

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Volkswagen Group of America, Inc.,
Petitioner

v.

Michigan Motor Technologies LLC,
Patent Owner

Case IPR2020-00446
Patent No. 6,763,804

DECLARATION OF DR. RUSSELL LEONARD

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1. I, Dr. Russell Leonard, declare as follows:

I. INTRODUCTION

2. I have been retained as an expert in this proceeding by counsel for Michigan Motor Technologies (MMT). I have been asked for my expert conclusions.

II. BACKGROUND

3. I obtained my Bachelor's degree in Industrial Arts Education with an automotive emphasis from Central Michigan University in 1991. Next, I earned a Master of Education from Wayne State University in 1997, and a Ph.D. in Higher Educational Leadership from Western Michigan University in 2016.

4. I am currently a Professor at Ferris State University in the Automotive Department of the School of Automotive and Heavy Equipment where I teach in both the Automotive Engineering Technology and Automotive Service programs.

5. I began my automotive career working as a mechanic on civilian automobiles and military vehicles. After transitioning to building prototype vehicles at Roush, I started a new position as a contractor to Ford Motor Company teaching engineers on the topic of Ford powertrain electronic controls. I learned an incredible amount of detail that augmented my technician viewpoint with an

understanding from a design and manufacturing perspective. While earning my master's degree, a classmate suggested that I should apply to Hughes Aircraft.

6. At Hughes, I worked as a Systems Engineer designing and developing training for General Motors. The last assignment I performed at Hughes Aircraft was integrating advanced military technologies with civilian applications. It was during this project with Hughes that I was encouraged to apply for a position at General Motors as a Service Engineer for Cadillac.

7. While at Cadillac, I assisted field technicians with repairs over the phone, tracked trends and created engineering bulletins and campaigns as required. The next position in my General Motors career was a release engineer of diagnostic scan tool software after an internal transfer. In this position, I wrote code for the Tech 2 scan tool to request and receive data from various computer control modules for numerous GM vehicles to not only comply with OBD II, but to be a useful tool to the repair technician.

8. After the September 11th terrorist attack, I decided to share my experiences and enjoyment of automobiles with future generations, so I became an automotive professor at Ferris State University. I earned my Ph.D. during this time while teaching many automotive subjects in the automotive service program for technicians and in the automotive engineering technology program for engineering technologists.

9. I am a continuing member of multiple professional organizations, including SAE International, where I am the faculty advisor at Ferris State University for the student chapter of the collegiate design series, Baja SAE. At ASTM International, I am a voting member of Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants, and Committee D15 on Engine Coolants and Related Fluids. Additionally, I am a task group member of four work items within D15.

10. My career thus far includes 17 years teaching automotive engineering technology and servicing at a university, 7 years as an engineer for major automotive and technology corporations, 3 years as a trainer of powertrain electronic controls for an automobile manufacturer, 19 years of service in the United States military, 7 years of which I was a mechanic, and 4 years as a civilian automobile mechanic.

11. A copy of my curriculum vitae is attached as Appendix A, which contains further details regarding my experience, education, and other qualifications to render an expert opinion in connection with this proceeding.

12. I am being compensated at my normal consulting rate of \$240/hour for my work, but my opinions are based on my own views of the patented technology and the prior art. My compensation is not dependent on the outcome of

this proceeding and in no way influences the substance of my statements in this declaration.

13. I have no financial interests in the patent owner. Similarly, I have no financial interest in the '804 patent.

III. LEVEL OF ORDINARY SKILL IN THE ART

14. The level of ordinary skill in the art applicable to the '804 patent around the time of the invention in 2001 is a person with (1) a B.S. in mechanical engineering or a closely related field with three or more years of experience in either engine systems or engine control systems or (2) at least a M.S. in mechanical engineering.

IV. UNDERSTANDING OF THE LAW

15. I am not an attorney. For the purposes of this declaration, the patent owner's counsel has informed me about certain aspects of the law that are relevant to my opinions. I have applied those legal principles in arriving at my conclusions expressed in this Declaration.

a. Claim construction

16. I understand that "a claim of a patent . . . shall be construed using the same claim construction standard that would be used to construe the claim including construing the claim in accordance with the ordinary and customary

meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.”

17. I understand that claim terms that are not construed by the Board should be given their ordinary and customary meaning as would have been understood by a person of ordinary skill in the art at the time of the claimed invention.

18. I also understand that a “means-plus-function” claim term is a term that recites a certain function but does not recite sufficient structure for performing that function. I understand that means-plus-function terms are limited to the function recited in the claim term and the specific structure that is disclosed in the patent’s specification for performing that function and structures that are equivalent to the disclosed structures. Thus, I have been informed and understand that construing a means-plus-function claim term is a two-step process. First, the claimed function of the term must be identified. Second, the structure or structures described in the specification for performing that function must be identified.

b. Obviousness

19. I also understand that a showing of obviousness must include demonstrating that the cited references disclose each element of a challenged claim.

V. OVERVIEW OF THE '804 PATENT

20. The basic inventive concept disclosed and claimed in the subject '804 patent is to, in the controlling of an electronic throttle serve of an internal combustion engine, protect the system from overheating.

21. The method is comprised of commanding a position while detecting the control effort required during the change to the commanded position. In an effort to protect the system from overheating, A determination is made whether the control effort exceeds a threshold for a predetermined time period. If so, the control effort is reduced.

22. The method further describes the “said commanded position comprises at least one of commanding at least one of commanding the positioning device to open to a hold open mode and commanding the positioning device to a hold close mode.” EX 1001 at 5:27-31.

23. The Figure 2 flow chart shows the entry point at 40. Next, a decision is made at 42 where the control effort is first checked for being more positive than a given limit of approximately +6 volts for a predetermined continuous time period of about 300 milliseconds. EX. 1001 at 3:25-30. The values of position

effort in volts and duration in seconds can vary as shown in the hard open/close time period example within the '804 patent. EX. 1001 at 3:43-54.

24. As we go back to the figure 2 flow chart, we find that if the predetermined threshold has been exceeded at 42, a hold open mode initiates. Immediately afterward, the time period of the hold open mode is compared to the hard open time period in step 46. If the hold open mode is less than the hard open time period, maximum opening effort is applied through block 48 and then looping back to step 46 until the hold open mode is greater than or equal to the hard open time period. Once the hard open time period is no longer greater than the hold open mode, step 50 is entered, which reduces the opening effort to a moderate opening control effort, typically +5 volts, that can be applied to the motor indefinitely. EX. 1001 at 4:1-7. After step 50, the loop returns to 42 where the control effort is again checked for being more positive than a given limit for a predetermined continuous time period. If yes, the loop described above runs again, but if the predetermined threshold has not been exceeded, the next step is 52.

25. Step 52 is the beginning of a second similar loop to the first with a few exceptions. The first difference of the second loop is the decision question at 52, which is the control effort is first checked for being more *negative* than a

given limit of approximately *-6 volts* for a predetermined continuous time period of about 300 milliseconds. EX. 1001 at 4:15-22.

26. If the predetermined threshold has been exceeded at 52, a hold *close* mode initiates. Immediately afterward, the time period of the hold *close* mode is compared to the hard *close* time period in step 56. If the hold *close* mode time is less than the hard open time period, maximum *closing* effort is applied through block 58 and then looping back to step 56 until the hold *close* mode is greater than or equal to the hard *close* time period. Once the hard *close* time period is no longer greater than the hold *close* mode, step 60 is entered, which reduces the *closing* effort to a moderate *closing* control effort, typically *-5 volts*, that can be applied to the motor indefinitely. EX. 1001 at 4:33-43. After step 60, the loop returns to 52 where the control effort is again checked for being more *negative* than a given limit for a predetermined continuous time period. If yes, the loop described above runs again, but if the predetermined threshold has not been

exceeded, the next step is 62, which calls for normal operation, which loops back to step 42 to repeat all over again.

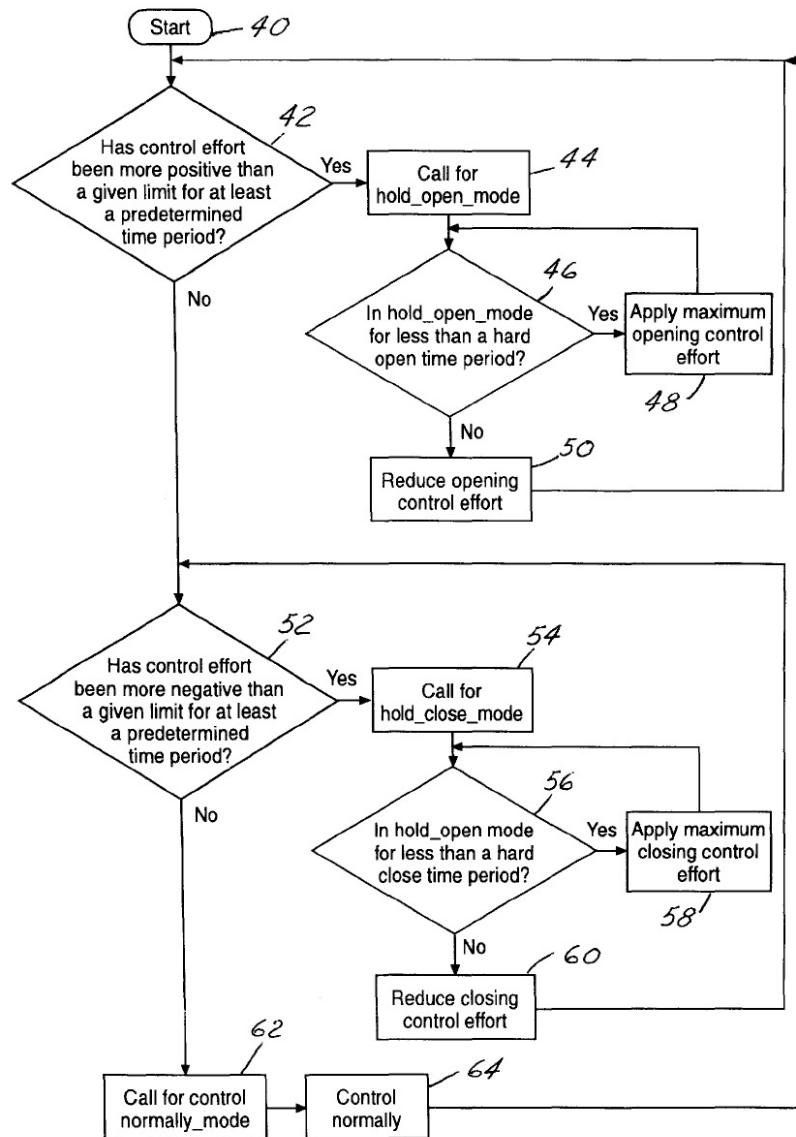


FIG. 2

27. The main difference between the prior art and the '804 patent is that the "control effort" is defined as the effort "required to change to said commanded position." EX. At Abstract, 2:4-6, Claim 1 at 5:19-20, Claim 11 at 6:16-17.

Additionally, Claim 1 of the '804 patent recites "said commanded position comprises at least one of commanding the positioning device to open to a hold open mode and commanding the positioning device to a hold close mode." EX 1001 at 5:27-31. None of the prior art in the Petition discloses these two features.

28. The improved and reliable servo overheat protection in that it will not cause mechanism failure or require significant and costly added robustness to the mechanism. EX. 1001 at 2:10-14. In addition, the system allows full control effort while preventing overheating. EX. 1001 at 1:59-63.

VI. OVERVIEW OF THE PRIOR ART

a. Itabashi

29. Itabashi is the first of two primary references relied upon by Petitioner for the first, second and third Grounds of the Petition. The Itabashi invention discloses a motor drive control apparatus and method of a throttle control system. During the "initial stage," or "starting period," the motor is driven with a high motor current for high torque output. Afterwards, the motor is driven with a low current. This design allows for a smaller size and cost of switching electronics because high torque usage is limited to the "initial stage." EX. 1007 at 1:53-63.

30. Itabashi also applies the motor drive method of "initial stage," or "starting period," to motor braking. Motor braking is when the motor current is temporarily reversed to stop the throttle valve at the target angle. *Id.*, at 1:24-28.

In the case of motor braking, the motor is reverse driven with a high motor current for high torque output. Afterwards, the motor is reverse driven with a low current.

Id., at 1:66-2:6.

31. Another aspect that Itabashi invention discloses is that excessive current is applied to the motor when the motor locks: “The current increases excessively when the motor locks due to jamming of foreign obstacles with the throttle valve.” EX1007, 1:27-29.

32. This jamming occurs when “control object,” in this case the throttle plate, does not attain a target position for more than a predetermined time period, then the motor current is shut off. This could occur if the throttle plate was stuck, perhaps from icing or by debris that prevent the throttle plate from moving. EX 1007 at 2:7-12.

33. Itabashi differs from the ‘804 patent in that the ‘804 teaches operating initially at a reduced control effort, not the maximum motor torque. As shown in Figure 2 of the ‘804 patent, a decision is made at block 42 where the control effort is first checked for being more positive than a *given limit of approximately +6 volts for a predetermined continuous time period of about 300 milliseconds*. EX. 1001 at 3:25-30.

34. Itabashi teaches a different method by disclosing that during the “initial stage,” or “starting period,” the motor is driven with a high motor current

for high torque output. Afterwards, the motor is driven with a low current. This design allows for a smaller size and cost of switching electronics because high torque usage is limited to the “initial stage.” EX. 1007 at 1:53-63.

35. Furthermore, Itabashi differs by not meeting Claim 1 of the ‘804 patent, which recites “said commanded position comprises at least one of commanding the positioning device to open to a hold open mode and commanding the positioning device to a hold close mode.” EX 1001 at 5:27-31. Indeed, the ‘804 patent discloses a method where a hold open mode is initiated and maximum torque is applied for a time period.

36. Referring back to Figure 2, the ‘804 patent discloses that if the predetermined threshold has been exceeded at block 42, a *hold open mode initiates*. Immediately afterward, the time period of the hold open mode is compared to the hard open time period in step 46. If the hold open mode is less than the hard open time period, *maximum opening effort is applied through block 48* and then looping back to step 46 until the hold open mode is greater than or equal to the hard open time period. Once the hard open time period is no longer greater than the hold open mode, step 50 is entered, *which reduces the opening*

*effort to a moderate opening control effort, typically +5 volts, **that can be applied to the motor indefinitely.*** EX. 1001 at 4:1-7.

37. A POSA would not have been motivated to combine Itabashi with any other teaching. Itabashi does not disclose commanding the positioning device (*e.g.*, throttle plate) to at least one of a hold open or hold closed mode, determining the control effort required to move the positioning device to the commanded position, determining whether the control effort exceeds a threshold for a predetermined time period, and reducing the control effort when the control effort exceeds the threshold for the predetermined time period.

38. Itabashi “discloses a throttle control system that limits the motor current when the current exceeds a threshold for a predetermined time period.” Petition at 8. The Patent Owner acknowledges that such a generic throttle control system was known in the art at the time the ‘804 claimed invention was made. However, the challenged claims of the ‘804 patent are not directed to and do not broadly encompass such a generic throttle control system. Thus, the Itabashi reference is completely irrelevant.

39. These are two major fatal flaws of Itabashi that clearly separate its method of control from the control method disclosed in the '804 patent.

b. Matsumoto

40. Matsumoto is the primary reference relied upon by Petitioner for the fourth, fifth and sixth Grounds of the Petition.

41. The Matsumoto invention discloses a control system that detects when the throttle valve is stuck.

42. Matsumoto discloses “an internal combustion engine equipped with an electronic throttle control device for electrically driving a throttle valve [and a] failure detecting means for detecting a failure of the electronic throttle control device.” EX1008, Matsumoto, Abstract. Matsumoto explains that a throttle valve can get stuck because of “foreign matters, such as dust, contained in exhaust gases recirculated by an exhaust gas recirculation system, or blow-by gas.” *Id.*, 2:66-3:3. The Matsumoto system identifies a stuck throttle and begins “fail-safe operation for dealing with sticking.” *Id.*, 15:4-5

43. A POSA would not have been motivated to combine Matsumoto any other teaching. Matsumoto does not disclose commanding the positioning device (*e.g.*, throttle plate) to at least one of a hold open or hold closed mode, determining the control effort required to move the positioning device to the commanded position, determining whether the control effort exceeds a threshold

for a predetermined time period, and reducing the control effort when the control effort exceeds the threshold for the predetermined time period.

44. Rather than commanding the positioning device to a hold open or hold closed mode and then determining whether the control effort required to move the positioning device to the commanded position exceeds a threshold for a predetermined time period, Matsumoto “detects when the throttle valve is stuck, such as in a fully open or closed position.” Petition at 12.

45. In short, Matsumoto does not even command the throttle valve to a fully open or closed position at all, but rather, Matsumoto detects when the throttle valve is stuck, which the Petitioner alleges could theoretically be when the throttle valve is in the fully open or fully closed position. However, Matsumoto does not actually disclose this theory. Regardless, Matsumoto never commands the throttle valve to a fully open or fully closed position, much less does Matsumoto then detect the control effort required to move the throttle valve to the *commanded* fully open or fully closed position.

c. Burney

46. Burney is the secondary reference used by the Petitioner for the fourth, fifth and sixth Grounds of the Petition.

47. The primary scope of Burney is the disclosure of a circuit that limits the control effort when the throttle motor stalls, including when the throttle is stuck.

48. Burney discloses a cruise control system with an electric motor for moving a throttle. EX1006, Burney, 1:6-15, 2:17-24. The system includes a method for “detecting when the servo motor is running in a stall position so the motor’s operation can be modified to prevent damage to the motor and gear reduction system.” EX1006, 1:8-15. “When the servo motor moves a vehicle’s throttle to its full-throttle position, so that operational travel of the servo motor is inhibited, the drive current of the servo motor will increase.” EX1006, 3:24-28. “This increase is sensed by limit detection circuitry to produce a limit signal that is used by the motor drive circuit to terminate the drive current.” *Id.*, 3:28-30.

d. Ritenour

49. Ritenour is the tertiary reference used by the Petitioner for the fourth, fifth and sixth Grounds of the Petition.

50. Ritenour discloses a servomotor control system that reduces current when current exceeds a threshold for a time period. Ritenour discloses “[a] servosystem drive current [that] includes means for sensing instances when the servomotor drive current exceeds a preset threshold level for a given time....” EX1027, Ritenour, 1:30-35.

e. GM and Chrysler Manual

51. The General Motors Reference Manual is used a by the Petitioner as a secondary reference for the Second Ground and quaternary reference for the Fifth Ground. The Chrysler Service Manual is used by the Petitioner as a tertiary reference for the Second Ground and quinary reference for the Fifth Ground.

52. The General Motors Reference Manual is for an aftermarket Snap-On scan tool used by an automobile repair technician. The Petitioner is using this manual to show the “typical” battery voltage of a General Motors vehicle. A POSA would know what the manual states and that is “the [voltage] reading should be close to the normal charging system regulated voltage with the engine running. This is typically 13.5 to 14.5 volts at idle. The manual states that the battery voltage on this scan tool has a measurable range of “0 to 25.5 volts.” Indeed, consideration was given to the fact that the charging system regulated voltage is not always typical meaning it could be above 14.5 volts. EX. 1023 at 0004.

53. The “Chrysler Manual” referenced by the Petitioner is a non-factory issued service information document which states the voltage regulator output ranges from 13.9 to 14.6 volts at 80 degrees Fahrenheit. A POSA would know that the voltage can vary for many reasons, the least of which is temperature as the

Chrysler Manual” reference qualifies the voltage with temperature. EX. 1024 at 3-9.

f. Ohta

54. Ohta is used a by the Petitioner as a secondary reference for the Third Ground and quaternary reference for the sixth Ground.

55. Ohta discloses a “tandem type” throttle valve system in which there are dual throttle valves in series with each other. The first throttle valve 2 operates in tandem with a second electronic throttle valve 6. The first throttle valve is operated directly by an accelerator pedal 4 while the second throttle valve 6 is operated by a DC motor 8 acting as a throttle actuator. Traction control is accomplished by controlling the opening of the second throttle valve 6. The second throttle valve is biased to the fully open position with a spring 10 for fail-safe operation. EX. 1020 at 2:58-68; FIGS. 1 & 2.

VII. NO MOTIVATION TO COMBINE THE PRIMARY REFERENCES

56. A POSA would not have been motivated to combine Matsumoto or Itabashi with any other teaching. Neither Itabashi nor Matsumoto disclose commanding the positioning device (*e.g.*, throttle plate) to at least one of a hold open or hold closed mode, determining the control effort required to move the positioning device to the commanded position, determining whether the control effort exceeds a threshold for a predetermined time period, and reducing the

control effort when the control effort exceeds the threshold for the predetermined time period.

57. Itabashi “discloses a throttle control system that limits the motor current when the current exceeds a threshold for a predetermined time period.” Petition at 8. The Patent Owner acknowledges that such a generic throttle control system was known in the art at the time the ‘804 claimed invention was made. However, the challenged claims of the ‘804 patent are not directed to and do not broadly encompass such a generic throttle control system. Thus, the Itabashi reference is completely irrelevant.

58. Rather than commanding the positioning device to a hold open or hold closed mode and then determining whether the control effort required to move the positioning device to the commanded position exceeds a threshold for a predetermined time period, Matsumoto “detects when the throttle valve is stuck, such as in a fully open or closed position.” Petition at 12.

59. In short, Matsumoto does not even command the throttle valve to a fully open or closed position at all, but rather, Matsumoto detects when the throttle valve is stuck, which the Petitioner alleges could theoretically be when the throttle valve is in the fully open or fully closed position. However, Matsumoto does not actually disclose this theory. Regardless, Matsumoto never commands the throttle valve to a fully open or fully closed position, much less does

Matsumoto then detect the control effort required to move the throttle valve to the *commanded* fully open or fully closed position.

60. **Ground 1: Itabashi renders obvious claims 1, 4, 7, 8, 11, 14, 15, and 18.**

61. Itabashi differs by not meeting Claims 1, 4, 7, 8, 11, 14, 15, nor 18 of the ‘804 patent as will be detailed below. Claim 1 recites “said commanded position comprises at least one of commanding the positioning device to open to a hold open mode and commanding the positioning device to a hold close mode.” EX 1001 at 5:27-31. Indeed, the ‘804 patent discloses a method where a hold open mode is initiated and maximum torque is applied for a time period.

62. The Petitioner states the Itabashi invention discloses Claims 1, 4, 7, 8, 11, 14, 15, and 18 because Itabashi has all the elements to perform the Claim 1, 4, 7, 8, 11, 14, 15, and 18.

63. What Itabashi actually discloses is that “[i]n the case that the target throttle position is changed with the movement of the accelerator pedal **16**, the engine control circuit **15** drives the motor **13** with the motor current of 100% duty ratio during the time period t_1 so that the actual throttle position approaches the target throttle position in a short period of time.” *Id.*, 6:46-51. This is represented in Itabashi with “drive command signals A1-A4” and the range of movement of the throttle valve can operate from “FULL OPEN” to “FULL CLOSE.” EX1007,

FIGS. 3, 4. In other words, whenever the accelerator pedal 16 moves to a position that commands a wide-open throttle or a closed throttle, the Itabashi invention drives the motor 13 at 100% duty cycle to move the throttle quickly to the commanded position and it just so happens that the commanded position can be either a wide open throttle or a closed throttle position depending on the command that originated from the operator pressing on accelerator pedal 16. The command in the case of Itabashi does not systematically occur as an element of a programmed method for an electronic throttle servo overheat protection system as shown in FIG 2 of the '804 patent. EX. 1001 at FIG 2. Indeed, this method is not disclosed in the claims of the Itabashi invention.

64. Referring back to Figure 2, the '804 patent discloses that if the predetermined threshold has been exceeded at block 42, a *hold open mode initiates*. Immediately afterward, the time period of the hold open mode is compared to the hard open time period in step 46. If the hold open mode is less than the hard open time period, *maximum opening effort is applied through block 48* and then looping back to step 46 until the hold open mode is greater than or equal to the hard open time period. Once the hard open time period is no longer greater than the hold open mode, step 50 is entered, *which reduces the opening*

effort to a moderate opening control effort, typically +5 volts, that can be applied to the motor indefinitely. EX. 1001 at 4:1-7.

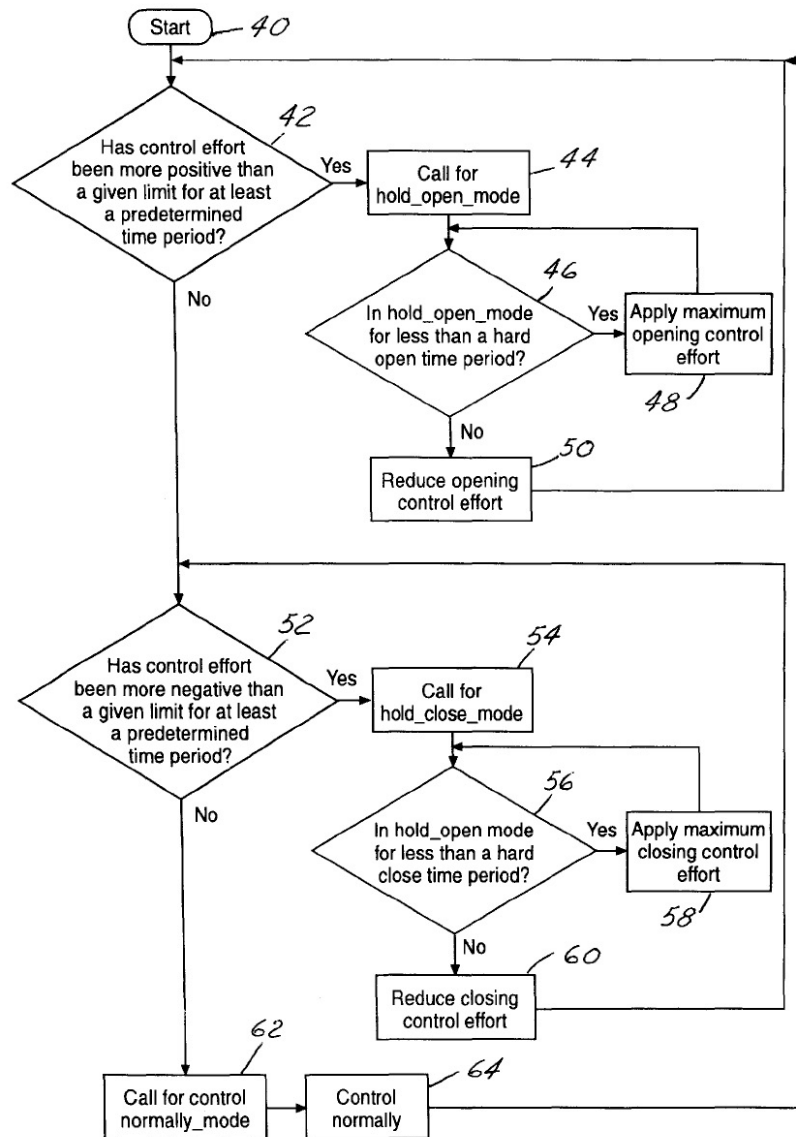


FIG. 2

65. Ground 2: Itabashi in view of the GM Manual and the Chrysler

Manual renders obvious claims 2, 5, 9, 12, 16, and 19.

66. Petitioner admits that Itabashi does not disclose the voltage that the storage battery 26 provides to the motor drive circuit. Petition at 39; 1007 at FIG. 2. The Petitioner uses the “GM Manual” to show the “typical” battery voltage of a General Motors vehicle. A POSA would know what the manual states which is “the [voltage] reading should be **close to the normal charging system regulated voltage** with the engine running. This is typically 13.5 to 14.5 volts at idle. The manual states that the battery voltage on this scan tool has a measurable range of “0 to 25.5 volts.” Indeed, consideration was given to the fact that the charging system regulated voltage is not always typical meaning it could be above 14.5 volts. EX. 1023 at 0004.

67. The “Chrysler Manual” referenced by the Petitioner is a non-factory issued service information document which states the voltage regulator output ranges from 13.9 to 14.6 volts at 80 degrees Fahrenheit. A POSA would know that the voltage can vary for many reasons, the least of which is temperature as the Chrysler Manual” reference qualifies the voltage with temperature. EX. 1024 at 3-9. None of these references would lead a POSA to select the matching voltages claimed in the ‘804 patent.

68. **Ground 3: Itabashi in view of Ohta renders obvious claims 3, 6, 10, 13, 17, and 20.**

69. Petitioner admits Itabashi uses a timer 38 to determine whether the motor current exceeds a threshold for a predetermined time period. EX1007, 5:8-35, FIG. 4. However, the Petitioner admits Itabashi does not expressly state the number of milliseconds for timer 38. Petition at 44. Rather, Itabashi states: “[T]his time period t38 is set a little longer than the period of motor drive starting or motor braking under the normal condition, that is, under the condition of no lock.” EX1007, 5:24-27.

70. Petitioner goes on to say that “[t]o determine the amount of time to use for the predetermined time period in [1.E], a POSA would have looked for the time it takes a typical motor to drive the valve from fully open to fully closed and vice versa.” Petition at 44. Petitioner claims that “a POSA would have looked for this time period because, if the throttle valve is not moved to the target position after this amount of time, the throttle valve is likely stuck.” *Id.*, at 45. This would have led a POSA to look for the time period in Ohta. Ohta shows a time period for moving the throttle from open to close is approximately 150 milliseconds. EX1020, Ohta, FIG. 6.

71. Then, the Petitioner takes a big leap by saying that “[a] POSA... would have been motivated to use a time higher than 150 milliseconds.” This logic is explained by the need “to build in tolerance, account for the additional time the system would take to move against the bias force of the throttle spring,

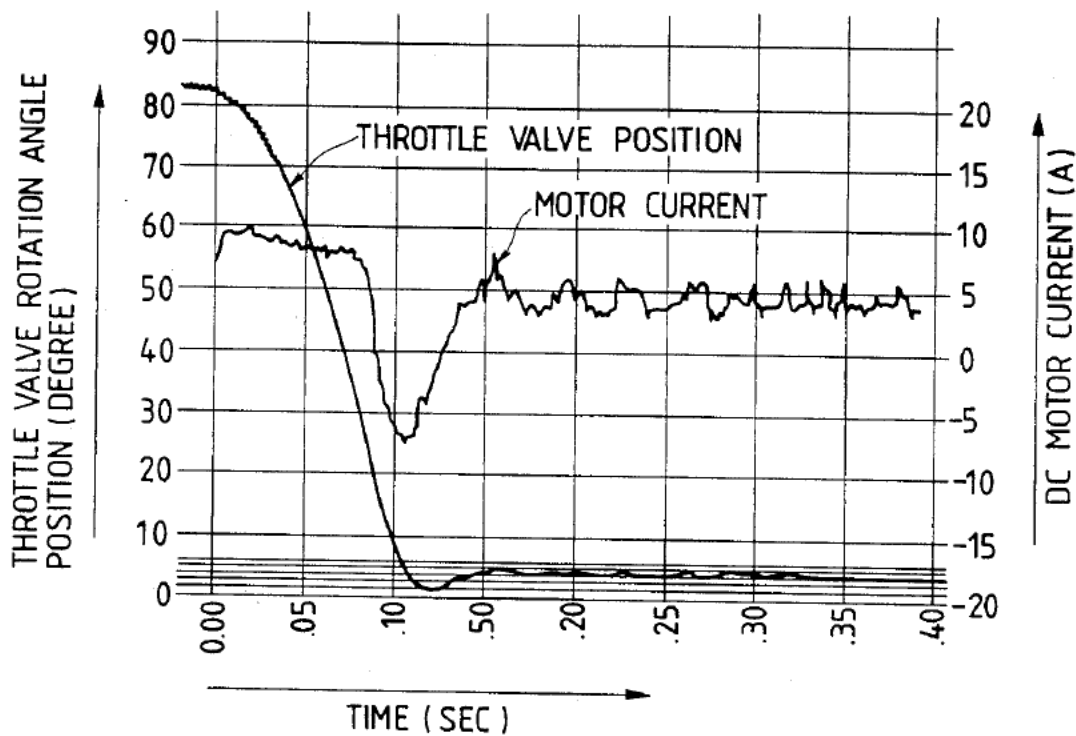
and account for instances where the system takes a while to unjam the throttle valve.” The Petitioner concludes with “[s]electing 300 milliseconds would have been an obvious design choice.” Petition at 45.

72. It is important to note that Ohta shows in FIG. 6 the time a throttle takes while it is being moved from an open position to a closed position. EX1020, Ohta, FIG. 6. Another important note is that Ohta also discloses a “tandem type” throttle valve system in which there are dual throttle valves in series with each other. The first throttle valve is operated directly by an accelerator pedal 4 while the second throttle valve 6 is operated by a DC motor 8 acting as a throttle actuator. The second throttle valve is **biased** to the **fully open position** with a spring 10 for fail-safe operation. EX. 1020 at 2:58-68; FIGS. 1, 2 & 6.

73. Indeed, this spring is working against the motor during the closure of the throttle shown in FIG. 6. And would not need to be compensated for as Ohta clearly shows it only takes 150 milliseconds to move the throttle from an open position to a closed position **working against spring 10 resistance**. *Id.*, at 2:58-68; FIGS. 1, 2 & 6. A POSA would not add time to a system to compensate for spring force in a system that already efficiently closes the throttle from an open position in 150 milliseconds while compensating for the opposing spring force. The Petitioner and its declarant make a large leap to 300 milliseconds without a

logical explanation. A POSA would not just find 150 milliseconds in Ohta then double the time to 300 milliseconds to match the '804 patent without good reason.

FIG. 6



EX1020, FIG. 6 (annotated to correct typo).

74. **Ground 4: Matsumoto in view of Burney and Ritenour renders obvious claims 1, 4, 7, 8, 11, 14, 15, 18.**

75. “Matsumoto discloses a control system that detects when the throttle valve is stuck, such as in a fully open or closed position.” Petition at 12.

76. “Burney discloses a circuit that limits the control effort when the throttle motor stalls, including when the throttle is stuck.” Petition at 15.

77. “Ritenour discloses a servomotor control system that reduces current when current exceeds a threshold for a time period.” Petition at 16

78. A POSA would not have been motivated to combine Matsumoto with any other teaching. Matsumoto does not disclose commanding the positioning device (*e.g.*, throttle plate) to at least one of a hold open or hold closed mode, determining the control effort required to move the positioning device to the commanded position, determining whether the control effort exceeds a threshold for a predetermined time period, and reducing the control effort when the control effort exceeds the threshold for the predetermined time period.

79. “Ritenour discloses a servomotor control system that reduces current when current exceeds a threshold for a time period.” Petition at 16 The Patent Owner acknowledges that such a generic throttle control system was known in the art at the time the ‘804 claimed invention was made. However, the challenged claims of the ‘804 patent are not directed to and do not broadly encompass such a generic throttle control system. Thus, the Itabashi reference is completely irrelevant.

80. Rather than commanding the positioning device to a hold open or hold closed mode and then determining whether the control effort required to move the

positioning device to the commanded position exceeds a threshold for a predetermined time period, Matsumoto “detects when the throttle valve is stuck, such as in a fully open or closed position.” Petition at 12.

81. In short, Matsumoto does not even command the throttle valve to a fully open or closed position at all, but rather, Matsumoto detects when the throttle valve is stuck, which the Petitioner alleges could theoretically be when the throttle valve is in the fully open or fully closed position. However, Matsumoto does not actually disclose this theory. Regardless, Matsumoto never commands the throttle valve to a fully open or fully closed position, much less does Matsumoto then detect the control effort required to move the throttle valve to the *commanded* fully open or fully closed position.

82. **Ground 5: Matsumoto in view of Burney, Ritenour, the GM Manual, and the Chrysler Manual renders obvious claims 2, 5, 9, 12, 16, and 19.**

83. Petitioner admits that Neither Matsumoto nor Burney (nor Ritenour) specifies the voltage that the storage battery 61 or V_{cc} provides to the motor drive circuit. Petition at 76. The Petitioner uses the “GM Manual” to show the “typical” battery voltage of a General Motors vehicle. A POSA would know what the manual states which is “the [voltage] reading should be **close** to the **normal charging system regulated voltage** with the engine running. This is typically

13.5 to 14.5 volts at idle. The manual states that the battery voltage on this scan tool has a measurable range of “0 to 25.5 volts.” Indeed, consideration was given to the fact that the charging system regulated voltage is not always typical meaning it could be above 14.5 volts. EX. 1023 at 0004.

84. The “Chrysler Manual” referenced by the Petitioner is a non-factory issued service information document which states the voltage regulator output ranges from 13.9 to 14.6 volts at 80 degrees Fahrenheit. A POSA would know that the voltage can vary for many reasons, the least of which is temperature as the Chrysler Manual” reference qualifies the voltage with temperature. EX. 1024 at 3-9. None of these references would lead a POSA to select the matching voltages claimed in the ‘804 patent.

85. Ground 6: Matsumoto in view of Burney, Ritenour, and Ohta renders obvious claims 3, 6, 10, 13, 17, and 20.

86. Petitioner admits neither Burney nor Ritenour specifies the number of milliseconds the circuit takes before reducing the threshold based on exceeding the control effort. Petition at 80.

87. Petitioner goes on to say that “[t]o determine the amount of time to use for the predetermined time period in [1.E], a POSA would have looked for the time it takes a typical motor to drive the valve from fully open to fully closed and vice versa.” Petition at 81. Petitioner claims that “a POSA would have looked for

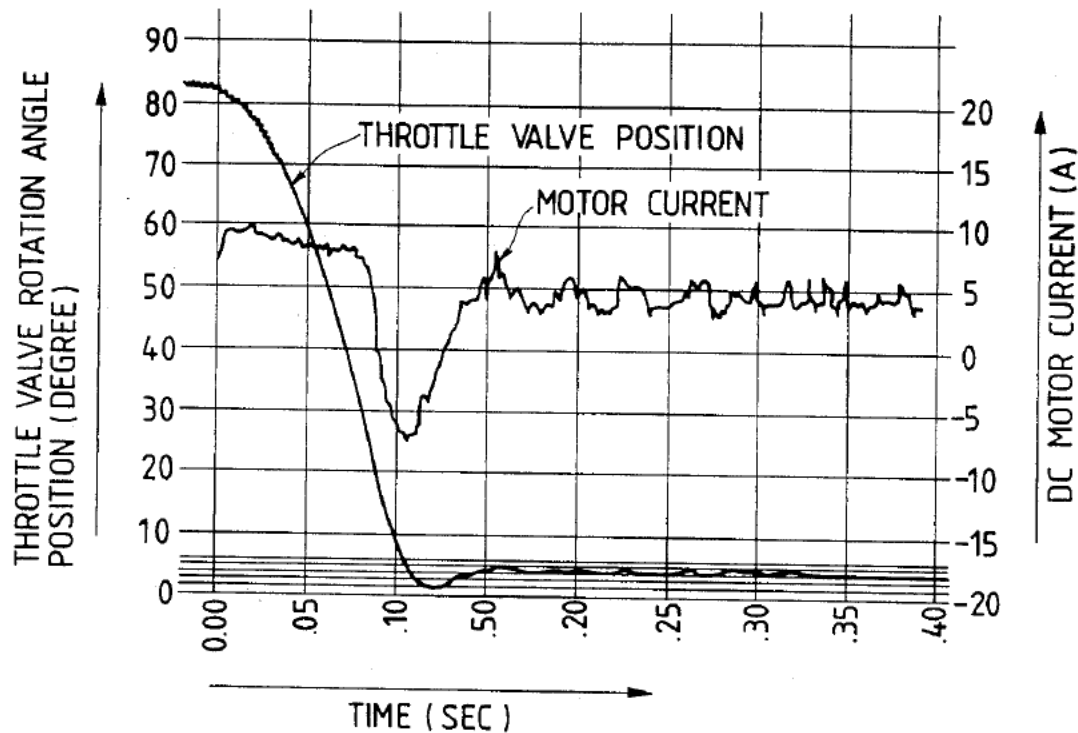
this time period because, if the throttle valve is not moved to the target position after this amount of time, the throttle valve is likely stuck.” *Id.*, at 81. This would have led a POSA to look for the time period in Ohta. Ohta shows a time period for moving the throttle from open to close is approximately 150 milliseconds.

EX1020, Ohta, FIG. 6.

88. Then, the Petitioner takes a big leap by saying that “[a] POSA... would have been motivated to use a time higher than 150 milliseconds.” This logic is explained by the need “to build in tolerance, account for the additional time the system would take to move against the bias force of the throttle spring, and account for instances where the system takes a while to unjam the throttle valve.” The Petitioner concludes with “[s]electing 300 milliseconds would have been an obvious design choice.” Petition at 45.

89. It is important to note that Ohta shows in FIG. 6 the time a throttle takes while it is being moved from an open position to a closed position. EX1020, Ohta, FIG. 6. Another important note is that Ohta also discloses a “tandem type” throttle valve system in which there are dual throttle valves in series with each other. The first throttle valve is operated directly by an accelerator pedal 4 while the second throttle valve 6 is operated by a DC motor 8 acting as a throttle actuator. The second throttle valve is **biased** to the **fully open position** with a spring 10 for fail-safe operation. EX. 1020 at 2:58-68; FIGS. 1, 2 & 6.

90. Indeed, this spring is working against the motor during the closure of the throttle shown in FIG. 6. And would not need to be compensated for as Ohta clearly shows it only takes 150 milliseconds to move the throttle from an open position to a closed position **working against spring 10 resistance**. *Id.*, at 2:58-68; FIGS. 1, 2 & 6. A POSA would not add time to a system to compensate for spring force in a system that already efficiently closes the throttle from an open position in 150 milliseconds while compensating for the opposing spring force. The Petitioner and its declarant make a large leap to 300 milliseconds without a logical explanation. A POSA would not just find 150 milliseconds in Ohta then double the time to 300 milliseconds to match the '804 patent without good reason.

FIG. 6

EX1020, FIG. 6 (annotated to correct typo).

VIII. AVAILABILITY FOR CROSS-EXAMINATION

91. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross examination in the case and that cross examination will take place within the United States. If cross examination is required of me, I will appear for

cross examination within the United States during the time allotted for cross examination.

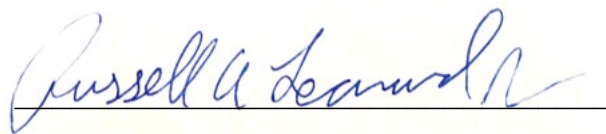
IX. RIGHT TO SUPPLEMENT

92. I reserve the right to supplement my opinions in the future to respond to any arguments that the Petitioner raises and to consider new information as it becomes available to me.

X. JURAT

93. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: June 15, 2020

A handwritten signature in blue ink, reading "Russell A. Leonard", is written over a horizontal line.

Dr. Russell Leonard

Appendix A

Russell A. Leonard, Jr., PhD

Work: 231-591-2357

E-mail: leonardr@ferris.edu

EDUCATION

Doctor of Philosophy, Higher Educational Leadership, June 2016
Western Michigan University, Kalamazoo, Michigan

Master of Education, December 1997, magna cum laude
Wayne State University, Detroit, Michigan
Curriculum: Instructional Systems Design & Adult Education

Bachelor of Science in Secondary Education, June 1991
Central Michigan University, Mount Pleasant, Michigan
Major: K-12 Industrial Engineering & Technology Education, Automotive Focus

WORK EXPERIENCE: FERRIS STATE UNIVERSITY

August 2018 - **Professor, Ferris State University**. College of Engineering Technology, School of
Present Automotive and Heavy Equipment
Currently instructing in both the Automotive Service and Automotive Engineering
Technology programs

August 2017 - **Chair, University Curriculum Committee**.
Present This position oversees curriculum changes at the university level, creates, enforces and
instructs on university policy, reports to the Academic Senate and works closely with the
Academic Affairs office and faculty

August 2015 - **Faculty Advisor, SAE Baja Racing Club**.
Present SAE Baja is a student led team that designs, builds, tests and races an off-road buggy.
The team competes against other universities from around the world

August 2008 - **Associate Professor, Ferris State University**. College of Engineering Technology,
August 2018 School of Automotive and Heavy Equipment
Instructed in both the Automotive Service and Automotive Engineering Technology
programs

August 2008 - **Motorcycle Safety Foundation (MSF) Ridercoach**. Corporate and Professional
August 2015 Development Center
Instructed the Basic Rider Course for the Motorcycle Safety Foundation Program

August 2010 - **Coordinator, Automotive Engineering Technology Program, Ferris State University**.
August 2012 College of Engineering Technology, School of Automotive and Heavy Equipment
Part-time administrator with teaching duties for the Automotive Engineering Technology
program

August 2002 - **Assistant Professor, Ferris State University.** College of Technology, Automotive
August 2008 Department
Instructed in both the Automotive Service and Automotive Engineering Technology
programs

WORK EXPERIENCE: GENERAL MOTORS

June 1998 - **Release Engineer,** Service Operations
August 2002 Developed and validated diagnostic tool software for various vehicle Electronic Control
Modules

August 1997- **Service Engineer,** Cadillac Motor Car Division
June 1998 Assisted technicians in diagnosis and repair of Cadillac vehicles, maintained an
information database, identified and tracked trends, performed root-cause analysis, and
recommended solutions

OTHER WORK EXPERIENCE

August 2008 - **Harley-Davidson Riding Academy Motorcycle Safety instructor,** Grand Rapids
Present Harley-Davidson
Instruct motorcycle rider safety course for Grand Rapids Harley-Davidson's Riding
Academy program

June 1995 - **Systems Engineer, Hughes Training Inc. (Hughes Aircraft Co.)**
August 1997 Designed and developed engineering courses for various General Motors' advanced
engineering projects

July 1986 - **Sergeant E-5, United States Army Reserve (retired)**
July 2005 Certified military instructor in three areas of expertise: Light-Wheeled Vehicle Mechanics,
Crane Operation, and Battlefield Communication

October 1992 - **Engineering Instructor, Ford Motor Co. (via Bartech)**
June 1995 Delivered stand-up instruction in a company-sponsored engineering university; created
lesson plans and wrote textbooks; developed subject-matter expertise in powertrain
controls, from microprocessor strategy to OBD-II systems

June - **Prototype Technician, Roush Industries**
October 1992 Prepared prototype vehicles for engineering testing

July 1991 - **Technician, Lakeside Toyota-Lexus**
June 1992 Performed light through heavy repairs, warranty diagnosis, and vehicle maintenance
programs

January - **Student Teacher, Midland Dow High School**
May 1991 Instructed Automotive Technology and Advanced Drafting

January - May 1990	Teaching Assistant, Central Michigan University Assisted Professor in automotive maintenance course by delivering course material and developing lab activities
1988-1991	Automotive Technician, Souder's Amoco Performed light repairs specializing in no-starts

SPECIAL SKILLS

Canvas and Blackboard Learning Management System (LMS)

Instructional Systems Design

Microsoft Word, Excel, Project, and PowerPoint

Benchmark stand-up instruction

Subject-matter expertise:

Vehicle ECM communication

Keyword protocol 82 and 2000, Class 2, CAN, GM LAN, J1979 (CARB) and J2190

Powertrain controls

Automotive transmissions (electrical and mechanical)

Engine design and performance

Spark ignition

Compression Ignition

Emission controls

Braking systems

HVAC

Suspension and steering systems

Military vehicle design and performance

Military communication networks and systems

Satellite communication hardware and software

PROFESSIONAL ASSOCIATIONS / CERTIFICATIONS / HONORS

ASE Master Recertified Automobile Technician

ASE Recertified, Advanced Engine Performance (L-1)

ASE Certified Truck Technician

Ferris Foundation Grant recipient, 2009, 2010 & 2011

Registered Student Organization Advisor of the Year, 2019 (SAE Baja)

Society of Automotive Engineers (SAE) member

Automotive Transmission Rebuilders Association (ATRA) member

ASTM International Voting Member, D02 & D15

Faculty Advisor, SAE Baja Racing Club

Former Faculty Advisor, Sigma Chi Fraternity

Former Faculty Advisor, Lambda Chi Alpha Fraternity

Former Faculty Advisor, High Performance Motorsports Student Organization (HPMSO)

Former Ferris State University Academic Senate Diversity Committee member

GM President's Council Honors
Ford Powertrain Customer Service Award
Security Clearance: SECRET (expired)

PUBLICATIONS

Leonard, Russell A. Jr., "Females in Automotive Careers: Career Decision-Making Influences and Experiences During University Preparation and Beyond" (2016). *Dissertations*. Paper 1608.
<http://scholarworks.wmich.edu/dissertations/1608>

I have reviewed the Manual Drivetrains and Axles book by Halderman/Birch multiple times including the latest edition (7th) dated 2015, Prentice Hall, 978-0-13-351504-6.

PRESENTATIONS

"How to Make Biodiesel" for the Energy Summer Youth Camp on July 12-16, 2010. The students made biodiesel fuel out of waste vegetable oil from the University's dining facility, and then used it to fuel the test diesel engine.

Biodiesel Processing, Michigan Energy conference, April 7-8, 2009.

Russell A. Leonard, Jr., PhD
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EDUCATION

Doctor of Philosophy, Higher Educational Leadership, June 2016
Western Michigan University, Kalamazoo, Michigan

Master of Education, December 1997, magna cum laude
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August 2018 - Present	Professor, Ferris State University. College of Engineering Technology, Present School of Automotive and Heavy Equipment Currently instructing in both the Automotive Service and Automotive Engineering Technology programs
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August 2010 - August 2012	Coordinator, Automotive Engineering Technology, Ferris State University. College of Engineering Technology, School of Automotive and Heavy Equipment Part-time administrator with teaching duties for the Automotive Engineering Technology program
August 2008 - August 2018	Associate Professor, Ferris State University. College of Engineering Technology, School of Automotive and Heavy Equipment Instructed in both the Automotive Service and Automotive Engineering Technology

programs

August 2008 -
2017 **Ridercoach, Motorcycle Safety Foundation (MSF)**
Ferris State University Corporate and Professional Development Center
Instructed the Basic Rider Course for the Motorcycle Safety Foundation Program

August 2002 -
August 2008 **Assistant Professor, Ferris State University.** College of Technology, Automotive Department
Instructed in both the Automotive Service and Automotive Engineering Technology programs

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Develop and validate diagnostic tool software for various vehicle Electronic Control Modules

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OTHER WORK EXPERIENCE

August 2008-
Present **Harley-Davidson Riding Academy Instructor, Grand Rapids Harley-Davidson**
Instruct basic motorcycle rider safety course for the Harley-Davidson Riding Academy program

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COURSES TAUGHT AT FERRIS STATE UNIVERSITY

AUTO 111 Manual Transmissions and Drivelines
 AUTO 112 Automotive Brake Systems
 AUTO 113 Automotive Electricity and Electronics
 AUTO 116 Engine Electrical Systems
 AUTO 117 Electronic Fuel Management Systems
 AUTO 200 Service Area
 AUTO 211 Automatic Transmission
 AUTO 214 Automotive HVAC
 AUTO 291 Auto Service Internship
 AUTO 450 Automotive Fuels and Lubes
 AUTO 460 Emissions Systems
 AUTO 493 Automotive Engineering Technology Internship
 AMGT 300 Automotive Materials
 AMGT 493 Automotive Management Internship
 FSUS 100 Freshman Seminar
 HEQT 230 Diesel Fuel Systems Technology
 HEQT 193 Industry Internship
 HSET 393 Industry Internship.

SPECIAL SKILLS

Canvas and Blackboard Learning Management Systems (LMS)
 Instructional Systems Design
 Subject-matter expertise:
 Automotive Fuels and Lubricants
 Automotive Coolants and other Liquids
 Vehicle ECM and Scan Tool Communication
 Powertrain Controls, both Hardware and Software
 Automotive Transmissions, Electrical, Mechanical, and Software Calibration
 Engine Design, Performance and Calibration
 Spark Ignition
 Compression Ignition

Gasoline and Diesel Emission Controls
Braking Systems
HVAC
Suspension and Steering Systems
Military Vehicle Design and Performance
Military Communication Networks and Systems
Satellite Communication Hardware and Software
Lift and Load (Crane Operation) Specialist

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PUBLICATIONS

Leonard, Russell A. Jr., "Females in Automotive Careers: Career Decision-Making Influences and Experiences During University Preparation and Beyond" (2016). *Dissertations*. Paper 1608.
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Biodiesel Processing, Michigan Energy conference, April 7-8, 2009.

PROFESSIONAL ORGANIZATIONS

ASTM International (2014-present)

I am a voting member of ASTM International's Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and Committee D15 on Engine Coolants and Related Fluids. ASTM International is an international, not-for-profit organization, based in the USA, for the development, collection, standardization and dissemination of technical knowledge in a wide range of disciplines and is a voluntary, consensus standards organization.

In this capacity, I review; changes to current specifications, new specifications, and the deletion of obsolete specifications. The changes typically come out at multiple times each month. It requires, on average, 5 to 10 hours per month to review all the new changes and determine if there is benefit to the automotive industry. Each main committee in ASTM International is composed of subcommittees that address specific segments within the general subject area covered by the technical committee. Along with the general subject area of D02 and D15, I am a member of the following subcommittees:

D02.01	Combustion Characteristics
D02.06	Analysis of Liquid Fuels and Lubricants
D02.08	Volatility
D02.09	Oxidation of Lubricants
D02.14	Stability and Cleanliness of Liquid Fuels
D02.A0	Gasoline and Oxygenated Fuels
D02.B0	Automotive Lubricants
D02.E0	Burner, Diesel, Non-Aviation Gas Turbine, and Marine Fuels
D02.G0	Lubricating Grease
D02.L0	Industrial Lubricants and Engineering Sciences of High Performance Fluids and Solids
D02.N0	Hydraulic Fluids
D02.P0	Recycled Products
D15.03	Physical Properties
D15.04	Chemical Properties
D15.07	Specifications
D15.11	Heavy Duty Coolants
D15.15	Recycled Engine Coolant
D15.21	Long Life Engine Coolant
D15.21.01	TG on Glycerin/Glycol Blend Base Fluids
D15.22	Non-Aqueous Coolants
D15.25	Diesel Exhaust Fluid
D15.97	World Coolant Standards

ASTM Task Groups

WK51908 – Standard Test Method for Freezing Point of Aqueous Engine Coolants

WK58499 - Standard Specification for Fully-Formulated Glycol Base Engine Coolant for Heavy-Duty Engines
 WK43678 – Standard Specification for Aqueous Engine Coolant Grade Glycol (53% Nominal)
 WK59630 – Standard Specification for Engine Coolant Grade 1,3-Propanediol (PDO)
 WK68375 - ASTM Reference Fluid for Carboxylate-Inhibited Coolant Tests

SAE Member since 2011

Fall 2015 – **Faculty Advisor, Ferris State University SAE Baja student race team**
 present Consult with the team during regular meetings regarding vehicle design, oversee the purchase of parts and materials for the team and expense them through the university accounting process. Assist in the planning of the team’s travel including three competitions per year with many competitions located out-of-state.

National Science Foundation (NSF) Grant			Contact	Credit	Semester
Hours	Rate	Hours			

06/2010	Selected Topics in Energy Education: Biofuels			Sem. Hrs.	1.0
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Professional Development Grants

02/2009	Performance Development of IC Engines	18	CEU	1.8
09/2009	Fuels & the Future for IC Engines	18	CEU	1.8
05/2014	ASTM Gasoline Specs, Testing,& Technology	21	CEU	2.1
09/2014	ASTM Diesel Specs, Testing & Technology	21	CEU	2.1
09/2016	ASTM Petroleum Lab Technician Series: Biodiesel	18	CEU	1.8
06/2019	Center for Advanced Automotive Technology (CAAT) Electric Drive Vehicles Technology	16	CEU	1.6

Non-credit coursework:

10/2008	Toyota TIS2	8		0.5
02/2009	Toyota Engine Management Systems Diagnosis	4		0.25
02/2009	Tech Expo: OBD II, Duramax Diesel, 5 gas	8		0.5
02/2010	Tech Expo: Alignment, Mitchel mgt., ABS	8		0.5
02/2011	Tech Expo: VW Drive By Wire & 6.7L Ford Diesel 8			0.5

03/2012	Powerstroke Diesel Fundamentals Seminar	4	0.25
08/2013	Automotive Networks and Fuel Trim issues	4	0.25
03/2019	National Alternative Fuels Training Consortium Electric Drive Vehicle Technician Training	32	2

PTS On-Demand: Professional Technician's Seminars

12/22/2015	Diagnosing Catalytic Converter Efficiency Codes	1	PDH
12/22/2015	HVAC Update 2015	1	PDH
12/19/2015	Variable Valve Timing Tips & Tricks	1	PDH
12/23/2015	Guerilla Diagnostics	1	PDH
12/23/2015	ABS and Vehicle Stability Control	1	PDH
01/01/2016	No-scope Diagnosis	1	PDH
01/01/2016	Hybrid HV Battery Diagnosis	1	PDH
01/01/2016	Ford 6.0 Powerstroke Misfire Tips	1	PDH
01/01/2016	Sensor Diagnosis	1	PDH
01/01/2016	Hyundai/Kia Tips & Tricks	1	PDH
01/01/2016	Voltage Drop Testing	1	PDH
01/01/2016	Chrysler EVAP Tips & Tricks	1	PDH
01/01/2016	OE Scan Tool Update	1	PDH
01/01/2016	Brain Teasers: Diagnostic Puzzles	1	PDH
01/01/2016	More Duramax Diesel Tips & Tricks	1	PDH
01/01/2016	Diesel No-Start Diagnosis	1	PDH
01/01/2016	GM Idle Stop and Light Hybrid	1	PDH

01/01/2016	Electronic Transmission Controls Part II	1	PDH
01/01/2016	Chrysler/Jeep Tips & Tricks	1	PDH
01/01/2016	Understanding Wiring Schematics Part II	1	PDH

ASTM Petroleum Lab Technician Series: Biodiesel

05/30/2017	ASTM Standard D2622-16 Standard Test Method for Sulfur in Petroleum Products	1	CEU	0.1
05/30/2017	ASTM Standard D1298-12b Standard Test Method for Density, Relative Density or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method	1	CEU	0.1
06/19/2017	ASTM Standard D1319-15 Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption	1	CEU	0.1
06/20/2017	ASTM Standard D4530-15 Standard Test Method for Determination of Carbon Residue (Micro Method)	1	CEU	0.1
06/20/2017	ASTM Standard D445-15a Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)	1	CEU	0.1
06/20/2017	ASTM Standard D4294-16e1 Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry	1	CEU	0.1
06/21/2017	ASTM Standard D5453-16 Standard Test Method for Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence	1	CEU	0.1
06/21/2017	ASTM Standard D524-15 Standard Test Method for Ramsbottom Carbon Residue of Petroleum Products	1	CEU	0.1
06/21/2017	ASTM Standard D482-13 Standard Test Method for Ash from Petroleum Products	1	CEU	0.1
06/22/2017	ASTM Standard D97-17 Standard Test Method for Pour Point of Petroleum Products	1	CEU	0.1

06/21/2017 ASTM Standard D93-15a Standard Test Method for Flash Point by Pensky-Martens Closed Cup Tester	1	CEU	0.1
06/22/2017 ASTM Standard D86-16a Standard Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure	1	CEU	0.1
06/22/2017 ASTM Standard D664-11a Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration	1	CEU	0.1
06/25/2017 ASTM Standard D974-14e2 Standard Test Method for Acid and Base Number by Color-Indicator Titration	1	CEU	0.1
06/25/2017 ASTM Standard D1319-14 Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption	1	CEU	0.1
06/25/2017 ASTM Standard D2622-10 Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry	1	CEU	0.1
06/25/2017 ASTM Standard D4294-10 Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry	1	CEU	0.1
06/25/2017 ASTM Standard D5453-12 Standard Test Method for Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence	1	CEU	0.1