 48 above. All portions of that information were material to the patentability and/or validity of one or more of the claims in those patents because that information demonstrated (a) commercial offers for sale and commercial sales of cutters capable of invalidating one or more of the claims of the '985, '640, '214, '033, '064, '447, and/or '098 Patents, and (b) derivation of invention capable of invalidating one or more of the claims of those patents because one or more employees of U.S. Synthetics invented one or more of those inventions and communicated those inventions to one or more of the named inventors from Camco prior to any conception of those inventions by the named inventors. However, on information and belief, to avoid the required disclosures to the USPTO and to obtain a patent on

those patent claims, Nigel Dennis Griffin, Camco, and/or others substantively involved in the prosecution of the '985, '640, '214, '033, '064, '447, and/or '098 Patents failed to disclose those material facts to the USPTO. Nigel Dennis Griffin, Camco, and/or others substantively involved in the prosecution of the '985, '640, '214, '033, '064, '447, and/or '098 Patents withheld material facts with an intent to deceive the USPTO and did so to obtain patents to which Camco (now RHL) was not entitled.

51. On October 25, 2002, the USPTO issued a notice of allowance for the claims in the '042 Application. The '985 Patent issued on July 15, 2003.

52. The following patents issued from divisional applications claiming priority from the '042 Application (the '985 Patent): (1) U.S. Patent No. 6,589,640 issued July 8, 2003; (2) U. S. Patent No. 6,739,214 issued May 25, 2004; and (3) U.S. Patent No. 6,749,033 issued July 15, 2004 (collectively, the "'042 Divisional Applications"). United States Patent No. 6,585,064, which issued July 1, 2003, from Application No. 10/065,615, and United States Patent No. 6,878,447, which issued April 12, 2005, from Application No. 10/604,007, are continuations of the '042 Application (collectively, the "'042 Continuation Applications"). United States Patent No. 6,861,098, which issued March 1, 2005, from Application No. 10/605,471 (the "'471 Application"), is a continuation of a continuation of the '042 Application. Because the '042 Divisional Applications, the '042 Continuation Applications, and the '471 Application all stem from a single parent application—the '042 Application—the prosecution history of the '042 Application, including any inequitable conduct before the USPTO regarding the '042 Application and the prior art, applies to the '042 Divisional Applications, the '042 Continuation Applications, and the '471 Application.

53. The USPTO allowed the claims in and issued the '640 Patent, the '214 Patent, the '033 Patent, the '064 Patent, the '447 Patent, and the '098 Patent between 2003 and 2005.

Prosecution of the '308 Patent, the '462 Patent, the '326 Patent, and the '137 Patent

54. On August 30, 2001, Camco filed Application No. 09/682,419 ("the '419 Application"), which eventually led to the issuance of U.S. Patent No. 6,544,308 (the '308 Patent). During the prosecution of the '419 Application, Camco disclosed the Sumitomo Published Patent Application to the USPTO as relevant prior art, and Camco also filed an English translation of that application in the USPTO.

55. The USPTO issued an office action rejecting all pending claims of the '419 Application as being anticipated by the Sumitomo Published Patent Application, among other references. On September 12, 2002, in response to that rejection of the claims, Camco, by and through its patent lawyer Jeffery E. Daly, amended claims 26 and 52 by adding a limitation that the surface layer section be substantially free of the catalyzing material (the ferrous metal binder phase) to a depth of "at least about 0.1 mm" and "between about 0.2 mm and about 0.3 mm," respectively. Camco noted that claim 52 previously contained the limitation that the surface layer section be substantially free of the catalyzing material (the ferrous metal binder phase) to a depth of "at least about 0.1 mm"

56. In its September 12, 2002 response, Camco remarked about the amendments to claims 26 and 52, and the relation of these amendments to the prior art, including the Sumitomo Published Patent Application, by stating the following:

> Applicants believe that the Office did not consider the limitations of dependent claim 52 when maintaining this rejection. *Claim 52, as filed, limited the thickness of the diamond cutting element devoid of binder to at least 0.1 mm. This limitation was not addressed in previous actions by the office in light of the*

> *prior art, and none of the prior art discloses this claimed thickness. Applicants believe this limitation, if added to claim 26, would make claim 26 allowable. Accordingly, claim 26 has been amended now to indicate that the first interstitial region extends beneath the cutting surface at least about 0.1 mm.* Claim 52 has been amended now to claim a narrower range of the thickness of the first interstitial region to between about 0.2 mm and about 0.3 mm.

(Emphasis added.)

57. Camco's September 12, 2002, representation to the USPTO about the Sumitomo Published Patent Application was misleading and/or false. Contrary to Camco's representation that "none of the prior art discloses this claimed thickness" "of the diamond cutting element devoid of binder to at least 0.1 mm," Camco and its patent lawyer, Mr. Daly, knew, should have known, and/or failed to disclose that the Sumitomo Published Patent Application described a PCD Insert in which the diamond cutting element was substantially free of the binder or catalyzing material to depth equal to or in excess of 0.1 mm from the working surface of the cutting element. The Sumitomo Published Patent Application, in the English translation supplied by Camco to the USPTO, expressly states that "[t]he majority of a ferrous metal binder phase [catalyzing material] that is already contained in the surface layer section at least 0.2 mm from the surface layer of the diamond sintered layer is removed electrolytically." Ex. A at 1; see also id. at 3 ("The majority of the ferrous metal binder phase is removed from an area that is at least 0.2 mm of the surface layer of the sintered diamond layer.") The Sumitomo Published Patent Application also discusses an embodiment in which "nearly all of the metal [cobalt] binder phase in an area 0.5 mm from the surface of the sintered diamond object had been removed electrolytically," and that the application allows for the creation of "a composite sintered diamond layer[] from which the binder phase has been removed from the surface layer." Id. at 2, 3.

58. Camco's and its patent lawyer's misrepresentation relating to the Sumitomo Published Patent Application was material because it concerned the very limitation that Camco claimed distinguished its inventions over the prior art. Camco knew, should have known, and/or failed to disclose that the Sumitomo Published Patent Application claimed a diamond layer made from diamond particles and a catalyzing material (the ferrous metal binder phase), that are attached to an ultra-hard alloy base material to form a hybrid sintered object, and that all, nearly all, or a majority of the catalyzing material contained in the diamond layer is removed to a depth of at least 0.2 mm from the working surface. Despite this fact, Camco stated that none of the references, including the Sumitomo Published Patent Application, disclosed a diamond body that is substantially free of catalyzing material to a depth of at least about 0.1 mm from the working surface.

59. On information and belief, Camco's and its patent lawyer's misrepresentation about the Sumitomo Published Patent Application was made with the intent to deceive the USPTO so that the '308 Patent and all patents derived from the '419 Application would issue.

60. Additionally, over ten years before the '419 Application was filed, on July 25, 1989, Louis Pope of U.S. Synthetics met with representatives of RHL's predecessor in interest Camco, including Terry R. Matthias and Nigel Dennis Griffin, a named inventor on the '308, '462, '326, and '137 Patents. The topic of the meeting was to discuss twenty (20) cutters named "TC220" (or otherwise known as "TERRACUT 220") that Camco had previously purchased from U.S. Synthetics. Subsequently, in October and November 1990, Camco purchased at least 125 additional TC220 cutters from U.S. Synthetics. In Purchase Order 10629, transmitted by

Terry R. Matthias of Camco to U.S. Synthetics, Camco ordered 100 of the TC220 cutters, while in Purchase Order 7640, Camco ordered 25 of the TC220 cutters.

61. The prior art TC220 cutters that Camco purchased from U.S. Synthetics included a diamond layer made from diamond particles attached to a tungsten carbide base material to form a hybrid sintered cutter. The diamond layer in the first twenty (20) TC220 cutters that Camco purchased from U.S. Synthetics were composed of diamond grains of roughly 60 microns in size. On information and belief, the diamond layer was characterized by at least two different parts. The upper part of the diamond layer from the working surface to at least about 0.1 mm of depth in the diamond layer contained no or very little cobalt or other catalyzing material (a ferrous metal binder). The lower part of the diamond layer underneath contained cobalt or other catalyzing material. Because of the absence or almost complete absence of catalyzing material in the upper part of the diamond layer, the TC220 cutters demonstrated greater wear resistance and thermal resistance than either polycrystalline diamond cutters that did not contain catalyzing material throughout the diamond layer or that contained catalyzing material throughout the diamond layer.

62. On information and belief, Nigel Dennis Griffin, Camco, and/or others substantively involved in the prosecution of the '308, '462, '326, and/or '137 Patents knew and/or should have known about all or most of the characteristics of the TC220 cutters described in paragraph 60 above. All portions of that information were material to the patentability and/or validity of one or more of the claims in those patents because that information demonstrated (a) commercial offers for sale and commercial sales of cutters capable of invalidating one or more of the claims of the '308, '462, '326, and/or '137 Patents, and (b) derivation of invention capable of

invalidating one or more of the claims of those patents because one or more employees of U.S. Synthetics invented one or more of those inventions and communicated those inventions to one or more of the named inventors from Camco prior to any conception of those inventions by the named inventors. However, on information and belief, to avoid the required disclosures to the USPTO and to obtain a patent on those patent claims, Nigel Dennis Griffin, Camco, and/or others substantively involved in the prosecution of the '308, '462, '326, and/or '137 Patents failed to disclose those material facts to the USPTO. Nigel Dennis Griffin, Camco, and/or others substantively involved in the prosecution of the '308, '462, '326, and/or '137 Patents withheld material facts with an intent to deceive the USPTO and did so to obtain patents to which Camco (now RHL) was not entitled.

63. On December 24, 2002, the USPTO issued a notice of allowance for the claims in the '419 Application. The '308 Patent issued on April 8, 2003.

64. The following patents issued from divisional applications claiming priority from the '419 Application (the '308 Patent): (1) U.S. Patent No. 6,562,462 issued May 13, 2003; and (2) U.S. Patent No. 6,797,326 issued September 28, 2004 (collectively, the "'419 Divisional Applications"). Furthermore, U.S. Patent No. 6,861,137, which issued March 1, 2005, from Application No. 10/604,210 (the "'210 Application"), is a continuation of the divisional application that issued as U.S. Patent No. 6,797,326. Because the '419 Divisional Applications and the '210 Application all stem from a single parent application—the '419 Application—the prosecution history of the '419 Application, including any inequitable conduct before the USPTO regarding the '419 Application and the prior art, apply to the '419 Divisional Applications and the '210 Application.

65. The USPTO allowed the claims in the '462 Patent, the '326 Patent, and the '137 Patent between 2003 and 2005.

Prosecution of the '462 Patent, A Divisional of the '308 Patent

66. On December 20, 2001, Camco filed Application No. 09/683,386 ("the '386 Application"), which was a divisional application claiming priority from the '419 Application. The '386 Application eventually resulted in the issuance of U.S. Patent No. 6,562,462 (the '462 Patent). During the prosecution of the '386 Application, Camco disclosed the Sumitomo Published Patent Application to the USPTO as relevant prior art, and Camco also filed an English translation of that application in the USPTO.

67. The USPTO issued an office action rejecting all pending claims of the '386 Application as being anticipated by the Sumitomo Published Patent Application, among other references. Similar to the misrepresentation noted above for the '419 Application, Camco misrepresented the disclosure in the Sumitomo Published Patent Application before the USPTO in connection with the prosecution of the '386 Application. On October 15, 2002, in response to the rejection of the claims, Camco, by and through its patent lawyer Jeffery E. Daly, canceled claims 2, 3, 14, 15, 29, and 30, and amended independent claims 1 and 28 to recite that a portion of the claimed PCD Insert be substantially free of catalyzing material extended "to a depth of at least about 0.1 mm." Camco noted that claim 39 previously contained the limitation that the surface layer section be substantially free of the catalyzing material (the ferrous metal binder phase) "to a depth of at least about 0.1 mm."

68. In its October 15, 2002 response, Camco remarked about the amendments to claims 1 and 28 and the relation of these amendments to the prior art, including the Sumitomo Published Patent Application, by stating the following:

> *In order to clearly distinguish the claims of the present invention from the coatings shown in the prior art*, claims 1 and 28 have been amended now to include the limitation that *the portion of the body that is substantially free of catalyzing material extends to a depth of at least about 0.1 mm from the working surface.* ... JP 59219500 [the Sumitomo Published Patent Application] is generally drawn to a polycrystalline diamond member, and is similar in many respects to Oles '149 at the intermediate step prior to the CVD coating. None [of the references, including] JP 59219500 [the Sumitomo Published Patent Application] ... individually show or describe, nor fairly teach to one skilled in the art, the specific limitations of amended claims 1 and 28, and previously amended claim 39. *Specifically, all the references [including the Sumitomo Published Patent Application] are silent about the claimed PDC [sic] element having a portion of the PCD body that is substantially free of catalyzing material extending to a depth of at least about 0.1 mm from the working surface in addition to the other claimed limitations.*

(Emphasis added.)

69. Camco's October 15, 2002 representations to the USPTO about the Sumitomo Published Patent Application were misleading and/or false. Contrary to Camco's representations that (1) the claim language "the portion of the body that is substantially free of catalyzing material extends to a depth of at least about 0.1 mm from the working surface" "clearly distinguish[ed] the claims ... from the prior art," (2) "[n]one [of the references, including] JP 59219500 [the Sumitomo Published Patent Application] ... individually show or describe, nor fairly teach to one skilled in the art, [these] specific limitations of amended claims 1 and 28, and previously amended claim 39," and (3) "all the references are silent about the claimed PDC [sic] element having a portion of the PCD body that is substantially free of catalyzing material extending to a depth of at least about 0.1 mm from the working surface," Camco and its patent

lawyer, Mr. Daly, knew, should have known, and/or failed to disclose that the Sumitomo Published Patent Application described an embodiment of a PCD Insert in which the polycrystalline surface layer was substantially free of catalyzing material or binder to a depth equal to or in excess of 0.1 mm from the working surface. The Sumitomo Published Patent Application, in the English translation supplied by Camco to the USPTO, expressly states that "[t]he majority of a ferrous metal binder phase [catalyzing material] that is already contained in the surface layer section at least 0.2 mm from the surface layer of the diamond sintered layer is removed electrolytically." Ex. A at 1; see also id. at 3 ("The majority of the ferrous metal binder phase is removed from an area that is at least 0.2 mm of the surface layer of the sintered diamond layer.") The Sumitomo Published Patent Application also discusses an embodiment in which "nearly all of the metal [cobalt] binder phase in an area 0.5 mm from the surface of the sintered diamond object had been removed electrolytically," and that the application allows for the creation of "a composite sintered diamond layer[] from which the binder phase has been removed from the surface layer." Id. at 2, 3.

70. Camco's and its patent lawyer's misrepresentation of the Sumitomo Published Patent Application were material because they concerned the very limitations that Camco claimed distinguished its inventions over the prior art. Camco knew, should have known, and/or failed to disclose that the Sumitomo Published Patent Application claimed a diamond layer made from diamond particles and a catalyzing material (the ferrous metal binder phase), that are attached to an ultra-hard alloy base material to form a hybrid sintered object, and that all, nearly all, or a majority of the catalyzing material contained in the diamond layer is removed to a depth of at least 0.2 mm from the working surface. Despite this fact, Camco stated that none of the

references, including the Sumitomo Published Patent Application, disclosed a diamond body that is substantially free of catalyzing material to a depth of at least about 0.1 mm from the working surface.

71. On information and belief, Camco's and its patent lawyer's misrepresentations about the Sumitomo Published Patent Application were made with the intent to deceive the USPTO so that the '462 Patent would issue.

72. On December 31, 2002, the USPTO issued a notice of allowance for the '386 Application. The '462 Patent issued on May 13, 2003.

73. An actual and present controversy exists between Baker Hughes and RHL with respect to the enforceability and scope of RHL's Patents.

74. RHL's predecessor's fraud on, and inequitable conduct before, the USPTO regarding the Sumitomo Published Patent Application render the RHL Patents unenforceable.

75. Baker Hughes is entitled to a judgment declaring that RHL's Patents are unenforceable.

76. Baker Hughes has suffered irreparable damage, injury, and harm from RHL's conduct, and will suffer further irreparable damage, injury, and harm unless the court adjudicates the controversy between the parties and issues a declaratory judgment of unenforceability of RHL's Patents.

77. Baker Hughes demands a trial by jury on all of the claims in this Complaint that may be tried to a jury.

WHEREFORE, Baker Hughes prays for Judgment as follows:

1. On the First Claim for Relief, for declaratory judgment that Baker Hughes has not infringed any of RHL's Patents;

2. On the Second Claim for Relief, for a declaratory judgment that one or more claims of one or more of RHL's Patents are invalid;

3. On the Third Claim for Relief, for a declaratory judgment that one or more of RHL's Patents are unenforceable;

4. That the Court find this case exceptional and award Baker Hughes its attorneys' fees, costs, and expenses against RHL pursuant to 35 U.S.C. § 285; and

5. That this Court award Baker Hughes such other and further relief as the Court deems just and proper.

DATED this 9th day of November, 2005.

C. Kevin Speirs

DAVID G. MANGUM
C. KEVIN SPEIRS
PARSONS BEHLE & LATIMER
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(19) Japan Patent Office (JP)
(11) Japanese Unexamined Patent Application Publication
(12) Public Patent Information (A) S59 – 219500

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C 25 F 5/00		7011 – 4K	
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Number of Inventions: 2
Examination Request: Not Filed
(Total Pages: 4)

(54) Title of the Invention: DIAMOND SINTERING AND PROCESSING METHOD

(21) Application No.: S58 – 91691
(22) Application Filed: May 24, 1983

(72) Inventor: Shuji YATSU
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(71) Applicant: Sumitomo Electric Industries Co., Ltd.
5 – 15 Kitahama, Higashi-ku, Osaka

(74) Patent Representative Patent Attorney: Tetsuji JODAI

Specification

1. Title of the Invention: DIAMOND SINTERING AND PROCESSING METHOD

2. Patent Claims

(1) A sintered diamond layer made from diamond and a ferrous metal binder phase is joined to a base material made from an ultra-hard alloy during high-pressure sintering, forming a hybrid sintered object. The majority of a ferrous metal binder phase that is already contained in the surface layer section at least 0.2 mm from the surface layer of the diamond sintered layer is removed electrolytically.

(2) A method of processing sintered diamond objects with the following characteristics. A composite sintered diamond object is made by joining an ultra-hard alloy base material with a layer of a sintered diamond object that is made from a ferrous metal binder phase and diamond that is sintered under high pressure. Only the sintered diamond layer is immersed in acid or an electrolytic solution until the ferrous metals in the surface layer of the sintered diamond object have been dissolved.

3. Detailed Description of the Invention

(a) Technical Fields

This invention pertains to sintered diamonds, which are produced under ultra-high pressure and high temperatures and are used in machine tools and tools for digging and drilling through rock. In particular, it pertains to the marked improvement of such tools.

Prior Art and Problems

Diamond sintered objects produced by sintering diamond powder with metal as a binder under stable, ultra-high pressure and high temperature are among the most rigid of all diamond tool materials. Like monocrystalline diamond, there is no low-stress damage brought on by cleavage, so they are used in a wide variety of tools including machine tools, wire-drawing dies,

Exhibit A

dressers and rock cutting tools. Depending upon the use, these sintered diamond objects have all sorts of structures and shapes, but generally, there is a layer of sintered diamond like the one shown in Figure 1, which is bonded to a highly rigid base material such as an ultra-hard alloy for use in machine tools, dressers and rock cutting tools. Sintered objects with this sort of structure are known and have been described in JSP S46-005204, for example, where a sintered diamond is joined directly to a WC base, ultra-hard alloy material or JSP S54-045313 and JSP S56-00506, where the sintered diamond layer is joined to an ultra-hard alloy material through an intermediate binder layer. Currently, sintered diamond layers of this sort now often use a ferrous metal such as Co as a binder for the diamond granules. When synthesizing diamond from graphite, ferrous metal is used as a solvent and during sintering under ultra-high pressure, part of the diamond powder melts and, it is believed that this has the effect of causing the diamond granules to sinter into each other. These ferrous metals may be mixed with the diamond powder before sintering or, as in JSP S46-005204, the base material WC-Co lubricating binder may be placed in the diamond powder during sintering. Sintered diamond of this sort has superior wear resistance and exhibits superior performance in uses where monocrystalline diamond has traditionally been used. At the same time, however, there are significant limitations on the heat resistance. In the atmosphere, a diamond's surface turns to graphite at temperatures of 900° C or more. In a vacuum or in inert gas, graphite does not form easily even around 1400° C. In the conventional sintered diamond described above, inferior tool performance is seen at around 750° C. Naturally this means that when the tip of the machine tool or cutting tool reaches a high temperature during use, a decline in performance will be seen. It is believed that the reason that conventional sintered diamond degrades at a level of temperature than simple diamond is that there is a significant difference between the thermal expansion coefficients of the ferrous metal binder and the diamond. During heating, the amount of thermal stress in the sintered object increases and the structure breaks down. Additionally, ferrous metals have the effect of promoting the conversion of diamond into graphite. As a means of improving the heat resistance of sintered diamond, sintered objects have been created that are not bound to ultra-hard alloy base materials, which are then immersed in aqua regia or similar substance and heat treated. This dissolves the metal binder phase in the sintered object (JSP S53 – 114589). This is said to allow the sintered diamond to withstand temperatures of up to 1200° C. However, the metal binder phase escapes, leaving cavities in the sintered material, which degrades the strength of the sintered material. The result is a material which lacks sufficient hardness as a tool. With this method, there are also considerable binding limitations, which makes a strong bond between the sintered diamond and the tool difficult.

(b)

The purpose of this invention is to provide a new sintered diamond material that resolves the deficiencies of this sort of conventional sintered material. For instance, when using sintered diamond as a cutting tool, the part that becomes hottest is the tip of the tool that comes into contact with the material being worked. The temperature slope acid of this section is considerable and as one moves away from the point of contact of the material being worked, the temperature drops quickly. Therefore, improving the heat resistance of just the surface portion of a disk-shaped sintered object like the one in Figure 2, would offer a significant improvement in the performance of such a tool. This invention is based on this point. It is a composite sintered diamond layer, from which the binder phase has been removed from the surface layer. In this composite, the sintered diamond layer is joined to the ultra-hard alloy base material during ultra-

high pressure sintering of diamond and a ferrous metal binder phase as shown in Figure 2. The thermal resistance of tools made using this process is improved considerably. Additionally, there is binder phase inside the sintered diamond, so there is less loss of strength in the sintered object overall. Again, because there are no interior cavities, the thermal conductivity does not decline, which is effective in dispersing the heat that is generated at the tip of the tool. In the sintered objects of this invention, the thickness of the sintered diamond layer is normally 0.3 ~ 5 mm and this is joined to the ultra-hard alloy base material during ultra-high pressure sintering. The majority of the ferrous metal binder phase is removed from an area that is at least 0.2 mm of the surface layer of the sintered diamond layer. In the production of the sintered objects of this invention, methods described in JSP S46-005204, S54-045313 and S56-055506 which are mentioned above, could be used. Using these methods, composite sintered objects that join a diamond layer that is 0.3 ~ 5 mm to an ultra-hard alloy base can be obtained. In order to remove the ferrous metal binder phase from the sintered diamond surface layers of these sintered composites, electrolytic removal may be employed by placing a spongy material containing an aqueous hydrochloric acid solution on the surface of the sintered object and applying a DC voltage. Using this sort of method, the binder phase can be removed from just the surface layer of the sintered diamond object without having the acid cause any damage to the ultra-hard alloy that serves as the base material.

(c) Effect of the Invention

This invention makes it possible to improve significantly, the performance limit of insufficient heat resistance found in conventional composite sintered diamond used in tools, without damaging its strength. The following are the embodiments.

Embodiment 1

We made a sintered composite having the structure shown in Figure 1 by joining a sintered diamond object that was 26 mm in diameter and 1 mm thick with a base material that was made of WC-10% Co that was 2.5 mm thick. The sintered diamond object contained diamond particles having a granularity averaging 5 u that was 90% by volume and the remainder consisted of a Co binder phase. The surface of the sintered diamond layer in this sintered object was placed in contact with a plastic sponge containing hydrochloric acid water. Ten volts DC was applied between the ultra-hard alloy base and an electrode that had been placed below the sponge and left for 2 hours. Then the power was shut off and the sintered object was cut into many triangular pieces using electrical discharge machining. The cut surfaces were polished and examined, revealing that nearly all of the metal Co binder phase in an area 0.5 mm from the surface of the sintered diamond object had been removed electrolytically. We then ran alumina ceramic cutting tests by applying wax to another ultra-hard alloy metal base plate. For comparison, the same sort of unprocessed, composite sintered object was created using a tool of the same shape. The cutting tests were run under the following conditions: a 0.15 mm cut was made at a cutting speed of 60 m/minute and a feed of 0.02 mm/revolution while applying an aqueous cutting agent. With the sintered object of this invention, we were able to cut for 50 minutes until the relief wear land of the tool reached 0.4 mm, while the same relief wear land was attained after 10 minutes with the comparison sintered object.

Embodiment 2

In the same manner as Embodiment 1, we produced a core bit that was 46 mm in diameter using 4 of the sintered objects of this invention that were 8 mm in diameter with a 2.5 mm diamond sintered ultra-hard alloy base material. For the purpose of comparison, an object that was 8 mm in diameter and 2 mm thick made just from sintered diamond was heat-treated in aqua regia, resulting in a sintered object from which most of the metal Co binder phase had been removed. A core bit in the same shape was also produced. We ran uniaxial compressive strength tests (cutting 1.650 kg/cm2 andesite) on both bits. At a speed of 200 rpm with identical pressure applied to the bits, the bit using the sintered material of this invention could cut 20 m at a cutting speed of 10 cm per minute. Conversely, the bits using the comparison sintered material all broke during the initial cutting period.

4. Simple Description of Drawings

Figure 1 is an oblique view of a conventional diamond composite sintered object. 1 is the diamond sintered portion and 2 is the ultra-hard alloy base material. Figure 2 is a cross section of the sintered object of this invention. 1 and 2 are the same as in Figure 1. 1' is the area where most of the ferrous metal binder phase was removed from the diamond sintered material.

Representative and Patent Attorney: Tetsuji Jodai /official stamp/

Figure 1

Figure 2

Procedural Corrections

June 27th, 1983

To: Kazuo WAKASUGI, Patent Office Official

1. Matter Disclosed
   1983, Patent Application No. 91691

2. Title of the Invention
   Sintered Diamond Object and Its Processing Method

3. Party Making the Correction
   Relationship to this Matter: Patent Applicant
   Name (213): Tetsuro KAWAKAMI, President
   Address: Sumitomo Electric Industries Co., Ltd.
   5 – 15 Banchi, Kitahama, Higashi-ku, Osaka

4. Representative
   Name (7881): Tetsuji JODAI, Patent Attorney [Official Stamp]
   Address: Sumitomo Electric Industries Co., Ltd.
   1 – 1 – 3 Toriya, Konohana-ku, Osaka

5. Date Correction Ordered
   Voluntary Correction

Patent Office Stamp
June 29th, 1983
Applications, Section 2
Ikeda

6. Object of Correction
   Detailed Description of Invention in the Detailed Description

7. Description of Corrections
(1) We will make the following corrections to the detailed description of the invention.
(a) Page 2 line 4 of the document described above, "Conventional Technology and Problems" is to be corrected to read "(b) Conventional Technology and Problems."
(b) Page 4, line 8 of the document described above, "level of temperature" is to be corrected to read "low temperature."
(c) Page 5, line 5 of the document described above, "(b) Configuration of the Invention" is to be corrected to read "(c) Configuration of the Invention."
(d) Page 5, line 11 of the document described above, "slope acid " is to be corrected to read "slope."
(e) Page 7, line 3 of the document described above, "(c) Effect of the Invention" is to be corrected to read "(d) Effect of the Invention."

(f) Page 8, last line of the document described above, "1.65" is to be corrected to read "1,65."

(g) Page 9, line 3 of the document described above, "moat advance" is to be corrected to read "cut into."

(h) Page 9, line 4 of the document described above, "moat cut" is to be corrected to read "cut."

(i) Page 9, line 5 of the document described above, "moat cut" is to be corrected to read "cut."

⑲ 日本国特許庁 (JP)　　⑪ 特許出願公開

⑫ 公開特許公報 (A)　　昭59—219500

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B 22 F 3/24		6441—4K

⑬公開 昭和59年(1984)12月10日

発明の数 2
審査請求 未請求

(全 4 頁)

④ダイヤモンド焼結体及びその処理方法

②特　　願 昭58—91691
②出　　願 昭58(1983)5月24日

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大阪市東区北浜5丁目15番地

②代 理 人 弁理士 上代哲司

明　細　書

1. 発明の名称

ダイヤモンド焼結体及びその処理方法

2. 特許請求の範囲

(1) ダイヤモンドと鉄族金属結合相からなるダイヤモンド焼結体の層が超硬合金からなる基材に超高圧焼結時に接合されてなる複合焼結体において、ダイヤモンド焼結体層の表面から少くとも0.2㎜の表層部が予め含有されていた鉄族金属結合相の大部分を溶解除去したものであることを特徴とするダイヤモンド焼結体。

(2) 超高圧下で焼結されたダイヤモンドと鉄族金属結合相からなるダイヤモンド焼結体の層が超硬合金基材に接合されてなる複合ダイヤモンド焼結体のダイヤモンド焼結体層のみを鉄族金属を溶解する酸または電解液に浸し、ダイヤモンド焼結体の表層部の鉄族金属結合相を溶解除去することを特徴とするダイヤモンド焼結体の処理方法。

3. 発明の詳細な説明

(1) 技術分野

本発明は切削工具、岩石掘削工具等に用いられる超高圧、高温焼結によるダイヤモンド焼結体に関するもので特にその工具としての性能を著しく改良したものである。

従来技術とその問題点

ダイヤモンドの粉末を金属を結合材としてダイヤモンドが安定な超高圧、高温下で焼結して得られるダイヤモンド焼結体は工具材料の中では最も高硬度であるダイヤモンドの特徴を持ち、単結晶ダイヤモンドの如くへき開によつて低応力で破損することもないため、切削工具、伸線ダイス、ドレッサー、岩石掘削工具など多方面に工具として用いられている。このダイヤモンド焼結体には用途によつて各種の構造、形状のものがあるが、切削工具、ドレッサー、岩石掘削工具には一般に第1図に示したようなダイヤモンド焼結体の層が超硬合金等の剛性の高い母材に接合されたものが用いられている。このような構造の焼結体については例えば特開昭46—5204号の如くダイヤモンド焼結体の層がWC基超硬合金基材に直接接合さ

れて成る焼結体や、特開昭54-45313同56-55506号の如く中間接合層を介してダイヤモンド焼結体の層が超硬合金等の基材に接合された例が知られている。現在使用されているこのような焼結体のダイヤモンド焼結体層はダイヤモンド粒子の結合材としてCo等の鉄族金属を用いているものが多い。鉄族金属は黒鉛からダイヤモンドを合成する際の溶媒として用いられるもので、超高圧下における焼結時にダイヤモンド粉末の一部を溶解し、ダイヤモンド粒子相互を強固に焼結せしめる作用をすると考えられている。この鉄族金属は焼結前にダイヤモンド粉末と混合されたものを用いても良いし、特開昭46-5204号の如く焼結時に基材WC-Coの結合材融液をダイヤモンド粉末中に溶浸せしめる方法も知られている。このようなダイヤモンド焼結体は耐摩耗性強度が優れており、従来単結晶ダイヤモンドを用いていた用途でも優れた性能を発揮するが、一方耐熱性の点では大きな制約がある。ダイヤモンドは大気中では約900℃以上で表面より黒鉛化が生じるが、真空又は不活性ガス中では1400℃前後でも黒鉛化は生じ難い。しかるに前述した従来のダイヤモンド焼結体を加熱すると約750℃で工具性能の劣化が見られる。このことは切削工具や掘削工具の如く使用時に刃先が高温になるような使用条件下では当然性能が低下することを意味する。従来のダイヤモンド焼結体がダイヤモンド単味より低温で劣化する原因として考えられるのは鉄族金属結合材とダイヤモンドの熱膨張係数の差が大きく、加熱によって焼結体中の熱応力が大きくなり組織が破壊されることと、鉄族金属がダイヤモンドの黒鉛化を促進する作用を有することである。ダイヤモンド焼結体の耐熱性を改良する方法として超硬合金等の基材に接合されていない焼結体を作成し、このものを王水等に浸漬して加熱し焼結体中の金属結合相を溶出せしめる方法が考えられている。（特開昭53-114589）これによりダイヤモンド焼結体の耐熱性は1200℃までの加熱に耐えるようになるとされている。しかしながら金属結合相が抜けて焼結体全体に空孔が存在するため、焼結体の強度は大巾に低下し、工具としての強靭性の点で不充分のものしか得られない。またこの方法ではダイヤモンド焼結体を工具支持体に接合する方法が大きな制約を受け強固な接合が困難である。

(ハ) 発明の構成

本発明はこのような従来の焼結体の欠点を解消した新たなダイヤモンド焼結体を提供することを目的とする。ダイヤモンド焼結体を工具として使用する場合、例えば切削工具の場合に最も高温となるのは被加工材と接触する刃先先端である。この部分の温度勾配は大きく、被加工材との接触点から離れると急激に温度は低下している。従つて例えば第2図の如く円板形状焼結体の表層部のみ耐熱性を向上しておけば工具としての性能が大巾に改良されるのである。本発明はこの点に着目して第2図の如くダイヤモンドと鉄族金属結合相からなるダイヤモンド焼結体の層が超硬合金基材に超高圧焼結時に接合された複合焼結体のダイヤモンド焼結体層の表層部の結合相を除去したものである。これにより工具として使いときの耐熱性が大巾に向上する。またダイヤモンド焼結体内部は結合相が存在しており焼結体全体としての強度低下は少い。また内部は空孔が無いため熱伝導度も低下せず、刃先に生じた熱を発散させる上でも有効である。本発明焼結体ではダイヤモンド焼結体層の厚みは通常0.3～5㎜でこれが超硬合金基材上に超高圧下焼結時に接合されており、そのダイヤモンド焼結体層の表層部の少くとも0.2㎜の領域で鉄族金属結合相の大部分を除去したものである。本発明焼結体の製造に当つては例えば前記した特開昭46-5204号、54-45313号、56-55506号等に記載された方法を採ることができる。これ等の方法により0.3～5㎜のダイヤモンド焼結体層が超硬合金基材上に接合された複合焼結体を得る。この複合焼結体のダイヤモンド焼結体の表層部から鉄族金属結合相を除去するにはスポンヂ状の物質に塩酸水溶液を含ませ、これを焼結体の表面に置いて直流電圧を加え電解除去する方法が最も有効である。このような方法により基材の超硬合金を酸により侵めることなくダイ

ヤモンド焼結体の表層部のみ結合相を除去することができる。

(4) 発明の効果

本発明によれば従来の複合焼結ダイヤモンドの強度を害うことなく、耐熱性不足による工具としての性能の限界を大きく改善することが可能である。以下実施例を記す。

実施例1

超高圧下で焼結して得られた第1図の構造を有する直径26㎜、ダイヤモンド焼結体部の厚みが1㎜でWC−10%Coからなる厚さ2.5㎜の基材と接合された複合焼結体を作成した。ダイヤモンド焼結体部は平均粒度5μのダイヤモンド粒子を体積で90%含有し、残部がCo結合相からなるものである。この焼結体のダイヤモンド焼結体層の表面が希塩酸水を含んだプラスチックのスポンデに接するように置き、超硬合金基材とスポンデの下に置いた電極との間に10Vの直流電圧を加えて2時間放置した。通電を断ち、焼結体を放電加工により切断し多数の三角形状に分割した。断面を研摩して調べたところダイヤモンド焼結体の表面から0.5㎜の領域の結合金属Co相が殆んど電解除去されていた。この焼結体を別の超硬合金台金にロー付してアルミナ磁器の切削加工テストを行なつた。比較のため同様複合焼結体の未処理のもので同一形状工具を作成して用いた。切削テスト条件は切削速度60m/分切込み0.15㎜、送り0.02㎜/回転で水溶性切削剤をかけながら行なつた。本発明の焼結体では工具逃げ面摩耗巾が0.4㎜に達するまでに50分間切削できたが、比較焼結体では10分で同一摩耗巾に達した。

実施例2

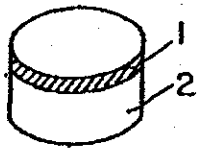
実施例1と同様にして直径8㎜、ダイヤモンド焼結体層1㎜、超硬合金基材2.5㎜の本発明焼結体を4ケ用いて直径4.6㎜のコアービットを製作した。比較のためダイヤモンド焼結体のみからなる直径8㎜厚さ2㎜のもので全体を王水中で加熱処理して結合金属Co相の大部分を焼結体の全体から除去したものを作成し、同一形状のコアビットを製作した。2つのビットで一軸圧縮強度1.65

0kg/㎠の安山岩の掘削テストを行なつた。回転数200回/分で同一ビット給圧でテストしたところ本発明焼結体を用いたビットでは掘進速度10㎝/分で20m掘削可能であつた。一方比較焼結体を用いたビットでは掘削初期に全ての焼結体が欠損した。

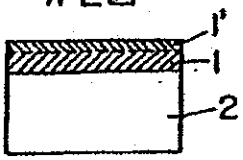
4. 図面の簡単な説明

第1図は典型的な従来のダイヤモンド複合焼結体の斜視図である。1はダイヤモンド焼結体部2は超硬合金基材である。第2図は本発明焼結体の断面図である。1，2は第1図と同じ、1'はダイヤモンド焼結体部から鉄族金属結合相の大部分が除去された領域である。

第1図



第2図



代理人 弁理士 上 代 哲 司

JS 44 (Rev. 11/04)

CIVIL COVER SHEET

The JS 44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. (SEE INSTRUCTIONS ON THE REVERSE OF THE FORM.)

FILED
U.S. DISTRICT COURT
2005 NOV -9 P 4:45
DISTRICT OF UTAH
DEPUTY CLERK

I. (a) PLAINTIFFS
Baker Hughes Oilfield Operations, Inc.

DEFENDANTS
Reedhycalog, L.P., and
Reedhycalog UK, Ltd.

(b) County of Residence of First Listed Plaintiff _____
(EXCEPT IN U.S. PLAINTIFF CASES)

County of Residence of First Listed Defendant _____
(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF THE LAND INVOLVED.

(c) Attorney's (Firm Name, Address, and Telephone Number)
David G. Mangum and C. Kevin Speirs
Parsons Behle & Latimer, 201 S. Main St., Suite 1800, Salt Lake City, UT, 84111

Attorneys (If Known)

II. BASIS OF JURISDICTION (Place an "X" in One Box Only)

- ☐ 1 U.S. Government Plaintiff
- ☒ 3 Federal Question (U.S. Government Not a Party)
- ☐ 2 U.S. Government Defendant
- ☐ 4 Diversity (Indicate Citizenship of Parties in Item III)

III. CITIZENSHIP OF PRINCIPAL PARTIES (Place an "X" in One Box for Plaintiff and One Box for Defendant)
(For Diversity Cases Only)

	PTF	DEF		PTF	DEF
Citizen of This State	☐ 1	☐ 1	Incorporated *or* Principal Place of Business in this State	☐ 4	☐ 4
Citizen of Another State	☒ 2	☒ 2	Incorporated *and* Principal Place of Business in Another State	☐ 5	☐ 5
Citizen or Subject of a Foreign Country	☐ 3	☒ 3	Foreign Nation	☐ 6	☐ 6

IV. NATURE OF SUIT (Place an "X" in One Box Only)

CONTRACT
- ☐ 110 Insurance
- ☐ 120 Marine
- ☐ 130 Miller Act
- ☐ 140 Negotiable Instrument
- ☐ 150 Recovery of Overpayment & Enforcement of Judgment
- ☐ 151 Medicare Act
- ☐ 152 Recovery of Defaulted Student Loans (Excl. Veterans)
- ☐ 153 Recovery of Overpayment of Veteran's Benefits
- ☐ 160 Stockholders' Suits
- ☐ 190 Other Contract
- ☐ 195 Contract Product Liability
- ☐ 196 Franchise

REAL PROPERTY
- ☐ 210 Land Condemnation
- ☐ 220 Foreclosure
- ☐ 230 Rent Lease & Ejectment
- ☐ 240 Torts to Land
- ☐ 245 Tort Product Liability
- ☐ 290 All Other Real Property

TORTS

PERSONAL INJURY
- ☐ 310 Airplane
- ☐ 315 Airplane Product Liability
- ☐ 320 Assault, Libel & Slander
- ☐ 330 Federal Employers' Liability
- ☐ 340 Marine
- ☐ 345 Marine Product Liability
- ☐ 350 Motor Vehicle
- ☐ 355 Motor Vehicle Product Liability
- ☐ 360 Other Personal Injury

PERSONAL INJURY
- ☐ 362 Personal Injury - Med. Malpractice
- ☐ 365 Personal Injury - Product Liability
- ☐ 368 Asbestos Personal Injury Product Liability

PERSONAL PROPERTY
- ☐ 370 Other Fraud
- ☐ 371 Truth in Lending
- ☐ 380 Other Personal Property Damage
- ☐ 385 Property Damage Product Liability

CIVIL RIGHTS
- ☐ 441 Voting
- ☐ 442 Employment
- ☐ 443 Housing/ Accommodations
- ☐ 444 Welfare
- ☐ 445 Amer. w/Disabilities - Employment
- ☐ 446 Amer. w/Disabilities - Other
- ☐ 440 Other Civil Rights

PRISONER PETITIONS
- ☐ 510 Motions to Vacate Sentence

Habeas Corpus:
- ☐ 530 General
- ☐ 535 Death Penalty
- ☐ 540 Mandamus & Other
- ☐ 550 Civil Rights
- ☐ 555 Prison Condition

FORFEITURE/PENALTY
- ☐ 610 Agriculture
- ☐ 620 Other Food & Drug
- ☐ 625 Drug Related Seizure of Property 21 USC 881
- ☐ 630 Liquor Laws
- ☐ 640 R.R. & Truck
- ☐ 650 Airline Regs.
- ☐ 660 Occupational Safety/Health
- ☐ 690 Other

LABOR
- ☐ 710 Fair Labor Standards Act
- ☐ 720 Labor/Mgmt. Relations
- ☐ 730 Labor/Mgmt. Reporting & Disclosure Act
- ☐ 740 Railway Labor Act
- ☐ 790 Other Labor Litigation
- ☐ 791 Empl. Ret. Inc. Security Act

BANKRUPTCY
- ☐ 422 Appeal 28 USC 158
- ☐ 423 Withdrawal 28 USC 157

PROPERTY RIGHTS
- ☐ 820 Copyrights
- ☒ 830 Patent
- ☐ 840 Trademark

SOCIAL SECURITY
- ☐ 861 HIA (1395ff)
- ☐ 862 Black Lung (923)
- ☐ 863 DIWC/DIWW (405(g))
- ☐ 864 SSID Title XVI
- ☐ 865 RSI (405(g))

FEDERAL TAX SUITS
- ☐ 870 Taxes (U.S. Plaintiff or Defendant)
- ☐ 871 IRS – Third Party 26 USC 7609

OTHER STATUTES
- ☐ 400 State Reapportionment
- ☐ 410 Antitrust
- ☐ 430 Banks and Banking
- ☐ 450 Commerce
- ☐ 460 Deportation
- ☐ 470 Racketeer Influenced and Corrupt Organizations
- ☐ 480 Consumer Credit
- ☐ 490 Cable/Sat TV
- ☐ 810 Selective Service
- ☐ 850 Securities/Commodities/ Exchange
- ☐ 875 Customer Challenge 12 USC 3410
- ☐ 890 Other Statutory Actions
- ☐ 891 Agricultural Acts
- ☐ 892 Economic Stabilization Act
- ☐ 893 Environmental Matters
- ☐ 894 Energy Allocation Act
- ☐ 895 Freedom of Information Act
- ☐ 900 Appeal of Fee Determination Under Equal Access to Justice
- ☐ 950 Constitutionality of State Statutes

V. ORIGIN (Place an "X" in One Box Only)

☒ 1 Original Proceeding ☐ 2 Removed from State Court ☐ 3 Remanded from Appellate Court ☐ 4 Reinstated or Reopened ☐ 5 Transferred from another district (specify) ☐ 6 Multidistrict Litigation ☐ 7 Appeal to District Judge from Magistrate Judgment

VI. CAUSE OF ACTION
Cite the U.S. Civil Statute under which you are filing **(Do not cite jurisdictional statutes unless diversity):** 35 U.S.C. §§ 1 et. seq.
Brief description of cause: Declaratory Judgment for Non-Infringement, Invalidity, and Unenforceability of Patents.

VII. REQUESTED IN COMPLAINT: ☐ CHECK IF THIS IS A CLASS ACTION UNDER F.R.C.P. 23 **DEMAND $** CHECK YES only if demanded in complaint: **JURY DEMAND:** ☒ Yes ☐ No

VIII. RELATED CASE(S) IF ANY (See instructions): JUDGE Dale A. Kimball DOCKET NUMBER 2:05 CV 00247

DATE 11/9/05 SIGNATURE OF ATTORNEY OF RECORD C. Kevin Speirs

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RECEIPT # _____ AMOUNT _____ APPLYING IFP _____

Judge Ted Stewart
DECK TYPE: Civil
DATE STAMP: 11/09/2005 @ 16:44:46
CASE NUMBER: 2:05CV00931 TS

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