

**IN THE UNITED STATES DISTRICT COURT  
FOR THE MIDDLE DISTRICT OF FLORIDA  
TAMPA DIVISION**

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SOLOMON TECHNOLOGIES, INC.,	:	
	:	
Plaintiff,	:	
	:	
v.	:	Case No. 8:05-cv-01702-JDW-MAP
	:	
TOYOTA MOTOR CORPORATION,	:	
TOYOTA MOTOR MANUFACTURING	:	
NORTH AMERICA, and TOYOTA MOTOR	:	
SALES, U.S.A., INC.,	:	
	:	
Defendants.	:	
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**DECLARATION OF PROFESSOR ALI EMADI, PH.D.**

I, Ali Emadi, declare as follows:

1. I am currently a Professor of Electrical Engineering and Director of the Electric Power and Power Electronics Center and Grainger Laboratories at the Illinois Institute of Technology (“IIT”) in Chicago, Illinois, where I have established research and teaching facilities, as well as courses in power electronics, electric motor drives, and vehicular power systems. I am the Founder, President and Chief Technology Officer of Hybrid Electric Vehicle Technologies, Inc.—an IIT spinoff company specializing in hybrid vehicle drive trains and components.

2. I have received numerous awards and recognitions, including being named as the Eta Kappa Nu, Outstanding Young Electrical Engineer of the Year 2003 for my contributions to the field of hybrid electric vehicle conversion. I also directed a team of students to design and build a novel motor drive, which won the First Place Overall Award at the 2003 IEEE/DOE/DOD International Future Energy Challenge for Motor Competition.

3. I am the principal author/co-author of over 250 journal and conference papers, as well as several books, including *Vehicular Electric Power Systems: Land, Sea, Air, and Space Vehicles* (Marcel Dekker, 2003), *Energy Efficient Electric Motors* (Marcel Dekker, 2004), and *Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design* (CRC Press, 2004). I am also the editor of the *Handbook of Automotive Power Electronics and Motor Drives* (Marcel Dekker, 2005).

4. I am the (a) founding General Chair of the 1<sup>st</sup> IEEE Vehicle Power and Propulsion Conference, (b) 2005 General Chair of the SAE International Future Transportation Technology Conference, (c) Chair of the IEEE Vehicle Power and Propulsion Steering Committee, (d) Chair of the Technical Committee on Transportation Power Electronics of the IEEE Power Electronics Society, (e) Chair of the Power Electronics Technical Committee of the IEEE Industrial Electronics Society, and (f) Chair of the 2007 IEEE International Future Energy Challenge.

5. In addition, I am the (a) Editor (North America) of the International Journal of Electric and Hybrid Vehicles and have been the Guest Editor-in-Chief of the Special Issue on Automotive Power Electronics and Motor Drives, *IEEE Transactions on Power Electronics*, (b) Guest Editor of the Special Section on Hybrid Electric and Fuel Cell Vehicles, *IEEE Transactions on Vehicular Technology*, and (c) Guest Editor of the Special Section on Automotive Electronics and Electrical Drives, *IEEE Transactions on Industrial Electronics*.

6. A true and correct copy of my *curriculum vitae* is attached hereto as Exhibit 1.

7. I consider myself to be one of skill in the art of automotive engineering, particularly with respect to electric motor / transmission devices.

8. In connection with this Declaration, I have reviewed (a) U.S. Patent No. 5,067,932 (“the ‘932 Patent”) and the record of its prosecution before the United States Patent &

Trademark Office, (b) the concurrently filed Declarations of Robert Alexander Pesiridis and Jonathan Rollin Edwards, (c) the decision of the United States Court of Appeals for the Federal Circuit (“Federal Circuit”) in *Solomon Technologies, Inc. v. ITC*, 524 F.3d 1310 (Fed. Cir. 2008), and (d) various schematics of Toyota’s accused transaxles. I have also relied on my previous knowledge of the accused transaxles from my work in this field and my extensive knowledge of, and expertise and experience with, electric motor / transmission devices in preparing this Declaration.

9. The opinions expressed in this Declaration are solely mine, and do not represent those of the Illinois Institute of Technology or anybody else.

10. Based on the foregoing, I have become very familiar with the structure and operation of Toyota’s accused transaxles, including those in the Toyota Prius and Toyota Highlander HV. I understand that the transaxles in the Toyota Prius and Toyota Highlander HV are representative of the transaxles that Solomon has accused of infringement in this case (“the accused transaxles”).

11. Claim 7 of the ‘932 patent recites, in part:

first power input means for receiving a first input of electrical power,  
second power input means for receiving a second input of electrical power,  
***power conversion means for converting said electrical power of said first and second inputs for output, said power conversion means including a mechanical power transmission unit, said transmission unit having two inputs for respectively receiving mechanical power corresponding to said first and second power inputs provided to said first and second power input means and an output for outputting the converted power as rotational mechanical power,***

. . .and ***said power conversion means includes, for each of said first and second power inputs, a respective integral combination of a respective electric motor element and an element of said transmission unit, each said integral combination involving one of said two respective elements thereof being at least to a large extent within an envelope containing the other, whereby a compact structure is provided for each said integral***

*combination, and said two integral combinations are **located closely adjacent each other.***

(‘932 patent, col. 11, lines 25-46 and last page (Certificate of Correction) (emphasis added)). I understand that the Federal Circuit concluded that the claimed “power conversion means” is not present in the accused transaxles.

12. I understand that the Federal Circuit based its decision on (1) the “power conversion means” of claim 7 being a so-called “means-plus-function” element, which, I understand, requires that sufficient structure for performing the function of the claimed means be absent from the claim, and (2) a comparison of the disks of the ‘932 patent with the rotor shafts in the accused transaxles. As described herein, I disagree with each of those bases.

13. In particular, as described below, (1) I believe that claim 7 recites sufficient structure for performing the claimed “power conversion means,” and (2) even assuming that claim 7 does not recite such sufficient structure (which, as noted, I disagree with), the Federal Circuit’s comparison of the disks of the ‘932 patent with the rotor shafts of the accused transaxles was improper. Under the proper comparison, I believe that the claimed “power conversion means” of claim 7 is present in the accused transaxles.

14. The function of the claimed “power conversion means” is to convert electrical power received by the “power conversion means” to rotational mechanical power as its output. Whether sufficient structure is recited in claim 7 for performing that function is a scientific inquiry. As one of skill in the art, I believe that the structural elements for performing that function, as well as the structural relationships between those elements, are more than sufficiently recited in claim 7. Indeed, all of the italicized language in claim 7 above (bolded and unbolded in paragraph 10, above), relates to the “power conversion means” and the bolded-italicized language highlights numerous structural elements of that “power conversion means.”

15. In particular, claim 7 specifies that the “*power conversion means*” includes a “*mechanical power transmission unit*,” which in turn has “*two inputs*” and “*an output*.” The two inputs of the transmission unit receive power from the electric motors and produce rotational mechanical power as its output.

16. It further specifies that the “power conversion means” includes two “respective *integral combination[s] of a respective electric motor element and an element of [the mechanical power] transmission unit*.” The “mechanical power transmission unit,” “electric motor element[s],” “inputs” and “output” of the transmission unit, and the “integral combination[s]” are all structural elements of the “power conversion means.”

17. The structural relationship of the elements in the preceding paragraph are also specified in claim 7—in particular, that each integral combination involves one of said two respective elements thereof being at least to a large extent within an envelope containing the other,” that each integral combination has “a compact structure,” and that the two integral combinations are “located closely adjacent each other.”

18. Accordingly, I believe that claim 7 more than sufficiently recites the structural elements, as well as the structural relationships between those elements, for performing the function of the claimed “power conversion means.”

19. Moreover, as noted, even assuming that claim 7 does not recite such sufficient structure (which, again, I disagree with), I still believe that the “power conversion means” of claim 7 is present in the accused transaxles. In particular, I understand that the Federal Circuit assessed whether the claimed “power conversion means” is present in the accused transaxles by comparing disks 23 and 33 of the ‘932 patent to the so-called rotor shafts in the accused vehicles. In my opinion, that is not a proper comparison.

20. As an initial matter, in comparing the elements of any structure or assembly with another, I believe that the specific roles and functions of the elements in the structures or assemblies, both singly and collectively, must be carefully considered. As I explain below, if the disks of the '932 patent are to be compared with elements in the accused transaxles, I believe that they should be compared with the *entire* rotor assembly in the accused transaxles—not just the rotor shaft, which is only one subcomponent of the rotor assembly.

21. In particular, the rotor assembly performs the same function in the accused transaxles as the disks do in the '932 patent. In particular, as shown in Figure 5 of the '932 patent below, disks 23 and 33 are attached to magnets (armature elements 22) in the electric motor that cause the disks to rotate, thereby providing power to the transmission unit.

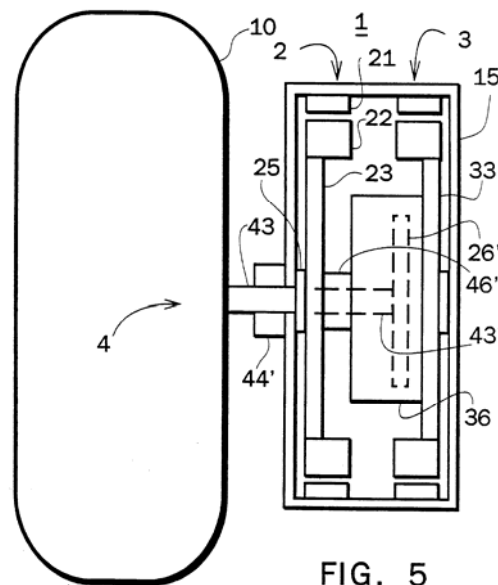
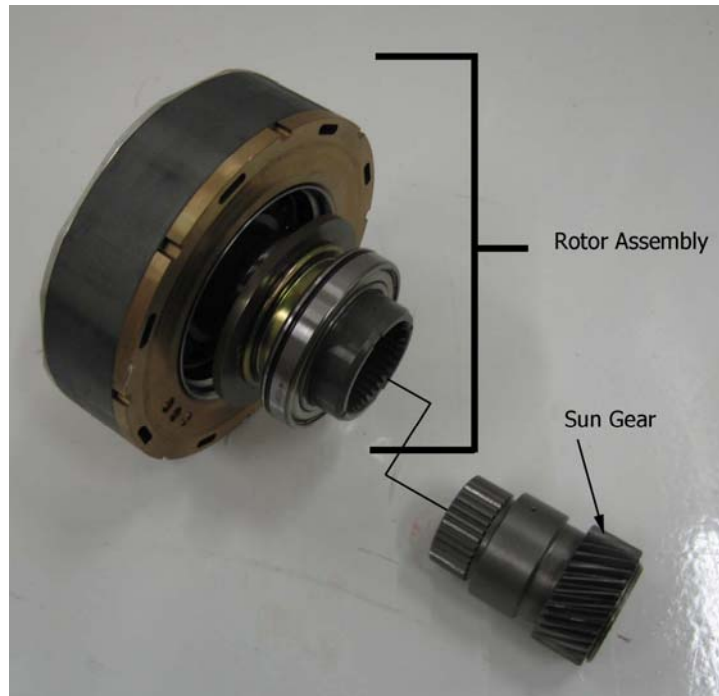


FIG. 5

22. In the same manner, the rotor assemblies in the accused transaxles are connected to magnets in the electric motor that cause the rotor assemblies to rotate, thereby providing power to the transmission unit. Indeed, as shown in the picture below, the rotor assembly is, in fact, disk-like. Thus, the proper comparison is between those two elements, *i.e.*, the disks of the

'932 patent and the rotor assemblies of the accused transaxles. Under that comparison, I believe that the claimed "power conversion means" of claim 7 is present in the accused transaxles.



(Note: As explained in the declaration of Mr. Pesiridis, this picture is of a rotor assembly and sun gear found in the accused transaxle of the 2001 Toyota Prius. I understand that Solomon purchased the transaxle through public means).

23. I understand that the Federal Circuit also based its decision on its determination that the patentee had disclaimed the use of "shafts" in his invention. I believe that that determination is inconsistent with Figure 5 of the '932 patent, which expressly shows the use of a shaft in the power conversion means. In particular, the sun gear extension in Figure 5 (depicted as 46') is a shaft. Indeed, I understand that during the earlier ITC proceedings, Toyota's expert admitted that the sun gear extension is a shaft.

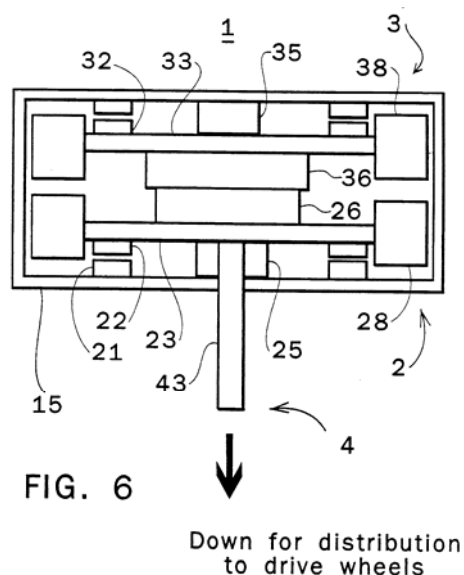
24. Just like the sun gear extension may be considered an element of the transmission unit, the so-called "rotor shafts" in the accused transaxles are each an element of a motor.

**REDACTED**

**REDACTED** Thus, if the '932 patent covers the Figure 5 embodiment, which includes a sun gear extension (a shaft) as an element of the transmission unit, so too would the '932 patent cover the accused transaxles, which have a rotor shaft as an element of the motor.

25. I understand that the Federal Circuit further determined that the “envelope” term, as it construed it, is met in the Figure 6 embodiment, shown below, by assuming that the heavy cylindrical peripheral masses of the '932 patent are electric motor elements. As explained below, I believe that that assumption is incorrect.

26. In particular, the heavy cylindrical peripheral masses are shown in Figure 6 below as reference numerals 28 and 38. Those masses store kinetic energy by increasing the moment of rotational inertia. The masses are plainly not motor elements. Indeed, I understand that there is no dispute between the parties that the masses are not motor elements. Because the Federal Circuit incorrectly concluded that the masses were electric motor elements, it construed the term “envelope” in claim 7 to include the space defined by the rotation of each peripheral mass.





27. In any event, when “envelope” is defined to include the space defined by, for example, all motor elements, as the Federal Circuit did, I believe that the “envelope” term is met by the accused transaxles. In particular, in the accused transaxles, the volume in space created by the rotation of all the motor elements in Toyota's accused transaxles, including the rotor assembly, includes, to a large extent, a transmission element or vice versa

28. Claim 7 of the ‘932 patent also recites an “integral combination of a respective electric *motor element* and an element of said transmission unit.” I understand that another issue in this case is whether the element in the accused transaxles that corresponds to the “*motor element*” is solely the respective rotating magnets of the accused transaxles. I understand that the Federal Circuit’s construction of the “integral combination” term did *not* limit the motor elements in the combination to only the motor’s magnets. Under that construction, I believe that the elements in the accused transaxles that correspond to the “motor element” in the “integral combination” term are, in fact, the entire “rotor assembly”—not just the rotating magnets.

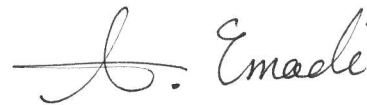
29. I understand that in evaluating whether the “integral combination” term was met in the accused transaxles, the ITC looked at the rotor shaft alone, rather than the entire rotor assembly. As I explain above, however, I believe that focusing on the rotor shaft alone is improper, as it is only one subcomponent of the rotor assembly; hence, it is the entire rotor assembly that should be considered when performing the comparison between claim 7 and the accused transaxles. Indeed, as I explain above, the rotor assemblies in the accused transaxles, are, in fact, disk-like.

30. As noted, I understand that the Federal Circuit based its decision on its conclusion that the use of “shafts” had been disclaimed in the ‘932 patent. I further understand that the Federal Circuit held that shafts that are part of the transmission unit or motor have not been

disclaimed. In particular, the Federal Circuit held that, based on the presence of the sun gear extension in Figure 5, shafts like the sun gear extension had not been disclaimed. As I explain above, the rotor shafts in the accused transaxles are each part of a motor, just like the sun gear extension (a shaft) is a part of the transmission unit. Accordingly, I believe that under the Federal Circuit's rationale, the use of rotor shafts in the accused transaxles have not been disclaimed from the '932 patented invention.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge, information and belief.

Executed on August 17, 2009

A handwritten signature in cursive script, appearing to read "A. Emadi".

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Dr. Ali Emadi, Ph.D.