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Paper 41
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZHONGSHAN BROAD OCEAN MOTOR CO., LTD.,
BROAD OCEAN MOTOR LLC, and
BROAD OCEAN TECHNOLOGIES, LLC,
Petitioners,

v.

NIDEC MOTOR CORPORATION,
Patent Owner.

Case IPR2014-01122
Patent 7,208,895 B2

Before BENJAMIN D. M. WOOD, JAMES A. TARTAL, and PATRICK M. BOUCHER, *Administrative Patent Judges*.

BOUCHER, *Administrative Patent Judge.*

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

A. Background

Zhongshan Broad Ocean Motor Co., Ltd., Broad Ocean Motor LLC, and Broad Ocean Technologies, LLC ("Petitioners") filed a corrected Petition (Paper 7, "Pet.") pursuant to 35 U.S.C. §§ 311–319 to institute an *inter partes* review of claims 9 and 21 of U.S. Patent No. 7,208,895 B2 ("the '895 patent"). After consideration of a Preliminary Response (Paper 14, "Prelim. Resp.") filed by Nidec Motor Corporation ("Patent Owner"), the Board instituted trial with respect to claims 9 and 21 on January 21, 2015. Paper 20 ("Dec."). A Request for Rehearing filed by Petitioners with respect to certain denied grounds was denied on February 24, 2015. Paper 25.

During the trial, Patent Owner timely filed a Patent Owner Response (Paper 29, "PO Resp."), and Petitioners timely filed a Reply to the Patent Owner Response (Paper 32, "Reply"). An oral hearing was held on October 16, 2015. Paper 40 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6(c). This Decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of the claims on which we instituted trial. Based on the record before us, Petitioners have shown, by a preponderance of the evidence, that claims 9 and 21 of the '895 patent are unpatentable.

B. The ’895 Patent (Ex. 1001)

The ’895 patent relates to torque control of permanent magnet rotating machines. Ex. 1001, col. 1, ll. 15–17. Figure 1 of the ’895 patent is reproduced below.

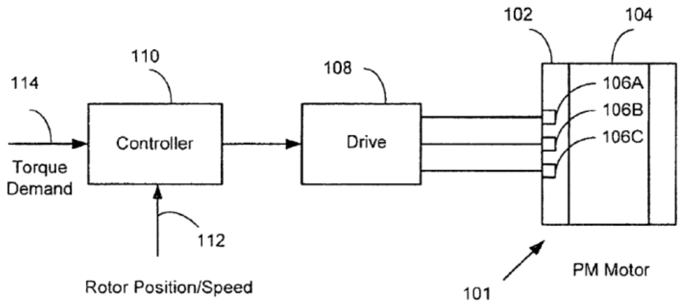


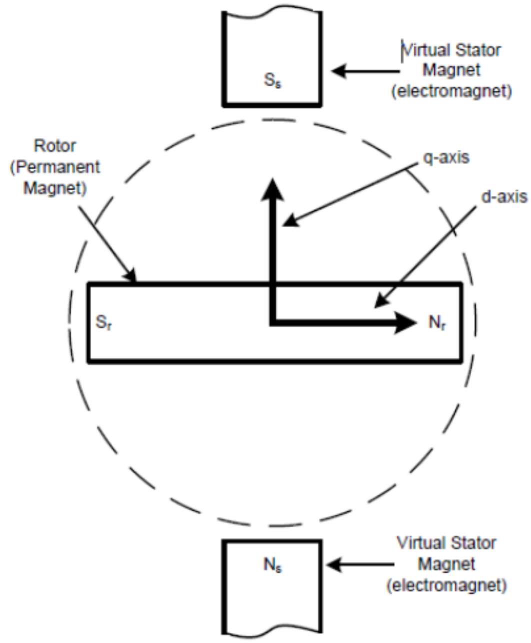
FIG. 1

Figure 1 is a block diagram of a rotating permanent magnet machine system. *Id.* at col. 2, ll. 4–6. Rotating permanent magnet electric machine 101 includes rotor 104 and stator 102, around which energizable phase windings 106A, 106B, and 106C are wound. *Id.* at col. 2, ll. 14–22. Drive 102 receives control inputs from controller 110, which receives rotor position and speed data 112 from sensors coupled to the machine. *Id.* at col. 2, ll. 24–30.

When operated in a torque control mode, input torque demand 114 is provided to a torque scalar that produces a scaled torque demand. *Id.* at col. 2, ll. 63–67. In one embodiment, calculation of the scaled torque demand is the sum of three components: (1) the torque offset, which is the minimum torque required to run the motor without a load; (2) the product of the torque demand and a torque multiplier; and (3) a speed offset, which may be determined from a look-up table containing speed-torque table values for the particular motor being controlled. *Id.* at col. 4, ll. 15–35, Fig. 3. The torque multiplier and the torque offset value "are preferably motor-specific parameters which compensate for individual motor characteristics." *Id.* at col. 4, ll. 20–22. A constant motor torque output with increasing motor speed may be achieved by increasing the value of the demanded torque by the control system as the motor operating speed increases, thereby making the torque lines flatter with speed. *Id.* at col. 4, ll. 39–43.

The scaled torque demand is used to calculate an "IQr demand" using motor-specific torque-to-IQr map data. *Id.* at col. 2, l. 67–col. 3, l. 3. The IQr demand is concatenated with an "Idr demand" (also referred to as a "dr-axis injection current") from an Idr injection block into a vector quantity, "IQdr demand." *Id.* at col. 3, ll. 3–6. The resulting IQdr demand takes into account the torque contribution, if any, of the dr-axis current. *Id.* at col. 3, ll. 10–12.

These parameters, "IQr demand" and "Idr demand," are not defined expressly in the specification of the '895 patent. Petitioners' witness, Dr. Mark Ehsani, explains that "vector control" provides one method of controlling permanent-magnet synchronous motors, and that "[t]he concept of vector control, which typically uses d and [Q] current components, arises from [a] principle [in which] torque arrives from the interaction of two magnetic fields, one originating from the stator and one originating from the rotor." Ex. 1010 ¶ 13. The drawing from page 7 of Dr. Ehsani's Declaration is reproduced below.



The drawing from Dr. Ehsani's Declaration illustrates a rotor, which has a permanent magnet having north and south poles N_r and S_r, respectively, and illustrates a stator, which includes electromagnets that result in a virtual stator magnet having north and south poles N_s and S_s, respectively. *Id.* ¶ 15. The d axis is aligned with the rotor and the Q axis[1] is offset 90° from the d axis. The motor commutates the winding currents to maintain orthogonality of the d and Q axes as the rotor turns. *Id.* ¶ 16.

C. Claims

The challenged claims are as follows.

9. A permanent magnet rotating machine and controller assembly configured to perform the method of claim 1.

[1] Dr. Ehsani uses a lower-case letter q in referring to this axis. We use an upper-case letter Q for consistency with the claims that are before us.

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