Intellectual Property Office

BL O/0833/25

10 September 2025

PATENTS ACT 1977

BETWEEN

Mr Ali Kordzadeh	Claimant
and	
MG Electric (Colchester) Limited	Defendant

PROCEEDINGS

Reference under sections 8 and 12 in respect of UK patent application GB2219033.4 and any international application arising from this application

HEARING OFFICER B Micklewright

For the Claimant: Mr Michael Smith of Counsel (instructed by Birkett Long LLP)
For the Defendant: Mr Michael Hicks of Counsel (instructed by Marks & Clerk Law LLP)
Hearing date: 6-7 November 2024

DECISION

1. Introduction

1 This decision is concerned with entitlement to UK patent application GB2219033.4, published as GB2625368 A ("the UK application"), and any international applications arising from this application ("the patent applications"). The UK application was filed on 16 December 2022 in the sole name of the defendant, MG Electric (Colchester) Limited ("MGE"). A PCT application, PCT/GB2023/053175, published as WO 2024/126984 A1 ("the PCT application"), has also been filed in the name of the defendant, claiming priority from the UK application. The patent applications list Hassan Shirvani and Vahaj Mohaghegh as inventors.

2 The invention concerns a blood flow monitoring device comprising a wearable sensor. It has particular application in the field of Arteriovenous Fistulas (AVFs).

3 The claimant, Mr Ali Kordzadeh, launched proceedings on 22 December 2023 under sections 8 and 12, claiming that he is entitled to the grant of the patent applications.

4 The defendant, MGE, seeks confirmation that they are entitled to the patent applications, and that the patent applications should proceed in the name of the defendant.

5 Following evidence rounds, the matter came before me at a two-day hearing held on 6-7 November 2024.

2. Background to the dispute

6 The dispute involves the development of an AVF blood monitoring device. The claimant, Mr Kordzadeh, is a consultant vascular and renal access surgeon. He was a PhD student at Anglia Ruskin University ("ARU") between January 2018 and January 2023. He was then involved in a project with ARU and the defendant, from which emerged the patent applications.

7 Mr Kordzadeh claims to have devised the invention in the patent applications, and to have communicated it to ARU on 2 April 2018 by way of a proposal attached to an email.

8 The defendant, on the other hand, claims that the invention was devised by Professor Hassan Shirvani, Professor of Engineering Design and Simulation at ARU, based on an initial idea he had in around 2016 concerning the use of a strain gauge as part of a medical monitoring device, and by Dr Vahaj Mohaghegh, who had been a PhD student at ARU and was subsequently employed by the defendant. According to the defendant's account, ARU and the defendant discussed a potential collaboration to further develop Professor Shirvani's ideas using the defendant's engineering expertise. This culminated in a collaboration agreement and, following a successful grant application, a project commenced on 1 July 2021. Dr Vahaj Mohaghegh was subsequently employed by the defendant to help to develop the idea.

9 Many of the details of events are disputed. Both parties provided chronologies of events, the defendant's chronology running to several pages. I will set out here a summary of some key events that are not in dispute.

- 2 April 2018: Mr Kordzadeh circulated a proposal (called a "cost-benefit paper" by the defendant) to Professor Shirvani and Dr Ali Parsa (Mr Kordzadeh's PhD supervisor) titled "Proposal for the Arteriovenous Fistula Sensor for Detection of Functional Maturation or Its Failure" and an accompanying poster.

- 30 April 2018: Meeting at which at least Simon Martin (Technical Director of the defendant), Dr Parsa, Professor Shirvani and Mr Kordzadeh were present.

- 8 May 2018: First research grant application was made by Simon Martin.

- 13 August 2018: First grant application was rejected.

- 19 January 2021: Second grant application was made by Simon Martin.

- 26 March 2021: Second grant application was approved.

- 23 April 2021: Defendant signed a collaboration agreement with ARU for a project called “Wearable Monitoring system for arteriovenous fistula (AVF)”. Mr Kordzadeh was not a party to this agreement.

- 10 June 2021: Innovation UK sent a grant offer letter.

- 15 September 2021: Dr Mohaghegh officially commenced employment with the defendant to work on the project.

- 16 December 2022: UK application filed.

- 8 December 2023: PCT application filed.

10 It is not disputed that, if I find that Mr Kordzadeh devised the inventive concept of the patent applications, he is entitled to those applications. This case will therefore turn on the identification of the inventive concept in the patent applications, and on who devised that inventive concept.

3. Witnesses and evidence

11 The claimant’s evidence comprises two witness statements from Mr Kordzadeh, including various exhibits. The defendant’s evidence comprises witness statements from Professor Shirvani, Dr Mohaghegh, and Mr Simon Martin. Various exhibits were included with the witness statements, including email exchanges, grant applications, academic papers and posters, and copies of presentations. All four witnesses gave oral evidence at the hearing.

12 Mr Hicks and Mr Smith both made submissions in their closing arguments in relation to the reliability of the witnesses.

13 Mr Hicks submitted that Mr Kordzadeh, under cross-examination, would sometimes, whether deliberately or inadvertently, fail to answer questions clearly and accurately. He suggested that, because he felt so passionate, Mr Kordzadeh may have persuaded himself that various things happened which he may have got out of order in terms of date, or he may have confused who proposed something first, pointing to examples from his cross-examination in support of this. Mr Smith however submitted that Mr Kordzadeh was a reliable witness, arguing that although he was passionate, and answered some questions in a longer way than may have been preferred, he is clearly the expert on AVFs in the room. He did, Mr Smith commented, sometimes adopt a teaching mode in the witness box, as some experts sometimes do.

14 Mr Smith considered Professor Shirvani an unreliable witness, appearing evasive in certain situations, and making tangential points to put across the defendant’s case. He identified an inconsistency in Professor Shirvani’s evidence in relation to the number of patents in which he had been named as inventor, to which Professor Shirvani replied that the number of patents listed in his CV may not have been updated. Mr Smith also considered Professor Shirvani’s narrative as to how he came up with an AVF monitor to quickly unravel, submitting that Professor Shirvani purposely selected this line of facts going back years in order to give credence to his narrative that he had the concept for the device in his mind in 2017 before he met the claimant.

15 Mr Smith considered Mr Martin an unsatisfactory witness and an unreliable narrator, citing two examples, one relating to the claimant's status at the university and the other to alleged inconsistencies in his evidence in relation to individuals' stated objectives for the project, in support of his submission.

16 Mr Smith considered Dr Mohaghegh to be generally a satisfactory witness, but submitted that, as he only came into the project in August 2021, he could not really say anything about what happened before that time.

17 In my view I found all the witnesses to be generally reliable. Mr Kordzadeh came across as passionate and committed to improving patient care and is clearly an expert in haemodialysis and AVFs. At times, it seemed that his passion for his subject resulted in him not answering some questions as clearly or succinctly as he could have. The events under discussion were some years ago, particularly those of 2017-2018, and, on occasions, it was not entirely clear as to how accurate Mr Kordzadeh's recollection of events was.

18 Professor Shirvani is clearly an experienced academic and, despite Mr Smith's criticisms, I generally found his evidence to be reliable, albeit that he did, at times, reiterate elements of the defendant's case which were not always directly relevant to the question being asked. Mr Martin was, in my view, also a reliable witness. He provided a reasonable account of why the grant application was drafted as it was, namely to maximise the chances of success. Dr Mohaghegh came across as a reliable witness, in particular in relation to the events following his appointment to the project in August 2021. I agree with Mr Smith that his evidence in relation to events before that time is more limited, which is unsurprising given that his awareness of the project before August 2021, if any, would have been informally through his ARU connections with Professor Shirvani.

4. The law

19 Both Mr Hicks and Mr Smith made submissions in relation to the relevant law. Mr Hicks' submissions were much more detailed and, in general, I did not understand Mr Smith to disagree with them. Mr Smith did however make distinct submissions on reduction to practice and causal link, which I will consider below.

20 Section 7 is concerned with the right to apply for and obtain a patent, and states:

> 7.-(1) Any person may make an application for a patent either alone or jointly with another.
>
> (2) A patent for an invention may be granted—
>
> (a) primarily to the inventor or joint inventors;
>
> (b) in preference to the foregoing, to any person or persons who, by virtue of any enactment or rule of law, or any foreign law or treaty or international convention, or by virtue of an enforceable term of any agreement entered into with the inventor before the making of the invention, was or were at the time of the making of the invention entitled to the whole of the property in it (other than equitable interests) in the United Kingdom;

(c) in any event, to the successor or successors in title of any person or persons mentioned in paragraph (a) or (b) above or any person so mentioned and the successor or successors in title of another person so mentioned;

and to no other person.

(3) In this Act "inventor" in relation to an invention means the actual deviser of the invention and "joint inventor" shall be construed accordingly.

(4) Except so far as the contrary is established, a person who makes an application for a patent shall be taken to be the person who is entitled under subsection (2) above to be granted a patent and two or more persons who make such an application jointly shall be taken to be the persons so entitled.

21 Thus, an inventor is entitled to ownership of any resulting patent for the invention, unless, under section 7(2)(b), "an enforceable term of any agreement entered into with the inventor before the making of the invention" displaces that entitlement, or entitlement passes to successors in title under section 7(2)(c).

22 Mr Hicks referred to Lord Hoffman's comments in paragraph 21 of *Yeda*[1] to argue that the burden of proof lies on the person seeking entitlement:

> *"The effect of s.7(4) is that a person who seeks to be added as a joint inventor bears the burden of proving that he contributed to the inventive concept underlying the claimed invention and a person who seeks to be substituted as sole inventor bears the additional burden of proving that the inventor named in the patent did not contribute to the inventive concept."*

23 I agree that the onus is on the claimant to prove, on the balance of probabilities, that they are entitled to the invention. Moreover, under section 7(4), there is a rebuttable presumption that the applicant for a patent is entitled to be granted that patent. The claimant therefore bears the burden of proving that they are entitled to the patent rights rather than the defendant.

24 Section 8 provides for the comptroller to decide entitlement to a UK patent application. Section 8(1) states:

8.-(1) At any time before a patent has been granted for an invention (whether or not an application has been made for it) —

(a) any person may refer to the comptroller the question whether he is entitled to be granted (alone or with any other persons) a patent for that invention or has or would have any right in or under any patent so granted or any application for such a patent; or

(b) …

and the comptroller shall determine the question and may make such order as he thinks fit to give effect to the determination.

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[1] *Yeda Research and Development Co Ltd v Rhone-Poulenc Rorer International Holdings Inc* [2007] UKHL 43; [2008] RPC 1

25 Section 12 is drafted in similar terms to section 8 and concerns entitlement to a granted patent arising from "an application made under the law of any country other than the United Kingdom or under any treaty or international convention (whether or not that application has been made)."

26 Mr Hicks provided a detailed analysis of the case law in his skeleton. He referred to *Yeda* in which, in paragraph 18, Lord Hoffman noted that section 7(3) is an exhaustive code for determining who is entitled to the grant of a patent. In paragraph 20 Lord Hoffman stated:

> *"The inventor is defined in section 7(3) as "the actual deviser of the invention". The word "actual" denotes a contrast with a deemed or pretended deviser of the invention; it means, as Laddie J said in* University of Southampton's Applications *[2005] RPC 220, 234, the natural person who "came up with the inventive concept." It is not enough that someone contributed to the claims, because they may include non-patentable integers derived from prior art: see* Henry Brothers (Magherafelt) Ltd v Ministry of Defence *[1997] RPC 693, 706; [1999] RPC 442. As Laddie J said in the* University of Southampton *case, the "contribution must be to the formulation of the inventive concept". Deciding upon inventorship will therefore involve assessing the evidence adduced by the parties as to the nature of the inventive concept and who contributed to it. In some cases this may be quite complex because the inventive concept is a relationship of discontinuity between the claimed invention and the prior art. Inventors themselves will often not know exactly where it lies."*

27 Mr Hicks also referred to *BDI v Argent*[2] where HHJ Hacon noted, in paragraph 15, that the effect of *Yeda* is that two questions must be answered in an entitlement dispute: firstly, what is the inventive concept, and secondly, who devised the inventive concept. I agree that these are the questions I must answer in these proceedings.

28 Mr Hicks submitted that validity is not relevant except in "clear and unarguable cases", referring to Jacob LJ's comments in *Markem v Zipher*[3] at paragraphs 87 and 88 as support for this submission, where he said:

> *"[87] This brings us to the next point. Mr Watson submits that under s.8 the validity of the patent is completely irrelevant. The only question is: who is entitled? Mr Thorley accepted that s.8 proceedings cannot turn into a full-scale inquiry into validity in a difficult case but that where an unanswerable case of validity was raised, the Comptroller can act upon it. He drew an analogy with proceedings for amendment of a patent where a roving inquiry into validity is not permitted but one can inquire as to whether a proposed amendment dealt with the reason advanced for making it,* Great Lakes Carbon Corp's Patent *[1971] R.P.C. 117.*
>
> *[88] We have no doubt that Mr Thorley is right. If the patent or part of it is clearly and unarguably invalid, then we see no reason why as a matter of convenience, the Comptroller should not take it into account in exercising his wide discretion. The sooner an obviously invalid monopoly is removed, the better from the public point of view. But we emphasise that the attack on validity should be clear and unarguable. Only when there is self-evidently no bone should the dogs be prevented from fighting over it."*

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[2] *BDI Holding v Argent Energy* [2019] FSR. 25
[3] *Markem Corp v Zipher Ltd* [2005] RPC 31

29 Mr Hicks also referred to comments by Christopher Floyd QC (as he then was) in paragraph 12 of *Stanelco*[4] in further support of his point that the court is not concerned with issues of validity or inventiveness but merely with the concept as described.

30 As Mr Hicks commented, the inventive concept is not determined by consideration of the claims alone. In *Yeda*, Lord Hoffman pointed out that there may be no claims to rely on. This a consequence of the drafting of section 8(1), which specifies that the comptroller can determine entitlement to an invention even if no patent application has been made for it. Mr Hicks however submitted that, in this case, there are claims and, in accordance with section 125, they provide some guidance since they are part of the specification.

31 Whilst I agree that the claims may provide some guidance in determining the inventive concept, I will need to consider the disclosure in the whole application, including the claims, to determine the inventive concept for the purposes of these proceedings. In doing so I will bear in mind that, in accordance with *Markem* and *Stanelco*, validity is not at issue unless there "is self-evidently no bone", as Jacob LJ put it in *Markem*.

32 Mr Hicks submitted that, in accordance with *Yeda*, to be an inventor, it is not enough to merely contribute to the claims, the contribution must be to the formulation of the inventive concept. I agree with Mr Hicks that an inventor must contribute to the formulation of the inventive concept itself, which I will need to identify.

33 Both Mr Smith and Mr Hicks made submissions on the extent to which an invention needs to be reduced to practice. Mr Hicks referred to *Stanelco* which states that having a vague idea or a pipe dream is not enough to make someone an inventor, whilst Mr Smith submitted that reduction to practice is not required. In *Stanelco* Christopher Floyd QC stated in paragraphs 13 and 14:

> *"[13] It is suggested by Mr Miller Q.C. who appeared for Stanelco that the requirement that the inventor be the "actual deviser" requires something more than a theoretical proposal. In his skeleton argument he said this: "At one extreme, there are vague ideas and pipedreams—the sort of thing where someone says 'Wouldn't it be nice if we could do such and such'—but without any idea as to whether 'such and such' can in fact be done or how it might be done. That person will not be an actual devisor of an invention that is subsequently made by another—even though without the initial prompt the invention might never have been made. At the other end of the scale there is the person who produces a fully worked-up proposal and an actual working embodiment of it. That person is clearly an actual devisor of the invention. If BioProgress made any contribution at all in this case, it falls at the 'Wouldn't it be nice if . ..' end of the scale." He relied on the decision of H.H. Judge Fysh Q.C. sitting as a High Court Judge in* Markem Corp v Zipher Ltd (No.1) *[2004] R.P.C. 10 at paras [72–74], where he proposed that: "at least one way of carrying the antecedent disclosure into effect must I think be ascertainable from the antecedent disclosure relied upon".*
>
> *[14] I think Mr Miller is right to the extent that it is never going to be enough for an antecedent worker to rely solely on an initial prompt of the vague kind he refers to: a "but for" approach would lead to all sorts of people being treated as inventors. But*

[4] *Stanelco Fibre Optics Ltd's Applications* [2005] RPC 15

> *where the antecedent worker comes up with and communicates an idea consisting of all of the elements in the claim, even though it is just an idea at that stage, it seems to me that he or she will normally, at the very least, be an inventor of the claim. What US patent law calls "reduction to practice" is not, it seems to me, a necessary component of a valid claim to any entitlement."*

34 *Stanelco* makes clear that reduction to practice is not a necessary component of a valid claim to entitlement, but something more than a vague prompt is needed.

35 Mr Hicks argued that, following *IDA*[5], merely verifying that an invention that has been made previously works does not amount to an invention. In that case, Jacob LJ said in paragraph 32:

> *"It is true that he [Mr Metcalf] did not know whether his idea would work and it is true that he had not realised that if it did work it would be by adhesion to the legs of the insects, or that because of that insects could be made to pick up insecticide (what Laddie J. called the "sticky poison concept"). Neither of these matters prevents Mr Metcalfe from being the sole devisor of the invention. For neither of these matters involve the contribution of anything inventive to his idea. So far as finding out whether or not his idea worked that was a matter of simple and routine experimentation—mere verification."*

36 I understand Jacob LJ's comments to be that, in the context of the invention he was considering, simple and routine experimentation to find out whether an idea worked was not necessary for Mr Metcalf to be the sole devisor of the invention in that case. Whilst this principle does have wider application, care is needed in applying it in different contexts and to different inventions.

37 Mr Smith submitted that, for a claim to succeed, they must show that there is a relevant causal link between the person claiming entitlement and the derivation of the inventive concept, giving an example that a claim must fail if a claimant independently devises the inventive concept. He referred to *Stanelco* in support of this, in which Christoper Floyd QC stated in paragraph 21:

> *"Finally, for entitlement to succeed there must be a causal link between the antecedent work in devising the invention and the subject matter of the patent applied for. That much was common ground."*

38 I agree that such a causal link must be present between the antecedent work in devising the invention and the subject matter of the patent applied for. Moreover, Lord Hoffman's comments in paragraph 20 of *Yeda*, where he states that deciding upon inventorship involves determining who contributed to the inventive concept, suggest that, to be an inventor, a person must contribute to the formulation of the inventive concept in the relevant patent or patent application.

5. Assessment

5.1. Preliminary point: Joint inventorship and entitlement

39 Throughout these proceedings the parties both argued that they are exclusively entitled to the applications. Neither party made any submissions in relation to joint

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[5] *IDA Ltd v The University of Southampton* [2006] EWCA Civ 145; [2006] RPC 21

entitlement. At the hearing I asked for submissions from the parties as to whether I could or should consider a finding of joint inventorship and therefore joint entitlement should I consider the facts to justify such a finding.

40 The pleadings themselves do not explicitly address this point. The Statement of Grounds specifies the relief sought in paragraph 8.1, which states: "*That the Comptroller confirms that the Claimant be entitled to the grant of patent application number GB2219033.4.*" Mr Smith submitted that this relief sought is wide enough to cover joint inventorship because it does not say sole inventorship. Mr Hicks, on the other hand, argued that it was quite clear from the pleadings that this is an all or nothing case, and this was apparent from Mr Smith's skeleton argument.

41 Mr Smith submitted that both parties have put forward factual cases which are irreconcilable with each other, and, if I found joint inventorship, both would be wrong, and it would be wrong in principle to visit the consequences of that on one party rather than the other. He argued that the Civil Procedure Rules allow a court to grant any remedy to which the claimant is entitled, even if that remedy is not specified in the claim form. Mr Hicks however submitted that, because the claimant had not set out a case of joint entitlement, the defendant would not know what evidence may be required in relation to such a case.

42 Whilst the statement specifying the relief sought is not explicitly restricted to a finding of sole entitlement, the Statement of Grounds is drafted on the basis that the claimant is the sole inventor and therefore should be the sole owner, for example in statements setting out that the claimant initially proposed the invention, is the inventor, and invented the invention independently of the university. I do not therefore consider that, in the event that I do not find for the claimant on sole inventorship, joint inventorship is pleaded. Moreover, the subsequent evidence rounds are all based on the claimant's case of sole ownership. Whilst I agree that I have the power to consider a remedy of joint inventorship even if it is not pleaded, I need to consider whether it would be just to do so in the specific circumstances of this case. Mr Smith did not provide any reasons as to why this point was not raised earlier, and it seems to me that, if the claimant wanted to rely on joint inventorship as a fallback position, this should have been raised at an earlier stage in the proceedings so that the defendant could have an opportunity respond to a case of joint inventorship. I agree with Mr Hicks that, because a case of joint inventorship has not been set out by the claimant, the defendant has not been in a position to respond to any such case with submissions and/or evidence. I therefore conclude that joint inventorship is not pleaded, and it would not be in the interest of fairness to allow it to be considered at this late stage in the proceedings.

5.2. The patent applications

43 There is agreement between the parties that the PCT application and the UK application are substantially the same in content. I will refer to the PCT application in this section for convenience. The PCT application is titled "Monitoring device" and relates to a blood flow monitoring device. It sets out the background to the invention on page 1 in describing stenoses in blood vessels and defining them as "an irregular narrowing or blockage inside the blood vessel". The PCT application defines arteriovenous fistulas (AVFs) as "an irregular connection between an artery and a vein" and explains that small AVFs may be surgically created for use in dialysis for

patients with severe kidney disease. Figure 6 of the PCT application illustrates a blood vessel including a stenotic region.

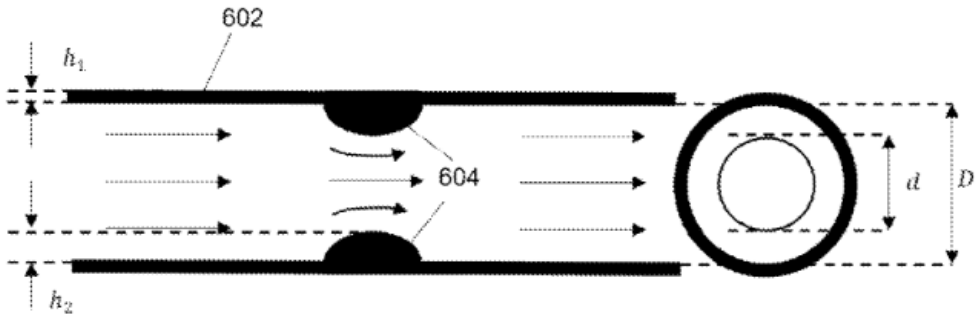


Fig. 6

44 The PCT application explains that such AVFs need to be continually monitored, for example for stenoses, and describes prior art methods of monitoring AVFs, which include ultrasound techniques such as Doppler and Magnetic Resonance Imaging (MRI). The application states that the extent of any stenoses may be determined based on the estimated blood flow speed. It explains that, typically, patients are required to attend multiple appointments with a professional to perform an ultrasound test and analyse the result.

45 The summary of the invention is set out on pages 2-4 of the application, and the statements in this section correspond to the claims. The PCT application as filed includes twenty claims, of which claims 1 and 13 are independent claims and relate to a blood flow monitoring device and a method of determining whether blood flow through a blood vessel is impaired respectively. The independent claims correspond to each other in scope and state:

> 1. A blood flow monitoring device comprising:
>
> a sensor configured to be placed against skin of a user and to collect data indicative of movement of the skin caused by blood flow through a blood vessel in a region under the skin; and
>
> a controller comprising:
>
> a blood flow parameter determiner configured to determine a blood flow parameter based on the data collected by the sensor, and
>
> a blood flow impairment determiner configured to determine whether blood flow through the blood vessel is impaired based on the calculated blood flow parameter.
>
> 13. A method of determining whether blood flow through a blood vessel is impaired, the method comprising:
>
> collecting, by a sensor placed against skin of a user, data indicative of movement of the skin caused by blood flow through a blood vessel in a region under the skin;

determining, by a blood flow parameter determiner, a blood flow parameter based on the data collected by the sensor, and

determining, by a blood flow impairment determiner, whether blood flow through the blood vessel is impaired based on the calculated blood flow parameter.

46 Dependent claim 2 defines a sensing element configured to deform on movement of the skin. Claim 3 states that the sensor comprises a strain gauge, claim 4 stating that data indicative of movement of the skin by the user comprises data indicative of strain applied to the strain gauge by that movement. Claim 5 states that a plurality of sensors can be placed against the skin. Claims 6 and 7 specify more detail of the blood flow parameter being determined whereby, according to claim 6, the maximum and minimum blood diameters of the blood vessel, based on the data collected by the sensor are determined, or, according to claim 7, a systolic blood pressure and a diastolic blood pressure are determined. Claim 8 provides for determining a degree of stenosis and a blood flow volume and claim 9 to thereby determining an extent of blood flow impairment. Claim 10 relates to using a stenosis threshold and a blood flow threshold in this determination and claim 11 to displaying effectively a traffic light indication of risk level: low, medium, or high risk. Claim 12 relates to providing an indication to the user concerning whether blood flow through the vessel has been impaired. Other dependent claims relate to equivalent features for the method claim.

47 Pages 5-19 provide a detailed description of the invention in relation to a specific embodiment, and with reference to the seven drawings. The PCT application highlights the advantages of the described device, namely to provide a non-invasive and cost-effective method of monitoring blood flow through a blood vessel, in particular an AVF. Furthermore, the application states that the patient is able to perform the test themselves, without the need to attend an appointment with a professional, and the device may provide an indication to the user of the extent of the stenosis and/or whether the user needs follow up with a professional.

48 Figure 1 of the PCT application illustrates the device in use. A sensor 102 is placed on the skin of the patient in the vicinity of the blood vessel being monitored, and at least part of it changes shape with movement of the skin against which it is placed. In the exemplary embodiment the sensor is a strain gauge. The sensor then sends data to controller 104 via either a wired or wireless connection.

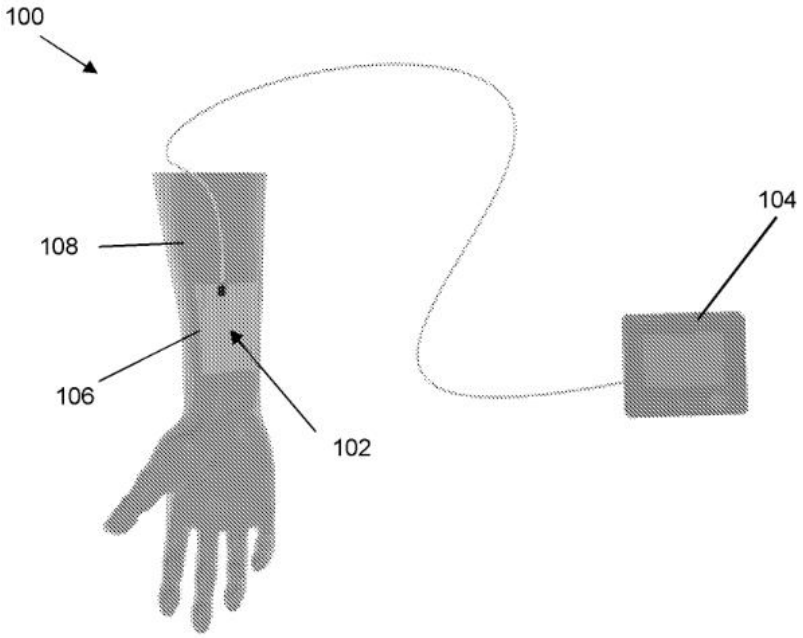


Fig. 1

49 The strain gauge is described on page 6 as being “known to the skilled person,” and the implication is therefore that the strain gauge used is a known strain gauge. The PCT application does however specify that other types of sensors could also be used and lists several examples.

50 On page 9, the PCT application describes a specific application for monitoring an AVF.

51 The output from the strain gauge, illustrated in Figure 4, is a waveform, as the sensor measures movement of the skin over a period of time. This feature was sometimes referred to at the hearing as dynamic strain analysis. The raw data is then processed by the controller to determine the one or more blood flow parameters and to give an indication of blood flow impairment using, for example, a Fast Fourier Transform.

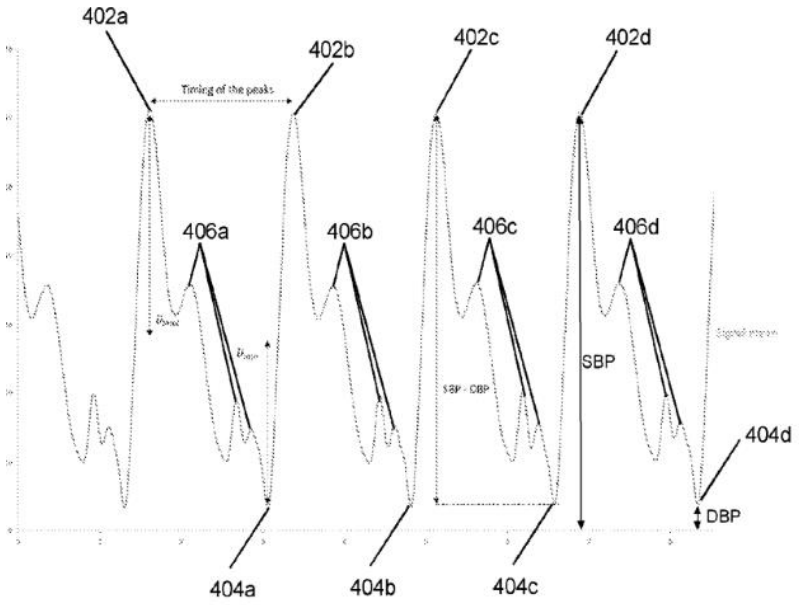


Fig. 4

5.3. The Inventive Concept

52 In order to determine inventorship, I must first identify the inventive concept in the patent applications, which is not necessarily that defined in the claims, and then determine who devised that inventive concept.

53 Both Mr Hicks and Mr Smith expressed confusion over the other party's identification of the inventive concept. I have some sympathy with both viewpoints, particularly given the claimant's various statements in relation to the inventive concept and the lack of a clear statement from the defendant. Nevertheless, at the hearing the parties' respective submissions on the identification of the inventive concept were clarified, as I will consider below.

54 In their Statement of Grounds, the claimant defined the invention as "determining the degree of stenosis and/or maturation in an AVF by measuring blood flow or pressure." They also stated that "further inventive concepts include measuring the blood flow by using a strain gauge (or similar) and measuring maximum and minimum flow parameters." In his skeleton Mr Smith argued that claim 1 is of limited, if any, assistance in determining the inventive concept for the purpose of these entitlement proceedings. Rather, on a fair reading of the specification, the claimant submitted that what was invented is a blood flow monitoring device configured to provide an indication as to whether blood flow through an AVF of the user is impaired, and to determine the degree of stenosis, not the "general device" claimed, which Mr Smith argued is either not inventive over a device specific to monitoring AVFs, or the application is insufficient to describe a "general device." Mr Smith also referred to the 2018 and 2020 grant applications, which both relate specifically to an AVF monitor. During the hearing Mr Smith provided the following definition of the inventive concept:

> *"a blood flow monitoring device for continuous monitoring of a surgically created AVF using a sensor, analysing data from the sensor in respect of parameters of blood*

pressure and vessel diameter by calculating the degree of stenosis and blood volume."

55 In their counter-statement the defendant did not give a clear definition of the inventive concept, although did set out claim 1 of the application. In his closing submissions, Mr Hicks referred to the Summary of the invention on page 2 of the PCT application as the definition of the inventive concept. It is not clear whether he intended to refer to the entire summary, which refers to a number of optional features, or merely to the first paragraph, which corresponds to claim 1 of the application. Given that Mr Hicks referred only to page 2, it seems that he intended the latter. Mr Hicks however also said that he considered a further aspect of the inventive concept to be that the device outputs a waveform rather than a single reading, involving a dynamic measurement of the movement of the skin over a period of time. This is not explicitly referred to in the summary of the invention on page 2 of the application, as Mr Smith pointed out. I therefore summarise the inventive concept identified by the defendant as (the addition of the waveform feature emphasised):

> *"A blood flow monitoring device comprising a sensor configured to be placed against skin of a user and to collect data indicative of movement of the skin caused by blood flow through a blood vessel in a region under the skin; and a controller comprising: a blood flow parameter determiner configured to determine a blood flow parameter based on the data collected by the sensor, and a blood flow impairment determiner configured to determine whether blood flow through the blood vessel is impaired based on the calculated blood flow parameter, the device outputting a waveform."*

56 There was some discussion as to whether the use of a strain gauge in a blood flow monitoring device was part of the inventive concept. Both parties were in agreement that the actual strain gauge itself was a known strain gauge. I found Mr Hicks' submissions on this point to be a little confusing. Whilst he pointed to the summary of the invention in the patent application as the inventive concept, which refers to a general sensor rather than to a strain gauge, and he appeared to acknowledge that other sensors could be used, he nevertheless submitted that the use of a known strain gauge in a medical device, and its use in such a device for dynamic strain analysis, was part of the inventive concept. On balance, I do not think Mr Hicks' submissions were limiting the inventive concept to a strain gauge. Rather, they are relevant to his submissions on how the inventive concept was arrived at, and the embodiment described in the application.

57 The differences between the parties as to the identification of the inventive concept can be summarised as follows:

i. Whether the inventive concept is limited to the monitoring of AVFs.

ii. Whether the invention includes the feature of a sensor being configured to be placed against the skin of a user and to collect data indicative of movement of the skin caused by blood flow through a blood vessel in a region under the skin.

iii. Whether the parameters determined relate specifically to blood pressure and/or vessel diameter.

iv. Whether determining blood flow impairment is equivalent to determining stenosis and blood volume.

v. Whether the inventive concept involves continuous monitoring, so that the output is a waveform.

I will consider these differences in turn.

Difference i: *whether the inventive concept is limited to the monitoring of AVFs*

58 I note that Dr Mohaghegh, in his evidence, considered the invention to relate to general blood flow monitoring devices, although he acknowledged that the only specific example in the application was for AVF monitoring. He claimed that tests were conducted in relation to broader applications, and data produced, through the development of the project, but, as there was no mention in the written evidence of any such tests or data, I attach little weight to this. Mr Kordzadeh's view was that, due to vein diameters being too variable, certain applications would not be viable, although Dr Mohaghegh did not agree. In any case, this does not preclude at least some additional applications. On a fair reading of the specification, it seems to me that the inventive concept is not limited to monitoring AVFs. Whilst the only detailed example relates to AVFs, it is apparent to me that the application envisages wider applications, and much of its disclosure applies to blood flow monitoring in general. Mr Hicks said that there was support for a wider application of the device in an email dated 9 November 2021 in which Dr Mohaghegh said that "the strain gauge sensor that we are using has a much wider application, not just for AVF monitoring" when sending some studies to Dr Kordzadeh. I am not however convinced that this provides support for a wider application *in blood flow monitoring*. The comment in the email relates to the strain gauge sensor, not to the blood flow monitoring device, and the wider application referred to could be in any number of fields. The PCT application itself states that the strain gauge is a known strain gauge, and there is nothing in the 9 November 2021 email to suggest that the wider application to which he was referring necessarily related specifically to blood flow monitoring applications. Nevertheless, I consider the inventive concept of the patent applications not to be limited to AVFs for the reasons I have given above, but to relate more generally to blood flow monitoring applications.

Difference ii: whether the invention includes the feature of a sensor being configured to be placed against the skin of a user and to collect data indicative of movement of the skin caused by blood flow through a blood vessel in a region under the skin

59 Mr Hicks considered this to be part of the inventive concept. Mr Smith, on the other hand, did not limit his identification of the inventive concept to a sensor configured to be placed against the skin, but argued that the type of sensor used did not matter for the inventive concept. In my analysis, whilst the claims of an application are not determinative in determining the inventive concept for the purposes of entitlement proceedings, I note that the claims are limited to the sensor being placed against the skin and collecting data indicative of movement of the skin, and this limitation appears throughout the PCT application. I therefore conclude that this feature does form part of the inventive concept.

Difference iii: Whether the parameters determined relate specifically to blood pressure and/or vessel diameter

60 Mr Smith considered these parameters to be part of the inventive concept. Whilst Mr Hicks did not comment at length, he considered the inventive concept to leave the specific blood flow parameter to be unspecified. In relation to difference iii, I note that dependent claims 6 and 7 relate to the parameters of vessel diameter and blood pressure respectively. It is therefore clear that these parameters are relevant to the invention. The application does, on page 11, refer to measuring heart rate as an alternative blood flow parameter, but this parameter seems only to be used to determine impairment of the vessel alongside the other parameters. Whilst it is the case that claim 1 is broader, it seems to me that the inventive concept requires the determination of at least one of blood pressure and vessel diameter in order to determine whether a vessel is impaired.

Difference iv: whether determining blood flow impairment is equivalent to determining stenosis and blood volume

61 Whilst Mr Smith and Mr Hicks used different terms to define the parameter determined by the device in their respective identifications of the inventive concept, I am not convinced that there is a great deal between the parties in relation to difference iv. The PCT application defines a stenosis as “an irregular narrowing or blockage inside the blood vessel.” I note that it is in dependent claim 8 that determination of stenosis and a blood flow volume is explicitly introduced, implying that blood flow impairment is a broader term. That said, the application, on page 8, defines “impaired” to mean “irregularly narrowed”. I do not therefore consider there to be much between the terms. To the extent that it could be construed as slightly broader, and the independent claims use this term, I will use the term “impairment,” in my identification of the inventive concept, but I do not consider this to make a substantial difference to the inventive concept over and above referring to stenosis and blood volume, at least for the purpose of these proceedings.

Difference v: Whether the inventive concept involves continuous monitoring, so that the output is a waveform

62 Regarding difference v, I note that the independent claims do not explicitly relate to dynamic measurement of movement of the skin. It however seems to me that the measurement needs to be dynamic, that is, carried out over a period of time, in order to determine the blood flow parameters required to determine whether the vessel is impaired. Moreover, I note that Mr Smith’s identification of the inventive concept includes continuous monitoring, and I do not therefore think there is a great deal of difference between the parties on this point, despite Mr Smith’s comments on whether dynamic strain analysis should be considered as part of the inventive concept.

63 Based on these findings, I therefore conclude that the inventive concept is that set out in claim 1 (or in the summary in the first paragraph of claim 2 of the application), with the addition of the features that collecting data indicative of movement of the skin relates to continuously collecting data over a period of time, and that the blood flow parameter relates to at least one of blood pressure and vessel diameter. The inventive concept I have identified is therefore:

> "A blood flow monitoring device comprising a sensor configured to be placed against skin of a user and to collect data indicative of movement of the skin caused by blood flow through a blood vessel in a region under the skin; and a controller comprising: a blood flow parameter determiner configured to determine a blood flow parameter based on the data collected by the sensor, and a blood flow impairment determiner configured to determine whether blood flow through the blood vessel is impaired based on the calculated blood flow parameter, wherein collecting data indicative of movement of the skin relates to continuously collecting data over a period of time, and wherein the blood flow parameter relates to at least one of blood pressure and vessel diameter."

5.4. Who devised the inventive concept

64 Unsurprisingly, the parties' accounts as to how the inventive concept was devised, and by whom, differ significantly. Mr Kordzadeh says that devising the invention was his own work. On the other hand, the defendant's case is that Professor Shirvani originally came up with the initial idea and then developed it, with Dr Mohaghegh coming on board with further development once the second grant application had been successful. There is little contemporaneous documentary evidence in relation to what happened prior to early 2018 in relation to either account. I will set out below Mr Kordzadeh's and Professor Shirvani's evidence as to how they initially devised and developed the inventive concept, and then consider the evidence and arguments from the parties in more depth as to the respective contributions of Mr Kordzadeh, Professor Shirvani, and Dr Mohaghegh, taking events in chronological order.

5.4.1. The claimant's case: 2014-2018

65 In his first witness statement Mr Kordzadeh said that he elucidated the inventive concept as a result of various publications in which he was listed as one of the authors. He said in paragraph 5.4 of his first witness statement:

> *"The real inventive feature of the Applications resides in monitoring a surgically created AVF by measurement of the blood flow, either by calculation of blood pressure or change in vessel diameter. This was elucidated by me as a result of the publications submitted in Exhibit AK1 on pages 13 to 21, and in more detail in Exhibit AK5."*

66 The earliest of these papers dates from 2014. Mr Kordzadeh said that he built on this previous work in compiling the proposal entitled "Proposal for the Arteriovenous Fistula Sensor for Detection of Functional Maturation or Its Failure," emailed to Professor Shirvani and Dr Parsa on 2 April 2018. Mr Kordzadeh referred to this proposal in paragraph 6.2 of his first witness statement:

> *"My proposal outlines the indications for creating an arteriovenous fistula, their success parameters (flow rate, vessel size, and length), current clinical surveillance techniques and their limitation (clinical and cost implications), and the need for an improved surveillance technique. It emphasised additional parameters necessary for a successful sensor, such as detection of pressure and flow changes which are crucial aspects of the inventive concept. The proposal further identifies the role of a simple sensor."*

67 The contents of this proposal are important, and I will consider it in more detail below. Mr Kordzadeh also said he provided another proposal in April 2019, but this proposal does not appear to have been relied on by Mr Kordzadeh in his timeline and it is not clear if, when or how it may have been transmitted to either MGE or Professor Shirvani. I will not therefore consider this later proposal any further.

68 At the hearing Mr Smith submitted that, by late 2017, Mr Kordzadeh had worked out a proposal for what became the invention, which he shared with Dr Parsa who then introduced him to Professor Shirvani. He said there was very limited challenge to that evidence, the height of it being that he did not have a source Word® document. Mr Smith said it was very likely that it was a work in progress, tweaked over time, and there was a version existing before he printed out a PDF on 2 April 2018 to send by email. This, Mr Smith submitted, is inherently plausible, is consistent with the documents, and fits into what happened next. The alternative, that someone else introduced the invention to him is, Mr Smith argued, inconsistent with the available documents, and he pointed out that there are no documents at all relating to what happened before 2 April 2018. Professor Shirvani denied that Mr Kordzadeh came to him with the idea for the invention. Mr Hicks argued that Professor Shirvani's account should be accepted, which is that Mr Kordzadeh began canvassing Dr Parsa to ask for a collaboration with any clinical project Professor Shirvani was involved in, bearing in mind Mr Kordzadeh was a student at ARU as well as a vascular surgeon, and wanted to improve his CV and profile for academia.

69 Mr Kordzadeh provided a list of what he claims to have provided to the project in his evidence in reply. Mr Hicks commented in his skeleton, reasonably in my view, that it is unfortunate that this list was not set out in his first statement, giving the defendant an opportunity to respond, although I do note that at least some of the items in the list are covered in the claimant's earlier evidence. In summary, Mr Kordzadeh claims to have provided to the project: knowledge of haemodialysis, AVFs including their creation, maturation and issues in routine practice, how AVFs are monitored in current practice such as Duplex sonography and shortcomings in these approaches, cost analysis for AVF failure, and what "thrill or bruit" is. I would categorise this knowledge as relevant background knowledge and do not understand the defendant's case to be that Mr Kordzadeh did not bring his broad knowledge of haemodialysis and AVFs into discussions, although the defendant does claim that this was all public knowledge, available in the academic literature and even in patient leaflets. Mr Hicks handed up examples of such leaflets, submitting that, based on these leaflets, the need to look after and monitor a fistula, that a patient needs to look out for thrill or bruit because they indicate the fistula is going well, that issues with fistulas can be stenosis or clotting, and that there may be need to go back for investigation, typically by ultrasound or Doppler, would all be known to the patient. Mr Hicks submitted that there is nothing extraordinary or inventive about any of these things, nor is there in relation to knowledge of typical blood pressures. This, Mr Hicks submitted, was the sort of contribution made by Mr Kordzadeh. It was at most advice, not inventive contribution.

70 In this list of what Mr Kordzadeh said he contributed to the project, he also said that he provided the understanding that continuous monitoring is needed, and the clinical benefits of, continuous monitoring, and also provided the indications to monitor. Mr Kordzadeh also said that he provided the insight that the solution to continuous

monitoring should be in the form of a sensor, and how such sensors could detect stenosis and maturation failure through [monitoring] flow and pressure. Mr Kordzadeh referred to his proposal of 2 April 2018 in support of at least some of these points. I will consider the 2 April 2018 proposal in detail below, but at this point will note that the claimant claims to have provided the case for continuous monitoring and also that the solution should involve a sensor which can detect stenosis and maturation failure through monitoring flow and pressure.

71 I find Mr Kordzadeh's evidence as to how he arrived at the inventive concept to be somewhat unclear, for example in relation to which of the numerous publications he listed in his evidence specifically led to devising the inventive concept in the application, and precisely how they relate to the specific elements of the inventive concept, and also in specifically how he devised the inventive concept. I nevertheless accept that, as a renal vascular surgeon with a particular interest in AVFs, he had a broad and extensive knowledge of the field prior to the compilation of the proposal on 2 April 2018, including existing problems with monitoring AVFs. The purpose and contents of the proposal, and its importance to the inventive concept, are disputed and I will consider it in detail below, in particular in relation to what Mr Kordzadeh may have communicated or contributed in relation to the inventive concept.

5.4.2. The defendant's case: 2010-2018

72 According to the defendant, and to Professor Shirvani's evidence, Professor Shirvani's first exposure to problems relating to AVF failure in haemodialysis patients was in 2010 when he accompanied his cousin to the renal unit of Broomfield hospital in Chelmsford, where he had some discussions with a Professor Ali Galil. Professor Shirvani's evidence is that he was personally aware of the problem because his cousin had a failing fistula. According to his evidence, Professor Shirvani then, in 2010, conducted a Computational Fluid Dynamics (CFD) simulation to analyse the non-Newtonian flow within an AVF. He discussed this with Professor Galil, who introduced him to a Mr Dave King in 2010-2011, a radiologist and inventor of a Doppler device called BlueDop for use in vascular applications. Professor Shirvani said in his witness statement that he assisted Mr King with a Bluetooth connection to the device, and due to this work, he became aware of the shortcomings of Doppler devices of this kind.

73 Between December 2013 and May 2017, Professor Shirvani's evidence is that he joined a new consortium known as RECONASS aimed at developing a monitoring system for constructed facilities, during which time he developed expertise in strain gauges. During a laboratory setup for RECONASS at ARU in 2015, Professor Shirvani said that he observed the high sensitivity of the strain gauge sensor and, after further experiments, confirmed its potential as a replacement for the Doppler devices. During 2014-2015 Professor Shirvani said that he began the development of the strain sensor technique to monitor the mass flow rate of a fluid inside a conduit (silicon tube), to see if it was in fact sensitive enough to validate the CFD analysis he had carried out earlier. After promising results, Professor Shirvani stated that he was inspired to develop the strain-gauge-based medical monitoring system that could overcome the problems associated with the BlueDop device. He said that he continued to work on this sensor technique during 2016-2017 and, by 2017, had devised a proof-of-concept device which gave him confidence that it would work as a

wearable device. He said that he then approached Simon Martin of MGE (with whom he was already collaborating on a different project) in about mid-2017 to ask if they wanted to be involved in the development of the device for monitoring AVFs into a prototype which could be used for clinical trials. Professor Shirvani emphasised the functionality of the strain gauge that enabled dynamic strain analysis.

74 Some of this narrative was corroborated by Mr Martin's evidence, who said that there were many discussions with Professor Shirvani in 2017, and various options were discussed, one of which was an idea he had for a medical monitoring device he felt could be used for AVFs. He said these were informal discussions, following other meetings about ways they could collaborate with ARU, which is why there are no notes or documents relating to those meetings, and that Professor Shirvani discussed a specific idea for an AVF monitor, and was not looking for any idea for using a strain gauge. He did not accept Mr Smith's suggestion that these discussions took place at the meeting on 30 April 2018, a meeting I will consider further below.

75 Mr Hicks submitted that Professor Shirvani was therefore aware of the problem since 2010 and identified a potential solution in the form of a device which measured the waveform created by a strain gauge placed on the skin of a patient before Mr Kordzadeh ever became involved. Mr Smith however portrayed Professor Shirvani as having a strain gauge but no project for it, and it was Mr Kordzadeh who came in and brought the project to him. Mr Smith argued that this is consistent with the arguments made in paragraph 6.3 of the counterstatement, which states:

> *"Prof Shirvani conceived the idea for use of a strain gauge as part of a medical monitoring device in or around 2016 and undertook testing and proof of concept analysis from 2017. Prof Shirvani co-authored a paper entitled "Experimental analysis of metal/plastic composites made by a new hybrid method" reporting on some of the work which was published in Additive Manufacturing in May 2018."*

76 Mr Smith pointed out that this paragraph does not mention AVF and refers to a proof of concept which, Mr Smith, argued, was a different concept, namely additive manufacturing, the paper Professor Shirvani published which is mentioned in this paragraph not being related to monitoring blood flow at all. Mr Smith submitted that Professor Shirvani's attempts to articulate the inventive concept in his oral evidence suggested he thought that what is inventive is his strain gauge analysis, and he considered Dr Mohaghegh's contribution to be skilful but uninventive.

77 Professor Shirvani's account of how he developed the initial idea is reasonably detailed, but, as Mr Smith pointed out, there is no corroborating documentary evidence, and Mr Smith suggested that his account unravelled during cross-examination. I am not convinced that it did but agree that Professor Shirvani's evidence would have had greater weight if there was any corroborating evidence. I also agree that the account, set out in paragraph 6.3 of the counterstatement, of the work he undertook in relation to the proof of concept was unclear as to whether his proof of concept was for some form of blood flow monitoring device or related to the contents of his paper on additive manufacturing. His evidence in his witness statement however provided more detail, paragraph 23 stating:

> *"From 2014 to 2016, my primary focus remained on the RECONASS project and various other commitments. One of these was exploring the multi-directional strain measurement technique. The potential of the technique was put to the test in the*

published study entitled "Experimental analysis of metal/plastic composites made by a new hybrid method" which I co-authored with my colleague Dr Javid Butt. During 2014/2015 at ARU I began the development of the multi-directional strain sensor technique (the waveform) to monitor mass flow rate of a fluid inside a conduit (silicon tube); this was to explore if the multi-directional strain sensor is in fact sensitive enough to help me to validate the CFD analysis I carried out earlier. The sensitivity that I observed proved to be promising, hence I was inspired to develop the multi directional sensor (strain gauge) based medical monitoring system that could overcome the problems associated with the BlueDop, i.e. the requirement for specific angle and directional use of doppler systems."

In paragraph 26 of his witness statement Professor Shirvani also stated:

"During 2016-2017 I continued to work on the multi-directional strain sensor technique. By late 2017, I devised a proof-of-concept device using a strain sensor mounted on a metallic tube for durability and connected it to a Wheatstone bridge circuit with a potentiometer and a digital volt counter coupled with a MX(P60) (dynamic strain measuring machine equipment required to do the measurement). The setup as a proof of hypothesis gave me the confidence that my device will work as a wearable device …"

78 I did not find Professor Shirvani's evidence during cross-examination to contradict his account in his witness statement. Although his oral evidence did emphasise the dynamic, continuous nature of the strain gauge monitoring, as Mr Smith submitted, my understanding is that he was not saying that this strain gauge analysis *per se* was the invention, but rather that its use for monitoring blood flow through a blood vessel was the invention. Taking all this into account, and given that I have found Professor Shirvani to be a generally reliable witness, I consider it more likely that his account of events is generally accurate, rather than being fabricated or misremembered. Moreover, Professor Shirvani's account includes development of many of the features of the inventive concept, including a blood flow monitoring device comprising a sensor configured to be placed against skin of a user to collect data indicative of movement of the skin caused by blood flow through a blood vessel in a region under the skin, and a controller for determining a blood flow parameter based on this data. The sensor would thereby determine if blood flow was impaired, with continuous monitoring capability by way of dynamic strain analysis.

79 There was some discussion as to whether Professor Shirvani had been discussing the AVF project with MGE prior to April 2018. Professor Shirvani's evidence is that he began discussions with Simon Martin in September/October 2017, but Mr Smith challenged this. The documentary evidence is inconclusive on this point. Mr Smith sought to make a point of this, arguing that, if discussions had taken place, surely there would be some documentary evidence such as emails or meeting minutes. Whilst I have some sympathy with this view, it seems to me that it is quite likely that, alongside discussions on the project already underway, Professor Shirvani could have had informal discussions with MGE on his next idea. I find his evidence on this point to be plausible and consistent with events that led up to the 30 April 2018 meeting and beyond. I therefore accept Professor Shirvani's evidence on this point. In summary, Professor Shirvani's evidence is that the inventive concept arose out an understanding of the problems concerning monitoring AVFs he developed from the exposure to the issue through his cousin, alongside his work on strain gauges, albeit that this work was initially in a different, non-medical field.

80 It is apparent that Mr Kordzadeh's evidence in relation to the initial development of the inventive concept is different to that of Professor Shirvani. It is however possible that both were considering sensors for monitoring AVFs prior to the 2 April work. Professor Shirvani's narrative in relation to development of the device and Mr Kordzadeh's evidence on his consideration of the invention both appear to be reasonable and were not, in my view, significantly disturbed during cross-examination. Some of the differences in their accounts may reflect their different understandings of the inventive concept. I therefore consider that their respective interests in the problems concerning monitoring AVFs developed independently. What is important is who directly contributed to the inventive concept I have identified, and whose contribution led to the filing of the patent application for this inventive concept. As Christopher Floyd QC (as he then was) said in *Stanelco*, there must be a causal link between the antecedent work in devising the invention and the subject matter of the patent applied for. Based on their respective accounts, Professor Shirvani's evidence ties more specifically into the inventive concept I have identified, whilst Mr Kordzadeh's evidence is less clear on specifically how he devised this inventive concept. Moreover, Professor Shirvani's evidence makes clear the causal link between his account of devising the invention and the subject matter of the patent applied for, whilst this causal link is not clear in Mr Kordzadeh's evidence. I will consider this further in the light of subsequent events, including a detailed consideration of Mr Kordzadeh's 2 April 2018 proposal.

5.4.3. First contact between Professor Shirvani and Mr Kordzadeh

81 The details as to when Professor Shirvani and Mr Kordzadeh first met, and how and when they first started working together, are disputed, although there was agreement that they did meet in hospital some time before 2018. The defendant's case is that Mr Kordzadeh made direct contact with Professor Shirvani in early 2018, seeking a collaboration to help his profile as he wanted a career in academia in the future. Professor Shirvani said that he was cautious in relation to bringing Mr Kordzadeh into the AVF project but considered that he might be a good person to undertake clinical trials, and therefore introduced him to a small consortium of individuals he had put together to progress the project. Mr Kordzadeh disputes this and says that he was introduced to Professor Shirvani as a consequence of forwarding his initial 2 April 2018 proposal to his PhD supervisor, Dr Parsa.

82 The important question is the extent to which this question is relevant to determining who devised the inventive concept. Professor Shirvani's case is that he came up with the basic idea and brought in Mr Kordzadeh to assist with clinical trials. Mr Kordzadeh says the idea was his, and he brought it to Professor Shirvani. I have found that it is more likely than not that they both independently developed an interest in the problem the invention was aiming to solve. In terms of the work causally linked to the invention, it was Professor Shirvani's account that demonstrated a clearer connection to the subject matter of the application. Mr Kordzadeh's case relies heavily on his 2 April 2018 proposal, and I will therefore consider this proposal in depth.

5.4.4. The 2 April 2018 proposal

83 There was significant discussion at the hearing in relation to the proposal emailed by Mr Kordzadeh to Professor Shirvani and Dr Parsa on 2 April 2018. It does not

appear to be disputed that Mr Kordzadeh produced the proposal, but nearly every other aspect of the proposal is disputed, including when it was produced, where its contents originated from, its purpose, and the relevance of its contents to the inventive concept. The proposal itself consists of a short paper, with a poster attached.

84 The origin of the proposal is in dispute. The defendant suggests that it was compiled specifically in response to a request made by Professor Shirvani and Dr Parsa to Mr Kordzadeh for some information on costs and clinical benefits of a device for monitoring AVFs. This, Mr Hicks argued, made sense because Professor Shirvani had obtained agreement in principle for MGE and Dr Parsa to be involved in the project, but they needed someone who could provide medical input, which would be useful for the grant application, and they also needed some costs justification to demonstrate the benefits of the device in the grant application. Mr Hicks submitted that the covering email suggested that Mr Kordzadeh produced the paper as a cost-benefit analysis for the purpose of the meeting, a meeting that Mr Martin said was held up because the proposal had not been produced. Mr Hicks also submitted that the covering email was consistent with their case that Mr Kordzadeh knew details of the project and was being asked to produce a cost-benefit analysis, the email stating: “It only focuses on the cost implication of the sensor and its wider use in practice”.

85 Mr Kordzadeh, on the other hand, said that he produced the proposal independently, reflecting his interest in such a device. Mr Kordzadeh’s evidence is that he wrote his proposal and then, during an introduction to Professor Shirvani by Dr Parsa, the discussion of the fistula project came up.

86 The timing of the production of the proposal is also disputed. Mr Kordzadeh said he developed it in 2017, whilst Mr Hicks argued that he produced the proposal only shortly before it was forwarded to Professor Shirvani. The lack of a dated source Microsoft Word® document was discussed (the proposal itself was in PDF format) but, given Mr Kordzadeh’s stated case that his ARU account had been deleted and the lack of certainty around this, I do not attach any weight to the lack of a source document. Mr Hicks pointed out that, in the covering email, Mr Kordzadeh apologised for the delay. I however note that a delay in sending the proposal could have been for any number of reasons and does not itself inform the question as to when the proposal was produced.

87 Mr Smith considered the claimant’s April 2018 proposal to be the key document that kicked everything off, or, as Mr Kordzadeh put it at the hearing, “the foundation of the entire innovation.” His submission is that it does not just identify costs and benefits, but also describes technical benefits such as the importance of the user being able to self-monitor. Mr Smith referred to details in the proposal relating to “functional maturation,” and a section entitled “The role of the AVF sensor”, both of which he argued included technical details, such as pressure and flow changes. He said that the proposal identified the flow and dynamics responsible for failure, and suggested continuous monitoring and what the continuous monitoring would look for. Mr Smith considered the type of sensor not to matter in terms of the inventive concept. Mr Kordzadeh did however concede that the proposal included only basic technical information. In relation to the poster, Mr Kordzadeh highlighted a list of cofounders which he said are important factors which can result in the success or failure of a

fistula. Mr Kordzadeh said that he got the cost-benefit analysis for his proposal from Cambridge University, and also said that it can be found by searching for it on the Internet. I find it difficult to reconcile this statement with Mr Kordzadeh's evidence in relation to the importance of the proposal to the inventive concept, as it is unclear as to which elements of the proposal originated from publicly available information, and which were his own work.

88 Mr Hicks, on the other hand, submitted that the proposal contains no technical detail of what the device should consist of or how it would work, but is a cost-benefit analysis, its purpose being to present a case for the development of a suitable device. He said that it was really setting out the problem in relation to AVF monitoring, and articulating demand. Mr Hicks submitted that the poster contained nothing of relevance to the application.

89 I will consider the contents of the 2 April 2018 proposal in some detail given its significance to the dispute. Its six pages begin with an introduction which provides an estimation of the number of people requiring haemodialysis globally and emphasises the importance of AVFs in the management of such patients. The next section is titled "Functional Maturation (FM)", a section to which Mr Smith referred, which is said to be necessary for an AVF to be useable and can be typically evaluated using ultrasound at six weeks after the creation of the fistula. The proposal specifies that a fistula needs to be no less than 0.5-0.6cm from the surface of the skin, and have a diameter of 6mm, a flow rate of 600ml/minute and a working length of 5-6cm for successful two needle dialysis. It appears that these figures are taken from a paper published in 2009. The proposal explains that, if a fistula does not gain FM, it cannot be used for haemodialysis.

90 Following this, the proposal describes the creation of AVFs and then the assessment of functional maturation in practice. It explains the processes whereby, following the creation of an AVF, the patient is regularly followed up in outpatient clinic for assessment, including determination as to whether "bruit" or "thrill" are present, and ultrasound examination to assess flow and pressure alteration of the AVF. The proposal here specifies a flow rate of more than 400-600 ml/minute as being essential for successful functional maturation.

91 The proposal then continues in a section titled "Cost Evaluation of AVF That Obtains Functional Maturation (60-70%)". In this section the costs of AVF creation, surveillance in 0-6 weeks, and haemodialysis sessions, are evaluated. This is followed by a section titled "Cost Evaluation of AVF That Don't Obtain Functional Maturation (30-40%)" in which the costs of AVF creation, surveillance in the first six weeks, and emergency surgery for impaired functional maturation are evaluated. The proposal then sets out additional operating costs.

92 The final section of the proposal is titled "The Role of AVF Sensor", another section to which Mr Smith referred, and states:

> *"The presence of a simple and applicable sensor following the creation of a AVF can help in detection of pressure and flow changes. These indicators are directly related to Functional maturation. The sensor can assist in the following clinical and subsequently* [sic] *cost savings: …"*

93 The cost savings are then listed and include, amongst other things, early detection of functional maturation or failure/impairment and consequential efficiency and efficacy improvements, reduction in ultrasound assessment of the fistula, early detection of failure or impairment, and reduction in the use of outpatient clinics. Also listed are the benefits that the sensor allows patient self-monitoring and optimisation of AVF care.

94 The poster was apparently published in 2016/17 and is entitled “Optimisation of Radio cephalic Arteriovenous Fistula (RCAVF) Maturation in Haemodialysis Patients”. Its stated aims are to identify factors that are independently associated with RCAVF maturation failure, to devise and implement changes to improve functional maturation of RCAVFs in clinical practice, and to optimise cost-effectiveness and minimise failure. The poster includes a list of cofounders which relate to the factors that can be relevant to RCAVF maturation failure. The poster also has some information on costs. It does not refer to any AVF sensor or, beyond the list of cofounders, to any specific processes for assessing AVF maturation.

95 Having carefully considered the contents of the proposal and the poster, I find that they set out the problem concerning the need to monitor and assess AVF maturation in outpatient clinics, and the clinical and cost benefits of “a simple and applicable sensor” that would allow patient self-monitoring and therefore optimisation of AVF care. The rest of the proposal provides background to the problem and sets out the costs associated with monitoring functional maturation of AVFs in outpatient clinics, and therefore the benefits of such a sensor. Despite Mr Smith’s argument that the proposal discloses continuous monitoring of fistulas, I can find no reference to this in the proposal. The reference to patient self-monitoring does not point to this, nor does this reference suggest that the sensor would be wearable. Having considered the proposal carefully, I consider that it explicitly describes the following elements relevant to the inventive concept:

- A blood flow monitoring device comprising a sensor to help in detection of pressure and flow changes which allows patient self-monitoring and optimisation of AVF care.

- The relevance of vessel diameter to a fistula useable for haemodialysis.

96 The proposal does not therefore disclose any specific detail of the inventive concept I have identified beyond these general disclosures. Whilst the reference to patient self-monitoring might distinguish the sensor from the prior art ultrasound techniques referred to in the patent applications (see paragraph 44 above), the proposal does not provide any details in relation to how patient self-monitoring may be achieved. Nor does it disclose a wearable sensor, but merely that the sensor allows patient self-monitoring. Moreover it does not disclose all the features of the inventive concept proposed by Mr Smith in that it does not make any reference to continuous monitoring, not does it explicitly refer to what the sensor would monitor, although it does state that AVF diameter and flow rate are the key parameters for assessing functional maturation, and it could therefore be implied that an AVF sensor would need to monitor these parameters. I note however that there is no explicit reference to calculating the degree of stenosis and blood volume.

97 Having carefully considered the content of the proposal I conclude that, even if I consider the proposal to be Mr Kordzadeh's independent work before any discussion with Professor Shirvani or others, it does not, in itself, demonstrate that, on the balance of probabilities, Mr Kordzadeh devised the inventive concept I have identified, or, for that matter, the inventive concept put forward by Mr Smith. As Mr Hicks submitted, the proposal is very much cast as a cost-benefit analysis of an AVF sensor suitable for patient self-monitoring. It does not describe the features of the inventive concept I have identified, and there is no causal link between the contents of this proposal and the subject matter of the patent applications.

98 The covering email to the 2 April 2018 proposal, entitled "Cost effectiveness of sensor", supports this conclusion. It states:

> *"Dear Prof Shirvani and Dr Parsa,*
>
> *I have completed a draft proposal for the cost effectiveness of the Sensor in mind. Please note that the proposal does not include the important clinical (flow and pressure and heamodynamic* [sic] *changes and evaluations in mind). It only focuses on the cost implication of the sensor and its wider use in practice.*
>
> *In second attachment, i have included the poster that won the East of England health education research award in 2016/17 and in the last section it also had the yearly cost implications too.*
>
> *In second section (could of weeks*) [sic] *i ll try to complete a practical proposal for the clinical (flow and pressure changes that need evaluating by the sensor in mind.*
>
> *Please let me know your thoughts and my apologies in delay.*
>
> *Once again very grateful for your help in this regard.*
>
> *Best regards. Ali."*

99 This email suggests that Mr Kordzadeh already has some sort of relationship with Professor Shirvani in relation to "the Sensor", and the apologies for the delay in the penultimate line, as well as the final comment, reinforce this. It therefore seems to me that, at the time this email was sent, Mr Kordzadeh had already had discussions of some sort with Professor Shirvani and Dr Parsa in relation to a "Sensor". Thus, this email suggests to me that it is more likely than not that the proposal arose out of discussions which had already taken place between Mr Kordzadeh and Professor Shirvani, which corresponds more closely to the defendant's version of events, namely that Mr Kordzadeh agreed to provide a paper on the cost effectiveness of the sensor, presumably for the purpose of taking the project forward. The evidence as to when the proposal was produced is inconclusive. It is inevitably the case that the proposal would have been drafted over a period of time, but it is unclear as to whether that time was a matter of days or weeks/months, as Mr Kordzadeh claims. I do not therefore place any weight on whether the proposal was produced in late 2017, as Mr Kordzadeh claims, or shortly before 2 April 2018, as the defendant claims. I do however consider that, on the balance of probabilities, it arose in response to discussions with Dr Parsa and Professor Shirvani, rather than it being the prompter of such discussions. Moreover, the email reinforces my finding that the purpose of the proposal was to set out the cost-effectiveness of the sensor.

100 In summary I have found that, on the balance of probabilities, the 2 April 2018 proposal arose out of discussions between Mr Kordzadeh, and Professor Shirvani and Dr Parsa, although I have made no conclusion as to when the proposal was originally produced. I have also found that, in relation to the features of the inventive concept I have identified, the proposal refers only to a blood flow monitoring device comprising a sensor to help in detection of pressure and flow changes which allows patient self-monitoring and optimisation of AVF care, and to the relevance of vessel diameter to a fistula useable for haemodialysis, with no indication as to how patient self-monitoring could be achieved. It does not therefore disclose the inventive concept I have identified. I therefore conclude, noting that the onus is on the claimant to prove his case, that the 2 April proposal, and the manner of its communication to Professor Shirvani and Dr Parsa, does not provide sufficient evidence to demonstrate, on the balance of probabilities, that Mr Kordzadeh devised the inventive concept of the patent applications.

5.4.5. The 30 April 2018 meeting

101 A meeting took place on 30 April 2018 which, according to Mr Martin, was to introduce his consortium to MGE and discuss the grant application. Mr Martin, Mr Kordzadeh and Professor Shirvani were all present, as well as Dr Parsa. There was considerable discussion at the hearing as to what took place at this meeting, although there is general agreement that Mr Kordzadeh's 2 April 2018 proposal was discussed at the meeting.

102 Mr Hicks referred to Mr Martin's evidence as to what those attending the meeting said their respective interests were in the project. Mr Martin set this out in paragraph 11 of his witness statement:

> *"Each party then set out their key objectives. For MGE, our desire for the Project would be to own the IP outright as well as manufacture and sell the end product. Professor Shirvani's driver was to get his idea into production and allow him to produce academic papers. Dr Kordzadeh stated that his aims from the Project were for someone to invent and produce a device that would enable continual, real time monitoring of AVFs to assist his patients and that he be allowed to publish academic papers to help enhance his own career. Dr Parsa was also just interested in the academic and medical benefits from the Project."*

103 Mr Kordzadeh however disagreed with Mr Martin's evidence as to what he wanted out of the project. Mr Smith submitted that Mr Martin's evidence on this point conflicts with what is stated in the first grant application, which refers to Mr Kordzadeh's drive to improve patient care and treatment methods. I don't see a particular conflict between Mr Martin's evidence and the statements in the grant application. I note that the grant application was written for the purpose of securing a grant, which I will discuss further below. I do not doubt Mr Kordzadeh's drive to improve patient care, and I also consider it likely that he wished to publish some academic papers, given that he has published such papers in the past. It is less clear whether he specifically wanted to be involved in the project to further his career but, even if he did have this aim, this does not detract from his desire to improve patient care.

104 Mr Martin gave further evidence as to what took place at this meeting. He said he was introduced to Mr Kordzadeh as a potential ARU team member for the project

due to his clinical knowledge and his affiliation with ARU as a PhD student, and due to a patient study he had recently completed in relation to AVFs, which is summarised in the poster attached to Mr Kordzadeh's proposal, discussed above. Mr Martin's evidence is that Mr Kordzadeh provided the proposal at the meeting. He also said that, at the meeting, Professor Shirvani explained an idea he had for utilising technology used in previous material testing he had done which would be capable of the real-time blood flow and pressure analysis required for an AVF monitor. Professor Shirvani agreed that Mr Kordzadeh's proposal would have been discussed at the meeting. He said that Mr Kordzadeh's contributions at the meeting were in relation to clinical issues. When challenged in relation to the content of a 2 May 2018 email chain, which did not mention dynamic strain analysis, Professor Shirvani confirmed that it nevertheless would have been discussed at the 30 April 2018 meeting, although he did not reveal the details of the strain gauge to MGE at this point. This seems plausible, given that an email in the 2 May 2018 chain from Simon Martin does refer to continuous, portable monitoring.

105 According to Mr Smith, Mr Kordzadeh communicated the five integers he considered constituted the inventive concept – continuous monitoring, of a surgically created AVF using a sensor, analysing the data from the sensor, in respect of blood pressure and vessel diameter parameters, and calculating the degree of stenosis and blood flow volume – at the 30 April meeting to Mr Martin, and communicated them to Professor Shirvani either at the meeting or shortly in advance of that meeting. Mr Martin however said the meeting was for him and his brother to meet Mr Kordzadeh to see if he was appropriate to join the project. Mr Martin said it was verbally confirmed that Mr Kordzadeh's paper was specifically produced for the meeting.

106 Unfortunately, there is no documentary evidence to confirm or refute any of the witnesses' evidence as to what was discussed at the 30 April meeting. Having considered matters, I am not sure that a great deal can be gained from this meeting. Whilst it seems to me to be likely that matters such as what parties wanted to get out of the meeting were discussed, and the evidence suggests Mr Kordzadeh's paper would have been discussed at the meeting, I do not have a great deal of confidence in the accuracy of the witnesses' recollections as to whether any specific features of the inventive concept were discussed at the meeting beyond the general idea and perhaps the idea of using dynamic strain analysis for continuous, portable monitoring, nor who brought such discussions to the meeting if they were discussed. I do not therefore think it greatly assists in determining the question of inventorship.

5.4.6. The first grant application

107 The first grant application was made on 8 May 2018, shortly after the 30 April 2018 meeting. Most of the discussion at the hearing in relation to both grant applications was in relation to the role they assigned to Mr Kordzadeh, a point that is disputed. Professor Shirvani's evidence is that Mr Martin drafted both applications. Professor Shirvani seems to have signed off on their contents, but there is some uncertainty as to the extent he influenced their content. He claimed that the drafting was Mr Martin's, but did then get confused as to whether he would have corrected any errors or omissions, or in fact did so. Mr Kordzadeh corrected his evidence as to whether he saw the first grant application before it was filed after the emergence of a chain of emails suggesting that he did, clarifying that he had been sent parts of it but did not see the whole grant application until after it was filed.

108 Mr Smith relied heavily on the grant applications as evidence that Mr Martin and Professor Shirvani, when drafting the applications, considered Mr Kordzadeh to have a significant and creative role in the project. Mr Martin's and Professor Shirvani's evidence is that this was not the case. Mr Smith said that he considered the 2018 grant application to be a key document. He pointed out that it states that "*The initial driver of the project comes from a need identified by the Vascular surgeon who will be involved,*" and also that Mr Kordzadeh was identified as part of the team, specifically as "*Medical Consultant, responsible for medical trials and device definition.*" In relation to Mr Kordzadeh's identified need, Professor Shirvani said that it probably related to Mr Kordzadeh's cost-benefit analysis, cost savings to the NHS, and his patient experience.

109 There was considerable discussion in relation to the intended meaning of "device definition" at the hearing. Professor Shirvani said that Mr Kordzadeh's role on the project was as a medical consultant, not part of the investigating team, and this is what this part of the grant application referred to. Mr Smith, on the other hand, argued that, in being responsible for device definition, he was defining the device. Professor Shirvani did not however accept that this was Mr Kordzadeh's role. Mr Smith also highlighted the reference to Mr Kordzadeh's stated role in "*clinical trials as well as design feedback.*" Professor Shirvani considered this to refer to feeding back the results of the patient trials.

110 Mr Martin said that he described Mr Kordzadeh as a medical consultant in the grant application because of the specific needs of grant applications, and to emphasise to the grant body that they had a medical consultant on board. Mr Martin considered that describing Mr Kordzadeh as responsible for "device definition" in the grant application was badly worded, due to the limits in the number of words that could be used in the grant application. He considered Mr Kordzadeh's role to relate to involving the end user in design work, which is what is done when designing medical products, and that, as is said later in the application, "clinical trials and design feedback" is what "device definition" really means. Mr Martin said they needed someone to give advice on the best way to display analysis for clinicians, and wanted to involve Mr Kordzadeh for this purpose, although he said that Dr Mohaghegh was the one who came up with the traffic light system they used, Mr Kordzadeh confirming this would work. Mr Martin said that this was Mr Kordzadeh's only real input in relation to "device definition". Mr Hicks submitted that the sensible reading of the term "device definition" is that Mr Kordzadeh was the person who would be helping MGE and the technical people to explain from a usability point of view what the device should consist of, and what patients and doctors would need to be persuaded to use it. He submitted that clearly Mr Kordzadeh did not come up with the idea of using a strain gauge.

111 Mr Smith argued that the grant application did not mention any of the reasons for the project given in Professor Shirvani's evidence, including Professor Shirvani's narrative as to how he came up with the idea, in support of support submissions that Mr Shirvani's evidence was not accurate on this point. Professor Shirvani said that a grant application would not normally look at the historical background as to how the project was arrived at. On balance, I agree with Professor Shirvani that, given the restricted format of grant applications, and their purpose for deciding whether to award grants, it seems to me that the history of how the idea was arrived at is not

necessarily relevant to determining whether to award a grant, and its omission from the grant application does not, in my view, lend weight to an argument that Professor Shirvani's evidence is inaccurate.

112 Mr Hicks submitted that the wording of the grant application was for a specific purpose, namely to secure a grant. He said that the boxes in the application had word limits, and the text was written for those considering the grant application. He argued that the aim of a grant of this nature is not just to come up with inventions, but to develop products which justify the expenditure of public money. Mr Hicks considered the wording used in the first grant application to relate to the application of a particular technology to a new area, namely monitoring AVFs. He submitted that the application was drafted with a view to securing a grant, hence the makeup of the team to include the commercial side, the academic side, and the medical side. He said that the people marking the application were going to be interested in whether this was worth putting money into, and this is the reason it was written the way it was, telling the assessors that they will have a commercial outcome.

113 I have some sympathy for Mr Hicks' submissions here. It seems to me to be reasonable that Mr Martin would have drafted the grant application in a manner to maximise the chance of success, as his evidence suggests, and I can understand the benefits in highlighting that a medical consultant is involved. The grant application does, in my view, demonstrate that there was a clear intention for Mr Kordzadeh to be involved in the project, and would bring his medical expertise and access to patients, as well as being representative of potential users of the product, at least from a medical perspective. I do not think the grant application, particularly the description of his responsibility as being "device definition", implies that he would be responsible for the design or invention of the device, but more likely that his role would be to ensure the device provided the right data in the right format for medical clinicians.

114 Mr Smith submitted that, of the five integers he identified as defining the inventive concept – continuous monitoring, of a surgically created AVF using a sensor, analysing the data from the sensor, in respect of blood pressure and vessel diameter parameters, and calculating the degree of stenosis and blood flow volume, the same integers he submitted were discussed in the 30 April 2018 meeting – the first three integers are set out in the grant application and the next two are hinted at. He referred to the stated aim of the project in the first grant application to develop an advanced wearable real-time monitoring system to monitor the status and performance of an AVF in support of this submission. Whilst I agree that the first integers are included in the grant application, and the other two may be hinted at, this does not get me any further in determining who contributed these integers to the inventive concept. They could have originated from either Mr Kordzadeh or Professor Shirvani prior to their inclusion in the grant application, and, in view of my analysis above, I do not consider that Mr Kordzadeh's responsibility for "device definition" implies that they originated from him. I note that the burden of proof is on the claimant to prove that he devised the inventive concept. I do not therefore consider the first grant application to get the claimant to where he seeks to get in proving, on the balance of probabilities, that he was the deviser of the inventive concept of the patent applications.

5.4.7. August 2018 to September 2021 (including filing of second grant application)

115 The first grant application was not successful, and a second application was made on 19 January 2021. There is little information in the evidence as to what happened between the failure of the first application in August 2018 and the making of the second grant application. It seems that Mr Kordzadeh had little or no input into the project between the first and second grant applications. It is not clear to me what development, if any, took place between these dates. In an email dated 17 September 2021, copied to Mr Kordzadeh, Mr Martin stated that there was now a live funded project following the success of the second grant application, and the project appears to have continued in earnest after the success of the second grant application.

116 The content of the second grant application is similar to that of the first grant application, except that further technical information relating to the product was included, including information in relation to two proof-of-concept tests. Also included was Mr Kordzadeh's poster which he had attached to his 2 April 2018 proposal. According to Professor Shirvani's evidence, these proof-of-concept tests were tests he carried out with Dr Javaid Butt during 2017 and 2018. Mr Kordzadeh confirmed that he had not been involved in these tests, and Professor Shirvani confirmed that he had carried them out and conveyed the relevant information to Mr Martin for the grant application. Mr Martin's evidence is that the second grant application was based very much on the first, but he had assistance, and more time, to write the second grant application, as well as the benefit of the scores applied by the funding body to the individual sections of the first grant application. He said that the definition of the team scored very highly in the first application, so he did not change that.

117 Due to the presence of drawings in the application relating to test setups, there was some discussion as to who had produced the document, particularly, as Mr Smith pointed out, since the only mention in the documents to the production of the grant application was a reference to a telephone call. Mr Martin confirmed that he produced the document, and the drawings came from long discussions with Professor Shirvani. Professor Shirvani confirmed that, for the second grant application, Mr Martin specifically needed his input in relation to technical solutions for the sensor and the testing that had been carried out, and Mr Martin created the drawings in the light of this conversation. Professor Shirvani confirmed that, for the 2021 grant application, he did assist with its drafting and had not merely read it.

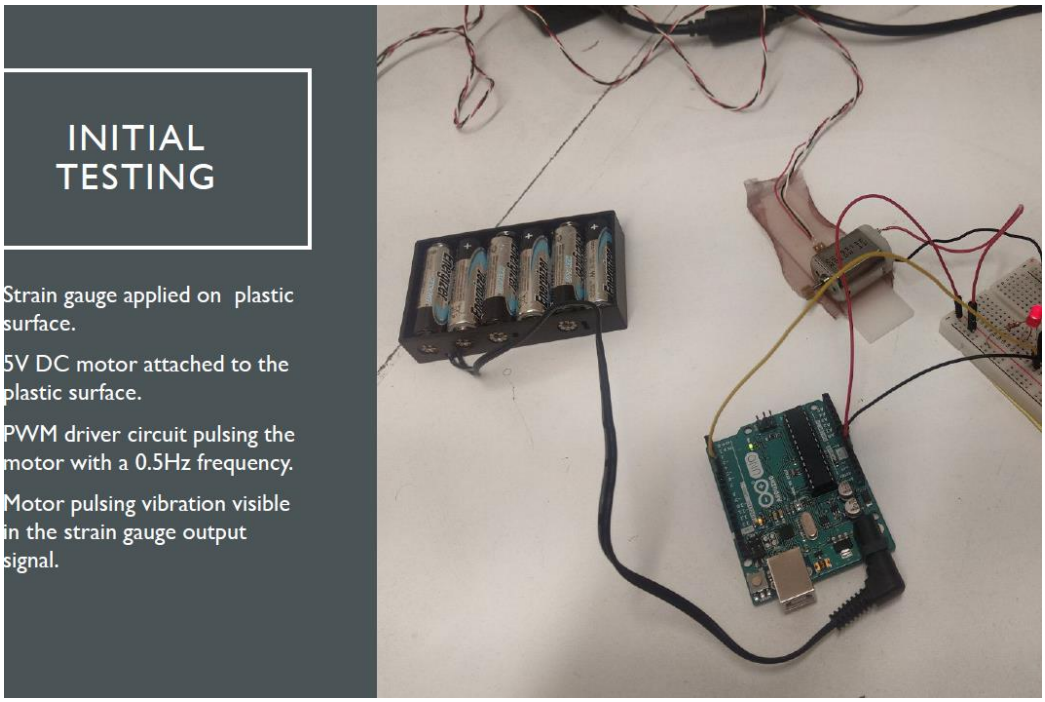
118 Mr Hicks referred to me an email dated 22 July 2021, which related to arranging a kick-off meeting for the project following the successful grant application, and in which Mr Martin said "Getting in contact with Dr Ali to sort out meetings with him and associates for establishing user requirements, trial ideas and locations etc." Mr Hicks submitted that this is consistent with the view that MGE wanted Mr Kordzadeh to help with usability and acceptance, get patient information completed, and get information together on testing equipment.

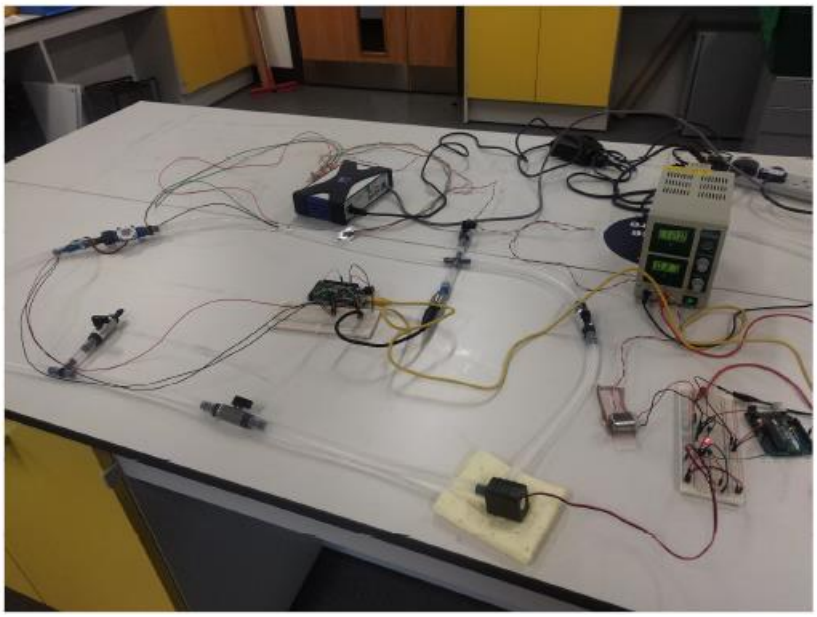
119 The information relating to the tests in the second grant application demonstrate that, by that point, some work had been carried out in relation to proof-of-concept testing of AVF monitoring using a strain sensor. Given Mr Kordzadeh's evidence that he was not involved in these tests, this seems to corollate with Professor Shirvani's version of events, particularly his early proof-of-concept testing. Although it is possible that these tests were first put together after, and in the light of, Mr

Kordzadeh's 2 April 2018 proposal and after the 30 April 2018 meeting, I consider it more likely than not that these tests were carried out during 2017 and 2018 by Professor Shirvani and Dr Butt, in accordance with Professor Shirvani's evidence on the matter, and were therefore carried out independently of any input from Mr Kordzadeh's 2 April 2018 proposal or from the 30 April 2018 meeting.

5.4.8. Test setups and further development: September 2021 to 2022

120 Following the success of the second grant application, Dr Mohaghegh was employed by MGE from 15 September 2021, at the suggestion of Professor Shirvani, to work on the project, and specifically worked on test setups. The extent to which he relied on Mr Kordzadeh's input for the test setups is disputed. Mr Martin sent a video of the first test setup on 7 October 2021, the video being in evidence, and this test setup was described in a presentation to UK Innovation (the grant providers) on 14 October 2021. A second test setup was described in a presentation to UK Innovation on 11 January 2022. Photographs produced of the first and second test setups respectively are reproduced below.





121 I found Mr Kordzadeh's evidence as to his involvement in the test setups to be somewhat unclear, although he is clear in stating that he gave Dr Mohaghegh guidance in relation to how the test setups should emulate a real AVF, and in relation to relevant parameters. Mr Kordzadeh said that he told Dr Mohaghegh a closed loop system was needed with a specific pressure, and the tubing needs to mimic that of a fistula, with silicone being the best type of tubing. Mr Kordzadeh also claimed that he told Dr Mohaghegh that the strain gauge needed to be away from the pump. In relation to the second photograph reproduced above, Mr Kordzadeh said that fewer loops were needed in the circuit, a view he maintained even when it was put to him that there was only a single loop shown in the circuit, and said he told Dr Mohaghegh this, as well as referring to the number of valves, the pressure required, the need to mimic heart activity, the need for a pinching device, and the need to get the parameters such as the diameters of inflow and outflow right, in discussions with Dr Mohaghegh.

122 Dr Mohaghegh's evidence is that Mr Kordzadeh had no involvement in the design of these test setups. He said that there is only one loop in the setup, a closed loop in the test arrangements. He also said that he knew the correct pulsing pressure parameters for a normal person, which he considered to be understood by everyone. He however stated that the first test setup was early in the process and was not calibrated. Dr Mohaghegh's recollection is that he knew about the timing, different tube parameters, and the pinching device from his own knowledge, but did accept that there was a possibility that Mr Kordzadeh suggested them to him as well. Dr Mohaghegh did not agree that Mr Kordzadeh inputted quite a lot into the ideas behind the redesign. Both Mr Kordzadeh and Dr Mohaghegh agree that, when Dr Mohaghegh asked for the parameters to monitor relating to blood flow and pressure measurements of the AVF, Mr Kordzadeh gave him this information by sending him a number of articles on 4 November 2021. Dr Mohaghegh's evidence is that Mr Kordzadeh did not explain what was in them, and he therefore had to work that out himself. He did acknowledge that they had a short conversation during a meeting, but the bulk of his understanding came from his own research.

123 Dr Mohaghegh said that the results to be produced by the device, and their interpretation, was an understanding developed by the whole project, not just by Mr Kordzadeh. He did acknowledge that Mr Kordzadeh provided the knowledge of AVFs and the issues that arise within routine practice, including how an AVF must mature before it can be monitored, how an AVF is used for haemodialysis, and possibly how an AVF could fail due to stenosis and thrombosis. He also acknowledged Mr Kordzadeh probably provided knowledge of existing practice and its shortcomings, and information on the vibration of the skin through a fistula. He however said that indications of how to calculate AVF flow rates, and also other information that Mr Kordzadeh provided, were "basically public knowledge". He said that Mr Kordzadeh had some high-level discussion about how AVF works, what the maturation is, what failure is, and what stenosis is, in two short early meetings, but did not provide much information after that point, with later understanding coming mostly from his own research. Dr Mohaghegh said that the details of determining the steps necessary for getting from the physical data collected by the sensor to a determination of the actual stenosis level was done by himself.

124 Considering the evidence of both Mr Kordzadeh and Dr Mohaghegh, and the submissions of Mr Smith and Mr Hicks, it seems to me that the most likely version of events is that Dr Mohaghegh independently developed the test setups, and, through reading the academic literature, including those provided by Mr Kordzadeh, and his own research, arrived at a setup that would effectively emulate a real AVF It seems to me that Mr Kordzadeh probably did discuss with Dr Mohaghegh the requirements of the test setup, based on his knowledge of real AVFs, but this merely confirmed Dr Mohaghegh's work rather than directly influence the test setup, and perhaps provided further background information on AVFs and on clinical practice relating to AVFs. Mr Kordzadeh was therefore passing on known public information rather than contributing to the inventive concept in these discussions. Mr Kordzadeh said that the test setup does not mimic a fistula, presumably suggesting that it was his input that resulted in an effective test setup, for example in relation to the requirement for a single closed loop, but it is not apparent to me that this is the case based on the requirements he referred to in his evidence, the evidence from Dr Mohaghegh, and the photographs of the test setups, which in my view show a single loop. Therefore I do not find that, on the balance of probabilities, this furthers Mr Kordzadeh's case that he contributed to the inventive concept in discussions on the test setups. It seems to me to be more likely that any contributions to the inventive concept made during these tests were made independently by Dr Mohaghegh. In any case, the onus is on Mr Kordzadeh to prove his case and I do not believe that, on the balance of probabilities, based on the evidence I have considered in relation to the conversations which took place concerning the test setups, he has done so.

125 At the hearing there was some discussion in relation to a meeting which took place on 3 November 2021 with Dr Mohaghegh and Mr Kordzadeh at Professor Shirvani's offices at ARU. Mr Kordzadeh seemed to be a little confused as to whether Professor Shirvani attended the meeting, the evidence suggesting he missed it due to illness. He possibly confused it with a separate online meeting. This is understandable given the several years that have elapsed since this meeting, but it does demonstrate the difficulties in determining what went on at such meetings if there is no documentary record of the discussion. Mr Smith did however highlight an email dated 5 November 2021 in which Mr Martin said that Mr Kordzadeh "gave

them a lot to think about". Mr Smith submitted that this comment indicates that Mr Kordzadeh was giving his input at the meeting rather than being brought up to date on progress of the project. This email does suggest to me that Mr Kordzadeh gave some input, and I have already found that he did input into discussions on the test set-ups, but it is also likely that he was brought up to date on latest developments at the meeting. The documents do not give any insight in relation to what Mr Kordzadeh's input might have been at this meeting. Mr Kordzadeh might have given input on any matter where the grant applications had considered he may give input or insights, but there is nothing in the documentary evidence to suggest that his comments at this meeting were relevant to the development of the inventive concept. I do not therefore consider the evidence as to what may have been said at this meeting to be helpful in determining who devised the inventive concept.

126 Mr Smith submitted that the data analysis required to translate the raw waveform data to the required clinical data was disclosed by Mr Kordzadeh either when the project was reignited in October/November 2021, or in April 2018. Much of the discussion at the hearing related to communications between Mr Kordzadeh and Dr Mohaghegh, which is more relevant to the later date. He argued that there was a definite specific contribution from the claimant here because no one else would have had the required clinical knowledge. Mr Smith accepted that Dr Mohaghegh helped with that journey in contributing the fast Fourier transforms, the well-known waveform analysis, fluid dynamics principles and engineering principles, but his submission is that he uninventively took the roadmap Mr Kordzadeh had given him to get from raw data to the required clinical data and completed the journey. Mr Smith considered the further prototypes produced not to relate to the invention, but rather added features to the device such as Bluetooth®, miniaturisation, or the like, which are not claimed in the patent. Mr Smith supported these submissions by referring me to an email dated 7 October 2021 in which Mr Martin asked Mr Kordzadeh if they could sit down with him and better understand the flows and pressures through the fistula and get his ideas on testing processes and ideally what information the monitor output should be giving. Mr Smith submitted that the claimant therefore provided the invention and Dr Mohaghegh implemented it using well-known techniques. Mr Hicks argued that Mr Kordzadeh had not said in his evidence that he described how to analyse the waveform coming from the sensor to determine the degree of stenosis. Rather, Mr Hicks submitted, Dr Mohaghegh, in an email dated 9 November 2021, stated that he was going to use a similar methodology to that discussed in some relevant studies he had found to analyse the waveform.

127 Professor Shirvani said that continuous monitoring was discussed with Mr Kordzadeh, but Mr Kordzadeh did not provide any information in relation to the system being tested, or how it would work, and the information relating to parameters such as pressure, velocity and flow rate, were in the public domain. Nor did Professor Shirvani agree that Mr Kordzadeh had provided information on waveform analysis and other information relating to AVFs. Professor Shirvani denied that all he had contributed was a strain gauge. He said that he contributed the dynamic strain gauge measurements, how a strain gauge could be used in transient mode, how the waveform is formed from this dynamic measurement, and also carried out various testing, with Dr Mohaghegh contributing to the test rig with himself.

128 Having considered all the evidence in relation to the need to provide appropriate clinical parameters and ensure the waveform data was translated into clinically appropriate information, it seems to me that, although Mr Kordzadeh probably did have discussions with Dr Mohaghegh and Professor Shirvani on these matters, these did not clearly result in any integers of the inventive concept. I consider it to be more likely, on the balance of probabilities, that Dr Mohaghegh and Professor Shirvani independently determined the relevant parameters and worked out how to transform the waveform data into clinically relevant data. Whilst Mr Kordzadeh may have inputted into discussions, I am not convinced that his input directly led to the inventive concept, but rather supplemented information already obtained by Professor Shirvani and Dr Mohaghegh, much of which was in any case in the public domain.

5.4.9. To the filing of the UK application in December 2022 and the PCT application in December 2023

129 Dr Mohaghegh's evidence is that development of the device continued through to the filing of the first patent application in December 2022. On 16 June 2022 Mr Martin emailed Mr Kordzadeh with a summary of the AVF sensor that had been developed, so that he could use it with the ethics committee responsible for trials. According to the defendant, Mr Kordzadeh undertook some trials, but the data could not be used for the project because necessary permissions had not been obtained.

130 By November 2022 it seems that the relationship between Mr Kordzadeh, and Mr Martin and Professor Shirvani was beginning to break down. It was at this point that questions relating to ownership of the idea of an AVF monitor began to arise, as well as in relation to Mr Kordzadeh's payments and expenses, although the latter seem to have been resolved at the time.

131 There was some confusion in relation to an email dated 22 August 2023 in which Mr Martin said that, if Mr Kordzadeh wanted to be included as an inventor on the patent application, he would need to make a separate assignment. At the hearing Mr Martin said that his comments were based on advice from a colleague based on his incorrect questions and lack of understanding in relation to filing of the statement of inventorship (Form 7) for the patent application. He said that he thought the form was for people majorly involved in the project. I accept Mr Martin's evidence that he could have been confused as to the purpose of the Form 7, given that he is not a patent specialist. There was some discussion at the hearing as to whether it was ever said at the meeting referred to in the email dated 22 August 2023 that Mr Kordzadeh could not be named on the patent application as an inventor because he was not an inventor. Mr Martin agreed that nobody said this at the meeting, but disagreed that the reason why was because, at that time, everybody thought he was an inventor. Mr Martin said he remembered reading an email in relation to telling Mr Kordzadeh that he was not an inventor, but could not remember if it was in the bundle, and seemed unsure on this point, although he did assert that there had been such an email.

132 In the period leading up to the filing of the PCT application, it is apparent that disagreements over inventorship began to emerge between the claimant and the defendant. By September 2023 it seems that Mr Martin considered MGE to be the

owners of the intellectual property, whilst Mr Kordzadeh considered that he was the inventor and therefore owned the patent applications.

133 Having considered the evidence both in the documents and given orally at the hearing for the period leading up to the filing of the patent applications, I am not convinced that this evidence assists in determining who invented the inventive concept. Peoples' assumptions, misunderstandings and disagreements could have been based on any number of factors, and I find that the evidence does not paint a clear picture as to who the relevant people understood to be the inventor at that time, let alone indicating who might actually have devised the inventive concept. I note that this is consistent with Jacob LJ's finding in *IDA*, where he held at paragraph 22 that "*the views held at the time as to who should own what, in the absence of any agreement, do not assist.*"

5.5. Summary of findings

134 In summary, I have made the following findings of fact in relation to events concerning the devising of the inventive concept:

a) Mr Kordzadeh claims to have arrived at the inventive concept through consideration of a number of academic papers, based on his experience with AVFs, and claims to have communicated this to Professor Shirvani and Dr Parsa in his 2 April 2018 proposal. I found Mr Kordzadeh's evidence as to how he came up with the inventive concept to be somewhat unclear, but nevertheless accepted that, as a renal vascular surgeon with a particular interest in AVFs, he had a broad and extensive knowledge of the field prior to the compilation of the 2 April 2018 proposal, including existing problems with monitoring AVFs.

b) Professor Shirvani claims to have developed the original idea by exposure to the problems with existing methods of monitoring AVFs (e.g. BlueDop) through his cousin's experiences, and identified the solution of using a strain-gauge-based sensor through his experience with using such sensors in other projects. I found it more likely that Professor Shirvani's account of events between 2010 and 2018 is generally accurate, rather than being fabricated or misremembered. I also found that Professor Shirvani's account includes development of many of the features of the inventive concept, including a blood flow monitoring device comprising a sensor configured to be placed against skin of a user to collect data indicative of movement of the skin caused by blood flow through a blood vessel in a region under the skin, and a controller for determining a blood flow parameter based on this data. The sensor would thereby determine if blood flow was impaired, with continuous monitoring capability by way of dynamic strain analysis.

c) I found that Mr Kordzadeh's and Professor Shirvani's respective interests in the problems concerning monitoring AVFs developed independently. I however found that Professor Shirvani's evidence makes clear the causal link between his account of devising the invention and the subject matter of the patent applied for, whilst this causal link is not clear in Mr Kordzadeh's evidence.

d) I found that, on the balance of probabilities, the 2 April 2018 proposal arose out of discussions between Mr Kordzadeh, and Professor Shirvani and Dr Parsa, although I made no conclusion as to when the proposal was originally produced. I found that the proposal did not disclose the inventive concept I identified and that Mr Kordzadeh's 2 April 2018 proposal, and its manner of communication, does not provide sufficient evidence to demonstrate, on the balance of probabilities, that Mr Kordzadeh devised the inventive concept of the patent applications.

e) In relation to the 30 April 2018 meeting, I found that, whilst it seemed likely that matters such as what parties wanted to get out of the meeting were discussed, and the evidence suggests Mr Kordzadeh's paper would have been discussed at the meeting, I did not have a great deal of confidence in the accuracy of the witnesses' recollections as to whether any specific features of the inventive concept were discussed at the meeting beyond the general idea and perhaps the idea of using dynamic strain analysis for continuous, portable monitoring, nor who brought such discussions to the meeting if they were discussed. I therefore found that it did not greatly assist me in determining the question of inventorship.

f) I found that the first grant application suggests a clear intention for Mr Kordzadeh to be involved in the project and bring his medical expertise and access to patients, as well as being a representative of potential users of the products from a medical perspective. I however found that the reference to his role in "device definition" does not imply that he would be responsible for the design or invention of the device, but more likely that his role would be to ensure the device provided the right data in the right format for medical clinicians. I found that the first grant application did not get the claimant to where he seeks to get in proving, on the balance of probabilities, that he was the deviser of the inventive concept of the patent applications.

g) I found that the test setups described in the second grant application were likely to have been carried out by Professor Shirvani and Dr Butt during 2017 and 2018, and were therefore carried out independently of any input from Mr Kordzadeh's 2 April 2018 proposal or from the 30 April 2018 meeting. In relation to the tests carried out during 2021 and 2022, I found that the most likely version of events is that Dr Mohaghegh independently developed the test setups and, through reading the academic literature including those provided by Mr Kordzadeh, and his own research, arrived at a setup that would effectively emulate a real AVF. I found that Mr Kordzadeh probably did discuss with Dr Mohaghegh the requirements of the test setup, based on his knowledge of real AVFs, but this merely confirmed Dr Mohaghegh's work rather than directly influence the test setup, and perhaps provided further background information on AVFs and on clinical practice relating to AVFs. But I found that, on the balance of probabilities, this did not further Mr Kordzadeh's case that he contributed to the inventive concept in discussions on the test setups.

h) I found that Dr Mohaghegh and Professor Shirvani independently determined the relevant parameters and worked out how to transform the waveform data into clinically relevant data. Whilst Mr Kordzadeh may have inputted into discussions, I found that his inputs did not directly lead to the inventive concept,

but rather supplemented information already obtained by Professor Shirvani and Dr Mohaghegh, much of which was in any case in the public domain. I found that evidence both in the documents and given orally at the hearing for the period leading up to the filing of the patent applications did not assist in determining who invented the inventive concept.

135 Both parties used the documents in evidence as a basis for arguing that their version of events was more likely to be correct than the other side's version of events. As can be seen from my conclusions above, these documents do not, however, definitively decide the matter as to whether the claimant was the actual devisor of the inventive concept in the patent applications. It is clear that Mr Kordzadeh has considerable experience with AVFs, and I do not doubt his drive for better patient care for patients undergoing haemodialysis. The poster submitted with his proposal of 2 April 2018 indicates a significant interest in this. At the hearing Mr Kordzadeh came across as passionate about the benefits of the invention in a clinical setting. I accepted his evidence that he had discussions with Professor Shirvani and Dr Mohaghegh in relation to the invention, the test setups, and relevant parameters for both the test setups and for displaying relevant results. But the claimant has not established that Professor Shirvani's narrative as to how he first came up with the idea for the invention is wrong. I do not accept Mr Smith's statement that Professor Shirvani was "a man with a strain gauge who was looking for a project to use it in." Rather, I consider that Professor Shirvani was aware of the problems with AVFs through the experience of his cousin and, through his work on strain gauges in other contexts, identified that they could provide a solution for better AVF monitoring.

136 I find Mr Kordzadeh's evidence as to how he devised the inventive concept to be less clear. I have found that his proposal of 2 April 2018 did not disclose the inventive concept, only referring in very general terms to a sensor. Rather, the proposal deals with the clinical and cost benefits of such a sensor. Moreover, I note Mr Kordzadeh's own evidence that information in the proposal was retrieved from the Internet. It is not therefore clear to me when and how Mr Kordzadeh believes he devised the inventive concept, or precisely how or when it was communicated to Professor Shirvani and MGE. Whilst Mr Kordzadeh suggested that it was communicated at the 30 April meeting, there is little in the evidence in relation to what discussions took place in that meeting, or in other meetings that subsequently occurred, and Mr Kordzadeh did not clearly explain how he communicated the inventive concept at these meetings or in other discussions.

137 Referring to the inventive concept I have identified above, particularly noting that I have found that it includes a sensor that measures movement of the skin, and collects data over a period of time, weighing all the evidence and considering my conclusions above in relation to that evidence, it seems to me to be more likely that it was Professor Shirvani who came up with the original idea for such a device, and that this idea was developed with Dr Mohaghegh. I have accepted Dr Mohaghegh's evidence that he was aware of the relevant parameters and of how to translate the waveform into clinically significant data, either because such information was well known, or readily available from the literature. Whilst I consider it likely that Mr Kordzadeh did have discussions with Professor Shirvani, Dr Mohaghegh and Mr Martin in which he shared his expertise, and it is possible that he independently identified the possibility of a sensor for continuous monitoring, it is not apparent that

these discussions provide the necessary causal link between any inventive activity by Mr Kordzadeh relating to the inventive concept and the filing of the patent applications. This was not helped by the lack of written or oral evidence as to the content of these discussions. Moreover, I note that the onus is on Mr Kordzadeh to prove, on the balance of probabilities, that he was the sole deviser of the inventive concept. Given my findings of fact summarised above, I do not consider Mr Kordzadeh to have discharged this onus.

138 Considering all the evidence provided in the witness statements and attached exhibits, and the oral evidence given at the hearing, I therefore conclude that, on the balance of probabilities, Mr Kordzadeh did not devise the inventive concept I have identified in the patent applications. He case therefore fails, and Professor Shirvani and Dr Mohaghegh are the devisers of the inventive concept. It is not in dispute that MGE derives the right to the applications from Professor Shirvani and Dr Mohaghegh. The applications will therefore proceed in the name of MGE.

6. Conclusion

139 I have found that Mr Kordzadeh is not the inventor of the inventive concept of the applications which are the subject of these proceedings. but rather that Professor Shirvani and Dr Mohaghegh are the joint inventors of the inventive concept. I therefore conclude that MG Electric is entitled to the applications. Since MG Electric is currently the sole named applicant, I need make no order in this regard.

140 I invite the parties' submissions on the matter of costs.

7. Appeal

141 Any appeal must be lodged within 28 days after the date of this decision.

Dr B MICKLEWRIGHT
Deputy Director, acting for the Comptroller