

OPINION UNDER SECTION 74A

Patent	EP 2121236 B1
Proprietor(s)	Element Six Limited
Exclusive Licensee	
Requester	Renishaw plc
Observer(s)	Element Six Limited
Date Opinion issued	02 August 2018

The request

1. The comptroller has been requested by Renishaw plc (“the requester”) to issue an opinion as to whether patent EP 2121236 B1 (“the patent”) is valid in light of the following documents:

A1: GB 2243688 A (DE BEERS)

A2: EP 1079201 A2 (RENISHAW)

A3: “Styli Ball grading” (RENISHAW)

A4: “Renishaw Styli and Accessories”, brochure, Issue 11 (2002), pages 1-21

A5: “Tribological testing of self-mated nanocrystalline diamond coatings on Si₃N₄ ceramics” CS Abreu et al., Surface & Coatings Technology 200 (2006) pages 6235-6239

A6: WO 2005/027799 A1 (ELEMENT SIX)

A7: WO 03/016240 A2 (ELEMENT SIX)

A8: US 5645601 A (POPE et al.)

A9: US 5458827 A (HOLLY)

A10: US 6410877 A (DIXON et al.)

A11: WO 2007/007126 A1 (ELEMENT SIX)

A12: "High NA Diamond Lenses for Near-Field Optical Storage" TJ Schaich et al. (Element Six B.V.), International Symposium on Optical Memory and Optical Data Storage, OSA Technical Digest Series (Optical Society of America, 2005), paper WD6 (2005)

2. Each of the documents A1 to A10 and A12 have a publication date prior to the priority date of the patent. A11 was published on the priority date of the patent. It has been published in the regional phase as EP 1902333 A1 which could be a novelty only prior art against the patent as it has an earlier priority date.

Observations

3. Observations have been received from Element Six Limited ("the observer") detailing how the claims of the patent are not anticipated by or obvious in light of the alleged prior art filed by the requester.

Observations in reply

4. The requester has provided observations in reply. These include further documents A4' and A6' to support their argument. The additional documents are as follows:

A4': "3 Dimensional Touch Trigger Probes for Measuring Machines", Renishaw, 1979

A6': WO 2006/011028 A1 (ELEMENT SIX)

5. I need to consider whether documents A4' and A6' are strictly observations in reply as required by Rule 96 of the Patent Rules. Whilst these documents could be considered to have been submitted in response to the observations filed by the observer, that is not in itself sufficient for them to be treated as evidence in reply. I need to consider the matter in a little more detail.
6. Turning firstly to A4' which has been filed to counter argument put forward by the observer in their observations that qualitative statements about sphericity made in 1990 would be very different to quantitative values to the same statement made in 2007 as technology moves on. The requesters argument involving A4' are directed to illustrating that the requirements for sphericity haven't changed during the period mentioned by the observer. As A4' is being used to show a flaw in the observations I will consider it.
7. However, having considered the matter carefully, I have concluded that A6' is not strictly evidence in reply as it is not merely being used to refute argument put forward by the observer and in support of the existing novelty argument. In my opinion A6' raises a new question regarding the novelty of claim 6 and is intended to strengthen the case initially advanced by the requester. The requester could have provided this additional evidence in their request but did not do so. If they had then the observer would have had an opportunity to make observations on it. According to section 8.2.2 of the Opinions Manual:

“It is fundamental to the opinions process that the requester raises their best argument at the outset. This allows any observers an opportunity to comment on the entire argument. If argument is introduced at the observations-in-reply stage the observer will not be able to respond”.

The observer would be denied that opportunity if I allowed the document to be introduced at this stage. That would be unfair to the observer and hence I will not consider A6' in this opinion.

8. In addition to the two documents above filed with the observations in reply, the requester draws attention to a number of further documents throughout the observations in reply. These include:

- (i) GB 1445977 A

- (ii) A white paper published on the Renishaw website

- (iii) Information available on the Zeiss website

- (iv) Information available on the Q-mark website

- (v) US 6655845 A

- (vi) A preliminary opinion issued by the EPO appeal board in relation to A11

- (vii) Information available on Wikipedia for Silicon Nitride

- (viii) WO 2006/043157 A2

Again I do not consider the above evidence to be strictly evidence in reply. It is not merely being used to refute argument put forward by the observer and in support of the existing argument but rather raises new questions and is intended to strengthen the case initially advanced by the requester. The requester could have provided this additional evidence in their request but did not do so. As with A6' it would be unfair on the observer to consider any argument based any of (i)-(viii) above and I will not do so in this opinion.

9. Further, as the requester acknowledges, they are free to submit A6' and (i)-(viii) as part of a further opinion request.
10. The requester also raises questions and argument regarding the sufficiency and enablement of the patent. Again these are new questions which will not be considered in this opinion.

Further observations

11. Following the observations in reply the requester filed further observations. The Opinion process is intended to be a low cost and quick service. It provides for three well defined rounds of argument i.e. the request, observations and observations in reply. Consequently for the purposes of this opinion I have not considered any observations or arguments filed outside of these rounds.

Allowance of A1, A2, A10 and A11

12. Documents A10 and A11 were cited as category “X” citations and documents A1 and A2 as Category “Y” citations in the European search report. These documents were cited in the international preliminary report on patentability and subsequent EPO exam report. In the final EPO exam report issued prior to allowing the granted claims the EPO examiner stated that A1 was the closest prior art to the claims. I need to consider whether it would be appropriate to issue an opinion based on these documents.

13. By virtue of section 74A(3)(b) an opinion shall not be issued if it is considered inappropriate in all circumstances to do so. In decision BLO370/07 the hearing officer stated that:

“It is an intrinsic part of the substantive examination process to assess the novelty and obviousness of the claims, as properly construed, in light of the prior art. In this context “prior art” means documents cited in the search report (at least under category “X” or “Y”, which indicate possible relevance to novelty or inventive step) as well as material which has come to the examiner’s attention in some other way. I think it reasonable to suppose in general that the examiner will have done his or her job properly in the absence of indication to the contrary, and I see no reason why this assumption should not apply even if the examiner has decided not to raise objection on the basis of any citations at substantive examination”.

14. The observer argues that A1, A2, A10 and A11 should be disregarded and not considered in this opinion, as they have already been considered with regard to novelty and inventive step by the EPO examiner during the examination process.

15. In the initial request the requester argues that A1 and A2 should be considered in this opinion as the Examining Division at the EPO did not consider what would have been implicit in these documents and/or considered them in light of the common general knowledge in the field of metrology styli. In their observations in reply the requester takes the argument further to allege that they get the impression that A1 and A2 were not properly considered at all by the EPO examiner. This is due to the fact that nowhere in the opinion or examination report issued during prosecution is any reasoned statement provided by the EPO examiner in respect of these documents.

16. I am not persuaded by the requester’s argument. A patent examiner, as part of the substantive examination process, would routinely consider what is implicit in a document and also consider any document in light of the common general knowledge in the relevant field when analysing a claim set for novelty and inventive step. Further as the EPO examiner stated in the final examination report that A1 is the closest prior art to the granted claims I find it difficult to accept that the examiner would not have considered any of these documents “properly” in all regards when forming that opinion.

17. The requester has not provided any argument regarding the allowability of documents A10 and A11.

18. In my opinion it is reasonable to assume that the EPO examiner has given due consideration to A1, A2, A10 and A11 during the examination process. I shall therefore not consider any of these documents in this opinion. I would note finally that the requester is free to raise any of documents A1, A2, A10 and A11 in a revocation action under section 72 should they wish to do so.

The Patent

19. The patent, EP 2121236 B1, is titled "POLYCRYSTALLINE DIAMOND ELEMENTS HAVING CONVEX SURFACES; METHOD OF CUTTING A ROTATIONAL SYMMETRICAL SURFACE OF A DIAMOND ELEMENT USING A LASER; METHOD OF POLISHING A SPHERICAL SURFACE OF A POLYCRYSTALLINE OR COATED DIAMOND ELEMENT". It was filed on 18th January 2008 with a priority date of 18 January 2007, published on 25th November 2009 and granted on 15th August 2012. The patent remains in force.
20. The patent relates to a method of forming a rotationally symmetrical surface on diamond elements and to an element of diamond material for use as metrology tips.
21. In coordinate measuring machines (CMMs) or metrology tips, a spherical tip is mounted on a stem and used to measure or profile a workpiece. In metrology, spherical tips are used to map out the shape and roughness of surfaces made from metals, glasses, ceramics, crystalline, and other materials, whose surface shape needs to be measured with high accuracy. The tip is usually mounted on a partially flexible arm, which is fitted with a highly sensitive detector for sensing any flexing of the arm. Typically, movements of the order of a few nanometres can be detected. Conventionally, CMM probes are typically made from high chrome, high carbon, stainless steel.
22. In typical metrology applications, since the object to be measured is in general non-planar, different parts of the tip are in contact with the measurement object. In order to have a flexing of the measurement arm which is independent of the position on the tip, which is in contact with the object, the tip itself needs to be spherical to an accuracy which exceeds the accuracy of the motion so that the accuracy of the measurement is not adversely affected by the shape of the tip. Currently available tips suffer from the problem of wear, since the tip can be in continuous sliding contact with the surface of the object. Especially when hard and/or rough materials are measured, the wear of the tips leads to rapid deterioration of the spherical shape of the tip. This leads to measurement errors when using these tips. In such cases, the tip must be replaced by a new and undamaged tip. This leads to a high cost of measurement caused by the high cost of the tips and the need to recalibrate each new tip. Another common problem with softer materials such as aluminium is a build-up, even during a single measurement, of the material from which the measurement object is made on the surface of the tip, thus leading to measurement errors.
23. There is thus a great need for tool tips which are resistant to wear, resistant to the accumulation of detritus thereon and which can be caused to move over the surface under observation in a reliable continuous motion.
24. The inventors have established that diamond shows exceedingly low wear

characteristics and would be an ideal material from which to manufacture metrology tips and/or measurement balls. Further advantages to the use of diamond are provided by its hardness and very low friction coefficient when in contact with most hard and soft materials, including diamond itself. They consider that this would make diamond the preferred material for use in a metrology tip or measurement ball. Key to this invention is the realization that a diamond surface, particularly a diamond surface with low surface Ra and Rq (roughness) and which is free of defects such as pits, digs and scratches, accumulates less material from the surface being measured, and thus provides a longer life.

25. Furthermore a particular advantage of diamond over conventionally used materials is that on aluminium, pick up is very much reduced i.e. the accumulation of material from the surface being tested is very much reduced. This is thought to be related to the low chemical reactivity of diamond.
26. In particular, it is an object of the invention disclosed in the patent to produce hemispherical or super-hemispherical surfaces on a diamond element suitable for use as a tool tip in a metrology system. It is a further object of this invention to provide a method that addresses the problems in polishing diamond material to a required thickness to within high accuracy. Diamond spheres and super-hemispheres according to the invention can be formed in two ways, either from solid freestanding polycrystalline diamond, or by coating a different base material already in the form of a sphere or appropriate spherical segment.

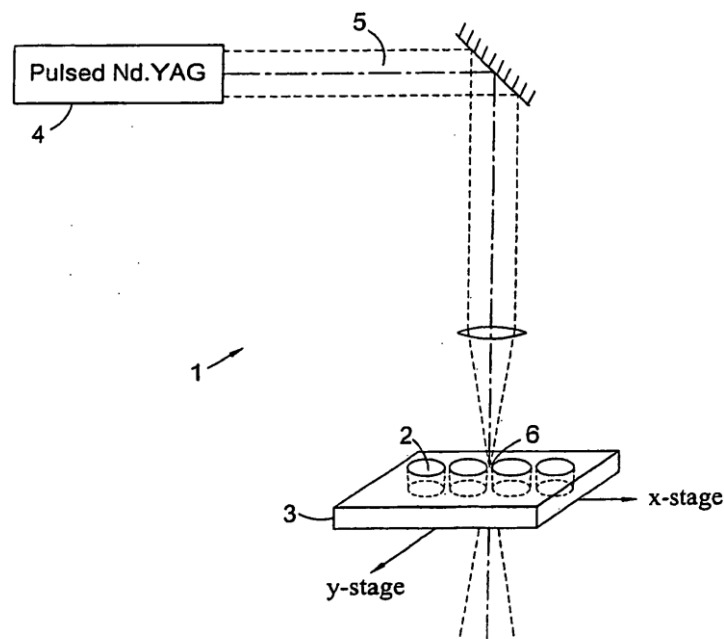


FIG. 1

27. Figure 1 is a schematic view of an apparatus 1 for cutting cylindrical sections 2 from a diamond plate 3 for use as blanks onto which spherical surfaces can be formed. The apparatus comprises an X-Y translation stage (not shown) onto which the diamond plate 3 is mounted. A cutting laser 4, for example a pulsed Nd:YAG laser, generates a light beam 5 which is focussed onto the diamond plate 3 and which has

sufficient energy to cut the diamond of the plate. The diamond cylinder 2 is subsequently brazed with one of its flat sides onto a cylindrical rod 11.

28. The rod 11 is mounted in a high speed rotating spindle. The diamond cylinder 2 mounted on the rod 11 is positioned close to the focus 13 of a high power laser 14 so that the axis of rotation 12 of the spindle is perpendicular to the direction of the incoming laser light 15. The spindle is mounted on a translation stage so that the diamond cylinder 2 can be translated in two dimensions in a plane perpendicular to the direction of the incoming light, as shown in Figure 2C below. By translating the cylinder relative to the laser 14 as it is rotated, a shape can be cut out of the diamond that has rotational symmetry with respect to the rotation axis 12 of the spindle. If the translation follows the arc of a circle 16, the surface 10 cut into the cylinder 2 is spherical.

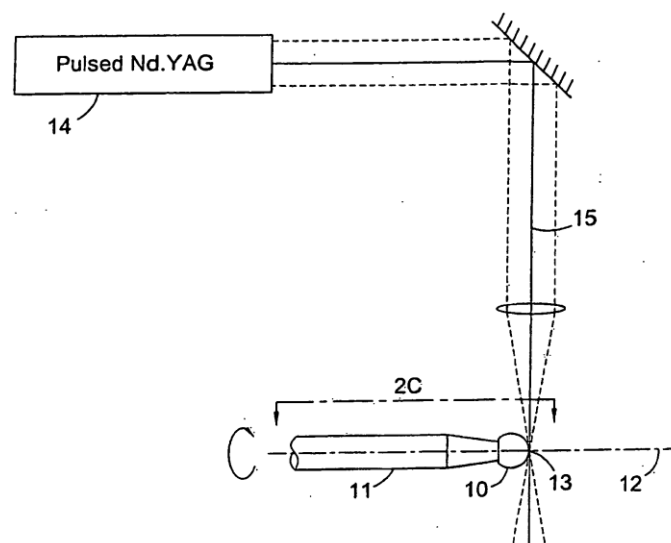


FIG. 2A

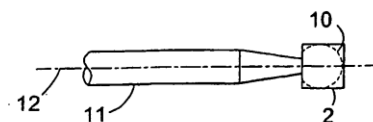


FIG. 2B

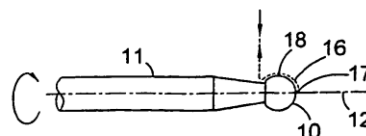


FIG. 2C

29. In the formed spherical surface, deviations from the ideal spherical surface are less than about $5\ \mu\text{m}$. The surface itself at this stage has a RMS roughness R_q of less than about $30\ \text{nm}$. Should the spherical surface not meet these characteristics for the sphericity and roughness of the element further polishing will be necessary.
30. Figure 3 below is a schematic view of an apparatus for polishing the spherical surface on a diamond element 2 to improve the characteristics. The element 2, still brazed to the rod 11, is mounted in a rotational stage 20, which rotates at a low rate

of typically 0.1-100 rpm around the axis 12 of the rod 11. A high-speed rotary spindle 21 fitted with a polishing cup 22 is pressed against the rotating diamond element 2. The force with which this cup 22 is pressed against the sphere may be adjusted by a spring (not shown) and depends on the size of the element 2 to be polished.

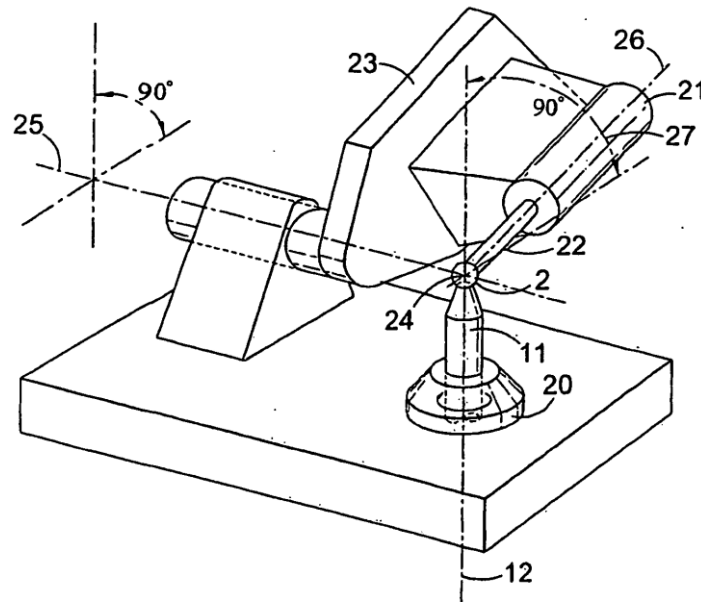


FIG. 3

31. The patent has fourteen claims including two independent claims – claims 1 and 6. Independent claim 1 reads as follows:

1. *A method of forming a rotationally symmetrical surface on a polycrystalline diamond element or diamond element comprising base material coated with diamond, characterized in that the method comprises the steps of:*

rotating a blank (2) formed from diamond material about a first axis (12);

applying a laser beam (15) to the blank (2) the laser beam (15) supplying sufficient light intensity to cut the blank (2); and

translating the blank (2) relative to the laser beam (15) along a two-dimensional path;

whereby the simultaneous rotation of the blank (2) and translation of the blank (2) relative to the laser beam (15) results in the rotationally symmetrical surface (10) being cut in the blank (2).

Independent claim 6 reads as follows:

6. *An element of diamond material having a convex surface (10) formed thereon, wherein the diamond element is polycrystalline or the diamond element comprises base material which is coated with diamond, characterised in that the convex surface (10) having a root mean square*

roughness, Rq, of less than about 30 nm, the element further having at least one of the properties from the following list:

(a) the convex surface (10) including a spherical segment having a conical halfangle greater than about 10°, for which the maximum peak to valley deviation from a perfect spherical surface is less than about 5 µm;

(b) the convex surface (10) including a spherical segment having a conical halfangle greater than about 10° for which the RMS deviation of the spherical segment, as measured by averaging over the square of deviations over the spherical segment, is less than or equal to about 500 nm.

32. I will consider the novelty and inventive step of the dependent claims should that become necessary after my assessment of independent claims 1 and 6.

Novelty and Inventive step – the law

33. Section 1(1)(a) and (b) of the Patents Act (henceforth ‘the Act’) reads:

1(1) A patent may be granted only for an invention in respect of which the following conditions are satisfied, that is to say –

- (a) the invention is new;*
(b) it involves an inventive step;

34. The relevant provisions in relation to novelty are found in section 2(1) and section 2(2) which read:

2(1) An invention shall be taken to be new if it does not form part of the state of the art.

2(2) The state of the art in the case of an invention shall be taken to comprise all matter (whether a product, a process, information about either, or anything else) which has at any time before the priority date of that invention been made available to the public (whether in the United Kingdom or elsewhere) by written or oral description, by use or in any other way.

35. The provisions in relation to inventive step are found in section 3 which states:

3. An invention shall be taken to involve an inventive step if it is not obvious to a person skilled in the art, having regard to any matter which forms part of the state of the art by virtue only of section 2(2) above (and disregarding section 2(3) above).

36. The Court of Appeal in *Windsurfing*¹ formulated a four-step approach for assessing whether an invention is obvious to a person skilled in the art. This approach was restated and elaborated upon by the Court of Appeal in *Pozzoli*². Here, Jacob LJ reformulated the *Windsurfing* approach as follows:

¹ *Windsurfing International Inc. v Tabur Marine (Great Britain) Ltd*, [1985] RPC 59

² *Pozzoli SPA v BDMO SA* [2007] EWCA Civ 588

- (1)(a) *Identify the notional “person skilled in the art”*
- (1)(b) *Identify the common general knowledge of that person;*
- (2) *Identify the inventive concept of the claim in question or if that cannot be readily done, construe it;*
- (3) *Identify what, if any, differences exist between the matter cited as forming part of the “state of the art” and the inventive concept of the claim or the claim as construed.*
- (4) *Viewed without any knowledge of the alleged invention as claimed, do those differences constitute steps that would have been obvious to the person skilled in the art or do they require any degree of invention?*

37. I will begin by considering the validity of the invention as defined by independent claims 1 and 6. Only if I find either or both claims to be invalid will I consider the remaining dependent claims.

Claim construction

38. Before considering the documents put forward in the request I need to construe claims 1 and 6 of the Patent, that is to say I must interpret it in the light of the description and drawings as instructed by Section 125(1). In doing so I must interpret the claims in context through the eyes of the person skilled in the art. Ultimately the question is what the person skilled in the art would have understood the patentee to be using the language of the claims to mean. This approach has been confirmed in the recent decisions of the High Court in *Mylan v Yeda*³ and the Court of Appeal in *Actavis v ICOS*⁴.

39. Section 125(1) of the Act states that:

For the purposes of this Act an invention for a patent for which an application has been made or for which a patent has been granted shall, unless the context otherwise requires, be taken to be that specified in a claim of the specification of the application or patent, as the case may be, as interpreted by the description and any drawings contained in that specification, and the extent of protection conferred by a patent or application for a patent shall be determined accordingly.

40. Neither the requester nor the observer has filed any argument concerning the construction of claims 1 and 6. In my opinion these claims are clear and straightforward and a person skilled in the art would have no difficulty in construing the scope of the claim.

41. In their argument, the requester draws attention to the fact that claim 6 is not limited to metrology and is directed merely to a part-spherical diamond element having certain surface characteristics as defined in the claim. I agree with this.

42. Further the requester also points out that claim 6 is restricted to a spherical segment

³ *Generics UK Ltd (t/a Mylan) v Yeda Research and Development Co. Ltd & Anor* [2017] EWHC 2629 (Pat)

⁴ *Actavis Group & Ors v ICOS Corp & Eli Lilly & Co.* [2017] EWCA Civ 1671

having a conical half angle of 10° i.e. a sweep of 20° from one side to the other and not the full 360° of the sphere. Again I agree with this.

43. I will consider the construction of the dependent claims if necessary following my assessment of the validity of claims 1 and 6.

Does A9 disclose all of the features of claim 1?

44. The requester argues that A9 discloses all of the features of claim 1. A9 discloses a method of shaping and polishing the surface of a polycrystalline diamond including the steps of diffusion smoothing the diamond surface with hot reactive metals, shaping the smoothed diamond surface by laser ablation using a pulsed laser beam, and ion-beam assisted polishing the ablated diamond surface to optical smoothness. The polished diamond can be used for high quality optics.

45. The requester draws attention to a number of passages in A9 and of those I would highlight column 3, lines 18-24 and lines 54-62 which respectively read as follows:

“For shaping the diamond into a flat, spherical, cylindrical, or aspheric surface, a process of laser ablation is used which is similar to the operation of a computer-controlled lathe or a single-point diamond turning machine wherein the laser makes cuts at very small, microscopic increments to approximate the desired surface of a lens or a flat or other shape.”

“One method of using the laser in conjunction with the interferometer is to turn the diamond plate as a lathe would turn a workpiece and have the laser and interferometer at a fixed position, moving only radially with respect to the rotation axis of the spinning diamond plate. Another preferred configuration is to control an x-y coordinate stage carrying the diamond plate to be figured and have a fixed position for the laser and interferometer.”

46. The observer accepts that A9 discloses shaping and polishing the surface of a polycrystalline diamond using a focused laser beam. However the observer contends that A9 does not disclose simultaneous rotation of the blank and translation of the blank relative to the laser beam. Contrary to the requester's argument, the observer considers A9 to disclose two separate embodiments as outlined in the second of the two passages reproduced above. One embodiment disclosing rotational movement only and the other embodiment translational movement over two dimensions but with no rotation. As these are separate embodiments, A9 does not disclose the required feature of claim 1 of simultaneous rotational and translational movement of the blank relative to the laser beam.

47. The requester counters in their observation in reply that the skilled person would clearly understand from the teaching of A9 that the use of a laser ablation to shape the diamond material is basically similar to the operation of a computer-controlled lathe, in which there must necessarily be relative movement both radially and axially (i.e. in two dimensions as per claim 1 of the patent) between the cutting instrument (the laser) and the workpiece (the diamond plate). Without relative movement in two dimensions a 3D shape cannot be formed. With only radial movement all that can be done is to form a radial slot in the rotating material. The requester further argues that

this is no different from a conventional computer-controlled lathe which turns the workpiece whilst simultaneously translating it along the rotation axis, with a cutting tool being moved radially in and out to shape the workpiece; or the cutting tool can be moved axially along the rotating workpiece, or a combination of these.

48. I find myself in agreement with the requester. The skilled person from the first passage above would have understood A9 to be disclosing the shaping of a diamond into a spherical surface by a process of laser ablation which is similar to the operation of a computer-controlled lathe wherein the laser makes cuts at very small, microscopic increments to approximate the desired surface shape (i.e. a spherical surface). Computer-controlled lathes at the priority date of the application would be capable of providing simultaneous rotation of the blank and translation of the blank relative to the laser beam. Therefore the skilled person is taught by A9 to produce a spherical surface and in order to do so both rotational and translational movement of the diamond would be necessary to form the 3D shape.
49. Therefore in my opinion claim 1 is not novel in light of A9.

Dependent claims 2-5 and 12-14

50. With regard to claims 2-5 which are dependent upon claim 1, I can see no issue with their construction. Neither the requester nor the observer has filed any argument regarding the construction of these claims.
51. The requester has outlined in the request how claims 2-4 lack novelty over A9 and how claim 5 is obvious. The observer has not filed any argument regarding the novelty and/or inventive step of these claims other than they are novel and inventive due to their dependency on claim 1 (which is also novel and inventive).
52. The observer also argues that as the requester has not raised any arguments that claim 1 lacks an inventive step, it is therefore not appropriate for me to consider the inventiveness of claim 5 as it incorporates the features of claim 1, and these features should not be considered for inventive step. The requester has included argument regarding the inventive step of claim 5 in the initial request. As claim 1 has been found to be not novel and as claim 5 (through claim 4) is dependent thereon I do not agree with the observer that it would be inappropriate for me to consider the inventiveness of claim 5.
53. Having considered the requesters arguments I agree that claims 2-4 lack novelty over A9 and claim 5 is obvious.
54. The requester has relied on A10 in arguing that claims 12-14 are obvious. As I am not considering A10 in this opinion I do not consider claims 12-14 to lack an inventive step based on the evidence before me.

Is claim 6 novel?

Does A5 disclose all of the features of claim 6?

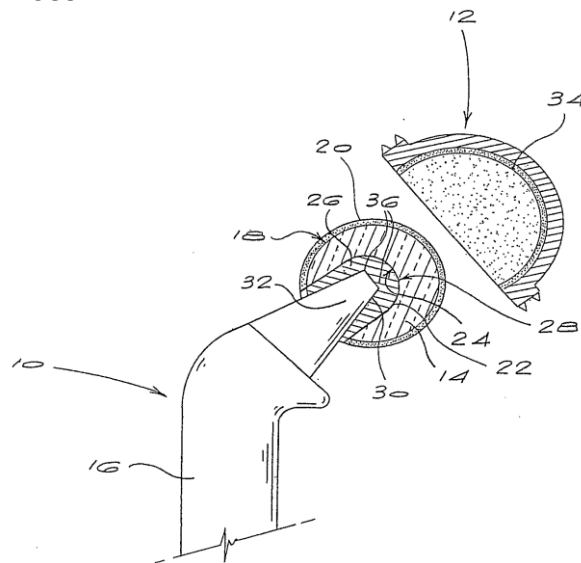
55. The requester considers A5 to include all of the features of claim 6. A5 discloses a technique for coating a silicon nitride (Si_3N_4) substrate with an "ultra-smooth"

polycrystalline diamond film, with the resultant surface having excellent tribological properties. As one example, it is described that a silicon nitride ball having a 5mm diameter is polished down to 1µm and used as the substrate. Over this substrate ball is deposited an ultra-smooth polycrystalline diamond film having a nanometre-scale crystal size (NCD). Section 3.1 states that the typical surface roughness values (R_a) for all NCD films is in the range of 20 and 40nm. Therefore the requester argues A5 discloses a method that results in an element of diamond having all of the features of claim 6 i.e. a spherical diamond-coated element having a surface roughness of less than 30nm and a sphericity of less than 5µm.

56. The observer argues that it is unclear whether the wording “polished down to 1µm” is referring to the sphericity or roughness of the balls. Further as it refers to the Si_3N_4 base material rather than the diamond material coated on the base material it is misleading to conflate the two. Therefore A5 does not disclose the required characteristics for the sphericity of the diamond element as required by claim 6.
57. I agree with the observer that it is not clear whether the wording “polished down to 1µm” is referring to the sphericity or roughness of the balls. I therefore also agree that A5 does not disclose the required sphericity of the diamond element as required by claim 6. Therefore in my opinion claim 6 is novel over A5.

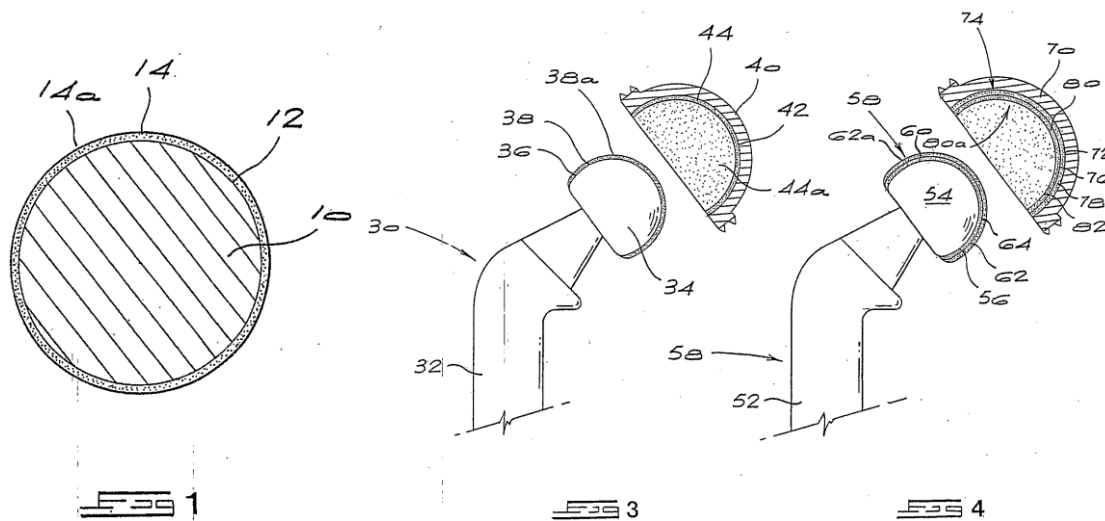
Do A6, A7 and A8 disclose all of the features of claim 6?

58. I will consider the relevance of documents A6, A7 and A8 first due to the similarity in the arguments for these documents.
59. A6 discloses (as illustrated below) a prosthetic joint ball component 10 receivable in a prosthetic joint socket component 12 to form a prosthetic joint. The ball component 10 comprises a generally spherical ball 14 mounted on a stem 16. The outer rounded surface 18 of the ball 14, in this case, is provided with a layer 20 of polycrystalline CVD diamond, prepared by mechanical polishing to present a surface with an R_a of 20 nm or less.

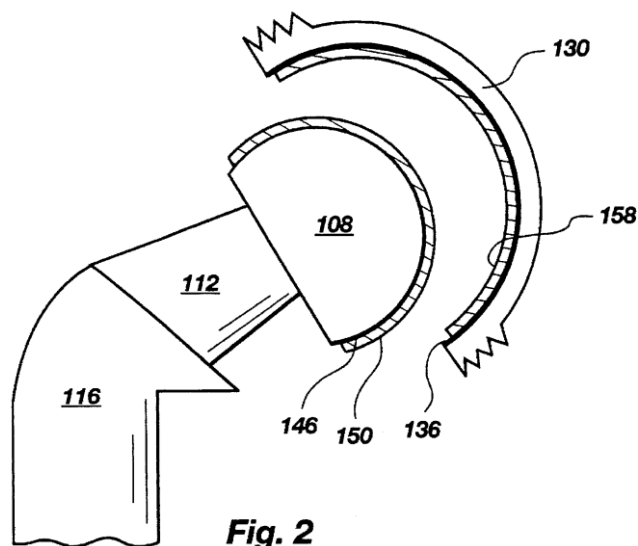


60. A7 discloses a number of different types of polycrystalline diamond-coated spherical elements. Page 7 lists a number of different possible applications of the polycrystalline diamond coated spherical element, including diamond-coated ball

bearings (figure 1 below) and ball and socket prosthetic joints (figures 3 and 4 below).



61. On page 4 of A7 the layer of polycrystalline diamond 38 is said to present a smooth surface, where “the smoothness of the surface will depend on the application to which the body is to be put and will typically have a R_a roughness of less than 40nm”.
62. A8 discloses a diamond-coated ball joint as illustrated below. Once the polycrystalline diamond compact has been applied to the load-bearing surfaces 146 and 136 of the prosthetic joint 48, it is polished to an R_a value of 0.1 to 0.01 microns (100nm to 10nm) by the use of concave and convex spherical diamond laps.



63. As argued by the requester each of documents A6, A7 and A8 discloses a polycrystalline or a diamond element comprising a base material which is coated with diamond, characterised in that the convex surface has a root mean square roughness, R_q , of less than about 30 nm. Paragraph [0020] of the patent gives the root mean square surface roughness, R_q , is related to the average surface

roughness, Ra, such that for a Gaussian distribution of deviations from the mean, Rq is equal to 1.25 Ra.

64. However none of documents A6, A7 and A8 explicitly discloses the sphericity of the convex surface. The requester has argued that the characteristics of femoral heads in artificial joints are governed by the ASTM F2033 standard (a version of which was published in 2005 – ASTM F2033-05). According to this standard, the deviation from spherical form of the femoral head (i.e. the ball joint) must not exceed 5µm. Therefore, the requester contends, when implementing the disclosure of documents A6, A7 and A8 in a practical context, it would have been a requirement to provide the outer surface of the prosthetic joint ball with a sphericity that falls within the claimed range. In other words, carrying out the teaching of documents A6, A7 and A8 in accordance with the required standard would have inevitably led to a diamond element as claimed in claim 6 of the patent. The requester considers claim 6 to lack novelty over each of documents A6, A7 and A8 as the values for sphericity given in the ASTM F2033 standard are thus implied in each of these documents.
65. The requester also uses a similar argument for the ball bearing embodiment in A7 along with the ball bearing standards DIN 5401, ABMA STD-10 and ISO 3290.
66. The observer argues that ASTM F2033 does not refer to diamond prosthetic joints but rather for prosthetic joints made from softer non-diamond materials. Therefore the disclosure cannot be taken as implicit in any of documents A6, A7 and A8. Further with regard to the DIN 5401, ABMA STD-10 and ISO 3290 standards the observer argues that no copies have been provided so their contents and publication dates cannot be verified. The requester has provided detail from the standards and comment on their publication dates (all pre-dating the priority of the patent) in the observations in reply.
67. I find myself in agreement with the observer. I do not consider the disclosure any of the standards mentioned above to be implicit in any of documents A6, A7 and A8. Therefore in my opinion claim 6 is novel over documents A6, A7 and A8.

Does A9 disclose all of the features of claim 6?

68. A9 has been considered above with regard to claim 1. The requester argues that A9 teaches the shaping of a polycrystalline diamond material into a spherical form using laser ablation, and subsequent polishing of the surface to optical smoothness using ion-beam assisted polishing and therefore claim 6 lacks novelty over A9.
69. The observer counters that A9 does not disclose the required surface roughness or sphericity of claim 6.
70. Again I agree with the observer. A9 does not disclose the values for surface roughness and sphericity required by claim 6. Therefore in my opinion claim 6 is novel over A9.

Inventive step

71. The observer argues that as the requester has not provided any reasoned argument

with regard to the inventiveness of independent claim 6, it would be inappropriate for me to consider the inventiveness of claim 6 and claims dependent thereon. I agree with the observer that in the absence of detailed argument with regard to inventive step it would be inappropriate for me to provide a detailed analysis of inventive step following the reformulated the Windsurfing approach detailed above in paragraph 36.

Conclusion

72. I consider that the invention as defined by independent claim 1 to be anticipated by A9 and dependent claims 2-5 lack novelty and/or inventiveness as outlined above.
73. I consider independent claim 6 and claims dependent thereon novel in light of the evidence before me.
74. I have not considered the inventiveness of independent claim 6 and claims dependent thereon in light of the absence of reasoned argument in the initial request with regard to inventive step as discussed above.

Application for review

75. Under section 74B and rule 98, the proprietor may, within three months of the date of issue of this opinion, apply to the comptroller for a review of the opinion.

Marc Collins
Examiner

NOTE

This opinion is not based on the outcome of fully litigated proceedings. Rather, it is based on whatever material the persons requesting the opinion and filing observations have chosen to put before the Office.