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**PATENTS ACT 1977**

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| APPLICANT | Dr. Wei Wu |
| ISSUE | Estoppel, Excluded Matter, Inventive Step, Sufficiency |
| HEARING OFFICER | Ben Buchanan |

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**DECISION**

**Background**

1 This decision relates to the issue of whether the application, GB1604161.8, meets the requirements of sections 1(2), 3, and 14(3) of the Patents Act 1977 ("the Act").

2 The application is the national phase of an international application (WO2015/048927) with a filing date of 7 September 2014 and a priority date of 6 October 2013. The application was first examined by this office on 23 April 2019 and in his letter accompanying the examination report, the Examiner notified the Applicant that the compliance period under rule 30(2)(b) was extended until 23 April 2020. Several rounds of correspondence and amendment ensued, but the Applicant was unable to persuade the Examiner that the application met the requirements of the Act. In his letter of 17 January 2020, the Examiner invited the Applicant to request a hearing to resolve the disagreement. The Applicant responded on 2 February, requesting that a hearing officer decide the matter on the papers, and submitted amended claims and supporting remarks.

3 In his final report dated 6 March 2020 the Examiner acknowledged these new claims, summarised the issues in dispute and reminded the Applicant that the compliance period was due to expire on 23 April. He took the opportunity to explain that a request to extend the compliance period as of right by two months could be filed retrospectively, until 23 June 2020, and advised the Applicant not to do so until shortly beforehand. However, as a result of the Coronavirus pandemic the Office has declared 24 March 2020 and subsequent days until further notice to be "interrupted days". This means that the compliance period of 23 April 2020 will be extended until the next uninterrupted day, and that an as of right extension to the compliance period, of two months, may now be requested in advance, or retrospectively any time in the two months following the first uninterrupted day. At the time of writing, the Office has not yet announced when the period of interrupted days will end.

4 My analysis is based upon the claims and the associated comments filed by the Applicant on 2 February 2020.

5 The specification including the claims, the objections raised by the Examiner and the Applicant's arguments and observations can all be viewed at the IPO's online file inspection service:

https://www.ipo.gov.uk/p-ipsum.htm

**Subject matter**

6 The invention relates to the field of what the Applicant calls "auscultation". As the Examiner notes in his very helpful report dated 6 March 2020, this is referred to by others as "audification". It basically amounts to making a collection or series of data audible in order to analyse it. As the application explains, a simple example of auscultation is the function of a stethoscope; in order to monitor the physical beating of a heart, which could be visualised with an electronic pulse meter, echocardiogram or an invasive operation, a stethoscope is employed to translate the physical movement into an audible signal. Of course, the precise condition analysed and detected is different in each case but in each case the beat of the heart can be detected. The stethoscope audifies the beat of the heart.

7 So any signal which varies within the time domain can be audified, by converting it into a suitable electronic signal and playing it back through an audio transducer. In order for it to be detectable by the human ear, and subject to the characteristics of the equipment used, it may be necessary to alter the amplitude and/or frequency to enable the features of such an audified signal to be heard and analysed.

8 The present invention is distinctive because it provides a means for auscultating a signal which *does not vary with the time domain*, and is also compatible for use with a time-varying signal in a way which, the Applicant alleges, is different from the prior art. The Applicant's letter of 6 January 2020 is most helpful in clarifying the problem to be solved and the steps employed by the invention to do so. The example used is to auscultate topographic data. Now, topographic data could be associated with the time domain, for example if an aircraft or satellite were to fly overhead taking readings. But what if the topography is displayed in a photograph?

9 In this case, the method provides for the analysis of the data (for example using a tool such as MATLAB) to extract the fluctuation (signal) of interest, for example the ridgeline of a range of hills. These data points, representing a "waveform" of the profile of the ridgeline, are then transformed into an audible signal and played through an audio player to realise auscultation. The application is not wholly explicit as to how this transformation takes place, but it is my understanding that each data point will coincide with a portion of the audible signal and the amplitude of the signal for that point will represent the value of the data point. This may occur at a particular frequency (associated with the data point) and the signal as a whole may comprise different data points at different frequencies. Thus, as the auscultated signal is played back, the amplitude will vary with the height of the topography determined by analysing a photograph. A listener could therefore identify the characteristics of the topography, including height and gradient by listening to the auscultated signal. Another non-time variant example is statistical data (presumably a snapshot in time).

10 The waveform of interest (derived from signal A) is described as being "mapped" into the audible signal (B) by "combining…with an audible play rate". Allegedly in contrast with the prior art it is not simply slowed down or sped up to shift or compress the originating frequency to within the audible range. Rather the play rate is identified and the waveform of interest (from signal A) is "combined" with it. This distinction is difficult to grasp and is dealt with further below, but what it does not appear to be is *amplitude modulation*. A characteristic of the waveform (from signal A) is adapted for the time domain and changed to make it audible. It is not combined with a carrier signal as in amplitude modulation[1]. In the case of a non-time-variant signal (such as topography) this mapping enables data points to be played back as a signal within the audible range. Somewhere therein lies the distinction of the "mapping/combining" operation, allegedly new and inventive and equally applicable for the case when the original signal A is time-variant:-

11 The invention may also be used to auscultate time-variant data by stripping the time series from the dataset, retaining the values of the data no longer associated with respective points in time, and applying the method of the invention. The method may be used when the sampling rate of the data is clearly unsuitable for audible detection e.g. if the data were a daily stock price, or measured in MHz.

12 I think I can summarise my understanding of the way the invention works, then, by saying that if the amplitude of data varies with a characteristic sampling rate in a "x" domain which may be plotted on the x-axis (e.g. distance in the topography example), in order to be able to play the signal back as an audible signal, the x domain is replaced by a time domain. The sampling rate of the data is mapped to the time domain such that when played back at the resultant play rate the combined signal is audible.

13 It strikes me that in order for the auscultated signal to make sense i.e. for a listener to be able to determine where in a photograph is the highest point of topography, a relationship between the extracted data and the auscultated signal must be maintained so that the point in the signal where the maximum height was detected can be mapped to the appropriate point in the photograph. The same goes for an auscultated time-variant data set. If a particular characteristic is identified (say, a daily stock price increasing past a capitalisation threshold) it would be helpful to be able to go back to the original data to identify when it happened. This is covered by the amended specification towards the end of section [0051] which refers to comparing the sampling rate and the play rate.

**The law**

14 The relevant law is defined in sections 1(2), 3, and 14(3) of the Act and can be viewed online at the IPO's website:

The Act: https://www.gov.uk/guidance/the-patent-act-1977

[1] https://en.wikipedia.org/wiki/Amplitude_modulation

The Manual of Patent Practice explains the IPO's practice under the Act and makes helpful references to case law. The Manual can be viewed online at the IPO's website: https://www.gov.uk/guidance/manual-of-patent-practice-mopp

In particular, sections 1.18-1.25.1 (which set out the test for excluded subject matter under section 1(2)) & 1.35-1.39.2 (which refer specifically to a program for a computer under section 1(2)(c)) are relevant; sections 3.11-3.45 which elucidate the relevant test for inventive step under section 3, and 14.60-14.88 which relate to sufficiency under section 14(3) are also helpful.

15 There is no dispute concerning the relevant law and its application to the facts of this case.

**The claims**

16 There are two independent claims. The first, claim 1, is to a method for auscultating inaudible signals. The second, claim 7, is to an apparatus for auscultating inaudible signals and defines hardware which is configured to carry out a method equivalent to that defined in claim 1.

17 Claim 1 reads as follows:

1. A method for auscultating inaudible signals, wherein the method comprises:

Obtaining an inaudible signal data A, wherein the inaudible data A, including data having no temporal properties, represents physical parameter changes configured to be expressed in a waveform format;

processing the inaudible signal data A, wherein processing the inaudible signal data A includes extracting a waveform from the inaudible signal data A by ignoring parameters other than the waveform or only copy waveform data from the signal data A, and the waveform after extraction is exactly the same as the waveform of the inaudible signal data A; or

processing the inaudible signal data A, wherein processing the inaudible signal data A includes extracting a waveform from the inaudible signal data A by ignoring parameters other than the waveform or only copy waveform data from the signal data A and the waveform after extraction is exactly the same as the waveform of the inaudible signal data A, and normalizing the extracted waveform;

mapping the extracted waveform into an audible signal B, wherein mapping the extracted waveform includes combining the extracted waveform with an audible play rate to constitute the audible signal B; and

outputting the audible signal B with an audio player device to realize the auscultation of the signal A;

wherein said method for auscultating inaudible signals, in case of the inaudible signals including voltage change of an electronic circuit, the voltages are auscultated by said method and by way of comparing the auscultation results, it is helpful to understand the electromagnetic interference distribution on the board.

18 Claim 7 reads as follows:

> 7. An apparatus for auscultating inaudible signals, comprising:
>
> a signal data acquisition unit configured to obtain an inaudible signal data A, wherein the signal data acquisition unit includes an analog-to-digital sampling unit and the inaudible signal data A, including data having no temporal properties, represents physical parameter changes configured to be expressed in a waveform format;
>
> a signal processing unit configured to process the inaudible signal data A and map a processed waveform into an audible signal B, wherein the signal processing unit includes a calculation unit and storage unit; and
>
> an audio play device configured to output the audible signal B, wherein the audio play device includes a digital-to-analog conversion unit and an electric-to-acoustic conversion unit;
>
> wherein processing the inaudible signal data A includes extracting a waveform from the inaudible signal data A by ignoring parameters other than the waveform or only copy waveform data from the signal data A, and the waveform after extraction is exactly the same as the waveform of the inaudible signal data A, and normalizing the extracted waveform where the normalizing is an option, and mapping the processed waveform includes combining the extracted waveform with an audible play rate to constitute the audible signal B;
>
> wherein said apparatus for auscultating inaudible signals, in case of the inaudible signals including voltage change of an electronic circuit, the voltages are auscultated through said apparatus and by way of comparing the auscultation results, it is helpful to understand the electromagnetic interference distribution on the board.

## Arguments and analysis

19 Construction of the claims has been discussed throughout the processing of this application. Some of the language of the claims is a little obscure in that it is not clear whether specific features are essential or not. For example "*including* data having no temporal properties" would seem to specifically include non-temporal data within the set of temporal and non-temporal data (and so not to limit the claim to data having no temporal properties); "*in case of* the inaudible signals *including* voltage change of an electronic circuit…and by way of comparing the auscultation results…to understand the electromagnetic interference distribution on the [circuit] board" suggests the inclusion of voltage signals within an electronic circuit to monitor interference (but not to the exclusion of other types and origins of signals). In both of these cases it seems the feature is included but not limited to being essential.

20 The Applicant suggested, together with filing amendments, in a letter dated 6 January 2020 a particular construction. The Examiner accepted this in his report dated 17 January. Although the amendments subsequently filed on 2 February 2020 introduce the conditional "electronic circuit" limitation, on the face of it this does not seem to limit the essential scope of the claims, as discussed above (although I will return to this point later). With this in mind, I will take, as the starting point for my analysis, the agreed construction of claim 1 set out in the examination report of 17 January without the conditional limitation:

> *A method for auscultating inaudible signals, wherein the method comprises:*

*i) obtaining data A by sampling a variable at a sampling rate (the data having temporal properties), or extracting it from an existing dataset (the dataset having no temporal properties), wherein parameters other than the amplitude of the variable (waveform) are not recorded in the data, or only waveform data from the signal data A are copied;*

*ii) combining the data of waveform A with an audible play rate to constitute an audible signal B, and outputting the audible signal B with an audio player to realise the auscultation of signal A.*

21 I agree with the Examiner's comment in his report of 17 January 2020 that, as the claim is currently worded, normalising the data is optional.

22 Claim 7 to the apparatus is, I think, easier to construe:

*Apparatus comprising:*

*i) a signal data acquisition unit having an analogue-to-digital sampling unit;*

*ii) a signal processing unit having a calculation unit and a storage unit; and*

*iii) an audio play device having a digital-to-analogue conversion unit,*

*iv) all of which is configured to carry out a method equivalent to that of claim 1.*

23 Claim 7 also references the specific case of voltage signals within an electronic circuit representing interference, but the feature is not understood to be essentially limiting here either. Moreover, unlike a method claim, defining apparatus by reference to another item with which the apparatus could interact with is not considered limiting where there are no complimentary characterising features associated with that interaction.

*Patentability under section 1(2)*

24 The Manual of Patent Practice explains the IPO's practice under the Act and makes helpful references to relevant case law. In particular the *Aerotel/Macrossan*[2] approach to assessing excluded matter and the *AT&T/CVON*[3] signposts as amended in *HTC v Apple*[4] which provide guidance in considering whether a computer program provides a technical contribution. The Examiner has referred to each of these precedents in his examination report of 17 January 2020 in arguing that the claims do not define a patentable invention because they relate only to a program for a computer as such and so the application as it stands is excluded under section 1(2)(c).

25 The Applicant contends that the Examiner is estopped from raising the excluded matter objection in his fifth report, having not raised it previously. I disagree. The

[2] Aerotel Ltd v Telco Holdings Ltd (and others) and Macrossan's Application [2006] EWCA Civ 1371
[3] AT&T Knowledge Ventures LP and CVON Innovations Limited v Comptroller General of Patents [2009] EWHC 343
[4] HTC v Apple [2013] EWCA Civ 451

matter was considered by the Comptroller in *Logined*[5] (see paragraph 10) and for the reasons stated therein, I do not accept that estoppel applies here. In a nutshell, Examiners are required by statute to ensure the validity of patents before they are granted. Nothing in the Act or Rules prevents an Examiner from raising or reinstating an objection under the Act throughout the examination stage to fulfil this obligation. The issue of whether a decision of the Comptroller arising from ex parte proceedings can give rise to estoppel has been considered in *Motorola*[6] (paragraphs 10-16) and *Balfour Beatty*[7] (paragraph 38). They are relevant to this decision only in respect that they acknowledge that a decision of the Comptroller is a final decision and may give rise to estoppel. A decision of an Examiner is not a final decision of a tribunal, and correspondingly an Applicant is permitted to argue against the decision. Estoppel does not apply.

26 Nonetheless, I can deal with the issue of patentability very quickly. The relevant law and the arguments of the Examiner and the Applicant are set out in correspondence. I will not repeat them here, for it seems to me that the contribution defined by the claims is clearly directed towards processing a signal representing a physical entity. Even if that signal is a daily stock price (as in one embodiment and hence arguably not in itself "technical"), the signal is then *transformed into a format which can be played and heard*, which also forms part of the contribution[8]. Notwithstanding the novelty and inventiveness of the claimed invention (which of course is a separate consideration), the contribution seems to me to clearly have a technical effect on a process carried on outside the computer and so to meet the requirement of signpost (i)[9]. It also seems to me to solve a technical problem; that of rendering an inaudible dataset audible. That meets signpost (v)[10] and reaffirms the existence of a technical effect.

27 I therefore find that the claims do not define an invention excluded from patentability under section 1(2)(c).

*Sufficiency under section 14(3)*

28 Turning to the objection of sufficiency raised by the Examiner, he argues that the skilled person has not been taught any technical way by which to determine the audible play rate. Rather, they would have to rely on trial and error. In response, the Applicant contends that "an audible play rate" is part of the common general knowledge of the skilled person who would be able to select it without difficulty.

29 Section 14(3) of the Act requires that the invention be disclosed completely enough to be performed by a person skilled in the art. Two fundamental principles underlying sufficiency are that substantially the whole scope of the claim should be enabled[11]

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[5] Logined B.V. BL O/550/16
[6] Motorola Solutions, Inc BL O/030/20
[7] Balfour Beatty plc BL O/369/19
[8] Step (ii) of the "Aerotel test"
[9] the "AT&T signposts"
[10] the "AT&T signposts"
[11] from Biogen Inc v Medeva plc [1997] RPC 1

and that the disclosure should not be so ambiguous as to make it impossible to know whether one has worked the invention or not[12].

30 The skilled person will bring the common general knowledge to the task and can be required to do some routine work, provided that there is no act of invention, nor an undue burden, in putting the whole of the claim into practice.

31 To work the present invention, three things would have to happen. Firstly, a waveform without temporal properties is generated (either directly because no such property exists or by divorcing time data from the amplitude data of the waveform), secondly an audible play rate is determined, then thirdly these two are combined.

32 The question here is whether the application describes the process in sufficient detail to allow a skilled person to carry it out across the entire scope of the claims. When I first read the claims in isolation, I understood the method to amount to amplitude modulation of an audible carrier signal with the amplitude representing the original waveform. However, notwithstanding whether that is novel and inventive, amplitude modulation is not supported by the description (although it would seem to fall within the scope of the wording of the claim). That, then, cannot be the invention claimed by the application. So what does the specification describe in enough detail for the skilled person to work the invention?

33 Turning to the description, I have found it very difficult to work out clearly how the extracted waveform is "mapped" into an audible signal B, including "combining" the extracted waveform with an audible play rate. If it is not by amplitude modulation, what else could be intended?

34 The Applicant's letter of 6 January 2020 very helpfully explains how a waveform could be derived from non-temporal data. In the examples used, the data is topographical data representative of a portion of the surface of the moon and statistical data representative of the tasks running on a computer. The subsequent sections explain the difference between signals A and B, but regrettably stop short of explaining the steps of "combining" or "mapping" (beyond mere assertion and reference to paragraphs of the description) and so this letter is of no further help in assisting my understanding of the description.

35 The closest explanation I can identify within the description for how the invention is practised are found at paragraphs [0052] and [0056] of the description as filed which state:

*Specific process is, change the conversion rate of the D/A digital/analog conversion unit 31 to change the play rate of the audio play device, meanwhile listen the sound from audio play device until the play rate reaches…the signal at Fig. 4(a) is mapped to a signal with… a clear noise and regular crackling sound is heard;*

*Considering that an audio play device normally plays the audio file in a play rate equals the sampling frequency of the audio signal, in this embodiment we replace the "sampling frequency" in WAV file heard with the paly [sic] rate of a mapped audio file.*

[12] from Anan Kasei v Neo Chemicals [2019] EWCA Civ 1646

36 From that I discern that the sampling rate and the play rate are independent (confirmed in original paragraph [0018]) and that the mapping is such that the inaudible data is rendered audible. It is hard to be certain of much more in terms of the general concepts, but I think it is key that the sampling and play rates are independent – they must be in order to enable auscultation of non-time variant data.

37 Original paragraphs [0052] and [0056] and the accompanying figures 4(a) – 4(d) are restricted to the specific embodiment of signals representing voltage change of an electronic circuit. In this embodiment, I think there is sufficient detail to enable the skilled person to be able to glean how the invention maps the waveform in this specific context. However, “mapping” and “combining” in the context of the full breadth of the claims are general terms and it is not clear how the method can be realised across the full range of applications which fall within the present scope of claim 1.

38 As noted above, the claims in isolation do not appear to exclude combining the waveform of signal A with a carrier signal such as in amplitude modulation. However, the description does not support that interpretation. The description (e.g. at paragraph [0052] quoted above) seems to support frequency shifting as a means of mapping an inaudible signal having a sampling rate to an audible play rate and it might be considered as a “combination” of a waveform with a play rate but that would be at odds with the earlier declaration that the sampling and play rates are independent.

39 Whilst apparently suitable techniques for “combining” such as amplitude modulation and frequency shifting may be discounted based on their absence from the specification or inconsistency with independence, it is not clear what *is* meant by the term beyond the narrow teaching of embodiments 1-6 in original paragraphs [0052] onwards which all relate to voltage change of an electronic circuit. This uncertainty reaches to the heart of the issue in that the skilled person would be unable to perform the actual scope of the invention because the terminology defining and supporting the full breadth of the claims is ambiguous.

40 In the absence of a clear explanation of how the mapping and combination steps are carried out beyond the limited embodiments described (but to which the claims are not limited), I must conclude that the claims as they stand are insufficient under section 14(3) due to excessive claim breadth.

41 Having reached this conclusion I have to ask, how would claim 1 be understood if the conditional limitation to the electronic circuit were essentially applied? I note that in the Applicant’s latest response, the comments regarding patentability suggest that the intention may have been to limit the claim in this way (albeit unsuccessfully).

42 If the conditional limitation of claim 1 relating to the electronic circuit is applied, I think the skilled person would have the guidance within the worked embodiments to both work the invention across its full scope and to understand how to interpret that scope. In the context of its limitation to *inaudible signals representing voltage change of an electronic circuit and electromagnetic interference distribution*, the monopoly of the invention would be appear to be sufficiently disclosed and enabled.

*Inventive step under section 3*

43 I am reluctant to make a formal finding on the inventiveness of the presently claimed invention. This reluctance is on the basis that I cannot clearly discern how the full scope of the invention works because as it is presently claimed it is insufficient under section 14(3). I therefore make no finding under section 3 except where claim 1 would be understood as being limited to *inaudible signals representing voltage change of an electronic circuit and electromagnetic interference distribution*, as follows:-

44 Following the steps set out in *Windsurfing/Pozzoli*[13,14]

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

45 In his report dated 17 January 2020, the Examiner suggested this is someone who uses audification to analyse large data sets. This has not been disputed by the Applicant and I find it to be a reasonable assessment of the skilled person.

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

46 The Examiner has identified "The Sonification Handbook", 2011, Logos Verlag Berlin GmbH, and in particular chapter 12: "Audification" as forming part of the state of the art of the skilled person. The Applicant has not disputed this and I also agree. This would form part of the common general knowledge.

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

47 There is no dispute between the Examiner and Applicant as to the inventive concept and I consider it to be the same as the construction of the claim set out above but, as I have explained above, for the purposes of a meaningful analysis I am applying the limitation to *inaudible signals representing voltage change of an electronic circuit and electromagnetic interference distribution*.

(3) Identify what, if any, differences exist between the matter cited as forming part of the "state of the art" and the inventive concept of the claim or the claim as construed;

48 The state of the art does not hint at the audification of *voltage change of an electronic circuit,* much less to *signals representing electromagnetic interference on a circuit board* and therefore there is no useful starting point, beyond audification of time-variant signals by frequency shifting, as noted in the Examiner's report dated 17 January 2020. The differences may therefore be summarized as auscultating data, applicable to non-time-variant data, by extracting a waveform and mapping it to an independent audible play rate, applied to the specific field of *voltage change of an electronic circuit…to understand the electromagnetic interference distribution on the board*.

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

(4) Viewed without any knowledge of the alleged invention as claimed, do those differences constitute steps which would have been obvious to the person skilled in the art or do they require any degree of invention?

49 Given the lack of an appropriate starting point for auscultating *voltage change of an electronic circuit…to understand the electromagnetic interference distribution on the board* and the independence of the sampling and play rate in mapping an extracted waveform into an audible signal, it would not be obvious to the skilled person how to auscultate inaudible signals to understand the electromagnetic interference distribution on a circuit board as claimed when the conditional limitation is applied to claims 1 & 7.

**Conclusion**

50 This application is not excluded under section 1(2) but the claims as currently drafted do not meet the requirements of section 14(3). The obscurities in the claims may be overcome by clearly limiting claim 1 to define signal data A being voltage change of an electronic circuit representing electromagnetic interference distribution on a circuit board. A similar limitation should be applied to claim 7. I therefore remit the application to the Examiner to await a response from the Applicant to address this point and to ensure that the requirement for an inventive step under section 3 is consequently satisfied. I set a deadline for response of 28 days after the date of this decision. Should no response be received by the end of the response period (or an allowable extension period), the application will be refused under section 18(3) for failing to comply with section 14(3) of the Act.

51 As I noted in the introduction, the compliance period will end on the first uninterrupted day and may be extended as of right by two months by filing a Form 52 and the appropriate fee. If the Applicant intends to pursue the application, I strongly suggest that an extension would greatly facilitate the process of re-examination within a reasonable timescale.

**Appeal**

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

Ben Buchanan

Deputy Director, acting for the Comptroller