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OPINION UNDER SECTION 74A

Patent	EP 2262922 B1
Proprietor(s)	Commonwealth Scientific and Industrial Research Organisation
Exclusive Licensee	
Requester	TWI Technology Centre
Observer(s)	Commonwealth Scientific and Industrial Research Organisation
Date Opinion issued	01 February 2017

The request

1. The comptroller has received a request from TWI Technology Centre (the requester) to issue a validity opinion under section 74A(1)(b) in respect of patent EP 2262922 B1 (the patent) in the name of Commonwealth Scientific and Industrial Research Organisation (the proprietor). The request questions the validity of claims 1 to 9 on the basis that they lack novelty or an inventive step.

2. The patent has a filing date of 6 March 2009, a priority date of 6 March 2008 and was originally published as WO 2009/109016 A1. It was granted on 29 April 2015 and remains in force in the UK.

3. Observations were received from the proprietor and observations in reply were subsequently received from the requester.

Invention

4. The invention relates to a method of manufacturing pipes by spraying material onto a rotating mandrel and then withdrawing the mandrel from the so-formed pipe. In particular, the material is sprayed by cold-gas dynamic spraying and the mandrel is withdrawn from the pipe following cooling and contraction of the mandrel. The mandrel has a coefficient of thermal expansion which is greater than the coefficient of thermal expansion of the pipe so that the mandrel shrinks more than the pipe upon cooling.

5. One of the features of the invention is the use of cold-gas dynamic spraying rather than more conventional thermal spraying. As the name implies, cold-gas dynamic spraying takes place at lower temperatures than thermal spraying and in particular does not involve melting the material being sprayed.

Claim Construction

6. Before deciding the question of novelty it is necessary to properly construe the claim following the well-known House of Lords authority on claim construction in *Kirin-Amgen*[1]. This requires that I construe the claims purposively, interpreting them in the light of the description and drawings, to decide what a person skilled in the art would have understood the patentee to have used the language of the claim to mean.

7. Claim 1 of the patent reads as follows:

> *Claim 1*
>
> *A method of manufacturing a pipe,*
>
> *which method comprises cold-gas dynamic spraying of particles onto a mandrel thereby producing a pipe, and separating the pipe from the mandrel,*
>
> *wherein the external surface of the mandrel defines the internal surface of the pipe,*
>
> *wherein the mandrel has a coefficient of thermal expansion that is greater than the coefficient of thermal expansion of the pipe being manufactured and*
>
> *wherein separation of the pipe from the mandrel takes place by contraction of the mandrel away from the pipe.*

8. In general there are not considered to be any issues in construing the claim and it is considered that it may largely be construed as read save for the following points of note.

9. Firstly, the requester construes pipe as "a tube (often of cylindrical form) for conveyance of some substance or object". I consider this should be clarified, at least for the purposes of the patent, by the addition of "from a first end to a second end".

10. Secondly, the phrase "contraction of the mandrel away from the pipe" needs to be read in conjunction with paragraph [0007] of the description and corresponding claim 7 which specifies that separation is achieved "by heating *or* cooling the pipe *and/or* the support member". The use of "*or* … *and/or* …" in this way seemingly encompasses a large number of variations, some of which do not apparently fall within the scope of claim 1, e.g. heating only the mandrel or cooling only the pipe, and the claims must be construed accordingly. It is nevertheless considered to encompass heating only the pipe such that cooling of the mandrel is not necessarily required. Separation may therefore be achieved by heating of the pipe to expand it, which I interpret as a relative contraction of the mandrel from the pipe, and the term contraction needs to be construed as a relative contraction rather than an absolute contraction.

11. I also note that although there is no explicit connection in the claim between the differing coefficients of thermal expansion and the contraction of the mandrel away from the pipe, the difference in the coefficients of thermal expansions nevertheless

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[1] *Kirin-Amgen v Hoechst Marion Roussel and others* [2005] RPC 9.

places a limitation on how the separation can be achieved. In particular, the differing coefficients of thermal expansion do not allow the pipe to be separated from the mandrel by heating of both. However, separation by heating the pipe and cooling the mandrel, as identified above in relation to paragraph [0007], could be accomplished regardless of the coefficients of thermal expansion.

Novelty

12. The requester's first argument is that claim 1 lacks novelty based on the disclosure of US 2007/0036905 [D1].

13. This document relates to methods for manufacturing medical devices, in particular utilising thermal spray processing and cold spray processing. Of particular relevance are the manufacture of stents and catheters using a mandrel.

14. The requester makes particular references to paragraphs [0009], [0042] [0045] and [0047] of this document. The most salient parts of these paragraphs are reproduced below.

> *[0009] Hypotubing or other tube stock manufactured using the spray processes of the present invention may be configured into a stent or other tubular medical device…*
>
> *[0042] As used herein, spray processing describes a broad class of related processes in which molten (or semi-molten) droplets or fine particles of a metal, metal alloy, ceramic, glass, polymer and/or other suitable material are (1) sprayed to form a starting material (e.g., a tube stock or flat sheet); … Two types of spray process compatible with the present invention include thermal spray processing and cold spraying.*
>
> *[0045] Another benefit of using a spray process to manufacture a medical device is that the spray process may be used to form porous tube stock on top of a removable mandrel…*
>
> *[0046] … The inner mandrel may be made of a substance that melts out, or that is coated with a substance that allows easy removal of the finished sprayed tube stock. If the grain size, porosity, and dimensional tolerances (including wall runout, wall thickness, concentricity and surface roughness) are within specifications, the mandrel may be removed and the sprayed tube stock may be subjected to further processing into a stent or other tubular or ring-shaped product…*
>
> *[0047] For removal of the porous tube stock after it is formed, it may be beneficial to either melt or shrink the mandrel's diameter to ease removal of the tube stock. For example, the mandrel can be formed of metal that will shrink in diameter when cooled, while the tube stock may be heated so that it expands radially outwardly. The mandrel can then be easily removed from the tube stock. The mandrel and tube stock may also both be heated so that the difference in expansion rates may cause separation between the two…*

15. Although the observations appear to question whether a stent can be a pipe, the requester makes clear in the observations in reply that the pipe is the tube stock referred to. I agree with the requester that the tube stock is a pipe for the purposes of the claims. It seems clear from paragraph [0093] of D1 that to form a stent a complete tube is spray-formed and it is then laser ablated to form the stent. The complete tube is considered to be a pipe. For the avoidance of doubt, I do not believe the skilled person would consider a stent to be a pipe.

16. Paragraph [0042] specifies cold spraying, which is understood to be synonymous with cold gas dynamic spraying, the two terms being used interchangeably in the patent forming the subject of this opinion. Furthermore, paragraphs [0036] and [0037] of D1 specifically disclose forming tube stock by cold spraying.

17. D1 is therefore considered to teach all the features of claim 1 except that the coefficients of thermal expansion of the pipe and the mandrel are not explicitly specified.

18. The requester argues in the request [§1.13] that paragraph [0047] discloses the required differences in coefficient of thermal expansion as it discloses shrinking a metal mandrel away from the pipe. However, as stated in the observations, this paragraph does not disclose the required coefficients. It specifies that the mandrel may be cooled to shrink it and the tube stock heated to expand it in order to separate the two. Such a process will work regardless of the coefficients of thermal expansion. This paragraph is simply stating that differences in thermal expansion may be used to achieve separation. Nothing regarding the coefficients of thermal expansion is implied. That being said, paragraph [0047] goes on to state that "*The mandrel and tube stock may also both be heated so that the difference in expansion rates may cause separation between the two".* In order for this to work, this would apparently require the coefficient of thermal expansion of the tube stock to be greater than that of the mandrel in order that the tube stock expands more than the mandrel.

19. I therefore consider that the required difference in coefficients of thermal expansion is neither explicitly nor implicitly disclosed in D1. The claims are therefore novel in respect of this document.

20. A subsidiary argument relating to lack of inventive step based on D1 is also made in the request and this is dealt with later in this opinion, reflecting the order in which the arguments are made in the request.

Inventive step based on D2

21. The second argument put forward by the requester is that claim 1 lacks an inventive step based on EP 1659195 A2 [D2] in combination with either GB 2245514 [D3], US 6581415 B2 [D4] or an extract from the Science and Engineering of Thermal Spray Coatings (1995) [D5].

22. To determine whether or not an invention defined in a particular claim is inventive over the prior art, I will rely on the four step test established in *Pozzoli*[2] which reformulated

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

the well-known *Windsurfing*[3] test. The Pozzoli steps are as follows:

(1)(a) Identify the notional "person skilled in the art";

(1)(b) Identify the relevant common general knowledge of that person;

(2) Identify the inventive concept of the claim in question or if that cannot readily be 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, determine whether those differences constitute steps which would have been obvious to the person skilled in the art.

23. The requester identifies the notional skilled person and their common general knowledge as follows ("Arguments", page 2):

> *The appropriate person skilled in the art is one skilled in the art of spraying processes.*
>
> *The skilled person would be familiar with various spraying processes, including thermal spray and cold gas dynamic spray processes, applications of these processes, particularly in relation to coating, and the precursors (such as sprayed materials) and apparatus used in manufacturing products using spraying processes.*

24. The inventive concept is identified in the request as follows (¶ 1.19):

> *The inventive concept of claim 1 is to provide a method for removing a cold spray formed pipe from a mandrel using differences in coefficient of thermal expansion between the materials forming the pipe and the mandrel.*

25. The proprietor has not raised any objections to these definitions. Nevertheless, I consider that the inventive concept is narrower than that defined as I consider the invention requires the mandrel to have a greater coefficient of thermal expansion than the pipe so that a relative contraction of the mandrel effects separation. If that were not the case then D1 would apparently anticipate claim 1. The inventive concept is therefore considered to be:

> *A method for removing a cold spray formed pipe from a mandrel using differences in coefficient of thermal expansion between the materials forming the pipe and the mandrel, the material of the mandrel having a greater coefficient of thermal expansion than that of the pipe such that the mandrel contracts relative to the pipe.*

26. The state of the art put forward for step 3 of the Windsurfing/Pozzoli test is EP

[3] *Windsurfing International Inc. v Tabur Marine (GB) Ltd*. [1985] RPC 59

1659195 [D2]. This document teaches the formation of a combustion chamber liner by cold gas dynamic spraying of powdered metal onto a mandrel and removal of the mandrel to leave the formed liner. The combustion chamber liner is understood to be a pipe but formation of a copper tube is also disclosed (¶ [0034]). Various copper alloys are disclosed for the material of the liner. The mandrel is described as being formed from an aluminium containing material, and I consider the skilled person would interpret this as an aluminium alloy. This document specifies that the mandrel may be chemically or mechanically removed (¶ [0027]), and removal by dissolving the mandrel with heated sodium hydroxide is given as a specific example. I consider that the skilled person would understand the reference to removal by mechanical means to be a reference to a machining or milling operation. Based on the coefficients of thermal expansion of copper alloys and aluminium alloys of approximately $17x10^{-6}$ K^{-1} and $23x10^{-6}$ K^{-1} respectively, the mandrel is believed to have a higher coefficient of thermal expansion than the liner[4].

27. The only difference between this state of the art and the inventive concept is an alternative method of separating the pipe from the mandrel based on the different coefficients of thermal expansion whereby the mandrel is caused to contract relative to the pipe.

28. I must now decide whether this difference is obvious or not.

29. At paragraph 1.23 of the request the requester states:

> *The common general knowledge of the skilled worker clearly encompasses different methods of removing coatings from mandrels. Three examples of prior art [D3, D4, D5] which disclose exactly the inventive concept of the Subject Patent are discussed below to illustrate this.*

30. The scope of this statement is not entirely clear. Taken literally it suggests that the skilled person knows different methods exist but not the precise details of any of them. However, at paragraph 1.36 the requester clearly sets out that they consider the method of contraction of the mandrel from the pipe is common general knowledge. Unfortunately the proprietor does not appear to have picked up on this and has made no observations regarding whether or not this is common general knowledge. Instead, the proprietor has treated the request as directed to lack of inventive step based on particular combinations of D2 and D3, D4 or D5. Despite the lack of observations I must nevertheless consider whether D3, D4 or D5 are examples illustrating the common general knowledge.

31. In relation to what constitutes common general knowledge I note the comments in the High Court in *Raychem Corp's Patents*[5]. Laddie J explained common general knowledge as follows:

> *"The common general knowledge is the technical background of the notional man in the art against which the prior art must be considered. This is not limited to material he has memorized and has at the front of his mind. It includes all that material in the field he is working in which he knows exists,*

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[4] See http://www.engineeringtoolbox.com/thermal-expansion-metals-d_859.html
[5] *Raychem Corp's Patents* [1998] RPC 31

which he would refer to as a matter of course if he cannot remember it and which he understands is generally regarded as sufficiently reliable to use as a foundation for further work or to help understand the pleaded prior art. This does not mean that everything on the shelf which is capable of being referred to without difficulty is common general knowledge nor does it mean that every word in a common text book is either. In the case of standard textbooks, it is likely that all or most of the main text will be common general knowledge. In many cases common general knowledge will include or be reflected in readily available trade literature which a man in the art would be expected to have at his elbow and regard as basic reliable information."

32. D5 is an extract taken from a book titled "The Science and Engineering of Thermal Spray Coatings" which would appear on the face of it to be a standard textbook. Thus a significant proportion of it may be considered to be common general knowledge.

33. The particular extract of this book relied on is as follows:

> *"The coatings can be detached from the substrate in the following way:*
>
> *… spraying a coating of low TEC (e.g. Al2CO3) or CRO3 coating) on to a previously heated and slightly roughened metal mandrel of high TEC, as e.g. aluminium, the coating is detached after cooling down without any effort (the method can be used to manufacture plates and short hollow cylinders)."*

34. This passage is taken from a chapter entitled "7.2 Characterisation of Coating Properties" and it appears to be directed at creating rings for the purpose of determining the properties of the material of the rings. I do not consider that the quoted passage is directed to the manufacture of end-products as such. In this context I consider it to be subordinate to the main text and I do not consider it to be part of the common general knowledge of the skilled person.

35. The other prior art examples are both patent applications and as such do not normally form part of the common general knowledge based on the following statement of *Sachs LJ in General Tire*[6]:

> *…it is clear that individual patent specifications and their contents do not normally form part of the relevant common general knowledge, though there may be specifications which are so well known amongst those versed in the art that upon evidence of that state of affairs they form part of such knowledge, and also there may occasionally be particular industries (such as that of colour photography) in which the evidence may show that all specifications form part of the relevant knowledge.*

36. No evidence or argument has been provided to suggest that the patent applications cited are well known nor that this an industry in which all such specifications form part of the common general knowledge.

37. In the absence of further evidence, I do not consider these documents to be

[6] *General Tire & Rubber Co v Firestone Tyre & Rubber Co Ltd* [1972] RPC 457

exemplars of the common general knowledge.

38. If the teaching of the prior art documents is not common general knowledge then I must consider whether the invention is obvious based on a mosaic of D2 and each of the other prior art documents. In doing so I must take account of the statements made in the courts regarding such combinations.

39. Of particular relevance are the observations of Kitchin J in *Scinopharm Taiwan Ltd v Eli Lilly & Co*[7]:

> *83. There is one other matter it is convenient to mention at this stage. Scinopharm's case depends, in part, upon reading various items of prior art together. It contends it is permissible to do this if they are in the same technical field. I do not agree. In my judgment it is only permissible to read two documents together if it is obvious to do so, as the Court of Appeal made clear in Smithkline Beecham v Apotex Europe [2005] FSR 23 at [96]:*
>
> > *"96. I think the Judge erred in principle here. The skilled man has his common general knowledge — the mental tools of his trade — but no more. The law of obviousness supposes that he can be given any individual piece of prior art and read it with that knowledge. The piece of prior art forms part of the "state of the art". What he cannot do is to just link one piece of prior art with another, unless so to do would itself be uninventive. No-one disputes what Lord Reid said in Technograph v Mills & Rockley [1972] RPC 346 at page 355:*
> >
> > > *"In dealing with obviousness, unlike novelty, it is permissible to make a 'mosaic' out of the relevant documents, but it must be a mosaic which can be put together by an unimaginative man with no inventive capacity.""*
>
> *84. The question whether it is obvious to read two documents together is one to be considered in the light of the particular circumstances of each case. Relevant factors may include whether one document refers to the other or whether one or both documents would be found on a literature search of the kind the skilled person would routinely carry out before attempting to find a solution to the problem the patent addresses.*

40. The judge makes clear in this passage that one cannot combine documents simply because they are in the same technical field. It must be obvious for the two documents to be read together.

41. A similar sentiment was expressed in *Generics (UK) Ltd vs Daiichi Pharmaceutical Co Ltd*[8]:

> *230. And again in Glaxo Group's Patent [2004] RPC 43 at [35]:*
>
> > *35. These provisions do not permit what is sometimes called the*

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[7] *Kitchin J in Scinopharm Taiwan Ltd v Eli Lilly & Co* [2009] EWHC 631 (Pat)
[8] *Generics (UK) Ltd vs Daiichi Pharmaceutical Co Ltd* [2008] EWHC 2413 (Pat)

mosaicing of individual documents or prior uses said to form part of the state of the art, unless it can be shown that the skilled person, confronted with a particular citation, would turn to some other citation to supplement the information provided by the first. Such cases are not common … Laddie J gives a further example in paragraph 66 of his judgment in Pfizer[9]:

> *'When any piece of prior art is considered for the purposes of an obviousness attack, the question asked is "what would the skilled addressee think and do on the basis of this disclosure?" He will consider the disclosure in the light of the common general knowledge and it may be that in some cases he will also think it obvious to supplement the disclosure by consulting other readily accessible publicly available information. This will be particularly likely where the pleaded prior art encourages him to do so because it expressly cross-refers to other material. However, I do not think it is limited to cases where there is an express cross-reference. For example if a piece of prior art directs the skilled worker to use a member of a class of ingredients for a particular purpose and it would be obvious to him where and how to find details of member of that class, then he will do so and that act of pulling in other information is itself an obvious consequence of the disclosure in the prior art.'*

231. It seems to me that a subtle but potentially significant point of principle emerges from these passages. I can readily accept that, faced with a disclosure which forms part of the state of the art, it may be obvious for the skilled person to seek to acquire further information before he embarks on the problem to which the patent provides a solution. But that does not make all such information part of the common general knowledge. The distinction is a fine one but it may be important. If information is part of the common general knowledge then it forms part of the stock of knowledge which will inform and guide the skilled person's approach to the problem from the outset. It may, for example, affect the steps it will be obvious for him to take, including the nature and extent of any literature search.

42. This statement was approved by Jacob LJ in the same case in the Court of Appeal[10]:

> *27. I agree with that although I personally do not find the point of principle 'subtle'. It would be wholly subversive of patent and quite unfair to inventors if one could simply say 'piece of information A is in the standard literature, so is B albeit in a different place or context), so an invention consisting of putting A and B together cannot be inventive.' The skilled man reads each specific piece of prior art with his common general knowledge. If that makes the invention obvious, then it does. But he does not read a specific citation with another specific citation in mind, unless the first causes him to do so or both are part of the matter taken to be in his head.*

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[9] *Pfizer Ltd's Patent* [2001] FSR 16

[10] *Generics (UK) Ltd v Daiichi Pharmaceutical Co Ltd* [2009] RPC 23

43. The point of these passages from the court is that I must treat obviousness based on combinations of documents with caution.

44. No argument or evidence has been provided regarding why the skilled person would find it obvious to combine D2 with the other documents beyond the fact that they lie in the same technical field. Conversely, the proprietor has not made observations on why they should not be combined but has instead put forward observations on inventiveness based on the proposed combinations. I shall therefore proceed to consider whether they render claim 1 obvious on the basis that the skilled person would consider these documents together.

45. D3 (GB 2245514) describes a method for forming a ring structure by RF plasma spray deposition of a metal onto a mandrel and the subsequent separation of the ring from the mandrel due to contraction of the mandrel away from the ring as they cool to room temperature. The material of the mandrel has a higher coefficient of thermal expansion than that of the ring so that it contracts more on cooling. As a preliminary step a protective oxide coating is plasma sprayed onto the mandrel to ensure the ring does not bond to the mandrel. The paragraph at the top of page 12 of this document specifies that a significant difference in the coefficient of thermal expansion of the matrix and ring is required. I believe the skilled person would also understand that a large difference in temperature between the heated and cooled mandrel is required. This document also specifies heating the mandrel before commencing deposition.

46. For the reasons outlined by the proprietor in their observations I do not consider it obvious to modify the method of D2 based on the teaching of D3. In particular, D3 clearly anticipates significant heating of the mandrel due to the use of a plasma spray deposition process. The skilled person would recognise that it is only because of this significant heating and the consequential expansion of the mandrel that the subsequent contraction is sufficient to enable the ring and mandrel to separate. Although not explicitly specified, the skilled person would expect the heated mandrel of D3 to have a temperature of several hundred ºC whilst the temperature of the mandrel in D2 is specified as being 46ºC (¶ [0018]). Furthermore, it would not be obvious to heat the mandrel used in D2 any higher because the cold gas dynamic spray process has been specified precisely because it maintains a low mandrel temperature which avoids thermal effects on the finished article (¶ [0032]).

47. Having established that it is not obvious to modify D2 based on D3, I consider that the same reasoning applies in respect of D4 and D5 also.

48. D4 (US 6581415 B2) describes a method of producing semiconductor tubes by thermal spraying semiconductor material onto a rotating mandrel and subsequently removing the mandrel. Paragraph [0030] refers to the removal of the mandrel as follows:

> *… The most preferable method is to release the body mechanically by a more significant contraction of the mandrel during the cool-down of the coated part, due to its higher coefficient of expansion. This works, for example, when an internal or male mould mandrel has a uniform cross section over its length, or a taper from a small end to a larger end, that permits the mandrel to be withdrawn*

from the deposited body without interference, after a sufficient cool down contraction of the mandrel has occurred, breaking the bond between the semiconductor body and the mandrel surface.

49. As with D3 the skilled person would read this in the context of the thermal spray processes disclosed, in particular plasma spraying, and would anticipate significant heating of the mandrel. The paragraph quoted above also refers to *"sufficient cool down contraction*" and is considered to imply a relatively high difference between the hot and cold mandrel temperatures, such as that the skilled person would expect from a thermal spray process. Although D4 also refers to using a cooling gas stream, the temperatures specified in D4 are from below 200ºC to 400ºC which are still much higher than the mandrel temperature of D2. I consider that the skilled person would not consider contraction of the mandrel from the pipe appropriate for the method specified in D2. Accordingly I do not believe the skilled person would find it obvious to modify the method of D2 based on D4.

50. Although the specific examples of D4 (¶¶ [0034]-[0037]) refer to low mandrel temperatures of <70ºC to 120ºC, they do so in the context of different methods of mandrel removal (dissolution of the mandrel in acid and melting of the mandrel). These examples may therefore reinforce the skilled person's view that mandrel removal by contraction is not appropriate for such relatively low mandrel temperatures. This seems especially so in the light of the teaching of paragraph [0030] that cool down contraction is the most preferred method of mandrel removal.

51. The relevant part of D5 is limited to the following:

> *Spraying a coating of low thermal expansion coefficient (e.g. Al2o3 or Cr2O3 coating) on to a previously heated and slightly roughened metal mandrel of high thermal expansion coefficient, as, e.g. aluminium, the coating is detached after cooling down without any effort (the method can be used to manufacture plates and short hollow cylinders).*

52. I consider that, especially in the light of the reference to pre-heating the mandrel, the skilled person would interpret this passage on the basis that it was directed to a thermal spray process in which the mandrel was heated significantly such that there was a significant difference in the contraction of the mandrel and pipe to enable separation. The skilled person would accordingly not consider it appropriate for use with the method of D2.

53. A significant proportion of the observations and observations in reply were devoted to the similarities and differences between cold gas dynamic spraying and hot thermal spraying. The skilled person would be aware of the advantages and disadvantages of both and would be aware that cold gas dynamic spraying would be an obvious replacement for thermal spraying in certain situations and it would be unsuitable in others. However, the requester's argument does not rely on determining whether or not it is obvious to replace a thermal spray process with a cold spray process. Furthermore, in considering the state of the art, the skilled person would have in mind the particular parameters of the cold spray process specified and would not be considering whether the parameters at the limits of a generic cold spray process overlapped with those of a thermal spray process.

54. In summary, I do not consider it obvious to adapt the pipe forming method of D2 to use the mandrel removal method based on the cool down contraction of the mandrel as taught in D3, D4 or D5.

Inventive step based on D1

55. Although the majority of the request relates to lack of novelty based on D1 and lack of inventive step based on D2, the penultimate paragraph of the request also argues that the patent may lack inventive step based on D1 as a starting point. Although I have some sympathy with the proprietor's observation that this point is not fully argued, given that it is restricted to this single example I will nevertheless consider it.

56. As identified above, the inventive concept is considered to be:

> *A method for removing a cold spray formed pipe from a mandrel using differences in coefficient of thermal expansion between the materials forming the pipe and the mandrel, the material of the mandrel having a greater coefficient of thermal expansion than that of the pipe such that the mandrel contracts relative to the pipe.*

57. The difference between this inventive concept and the teaching of D1 is that D1 does not disclose that the material of the mandrel should have a greater coefficient of thermal expansion than that of the pipe such that the mandrel contracts relative to the pipe. D1 does however suggest that the mandrel may be made from metal (¶ [0047].

58. D1 teaches that the tube stock may be fabricated from titanium. Titanium has a relatively low coefficient of thermal expansion for a metal of $8.6 \times 10^{-6} K^{-1}$. I consider that it would be obvious to the skilled person based on their common general knowledge to form the mandrel from either stainless steel or aluminium, both of which have higher coefficients of thermal expansion than titanium of at least $10 \times 10^{-6} K^{-1}$ and $22 \times 10^{-6} K^{-1}$ respectively[11]. In any event, given the wide range of suitable metals that have a higher coefficient of thermal expansion than titanium, choosing a material for the mandrel which has a higher one is considered obvious.

59. D1 also teaches specifically that the mandrel may be removed by shrinking when cooled while the tube stock is heated so that it expands (¶ [0047]). Accordingly the skilled person will not be concerned that this a process that only works when there is a large difference between the temperatures of the mandrel when deposition is taking place and when it is cooled. The process is therefore appropriate for use with cold spraying.

60. I therefore consider that claim 1 of the patent lacks an inventive step based on a combination of D1 and common general knowledge.

61. Having found that claim 1 lacks an inventive step I must now consider the dependant claims. However, given that the request does not include any specific arguments relating to lack of inventive step of the dependant claims based on D1, the proprietor has accordingly not had any chance to put forward specific observations. I will

[11] http://www.engineeringtoolbox.com/linear-expansion-coefficients-d_95.html

therefore confine my analysis to whether the features of the claims are specifically disclosed in D1, such that they lack an inventive step based on D1 and common general knowledge alone.

62. The dependant claims read as follows:

> 2. *A method according to claim 1, wherein the surface of the mandrel is smooth and defect-free.*
> 3. *A method according to claim 1, wherein the composition of the pipe varies along the length and/or across the thickness of the pipe.*
> 4. *A method according to claim 3, wherein the pipe comprises two or more discrete lengths and/or layers of different materials.*
> 5. *A method according to claim 3, wherein the composition of the pipe varies gradually along the length and/or across the thickness of the pipe.*
> 6. *A method according to claim 1, wherein the pipe comprises a material to confer corrosion and/or wear resistance to a surface of the pipe.*
> 7. *A method according to claim 1, wherein separation of the pipe from the mandrel is achieved by heating or cooling the pipe and/or the mandrel.*
> 8. *A method according to claim 1, wherein the mandrel is heated prior to commencement of cold-gas dynamic spraying of the particles onto the mandrel.*
> 9. *A method according to claim 1, wherein the pipe comprises titanium and/or titanium alloy.*

63. D1 does not specify a smooth and defect free mandrel surface. D1 also specifies that the interior surface of the tube stock may be machined, reamed or ground, such that it would not necessarily require a smooth defect free mandrel surface. Further analysis beyond that provided in the request would therefore appear necessary before any conclusion on the inventiveness of this claim could be reached.

64. Based on the teaching of paragraph [0009], which specifies that “the process could also potentially spray different materials into the different layers” and “the base layer of the medical device could be metallic with an outer layer being formed from a sprayed ceramic”, D1 is considered to disclose a method where the composition varies across the thickness of the pipe. Claim 3 is therefore considered to lack an inventive step based on D1 and common general knowledge.

65. Similarly, D1 is considered to disclose that the tube stock comprises two discrete layers of different materials in the pipe composition and claim 4 is also considered to lack an inventive step.

66. In relation to claim 5 which requires that the composition of the pipe varies gradually along the length of across the thickness of the pipe, I am not convinced solely on the basis of the argument put forward by the requester that D1 discloses such an arrangement. Paragraph [0009] specifies that “a multiple gradient of porosity through and/or within the material, e.g. denser on the outer diameter … or denser then more porous then denser again …” is provided. However, it is not clear that the skilled person would interpret this as a variation in composition. It could be interpreted as a change in density only, the composition of the pipe remaining the same. Further argument would be appropriate before a definitive decision could be reached.

67. The use of titanium for the tube stock of D1 would seem to confer corrosion resistance such that claim 6 lacks an inventive step.

68. Paragraph [0047] specifically discloses cooling the mandrel and heating the tube stock and claim 7 therefore also lacks an inventive step.

69. D1 does not disclose the step of pre-heating the mandrel as required by claim 8. The requester's arguments that this claim lacks an inventive step based on D1 and D3 or D5 are not valid as they are made on the basis that only the feature of this claim is the inventive concept for the purpose of assessing inventiveness.

70. D1 specifies the use of titanium for the tube stock such that claim 9 lacks an inventive step.

Opinion

71. On the basis of the evidence and arguments put forward, I am of the opinion that claims 1, 3, 4, 6, 7 and 9 of EP 2262922 B1 lack an inventive step based on the disclosure of US 2007/0036905 (D1) and common general knowledge.

72. It is also my opinion that claim 1 is novel in relation to D1 and that it is inventive in relation to D2 when combined with D3, D4 or D5.

73. I offer no opinion in relation to claims 2, 5 and 8 on the basis that insufficient argument has been provided for me to make an accurate assessment.

Application for review

74. 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.

Matthew Jefferson
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.