Commissioner's Decision #1424

Décision du Commissaire n^{o} 1424

TOPIC: O-00 Obviousness

SUJET: O-00 Évidence

Application No: 2,803,394

Demande n^{o}: 2 803 394

IN THE CANADIAN PATENT OFFICE

DECISION OF THE COMMISSIONER OF PATENTS

Patent application number 2,803,394, having been rejected under subsection 30(3) of the *Patent Rules* (SOR/96-423), has consequently been reviewed in accordance with paragraph 30(6)(*c*) of the *Patent Rules*. The recommendation of the Board and the decision of the Commissioner are to refuse the application.

Agent for the Applicant

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INTRODUCTION

[1] This recommendation deals with a review of the rejection under subsection 30(3) of the *Patent Rules* of patent application number 2,803,394 entitled "Brushless DC motorization apparatus." The Applicant is Bionx Canada Inc.

[2] The application relates to electric motors used to power vehicles such as bicycles, scooters, tricycles and golf carts. It was rejected by the Examiner on the grounds of obviousness under section 28.3 of the *Patent Act*.

[3] For the reasons that follow, we recommend that the application be refused.

PROCEDURAL HISTORY

[4] The application was filed on July 20, 2011. Examination culminated with the issuance of a Final Action ("FA") dated December 29, 2014, in which the application was rejected on the grounds of obviousness. In its response to the FA ("R-FA") dated March 30, 2015, the Applicant argued that the subject-matter of the claims would not have been obvious to the person skilled in the art at the relevant date.

[5] The application was forwarded to the Patent Appeal Board on June 10, 2015 along with a Summary of Reasons ("SOR") setting out why the Examiner maintained that the claimed invention would have been obvious. The SOR was forwarded to the Applicant on July 27, 2015.

[6] The present panel was formed to review the application under paragraph 30(6)(*c*) of the *Patent Rules*. In a letter sent to the Applicant dated April 13, 2017 (the "Panel Letter"), we set out our preliminary view as to why, based on the record before us, the subject-matter of the claims would have been obvious. The Panel Letter invited the Applicant to provide written submissions on our preliminary view and proposed a date for a hearing on the matter.

[7] In a letter dated April 27, 2017, the Applicant indicated that the proposed hearing date was acceptable. However, the Applicant subsequently indicated via an email dated May 8, 2017 that it would not be attending the hearing and that it would await our recommendation. The Applicant neither provided further written submissions nor

disputed our preliminary view outlined in the Panel Letter. The Applicant's last submissions on the matter are therefore those outlined in the R-FA, previously taken into consideration when we formed our preliminary view.

[8] Accordingly, as there are no new submissions from the Applicant on record for the Panel to consider, our preliminary view on the matter outlined in detail in the Panel Letter forms the basis for our conclusion that the claimed subject-matter would have been obvious.

ISSUE

[9] The issue addressed in this recommendation is whether the subject-matter of claims 1-10 would have been obvious to a person skilled in the art, contrary to section 28.3 of the *Patent Act*.

LEGAL PRINCIPLES AND PATENT OFFICE PRACTICE

Claim construction

[10] In accordance with *Free World Trust v Électro Santé Inc.*, 2000 SCC 66 essential elements are identified through a purposive construction of the claims done by considering the whole of the disclosure, including the specification and drawings (see also *Whirlpool Corp v Camco Inc.*, 2000 SCC 67 at paras. 49(f) and (g) and 52). In accordance with the *Manual of Patent Office Practice* §13.05, the first step of purposive claim construction is to identify the person of ordinary skill in the art and their relevant common general knowledge. The next step is to identify the problem addressed by the inventors and the solution disclosed in the application. Essential elements can then be identified as those elements of the claims that are required to achieve the disclosed solution.

Obviousness

[11] The *Patent Act* requires that the subject-matter of a claim not be obvious. Section 28.3 of the Act provides as follows:

> 28.3 The subject-matter defined by a claim in an application for a patent in Canada must be subject matter that would not have been obvious on the claim date to a person skilled in the art or science to which it pertains, having regard to

> (a) information disclosed more than one year before the filing date by the applicant, or by a person who obtained knowledge, directly or indirectly, from the applicant in such a manner that the information became available to the public in Canada or elsewhere; and
>
> (b) information disclosed before the claim date by a person not mentioned in paragraph (a) in such a manner that the information became available to the public in Canada or elsewhere.

[12] In *Apotex Inc v Sanofi-Synthelabo Canada Inc*, 2008 SCC 61 at para. 67 (*Sanofi*), the Supreme Court of Canada stated that it is useful in an obviousness inquiry to follow the following four-step approach:

> (1)(a) Identify the notional "person skilled in the art";
> (b) Identify the relevant common general knowledge of that person;
> (2) Identify the inventive concept of the claim in question or if that cannot readily be done, construe it;
> (3) Identify what, if any, differences exist between the matter cited as forming part of the "state of the art" and the inventive concept of the claim or the claim as construed;
> (4) Viewed without any knowledge of the alleged invention as claimed, 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?

ANALYSIS

The application

[13] The application concerns the "motorization of electric vehicles using permanent-magnet synchronous machine such as brushless DC machines, for electric vehicles such as bicycles, rolling chairs, scooters, tricycles, golf carts, trolleys and small utility vehicles, or the like" (para [0002]).

[14] A lightweight brushless DC apparatus seems to be a theme that runs through the specification. Para [0003] states:

> In lightweight vehicle applications, it is often desired to produce high starting torque and to ensure variable assistance, whereby electric machines are well suited therefor as opposed to other types of motors or engines. The use of a brushless direct-current (DC) machine is particularly well adapted to these kinds of applications.

[15] Para [0004] indicates that "the weight of the machine components must be minimized, while not affecting the structural integrity of the machine." The Summary of the

Application at para [0005] similarly indicates that "it is a further aim of the present disclosure to have a brushless DC machine that is relatively lightweight."

[16] Claim 1 as it currently reads is representative of the claimed invention:

> A direct-drive brushless DC motorization apparatus comprising:
>
> an outer rotor with forty or forty-four poles constructed with segments of permanent magnet material alternatively magnetized north and south, the outer rotor adapted to be part of a wheel and rotating with the wheel about an axis thereof;
>
> a stator core of ferromagnetic material spaced inwardly of said rotor and defining a clearance gap with the rotor such that the rotor is rotatable about the stator core, the stator core having an outer diameter ranging between 150 mm and 350 mm, said stator core having forty-two slots and defining teeth between said slots; and
>
> a three-phase winding with coils of insulated wire being wound around the teeth of the stator core, the three-phase winding being divided in two sets of consecutive teeth for each of the three phases, with each of the two sets of a same phase being diametrically opposed in the stator core.

[17] Para [0029] suggests that the claimed invention is lighter in weight relative to machines having fewer poles, yet has a similar power output:

> The high number of poles reduces the iron volume. By increasing the number of poles, the flux per pole during operation is reduced as compared with a machine producing a similar power output with a lesser amount of poles. Accordingly, as the sectional dimensions of teeth are proportional to the flux, the sectional dimensions for a forty-two pole machine are smaller than the sectional dimensions for the teeth of a machine with fewer poles, for a similar power output. There results a lower weight for the forty-two pole machine when compared to machines having a fewer amount of poles for a similar power output.

Claim construction

The person skilled in the art and their relevant common general knowledge

[18] In the Panel Letter, we noted that the FA identified the person skilled in the art as "an electrical engineer specialized in the field of electric machine design" and explained that

such a person "can use electromagnetic simulation tools allowing him to quickly evaluate the electromagnetic performance of a particular machine design." The common general knowledge was said to include "the general theory of permanent magnet electric machines, particularly electric machines with concentrated windings."

[19] In the Panel Letter, we noted that the Applicant took issue with the Examiner's definition of the person skilled in the art in the R-FA but, for the sake of clarity, elected to focus on Steps 3 and 4 of the *Sanofi* approach to obviousness. The Applicant did not provide its view of the person skilled in the art. We therefore proceed on the basis of the definitions provided above.

The problem the inventors set out to address and its proposed solution

[20] In the Panel Letter, we noted that, according to the FA, the "problem that the present invention tries to solve is to find an optimal pole-slot combination in an outer-rotor permanent magnet machine with concentrated windings and a stator core having a diameter in the range between 150 mm and 350 mm." The combination would be optimal in terms of "starting torque and cogging torque, in terms of mechanical characteristics such as weight and structural integrity of the teeth and also in terms of non-technical characteristics such as fabrication cost." The "proposed invention is considered to be an outer-rotor permanent magnet electrical machine having optimal characteristics for a stator core having a diameter between 150 mm and 350 mm."

[21] In the Panel Letter, we observed that the R-FA did not address this assessment. We therefore now proceed on the basis of the assessments provided in the preceding paragraph.

The essential elements of the claims

[22] In the Panel Letter, we noted that the FA identified the essential elements of the claims as:

- an outer rotor with forty or forty-four permanent magnet poles;
- a stator core with an outer diameter ranging between 150 mm and 350 mm; and,
- a stator having forty-two slots.

[23] Since the R-FA did not indicate disagreement with the Examiner's identification of the essential elements, we therefore now proceed on the understanding that the essential elements of the claims are those identified in the FA.

Obviousness

The person skilled in the art and the relevant common general knowledge

[24] The person skilled in the art and the common general knowledge have been defined above.

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

[25] In the Panel Letter, we agreed with the Examiner's assessment that the inventive concept is the "discovery that an outer-rotor electric machine comprising forty two slots and forty or forty-four rotor poles has particular advantages when used as an in-wheel motor having a stator core in the range between 150 mm and 350 mm." The combination of these features was "deemed to be optimal in terms of electrical characteristics such as starting torque and cogging torque, in terms of mechanical characteristics such as weight and structural integrity of the teeth and also in terms of non-technical characteristics such as fabrication cost."

[26] Since the R-FA did not indicate disagreement with this inventive concept, it has been adopted for the purposes of this recommendation.

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

[27] Two references were cited in the FA as forming part of the "state of the art":

- Libert et al., *Investigation on pole-slot combinations for permanent-magnet machines with concentrated windings*, Proc. ICEM, pp. 530-535, December 31, 2004 (document "D2"); and,
- United States patent application 2004/104637 A1, published June 3, 2004 (document "D4").

[28] According to the FA, D2 discloses a direct-drive brushless DC motorization apparatus comprising a rotor with the claimed forty or forty-four poles when certain variables in an equation used to calculate appropriate pole/slot combinations are selected.

[29] In the Panel Letter, we did not agree with this assessment and explained that, in our view, the person skilled in the art would not see an explicit disclosure in D2 of the specific pole/slot combination claimed. We were thus not satisfied that D2 alone would have led the person skilled in the art to the specific combination claimed from amongst the many other possibilities.

[30] In the Panel Letter, we noted that the differences between D4 and the inventive concept were not discussed in the FA as part of the analysis to be done at Step 3 of the *Sanofi* approach to obviousness. D4 was mentioned in the FA as disclosing only "an outer-rotor in-wheel motor with concentrated windings".

[31] We noted that D4, much like the present application, "relates to a low cost electric system composed of a new DC brushless permanent magnet motor and its electronic drive which provides high efficiency operation and low torque ripple for the motorization of electric vehicles like, bicycles, rolling chairs, scooters, tricycles, golf cars, trolleys and small utility vehicles" (para [0002]).

[32] Concerning Figure 15 of D4, it shows a DC brushless motor coupled through its rotor to what appears to be a typical wheel of a bicycle. We concluded that it would seem to follow that the person skilled in the art would appreciate that the stator core is proportional to the rotor and wheel diameters and in the range typical of such arrangements, i.e., between 150 mm and 350 mm, and that there would therefore be no difference between D4 and the inventive concept in that respect.

[33] Of particular interest to us were claims 1 and 2 of D4. Claim 1 defines a brushless DC motor/generator similar to the apparatus of claim 1 of the present application. The apparatus of D4 is "characterized in that an additional two coils (7) per slot (18) with predetermined connection patterns: C, C′, C, C′, B′, B, B′, A′, A, A′, A, A′, C′, C, C′, B′, B, B′, B, B′, A′, A, A′, C′, resulting in reduced torque ripple without any slot or magnet skewing". Claim 2, which depends from claim 1, specifies that the brushless DC motor/generator has "a multiple combination of additions of the number of said twenty-

two poles and said twenty-four slots (18), such as forty-four said poles and forty-eight said slots" (emphasis added).

[34] In the Panel Letter, we identified the difference between D4 and the inventive concept as lying in the pole/slot combination. In the inventive concept, it is 40 or 44 poles, and 42 slots, whereas D4 explicitly discloses that the combination can be 44 poles and 48 slots.

Summary of differences

[35] In the Panel Letter, we summarized the differences between the matter cited as forming part of the "state of the art" and the inventive concept of the claims as follows:

- D2 does not disclose a brushless DC motor with a rotor adapted to be part of an in-wheel arrangement;
- D2 does not disclose the stator core having an outer diameter ranging between 150mm and 350mm;
- D2 does not disclose the combination of 40 or 44 poles, and 42 slots; and,
- D4 does not disclose the combination of 40 or 44 poles, and 42 slots.

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?

[36] In the Panel Letter, we concluded that there were no differences between D4 and the inventive concept other than the specific combination of poles and slots mentioned in the claims. In our view, the question at Step 4 of the *Sanofi* approach was whether either of the specific combinations of 40 or 44 poles and 42 slots would have been obvious to the person skilled in the art, or would they have required a degree of invention. For the reasons that follow, we now conclude that both of these specific combinations of poles and slots constitute steps that would have been obvious to the person skilled in the art.

[37] The person skilled in the art starting from D4 would, in our view, fairly see that the specific combinations now claimed have been suggested in the prior art by virtue of the mention of a similar combination, i.e., 44 poles and 48 slots. Varying that combination to arrive at a 40 or 44 poles/42 slots combination would be a matter of routine experimentation for the person skilled in the art, given the nature of the common general knowledge and the disclosures of D2 which provides general guidance and formulae to be

used in designing a brushless DC motor with concentrated windings and high pole numbers.

[38] The advantages associated with an invention are considerations that can factor into the obviousness analysis. In that regard, the FA attributed particular advantages to the claimed invention. At page 4, the FA states that the combination of poles and slots is "deemed to be optimal in terms of electrical characteristics such as starting torque and cogging torque, in terms of mechanical characteristics such as weight and structural integrity of the teeth and also in terms of non-technical characteristics such as fabrication cost."

[39] In the R-FA, the Applicant disputed that any of these advantages are disclosed in either prior art reference. For that reason, the Applicant argued that the person skilled in the art "attempting to arrive at the claimed invention in view of D2, D4, and the common general knowledge, and having no prior knowledge of the claimed invention, would therefore not be led directly and without difficulty to the recited combination because none of the references suggests the advantages of such a combination" (emphasis in original text).

[40] However, in our view, each reference discloses advantages associated either with a permanent magnet machine in general, or those adapted for use with electric vehicles in particular:

- "a [permanent magnet] direct drive can indeed provide better performance and/or be lighter than the induction motor with a gearbox. For these machines, concentrated windings around teeth, with their simple structure and short end-windings, are very attractive" (D2, page 530, left column, first paragraph);
- "In electrical vehicle applications, it is necessary to produce high starting torque and to ensure variable speed in both motor and generator modes of operation. The use of a brushless DC motor is particularly well adapted to this kind of applications. To reduce the cost of the electronic system and the number of sensors, it is better to supply the motor winding phases with a rectangular waveform current" (D4, para [0037]);

- "Another feature of the invention is to provide a special design and the design of its three-phase winding maximize the energy efficiency and the motor starting torque per unit volume of winding" (D4, para [0015]); and,

- "The amount of vibrations, the cogging torque ripple and the radial force are greatly reduced" (D4, para [0016]).

[41] Further, by virtue of the high pole numbers of the apparatus of D4, and its application in electric vehicles such as bicycles, it is necessarily lighter in weight relative to devices with fewer poles, in the same way that the presently claimed apparatus apparently is (see para [0029] of the description of the present application).

[42] In sum, advantages of the type associated with the inventive concept are disclosed in the prior art. As such, they are not regarded as considerations that weigh in favour of a finding of non-obviousness.

[43] Lastly, since there does not appear to be any advantages particularly disclosed for the 40 poles/42 slots or 44 poles/42 slots combination of the present application over the 44 poles/48 slots combination of D4, the claimed combinations would be regarded by the person skilled in the art as obvious design variations.

Conclusion

[44] In our view, the subject-matter of the claims would have been obvious to the person skilled in the art, contrary to section 28.3 of the Act.

RECOMMENDATION OF THE BOARD

[45] For the reasons given in this recommendation, and as previously indicated in the Panel Letter, we recommend that the application be refused because the subject-matter of the claims would have been obvious to the person skilled in the art, contrary to section 28.3 of the *Patent Act*.

Ed MacLaurin	Andrew Strong	Kristina Bodnar
Member	Member	Member

DECISION

[46] I concur with the conclusions and recommendation of the Patent Appeal Board that the application be refused because the subject-matter of the claims would have been obvious to the person skilled in the art, contrary to section 28.3 of the *Patent Act*.

[47] Therefore, in accordance with section 40 of the *Patent Act*, I refuse to grant a patent on this application. Under section 41 of the *Patent Act*, the Applicant has six months within which to appeal my decision to the Federal Court of Canada.

Johanne Bélisle
Commissioner of Patents

Dated at Gatineau, Quebec,
this 27th day of July, 2017