Patents Act 1977 **Opinion Number** **21/16**

OPINION UNDER SECTION 74A

Patent	EP 2598313 B1
Proprietor(s)	CL Schutzrechtsverwaltungs GmbH; Katholieke Universiteit Leuven
Exclusive Licensee	
Requester	Renishaw plc
Observer(s)	Hafner & Kohl; Prüfer & Partner mbB
Date Opinion issued	21 October 2016

The request

1. The comptroller has been requested by Renishaw plc ("the Requester") to issue an opinion as to whether EP 2598313 B1 ("the Patent") is valid on the following grounds: firstly whether the Patent discloses the invention (as defined in claims 1, 10 and 11) clearly enough and completely enough for it to be performed by a person skilled in the art; secondly whether the claimed invention of the Patent is excluded from patentability on the grounds that it relates to the presentation of information; and thirdly whether the subject matter of the claims lack novelty and/or an inventive step in light of cited references E1-E17.

2. The request was received on 26 July 2016. It was accompanied by a statement explaining the request as well as copies of the cited references.

Observations & Observations in reply

3. Observations were received on 24 August 2016 from Hafner & Kohl on behalf of the proprietor, CL Schutzrechtsverwaltungs GmbH et al. ("the Observer").

4. Observations were also received from Prüfer & Partner mbB who are representing EOS GmbH Electro Optical Systems in opposition proceedings against the Patent. Prüfer & Partner submitted arguments regarding the validity of the Patent firstly with respect to whether the Patent discloses the invention (as defined in claim 13) clearly enough and completely enough for it to be carried out by a person skilled in the art; and secondly with respect to whether the subject matter of the claims lack an inventive step in light of eight documents. Regarding the documents, five of these were cited in addition to the prior art cited by the Requester; three were already cited by the Requester or were a member of the patent family of a document cited by the Requester. In the opinions process, any observations must focus on the issues

raised in the request. I have therefore only considered arguments that were directly related to the original request. If an opinion on new issues is required then a separate request for an opinion should be made.

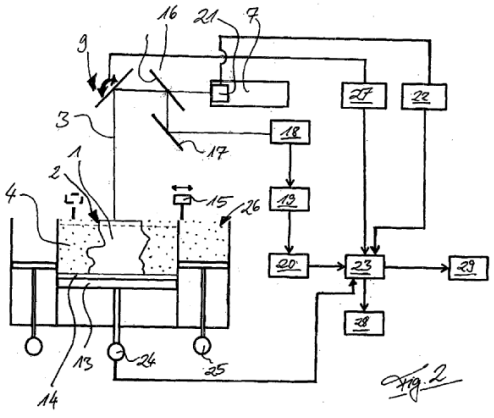
5. Observations in reply were received from the Requester on 8 August 2016. The Requester submitted a copy of US 2013/0168902 A1 for my convenience and pointed out that as a family member it provides an English language translation of much of the description of the Patent. Therefore, in this opinion, where I refer to paragraph numbers and provide extracts, these refer to US ‘902 where appropriate.

Basis of the Opinion

6. As detailed above the Requester has requested an opinion on three different grounds of validity, requiring consideration of 17 cited references. The opinion service is a simple, low-cost, quick service for helping parties resolve disputes. In order to reduce the request to a manageable size, I have restricted my opinion to consideration of independent claim 1 only.

The Patent

7. The Patent entitled “Method and apparatus for producing a three-dimensional component” was granted on 12 August 2015. In particular, the Patent relates to a method for producing a component by a selective laser melting process. From Figure 2 reproduced below, a component 1 is assembled from powdered building material 4 which is exposed with laser beam 3 from laser 7. The laser beam is guided over the powder surface via scanner 9 and melts the powder within a melt region. The melt region subsequently solidifies to form the component. In order to assess the quality of the component, radiation emitted from the melt region is detected by sensor device 18 via the scanning optics, and derived parameters displayed in a 2D or multi-dimensional representation with respect to their origin via a visualization element 29.



8. There are 15 claims including two independent claims, 1 and 15. Claim 1 reads as follows with the features separated out:

1 *(i) A method for producing a three-dimensional component (1) by a laser*

melting process, in which the component (1) is produced by successive solidification of individual layers of building material (4) which can be solidified by the action of radiation, by fusing the building material (4),
(ii) wherein the melt region (5) created by a point-and/or line-shaped energy influx is captured by a sensor device (6,11,12,18) and
(iii) sensor values for evaluating component quality are derived therefrom, ***characterized in that***
(iv) the sensor values captured for evaluating the component quality are stored together with the coordinate values localizing the sensor values in the component (1) and
(v) are displayed by means of a visualization apparatus (29) in a two-dimensional and/or multidimensional representation in respect of the capture location thereof in the component.

9. I will begin by considering the question of sufficiency of disclosure.

Sufficiency of Disclosure – the law

10. Section 14(3) of the Patents Act states:

> *The specification of an application shall disclose the invention in a manner which is clear enough and complete enough for the invention to be performed by a person skilled in the art.*

Sufficiency of Disclosure – arguments

11. The Requester argues that the Patent does not disclose the invention of claim 1 specifically, "the sensor values … are stored together with the coordinate values localizing the sensor values in the component", clearly enough and completely enough for it to be carried out by a person skilled in the art. In particular, the Requester asserts that the description and claims fail to disclose how a particular sensor value is linked to a particular coordinate value.

12. The Requester acknowledges that the description and claims 6 to 9 disclose various sources for the coordinate values. In particular, paragraph 0018 specifies that, "The coordinate values localizing the sensor values in the component can be the build coordinate values used to produce the component. These are the values which are used to guide the laser beam over the powder surface and values that represent a Z coordinate in respect of the layer number." Paragraph 0018 also informs us that alternatively coordinate values can be obtained by scanning the component surface and storing values that correspond to a solidification point by taking an 'areal' capture of the whole build plane or only a section containing the component region.

13. Regarding the sensor values, in paragraph 0031 we are told that radiation emitted from the melt region is detected by the sensor device which " leads to an evaluation (e.g. according to the length, width, area, etc.)". From Figure 2 and paragraph 0029 a data linkage/data assignment unit 23 receives signals from the sensor 18, controller of the laser 22 and control module 27 of the scanner. From paragraph 0028 the data collected in unit 23 can be further processed in a further data

processing unit 28 and/or visualized via a visualization element 29.

14. The Requester argues that linking the sensor values with the coordinate values (from build coordinates or areal capture) is not a trivial task with potential inaccuracies, and how to do this is not disclosed in the Patent. I agree that linking the values would not be trivial especially if high accuracy were required. However, I consider the skilled person would be able to link in particular the build coordinates with the sensor values using the information provided as summarized above. There may well be inaccuracies involved but I think the skilled person would be able to store sensor values and coordinate values together to enable a reasonably accurate visualization of the sensor values with respect to a capture region to be achieved as required by claim 1. Therefore I consider the Patent discloses the invention as defined in independent claim 1 clearly enough and completely enough for it to be performed by a person skilled in the art.

Presentation of information – the law

15. The Requester asserts that the invention of the Patent is not valid because it relates to the presentation of information. The relevant section of the Act is Section 1(2) that reads as follows:

> *1(2) It is hereby declared that the following (among other things) are not inventions for the purposes of this Act, that is to say, anything which consists of -*
> *(a) a discovery, scientific theory or mathematical method;*
> *(b) a literary, dramatic, musical or artistic work or any other aesthetic creation whatsoever;*
> *(c) a scheme, rule or method for performing a mental act, playing a game or doing business, or a program for a computer;*
> *(d) the presentation of information;*
>
> *but the foregoing provision shall prevent anything from being treated as an invention for the purposes of this Act only to the extent that a patent or application for a patent relates to that thing as such.*

16. The approach for determining whether an invention falls within the exclusions defined in section 1(2) is set out in the judgment in *Aerotel/Macrossan*[1]. The so-called 'Aerotel test' comprises four steps:

> *1) properly construe the claim;*
> *2) identify the actual contribution;*
> *3) ask whether it falls solely within the excluded subject matter;*
> *4) check whether the actual or alleged contribution is actually technical in nature.*

[1] *Aerotel Ltd v Telco Holdings Ltd & Ors Rev 1 [2007] RPC 7*

Presentation of information - arguments

17. Regarding step 1 of the four-step test, for the purposes of this section, claim 1 requires no particular construction and can be read as it stands.

18. Regarding step 2, the Requester submits that producing a three-dimensional component through a layered manufacturing process is well-known. Further they submit that the sensing of melt pool data is also well-known (as explained in the Patent with reference to prior art document WO 2007/147221). They argue that the alleged contribution of the invention is that the sensor values are displayed by means of a visualisation apparatus in a two-dimensional or multi-dimensional representation in respect of a capture location in the component. The Observer, however, notes that claim 1 of the Patent refers to a method for producing three-dimensional components and therefore is clearly directed to a manufacturing process.

19. I agree with the Requester that the process as set out in the preamble of claim 1 (parts (i) – (iii)) is known and that the invention is concerned with a means of visualising the sensor data with respect to a capture location. I also agree with the Observer that claim 1 is concerned with a manufacturing process. I consider the contribution to be a method for producing a three-dimensional component by a selective laser melting process wherein sensor values for evaluating component quality are derived from the melt region when captured by a sensor device and the sensor values are displayed by means of a visualisation apparatus in a two-dimensional or multi-dimensional representation in respect of a capture location in the component.

20. I can deal with steps 3 and 4 together. The Requester argues that there is no technical effect either within or outside the “visualisation apparatus”; the effect of displaying information in a user-friendly way is not technical in nature. The Observer, however, asserts that the invention allows for a specific quality control of production processes and components, the features concerning the display of sensor values providing a technical contribution to the quality control. The Requester and Observer both note from paragraph 0014 of the Patent that the visualization method is implemented to display values captured in the melt pool during the building process to provide information as to whether the component layers satisfy requirements in respect of fusion, temperature profile, work piece solidity etc. Further from this paragraph, visualization information can be used at a later date to determine for example the cause of a breakpoint of the tool.

21. I agree that visualizing data in a multi-dimensional format on its own would not necessarily provide a technical effect. However, here linking of component data with a capture region and subsequent visualization appears to be a key part of the manufacturing process allowing components to be made that satisfy particular technical requirements. This results in a better manufacturing process which is a real-world technical achievement outside the information itself. Therefore in my view, looking at the contribution of claim 1 as a whole, the defined invention has a technical effect and does not relate to the presentation of information as such.

Novelty and Inventive step – the law

22. The Requester argues that claim 1 lacks novelty and/or an inventive step in light of provided references. Section 1(1)(a) and (b) of 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;*

23. 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.*

24. 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).*

25. The Court of Appeal in *Windsurfing*[2] 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*.[3] Here, Jacob LJ reformulated the *Windsurfing* approach as follows:

> *(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?*

26. I will begin by determining whether claim 1 is novel. I will then use the *Windsurfing/Pozzoli* approach to assess whether claim 1 involves an inventive step. The Requester referred to 17 cited references including 15 separate disclosures. I

[2] Windsurfing International Inc. v Tabur Marine (Great Britain) Ltd, [1985] RPC 59
[3] Pozzoli SPA v BDMO SA [2007] EWCA Civ 588

will consider them in the combinations suggested. I am satisfied that each disclosure discussed was published before the priority date of the Patent and therefore forms part of the state of the art.

Construction of claim 1

27. In order to carry out this process, I first need to construe claim 1 of the Patent following the well-known authority on claim construction which is Kirin-Amgen and others v Hoechst Marion Roussel Limited and others [2005] RPC 9. This requires that I put a purposive construction on the claim, interpret it in the light of the description and drawings as instructed by section 125(1) of the Act and take account of the Protocol to Article 69 of the EPC. Simply put, I must decide what a person skilled in the art would have understood the patentee to have used the language of the claim to mean.

28. I consider the person skilled in the art to be a person (or team or persons) skilled in the manufacturing of three-dimensional components using a selective laser melting or related process.

29. Claim 1 is generally straightforward to construe. Feature (i) reads: *A method for producing a three-dimensional component (1) by a laser melting process, in which the component (1) is produced by successive solidification of individual layers of building material (4) which can be solidified by the action of radiation, by fusing the building material (4)*. The skilled person would realise from the Patent that this feature refers to a particular manufacturing process often referred to as the selective laser melting process. No other processes are described in the Patent.

30. Features (ii) and (iii) read: *wherein the melt region (5) created by a point-and/or line-shaped energy influx is captured by a sensor device (6,11,12,18) and sensor values for evaluating component quality are derived therefrom.* Here, sensor values must be *suitable for* evaluating component quality. Moreover, the skilled person would realise that the sensor values are *derived* from the capturing of the melt region by the sensor device. In particular from the Patent these values relate to parameters of the melt region for example its dimensions (length, width, area), shape or temperature (paragraphs 0025, 0031).

31. Finally, it follows from above, that the skilled person would consider the 'melt region' in claim 1 to be the region of melted building material that is produced during the selective laser melting process.

Novelty - arguments

32. The Requester argues that claim 1 of the Patent lacks novelty over E1 (patent document US 2004/0173946 A1). E1 discloses the production of 3D bodies using a layer build-up process. A powder material is: a) dispensed; b) flattened; and subsequently c) hardened in defined areas by moistening using binder liquid or by melting/sintering using laser radiation. An optical image of the applied, flattened or hardened layer is taken following process steps a), b) and/or c). The image is processed to detect defects in the layer plane.

33. E1 discloses a selective laser melting process and therefore discloses feature (i) of claim 1. Regarding feature (ii), the Observer argues that the optical inspection is conducted *after* each of the process steps a), b), c) (from for example paragraph 0030) and therefore a melt region will not be captured as it will already be hardened. The Requester points out that paragraph 0073 states that "The high colour or light intensity contrast between the moistened or hardened areas on the one hand, and the untreated particles on the other hand … makes it possible to employ a conventional digital camera". Therefore they claim images are captured when the layer has been moistened i.e. during hardening.

34. It seems that paragraph 0073 is referring to the 3D-binder printing process where the particles are moistened with binder liquid which subsequently harden rather than the alternative laser melting/sintering process. Paragraphs 0049-0062 describe the latter process where for example dyestuffs which darken or blacken under the heat effect of the radiation are used for optical inspection. Regarding this process, we are told that the evaluation of the image of the 'hardened layer' can be used to post-harden specific areas (paragraph 0052). I can see no reference to an image being obtained during the hardening process itself. Therefore there is no disclosure that a melt region is captured and feature (ii) of claim 1 is not disclosed. It follows that features (iii)-(v) are also not disclosed by this document. I therefore find claim 1 to be novel in light of E1.

The Windsurfing/Pozzoli steps

Steps 1(a) and 1(b): Identify the notional "person skilled in the art" and the common general knowledge of that person

35. As discussed above, I consider the person skilled in the art to be a person (or team or persons) skilled in the manufacturing of three-dimensional components using a selective laser melting or related process. The common general knowledge of that person would include a familiarity with established quality control procedures. I note that the contents of individual patent specifications do not normally form part of the relevant common general knowledge.

Step (2): Identify the inventive concept of the claim in question or, if that cannot be readily done, construe it.

36. I consider the inventive concept of claim 1 as construed above to be a method for producing a three-dimensional component by a selective laser melting process wherein sensor values suitable for evaluating component quality are derived from the melt region when captured by a sensor device and the sensor values are displayed by means of a visualisation apparatus in a two-dimensional or multi-dimensional representation in respect of a capture location in the component.

Step (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 claim as construed.

Step (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.

I will deal with steps 3 and 4 together for the different combinations of documents suggested.

Whether claim 1 lacks an inventive step over E1 and common general knowledge

37. As discussed above E1 does not disclose that a melt region is captured by a sensor device, feature (ii) of claim 1, and therefore also does not disclose further features (iii) to (v).

38. The Requester employs documents E3, E9 and E11 to argue that it is obvious to display data collected during a layer-wise laser process. E3 (patent US 6580959 B1) relates to a system and method for monitoring and controlling laser-aided direct material deposition processes. E9 (patent document US 2004/0217095 A1) discloses a method for producing 3D work pieces in a laser material machining unit or a stereo-lithography unit. E11 (patent document JP 2004-223789 with reference to associated English translation E12) discloses an optical micro-shaping apparatus where a liquid photo-curable resin is selectively cured by laser energy. As the Requester concedes, none of these three documents discloses producing a 3D component by a selective laser melting process as described in the Patent and defined in claim 1. Therefore, none discloses capturing a melt region by a sensor device as required by missing feature (ii). Thus, the skilled person would not be able to look to these documents to provide the required features.

39. The Requester in their observations in reply argues further that documents E5, E7 and E13 provide evidence that it is known in a layer-wise laser process to capture sensor values of a melt region and determine sensor values for evaluating component quality. E7 and E13 are discussed in detail later on and will be dealt with then. E5 (patent document US 2009/0206065 A1) is a family member of WO 2007/147221 cited as acknowledged prior art in the Patent specification. It discloses a method to monitor and control a selective laser melting process. Radiation emitted or reflected from the melt zone is captured by a detector. Geometric quantities of the melt zone are derived and used for process control.

40. Therefore E5 discloses the preamble of claim 1 of the Patent i.e. features (i)-(iii). However, there is no disclosure in either E1 or E5 of storing sensor values with their coordinate values and subsequently visualizing them in a 2D or multi-dimensional way. Therefore the skilled person would not be able to arrive at claim 1 with the disclosures in these two documents alone. The teaching in E1 appears to be to monitor the particle layer only once hardened. The skilled person in light of E1 would not consider monitoring the melt zone as carried out in E5 and then subsequently store and display the data to arrive at the subject matter of claim 1 without exercising some inventive ingenuity. Therefore I consider the invention as defined in claim 1 to involve an inventive step in light of E1 and common general knowledge.

Whether claim 1 lacks an inventive step over E2 and common general knowledge

41. E2 is patent document US 2006/0032840 A1 and relates to the fabrication of metal

parts by the direct metal deposition (DMD) of a plurality of thin layers on an underlying substrate. A head consisting of a power laser and gas propelled metal powder dispenser is employed to produce a weld pool at a point on a substrate. The substrate is moved relative to the head so that the weld pool follows the path along the substrate so as to create a metallic layer on the substrate. A pair of CCD cameras generate images of the weld pool from two opposed sides. The "weld pool size" which is related to weld pool temperature is extracted from the image and is used to control the laser power in a feedback system (paragraph 0026). In particular, the weld pool size is determined at selected coordinates as the deposition progresses and these values are stored (paragraph 0025).

42. As the Observer points out, the DMD fabrication method of E2 is not a selective laser melting process. In particular, the metal powder in E2 is passed through the laser beam before it meets the substrate to form a deposition rather than a laser-melting process. Therefore the "weld pool" deposited in E2 is not the "melt region" created in situ required by claim 1. As the Requester concedes, E2 does not disclose that the sensor values (i.e. weld pool size) are displayed by means of a visualization apparatus. Therefore E2 does not disclose features (i) and (v). Features (ii)-(iv) are disclosed for a weld pool rather than for the required melt region i.e. for a different manufacturing process.

43. The Requester employs documents E1, E4 and E15 to demonstrate that multi-dimensional data visualization is part of the skilled person's common general knowledge. E1 been discussed above and does not disclose capturing a melt region. E4 (P.J. Sackett et al, "A review of data visualization: opportunities in manufacturing sequence management", International Journal of Computer Manufacturing, 2006) and E15 (A. Kaufman et al, "Volume visualization and volume graphics", Technical Report, Computer Science Department, Stony Brook University, 2003) are general articles not concerned with additive manufacturing processes. Therefore the skilled person would not be able to look to these documents to supply all the features missing from E2. Similarly documents E3, E9 and E11 discussed above would not be able to provide the missing disclosure.

44. The Requester argues in their observations in reply that the person skilled in the art of selective laser melting would look to DMD processes in order to solve problems within selective laser melting as both processes fall within the general field of additive/3D printing. This may be the case. However, I do not consider the skilled person with knowledge of E2 would be able to apply the teaching to a different technology area (albeit related) and also modify it to include visualization of the data as required without exercising some inventive ingenuity. Therefore I consider the invention as defined in claim 1 to involve an inventive step in light of E2 and common general knowledge.

Whether claim 1 lacks an inventive step over E6 and common general knowledge

45. E6 is patent document US 2004/0026807 A1 and discloses a method of manufacturing a three-dimensional product through successive fusion of chosen parts of powder layers using a ray gun which may be constituted by a laser (paragraph 0049). Therefore E6 discloses a selective laser melting process and meets the terms of feature (i) of claim 1.

46. A camera is used to measure the temperature distribution of a surface layer (paragraph 0037). In particular paragraph 0043 explains that a temperature distribution matrix $T_{ij\text{-measured}}$ is generated from the measured temperature distribution in which the temperature of small sub-areas of the surface layer is stored. These areas we are told include those in which fusion is taking place (i.e. within a melt region). Each temperature value in the matrix is compared with a desired value.

47. The Observer argues that E6 teaches to divide the entire surface layer of the powder layer into three different temperature categories only one of which includes the areas where fusion takes place and therefore does not disclose a special and individual capture of a melt region. The Observer similarly argues that E6 does not disclose to derive sensor values for evaluating component quality from a captured melt region as there is no isolated observation where the fusion takes place. I consider the skilled person would realise from in particular paragraphs 0014 and 0043-0045, that although temperature values are obtained from the whole surface layer of the powder bed, this includes areas where fusion is taking place. I agree with the Requester that claim 1 merely requires that the melt region is captured by the sensor device not that it is the only region captured. Therefore E6 discloses feature (ii) of claim 1.

48. The skilled person would understand that the temperature values are used to control temperature during fusion of the powder particles thus reducing the risk of occurrence of defects and are therefore suitable for evaluating component quality. Moreover, paragraph 0025 of the Patent suggests temperature as a suitable sensor value. Therefore E6 discloses feature (iii) of claim 1. The (i, j) values must have a known correspondence to the coordinate values in the component in order that the temperature values can be compared with desired values. Therefore I consider that E6 further discloses feature (iv) of claim 1.

49. The difference between this disclosure and that defined in claim 1 is feature (v) i.e. the sensor values are displayed by means of a visualization apparatus in a two-dimensional and/or multidimensional representation in respect of the capture location in the component. The Requester argues that the display of the sensor values in such a representation is obvious from the common general knowledge. I agree that once the matrix of temperature values have been evaluated at the coordinate positions, the skilled person would consider displaying these values in at least a two-dimensional arrangement. Although these values will include those not related to the melt region, some of them will as discussed above. The skilled person would realise the usefulness of such a representation in visualizing the temperature distribution across the component. Therefore it is my view that by combining the disclosure in E6 with common general knowledge claim 1 is obvious.

Whether claim 1 lacks an inventive step over E7 and common general knowledge

50. E7 (J-P. Kruth et al., “Feedback control of Selective Laser Melting”, Proc. of the 3rd International Conference on Advanced Research in Virtual and Rapid Prototyping, pp 521, 2007) discloses an in-process monitoring system for a selective laser melting powder bed based manufacturing process. The monitoring system is based on a CMOS camera and photodiode which look at the process through the beam deflection unit and are used to observe the laser spot and melt pool (or melt region)

at all times from the melt pool radiation. Therefore there is no dispute that E7 discloses features (i) and (ii) of claim 1.

51. E7 explains that the sensors can be used to determine melt pool area. The Observer argues that sensor values for evaluating component quality are not derived from the melt pool area as required by part (iii) of claim 1. However I agree with the Requester that the Patent (paragraph 0031) specifies that detection by the sensor device leads to an evaluation which may be melt pool area. Therefore the skilled person would consider melt pool area to be a sensor value *suitable fo*r evaluating component quality. Thus, E7 also discloses feature (iii).

52. Regarding feature (iv), E7 includes a plot (Figure 9) of melt pool area during scanning of a structure when the scanning direction is either parallel to or perpendicular to the transition line of an overhang geometry. The horizontal axis represents the number of samples and three zones A, B, C are identified. The Requester asserts that the sample number from Figure 9 can be correlated with position on the component particularly as the scan paths, scan speed and sampling speed are known. They argue further that the sample number must have been stored with the sample value to produce Figure 9. However, I agree with the Observer that Figure 9 only qualitatively refers to the three zones and there is no explicit correlation between respective sensor values and coordinate values localising the sensor values in the respective zones. Therefore E7 does not disclose feature (iv). There is no disclosure of the sensor values being displayed in a 2D or multidimensional representation and therefore E7 also does not meet the terms of feature (v).

53. Therefore in order to arrive at claim 1 from E7, the skilled person would need to firstly relate the sample numbers to coordinate values in the component and then secondly make at least a 2D representation of the melt pool area with respect to these values. This does not seem straightforward even if the scan paths, speeds etc. are known. It is also not clear from E7 whether these steps would be beneficial to the feedback control system thus providing an incentive for the skilled person to do this. Further, none of the additional documents cited by the Requester would appear to assist the skilled person in making these steps. Therefore I consider the invention as set out in claim 1 to involve an inventive step in light of E7 and common general knowledge.

Whether claim 1 lacks an inventive step over E13 and common general knowledge

54. E13 (A. Heralic, “Towards full Automation of Robotized Laser Metal-wire Deposition”, Chalmers University of Technology, 2009) discloses a layered manufacturing technique where metal structures are built by using a laser to melt metal wire into beads that are deposited side by side and layer upon layer. In particular a laser generates a melt pool on the substrate material into which the metal wire is fed. I agree with the Observer that this is a deposition process rather than a selective laser melting process as required by claim 1. Therefore further the melt pool of E13 cannot be considered to be the required melt region. As the Requester concedes, although some sensor data is stored and subsequently displayed the sensor values are not displayed in respect of the capture location in the component.

55. Therefore it is clear that there are significant differences between the disclosure in E13 and that required by claim 1. I do not consider that the skilled person would be able to arrive at the invention of claim 1 from this document and common general knowledge alone. Therefore I consider the invention as set out in claim 1 to involve an inventive step in light of E13 and common general knowledge.

Whether claim 1 lacks an inventive step over E14 and E11

56. E14 (patent document US 5530221) discloses a temperature-controlled selective laser melting process. Thermal radiation emitted from the melt region is focussed onto an infrared photo-detector. The photo-detector provides an electrical control signal to maintain the magnitude of the thermal emissions at a substantially constant level by adjusting the optical power of the incoming laser light (see column 5 lines 4 – 59). Therefore E14 clearly discloses features (i) and (ii) of claim 1. The photo-detector measures a parameter related to temperature of the melt region and therefore it can be argued that further feature (iii) is disclosed for reasons discussed above. E14 does not, however, disclose features (iv) and (v) because the sensor values are neither stored nor displayed in respect of a capture location.

57. E11 (patent document JP2004-223789) has already been discussed briefly above. It discloses an optical micro-shaping apparatus where a liquid photo-curable resin is selectively cured by laser energy. As explained in paragraph 0008 the key characteristic of the invention is the provision to provide real-time observation of the photo-curing process. This is achieved by illuminating the resin from below and capturing the area at the laser spot with a camera. The resulting image is projected on a monitor screen and confirmation of the state of the cure conditions can be observed. Paragraph 0008 continues to explain that (referring to the supplied translation in E12), “Additionally, a post-confirmation may be made by retaining the record of the image and comparing it with the production mould”.

58. Therefore E11 does not describe a selective laser melting process and does not disclose feature (i) of claim 1. The required melt region is therefore not captured as required by the subsequent features. The additional disclosures in E11 regarding capturing and observing images of the cure position would not be part of the common general knowledge of the skilled person.

59. The two documents are concerned with different objectives. E14 is concerned with a feedback process to maintain temperature at a constant level by controlling the optical power of the laser beam. E11 on the other hand is concerned with a monitor mechanism to observe the progress of a curing process. I do not see that the skilled person would consider combining the teaching in these two documents and therefore be able to arrive at what is claimed in claim 1. Therefore I consider the invention as defined in claim 1 to involve an inventive step in light of E14 and E11

Opinion

60. It is my opinion that the Patent discloses the invention as defined by independent claim 1 clearly enough and completely enough for it to be performed by a person skilled in the art. I am also of the opinion that the claimed invention of the Patent as defined by claim 1 is not excluded from patentability on the grounds that it relates to

the presentation of information. Finally, I consider the invention of claim 1 to lack an inventive step in light of patent document E6 (US 2004/0026807 A1) in combination with the common general knowledge of the relevant skilled person.

Application for review

61. 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.

Susan Dewar
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.