

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

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 6,763,804**

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TABLE OF CONTENTS

I.	Introduction	1
II.	Mandatory Notices (37 C.F.R. § 42.8(a)(1)).....	1
III.	Grounds for Standing (37 C.F.R. § 42.104(a))	3
IV.	Identification of the Challenge (37 C.F.R. § 42.104(b)).....	3
A.	Statutory Grounds for the Challenge.....	3
B.	Citation of Prior Art	4
V.	The '804 Patent	5
A.	To prevent a throttle valve motor from overheating, the '804 patent reduces the control effort to the motor when the control effort exceeds a threshold for a predetermined time period.....	5
B.	The '804 patent underwent limited prosecution.	6
C.	Level of Ordinary Skill in the Art	7
D.	Claim Construction.....	7
VI.	Overview of the Applied References	8
A.	Itabashi discloses a throttle control system that limits the motor current when the current exceeds a threshold for a predetermined time period.....	8
B.	Matsumoto discloses a control system that detects when the throttle valve is stuck, such as in a fully open or closed position.....	12
C.	Burney discloses a circuit that limits the control effort when the throttle motor stalls, including when the throttle is stuck.....	15
D.	Ritenour discloses a servomotor control system that reduces current when current exceeds a threshold for a time period.	16
E.	The GM Manual and the Chrysler Manual show that a car battery typically supplied up to 14.5 volts.	17

*Petition for Inter Partes Review of
U.S. Patent No. 6,763,804*

F.	Ohta discloses a graph showing the relationship between throttle position, current, and time.....	18
VII.	Ground 1: Itabashi renders obvious claims 1, 4, 7, 8, 11, 14, 15, and 18.	18
A.	Independent Claim 1	18
1.	[1.P] “A method for controlling a positioning device of an internal combustion engine”	18
2.	[1.A] “providing an electric motor for actuating the positioning device”	19
3.	[1.B] “commanding the positioning device to change to a commanded position”	19
4.	[1.C] “detecting a control effort required to change to said commanded position”	21
5.	[1.D] “determining whether said control effort exceeds a threshold for a predetermined time period”	23
6.	[1.E] “reducing said control effort when said control effort exceeds said threshold for said predetermined time period”	25
7.	[1.F] “wherein commanding the positioning device to change to 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 dose [sic] to a hold close mode”	27
B.	Claim 4	30
C.	Claim 7	31
D.	Claim 8	32
E.	Independent Claim 11	33
1.	[11.P] “A system for controlling a positioning device of an internal combustion engine to prevent overheat conditions”	33

*Petition for Inter Partes Review of
U.S. Patent No. 6,763,804*

2.	[11.A] “an electric motor for actuating the positioning device with a control effort”	33
3.	[11.B] “a control effort detector coupled to said electric motor and intended to detect said control effort”	33
4.	[11.C] “a controller coupled to said electric motor and said control effort detector, said controller including control logic operative to command the positioning device to change to a commanded position, detect a control effort required to change to said commanded position, determine whether said control effort exceeds a threshold for a predetermined time period, and reduce said control effort when said control effort exceeds said threshold for said predetermined time period”	34
5.	[11.D] “wherein said controller further includes control logic operative to command the positioning device to close to said commanded position in a hold close mode”	37
F.	Claim 14	37
G.	Claim 15	38
H.	Claim 18	38
VIII.	Ground 2: Itabashi in view of the GM Manual and the Chrysler Manual renders obvious claims 2, 5, 9, 12, 16, and 19.....	38
A.	Rationale for Combining Itabashi, the GM Manual, and the Chrysler Manual	38
B.	Claims 5, 9, 16, and 19.....	41
C.	Claims 2 and 12.....	42
IX.	Ground 3: Itabashi in view of Ohta renders obvious claims 3, 6, 10, 13, 17, and 20.	44
A.	Rationale for Combining Itabashi and Ohta.....	44
B.	Claims 3 and 13.....	47

*Petition for Inter Partes Review of
U.S. Patent No. 6,763,804*

C.	Claims 6, 10, 17, and 20.....	48
X.	Ground 4: Matsumoto in view of Burney and Ritenour renders obvious claims 1, 4, 7, 8, 11, 14, 15, 18.....	49
A.	Rationale for Combining Matsumoto, Burney, and Ritenour	49
B.	Independent Claim 1	54
1.	[1.P] “A method for controlling a positioning device of an internal combustion engine”	54
2.	[1.A] “providing an electric motor for actuating the positioning device”	55
3.	[1.B] “commanding the positioning device to change to a commanded position”	56
4.	[1.C] “detecting a control effort required to change to said commanded position”	57
5.	[1.D] “determining whether said control effort exceeds a threshold for a predetermined time period”	60
6.	[1.E] “reducing said control effort when said control effort exceeds said threshold for said predetermined time period”	64
7.	[1.F] “wherein commanding the positioning device to change to 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 dose [sic] to a hold close mode”	67
C.	Claim 4	68
D.	Claim 7	69
E.	Claim 8	69
F.	Independent Claim 11	70
1.	[11.P] “A system for controlling a positioning device of an internal combustion engine to prevent overheat conditions”	70

*Petition for Inter Partes Review of
U.S. Patent No. 6,763,804*

2.	[11.A] “an electric motor for actuating the positioning device with a control effort”	71
3.	[11.B] “a control effort detector coupled to said electric motor and intended to detect said control effort”	71
4.	[11.C] “a controller coupled to said electric motor and said control effort detector, said controller including control logic operative to command the positioning device to change to a commanded position, detect a control effort required to change to said commanded position, determine whether said control effort exceeds a threshold for a predetermined time period, and reduce said control effort when said control effort exceeds said threshold for said predetermined time period”	72
5.	[11.D] “wherein said controller further includes control logic operative to command the positioning device to close to said commanded position in a hold close mode”	73
G.	Claim 14	73
H.	Claim 15	74
I.	Claim 18	74
XI.	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.	74
A.	Rationale for Combining Matsumoto, Burney, Ritenour, the GM Manual, and the Chrysler Manual	74
B.	Claims 5, 9, 16, and 19	77
C.	Claims 2 and 12	78
XII.	Ground 6: Matsumoto in view of Burney, Ritenour, and Ohta renders obvious claims 3, 6, 10, 13, 17, and 20.	80
A.	Rationale for Combining Matsumoto, Burney, Ritenour, and Ohta	80

*Petition for Inter Partes Review of
U.S. Patent No. 6,763,804*

B.	Claims 3 and 13	83
C.	Claims 6, 10, 17, and 20	84
XIII.	CONCLUSION	85

EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 6,763,804 to Pursifull (“’804 patent”)
1002	Prosecution File History of U.S. Patent No. 6,763,804 B2 (“’804 history”)
1003	Declaration of Gerald Micklow, Ph.D. (“Micklow Decl.”)
1004	<i>Curriculum Vitae</i> (CV) of Gerald Micklow, Ph.D. (“Micklow CV”)
1005	U.S. Patent No. 4,850,319 to Imoehl, titled “Electronic Throttle Actuator,” issued July 25, 1989 (“Imoehl”)
1006	U.S. Patent No. 4,656,407 to Burney, titled “Electric Motor Servo Control System and Method,” issued April 7, 1987 (“Burney”)
1007	U.S. Patent No. 6,329,777 to Itabashi et al., titled “Motor Drive Control Apparatus and Method Having Motor Current Limit Function Upon Motor Lock,” filed Sept. 7, 1999 (“Itabashi”)
1008	U.S. Patent No. 6,073,610 A to Matsumoto et al., titled “Control Apparatus of Internal Combustion Engine Equipped with Electronic Throttle Control Device,” issued June 13, 2000 (“Matsumoto”)
1009	European Patent Pub. No. 0121938 B1 to Murakami, titled “Throttle Control System for Automotive Vehicle,” published Dec. 30, 1986 (“Murakami”)

*Petition for Inter Partes Review of
U.S. Patent No. 6,763,804*

Exhibit No.	Description
1010	European Patent Application No. EP 0874148 A2 to Matsumoto et al., titled “Control Apparatus for a Vehicle,” published Oct. 28, 1998 (“Matsumoto II”)
1011	UK Patent Application No. GB 2339850 to Pursifull, titled “A Throttle Valve for an Internal Combustion Engine with a Limp Home Position,” published Feb. 9, 2000 (“Pursifull”)
1012	U.S. Patent No. 4,313,408 to Collonia, titled “Device for the Control of the Traveling Speed of a Motor Vehicle,” issued Feb. 2, 1982 (“Collonia”)
1013	U.S. Patent No. 5,078,110 A to Rodefled, titled “Method and Arrangement for Detecting and Loosening Jammed Actuators,” issued January 7, 1992 (“Rodefled”)
1014	U.S. Patent No. 4,854,283 to Kiyono et al., titled “Throttle Valve Control Apparatus,” issued Aug. 8, 1989 (“Kiyono”)
1015	U.S. Patent No. 6,286,481 to Bos et al., titled “Electronic Throttle Return Mechanism with a Two Spring and One Lever Default Mechanism,” issued Sept. 11, 2001 (“Bos”)
1016	U.S. Patent No. 4,771,850 to Matsuda, titled “Automotive Traction Control System with Feature of Enabling and Disabling Control Depending Upon Vehicle Speed,” issued September 20, 1988 (“Matsuda”)
1017	U.S. Patent No. 5,712,550 to Boll et al., titled “Apparatus for Controlling a Power Control Element of a Drive Unit of a Motor Vehicle,” issued Jan. 27, 1998 (“Boll”)

***Petition for Inter Partes Review of
U.S. Patent No. 6,763,804***

Exhibit No.	Description
1018	U.S. Patent No. 5,749,343 to Nichols et al., titled “Adaptive Electronic Throttle Control,” issued May 12, 1998 (“Nichols”)
1019	William M. Erickson, Protecting Servomotors from Self Destruction, Machine Design (Sept. 1, 2000) (“Erickson”)
1020	U.S. Patent No. 4,982,710 to Ohta et al., titled “Electronic Throttle Valve Opening Control Method and System Therefor,” issued Jan. 8, 1991 (“Ohta”)
1021	Snap-On, BMW Reference Manual (Aug. 2001, 1st ed.) (“BMW Manual”)
1022	William L. Husselbee, Automotive Computer Control Systems, Harcourt Brace (1989) (“Husselbee”)
1023	Snap-On, General Motors Reference Manual (Apr. 1995, 7th ed.) (“GM Manual”)
1024	Chrysler Front Wheel Drive 1981-92 Repair Manual (1992) (“Chrysler Manual”)
1025	Declaration of Sylvia D. Hall-Ellis, Ph.D. (“Hall-Ellis Decl.”)
1026	<i>Curriculum Vitae</i> (CV) of Sylvia D. Hall-Ellis, Ph.D. (“Hall-Ellis CV”)
1027	U.S. Patent No. 4,645,992 to Ritenour, titled “Electronically Controlled Servomotor Limit Stop,” issued Feb. 24, 1987 (“Ritenour”)

*Petition for Inter Partes Review of
U.S. Patent No. 6,763,804*

Exhibit No.	Description
1028	U.S. Patent No. 4,364,111 to Jocz, titled “Electronically Controlled Valve Actuator,” issued Dec. 14, 1982 (“Jocz”)
1029	Amended Complaint for Patent Infringement, <i>Michigan Motor Technologies LLC v. Volkswagen AG</i> , Case No. 2:19-cv-10485 (E.D. Mich.), filed April 30, 2019
1030	Second Amended Complaint for Patent Infringement, <i>Michigan Motor Technologies LLC v. Volkswagen AG</i> , Case No. 2:19-cv-10485 (E.D. Mich.), filed January 6, 2020
1031	Milestones on the Automotive Information Super-Highway, Snap-on Diagnostics (Apr. 13, 2001), <i>available at</i> https://web.archive.org/web/20010413220224/http://www.snapondia.com/mileston.htm
1032	MT2500 Scanner Home, Snap-on Diagnostics (June 11, 2001), <i>available at</i> https://web.archive.org/web/20010611023000/http://www.snapondia.com:80/scanner.htm
1033	Domestic Combo Primary Cartridge, Snap-on Diagnostics (April 11, 2001), <i>available at</i> https://web.archive.org/web/20010411032033/http://www.snapondia.com/99combo.htm

I. Introduction

Volkswagen Group of America, Inc. (“VWGoA”) petitions for *inter partes* review of claims 1-20 of U.S. Patent No. 6,763,804, titled “Electronic Throttle Servo Overheat Protection System.”

The ’804 patent describes and broadly claims a conventional engine throttle valve control system that reduces the control effort (e.g., voltage, current, duty cycle) to an electric motor when the control effort exceeds a threshold for a predetermined time period. This simple protective measure was well known. Moreover, the dependent claims merely recite obvious design choices for threshold levels (e.g., 6 volts) and predetermined time periods (e.g., 300 milliseconds).

The Petition, supported by Dr. Micklow and his over forty-five years of experience related to electronic throttle control systems, explains how all claims of the ’804 patent are unpatentable. Indeed, the ’804 patent does not claim any novel or nonobvious feature. Accordingly, Petitioner respectfully requests that the Board institute review and ultimately find all twenty claims unpatentable.

II. Mandatory Notices (37 C.F.R. § 42.8(a)(1))

REAL PARTY IN INTEREST: Volkswagen Group of America, Inc. and Volkswagen Aktiengesellschaft, which is the parent corporation of Volkswagen Group of America, Inc., are real parties-in-interest.

*Petition for Inter Partes Review of
U.S. Patent No. 6,763,804*

RELATED MATTERS: The '804 patent is the subject of the following civil actions: *Michigan Motor Technologies LLC v. Volkswagen AG*, Case No. 2:19-cv-10485 (E.D. Mich.), filed February 18, 2019. On January 6, 2020, Michigan Motor Technologies LLC ("MMT") filed a second amended complaint, which maintained its alleged infringement of the '804 patent. Second Amended Complaint for Patent Infringement, *Michigan Motor Technologies LLC v. Volkswagen AG*, No. 2:19-cv-10485 (E.D. Mich. Jan. 6, 2020).

LEAD AND BACKUP COUNSEL: Under 37 C.F.R. §§ 42.8(b)(3) and 42.10(a), Petitioner appoints: **Michael D. Specht** (Reg. No. 54,463) as lead counsel; **Jason A. Fitzsimmons** (Reg. No. 65,367) as first back-up counsel; and **Danny E. Yonan** (Reg. No. 53,812), **Richard Bemben** (Reg. No. 68,658), and **Tyler J. Dutton** (Reg. No. 75,069) as additional back-up counsel, all at the address: STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C., 1100 New York Avenue, N.W., Washington, D.C., 20005, phone (202) 371-2600 and facsimile (202) 371-2540.

SERVICE INFORMATION: Petitioner consents to electronic service by email at: **mspecht-PTAB@sternekessler.com; jfitzsimmons-PTAB@sternekessler.com; dyonan-PTAB@sternekessler.com; rbemben-PTAB@sternekessler.com; tdutton-PTAB@sternekessler.com; and PTAB@sternekessler.com.**

III. Grounds for Standing (37 C.F.R. § 42.104(a))

The undersigned and Petitioner certify that the '804 patent is available for *inter partes* review. Petitioner is not barred or estopped from requesting this *inter partes* review on the grounds herein. On February 18, 2019, MMT filed a complaint against Volkswagen Aktiengesellschaft alleging infringement of the '804 patent. VWGoA was added via amended complaint on April 30, 2019. A Certificate of Service on VWGoA was filed with the court on May 22, 2019. This Petition is filed within one year of service by MMT.

IV. Identification of the Challenge (37 C.F.R. § 42.104(b))

A. Statutory Grounds for the Challenge

Ground	References	Basis	Claims Challenged
1	Itabashi	§103	1, 4, 7, 8, 11, 14, 15, 18
2	Itabashi, GM Manual, Chrysler Manual	§103	2, 5, 9, 12, 16, 19
3	Itabashi, Ohta	§103	3, 6, 10, 13, 17, 20
4	Matsumoto, Burney, Ritenour	§103	1, 4, 7, 8, 11, 14, 15, 18
5	Matsumoto, Burney, Ritenour, GM Manual, Chrysler Manual	§103	2, 5, 9, 12, 16, 19
6	Matsumoto, Burney, Ritenour, Ohta	§103	3, 6, 10, 13, 17, 20

B. Citation of Prior Art

The earliest effective filing date of the '804 patent is October 9, 2001.

EX1001, (22). All the references in the grounds predate this date.

U.S. Patent No. 6,329,777 to Itabashi *et al.* (EX1007) is prior art under at least 35 U.S.C. § 102(e) because Itabashi was filed on September 7, 1999 and claims priority to November 18, 1998, nearly three years before the '804 patent.

U.S. Patent No. 6,073,610 to Matsumoto *et al.* (EX1008) is prior art under at least 35 U.S.C. § 102(b) because Matsumoto issued on June 13, 2000, more than a year before the '804 patent.

U.S. Patent No. 4,656,407 to Burney (EX1006) is prior art under at least 35 U.S.C. § 102(b) because Burney issued on April 7, 1987, more than fourteen years before the '804 patent.

U.S. Patent No. 4,645,992 to Ritenour (EX1027) is prior art under at least 35 U.S.C. § 102(b) because Ritenour issued on February 24, 1987, more than fourteen years before the '804 patent.

U.S. Patent No. 4,982,710 to Ohta *et al.* (EX1020) is prior art under at least 35 U.S.C. § 102(b) because Ohta issued on January 8, 1991, more than ten years before the '804 patent.

Snap-On, General Motors Reference Manual (1st ed.) (EX1023) is prior art under at least 35 U.S.C. § 102(b) because the GM Manual was published and

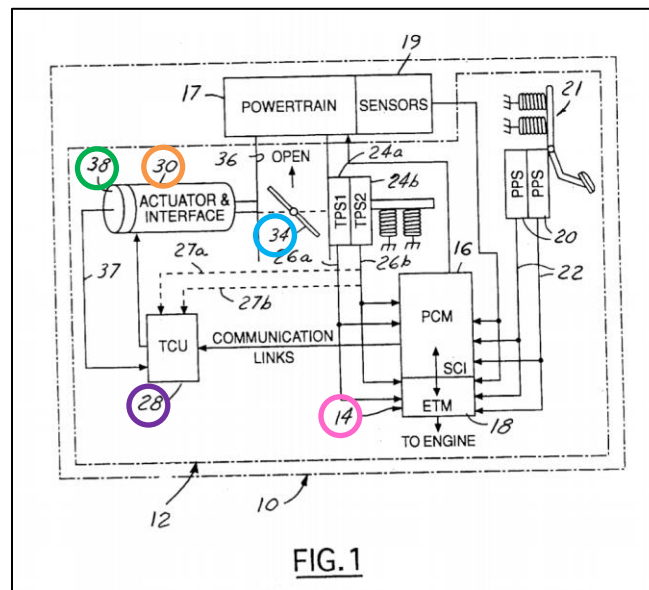
publicly accessible at least by April 1995, more than six years before the '804 patent. EX1023, 0002, 0005; EX1003, ¶102.

Chrysler Front Wheel Drive 1981-92 Repair Manual (EX1024) is prior art under at least 35 U.S.C. § 102(b) because the Chrysler Manual was published and publicly accessible at least by December 9, 1991, nearly ten years before the '804 patent. EX1024, 0001, 0002, 0008, 0009; EX1025, ¶¶38-44.

V. The '804 Patent

A. To prevent a throttle valve motor from overheating, the '804 patent reduces the control effort to the motor when the control effort exceeds a threshold for a predetermined time period.

The '804 patent describes a system to control a throttle motor. EX1001, '804 patent, Abstract, 1:59-2:9. The system uses conventional, well-known hardware. EX1003, Mickow Decl., ¶¶41, 56-66. Figure 1 shows: (1) a positioning device 34 (a throttle plate); (2) a motor 30 to change the position of the throttle; (3) a sensor 38 to detect a control effort; and (4) an electronic control unit 14 and a throttle control unit 28 to control the opening and closing of the throttle. EX1001, Abstract, 2:43-49, 3:4-13.



EX1001, FIG. 1 (annotated).

According to the '804 patent, applying a large and extended control effort to the throttle motor can overstress the motor's physical components. EX1001, 1:36-47. To prevent the motor from overheating, the system simply determines whether the control effort exceeds a threshold for a predetermined time period. *Id.*, 2:6-7. "When the control effort exceeds the threshold for the predetermined time period, the control effort is reduced." *Id.*, 2:7-9. But as this Petition explains, limiting the control effort to protect the motor was well known. *See also* EX1003, ¶62.

B. The '804 patent underwent limited prosecution.

During prosecution, the examiner raised only a single prior-art reference—JP 03226283 A to Fujiyoshi. The examiner rejected the then-pending independent claims as anticipated by Fujiyoshi and the then-pending dependent claims as obvious in view of Fujiyoshi. EX1002, '804 history, 0063-0065. In response to the

rejections, the applicant amended the claims to include what the examiner considered to be allowable subject matter: commanding the positioning device to open to a hold open mode or close to a hold close mode. EX1002, 0067-0073. The examiner then issued a Notice of Allowance. *Id.*, 0075-0080.

C. Level of Ordinary Skill in the Art

A person of ordinary skill in the art (“POSA”) at the time of the alleged invention would have had a B.S. degree in Mechanical Engineering or Electrical Engineering (or equivalent) and at least two to four years of academic or industry experience in the relevant field of engine control systems. EX1003, ¶¶51-53.

D. Claim Construction

Other than the term “dose” in claims 1 and 8, all other terms should receive their plain and ordinary meaning, in the context of the ’804 patent specification, under the *Phillips* standard.

The Board should construe “dose” as “close” to correct a printing error in the claims. EX1003, ¶55. The Board can use claim construction to correct minor typographical or clerical errors. *Novo Industries, L.P. v. Micro Molds Corp.*, 350 F.3d 1348, 1357 (Fed. Cir. 2003); *Ultimax Cement Mfg. Corp. v. CTS Cement Mfg. Corp.*, 587 F.3d 1339, 1353 (Fed. Cir. 2009). Here, claims 1 and 8 include a typographical error—the term “dose” should be “close,” which occurred upon printing the patent. EX1002, 0069-0071, 0121.

VI. Overview of the Applied References

The applied references disclose elements of an automotive control system and are in the same field of endeavor as the '804 patent. EX1003, ¶67. The applied references would have also been reasonably pertinent to problems faced by the inventor of the '804 patent. *Id.*, ¶68.

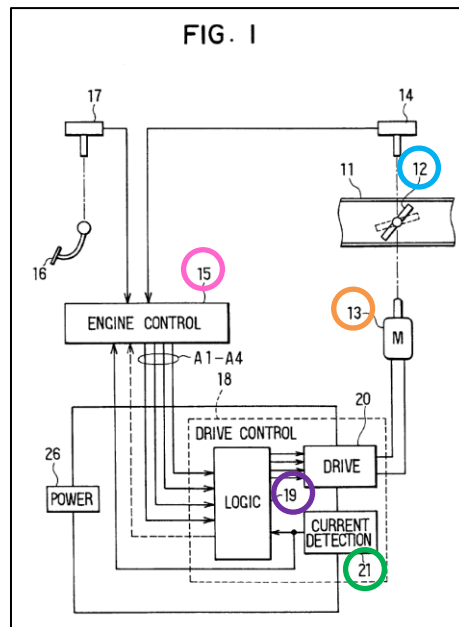
The Office has not considered the claims in view of the applied references. Itabashi and Matsumoto—the primary references—were neither cited nor applied during prosecution. Burney was cited in an IDS but never applied. *See* EX1002, 0033. Accordingly, the same or substantially the same prior art or arguments were not previously presented to the Office. *Cf. Microsoft Corp. v. Parallel Networks Licensing, LLC*, IPR2015-00486, Paper 10, 14-15 (July 15, 2015).

A. Itabashi discloses a throttle control system that limits the motor current when the current exceeds a threshold for a predetermined time period.

Itabashi discloses “a motor current limit function, which can be applied to a motor driven throttle valve control in an internal combustion engine.” EX1007, Itabashi, 1:13-16. Itabashi recognized 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. To limit excessive motor current, Itabashi’s system has a current detection circuit 21.

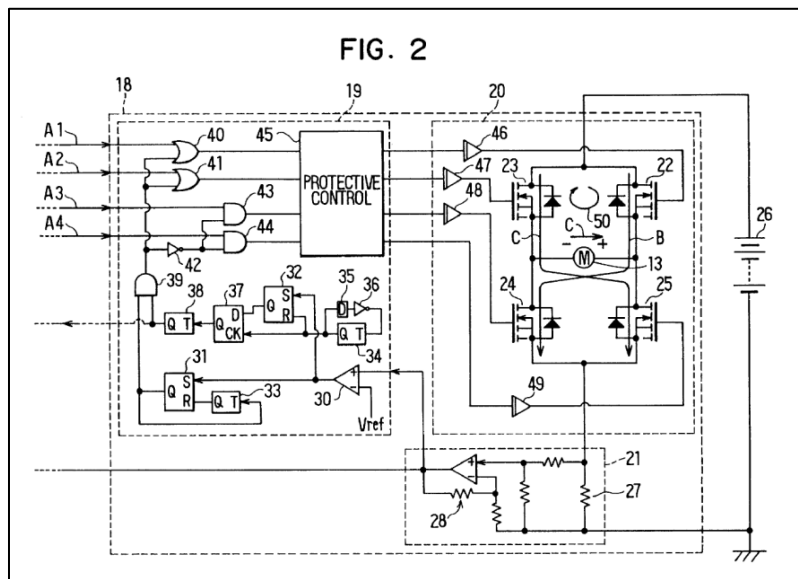
Itabashi discloses the same structure as the '804 patent. EX1003, ¶70.

Shown below, Itabashi's system has: (1) an electronic controlled throttle valve 12; (2) a direct current motor 13; (3) a current detection circuit 21; and (4) both an engine control circuit 15 and a drive logic circuit 19 to open and close the throttle valve 12. EX1007, 2:63-3:10, 3:48-55, 5:44-59, FIGS. 1, 2.



EX1007, FIG. 1 (annotated).

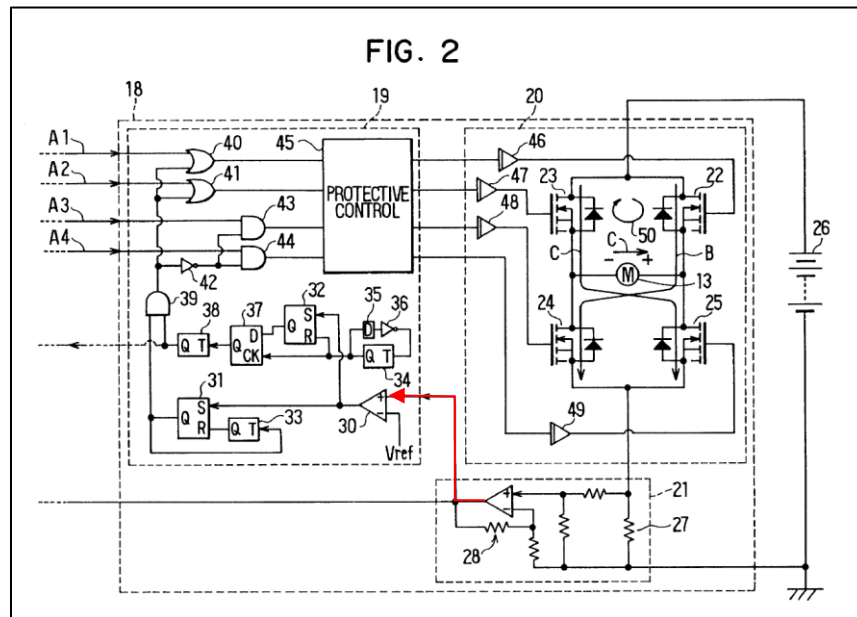
The drive control circuit 18 includes: (1) drive logic circuit 19; (2) drive circuit 20; and (3) current detection circuit 21. Figure 2 shows the circuitry for these three elements of the drive control circuit 18. *Id.*, 3:30-31, FIG. 2.



EX1007, FIG. 2.

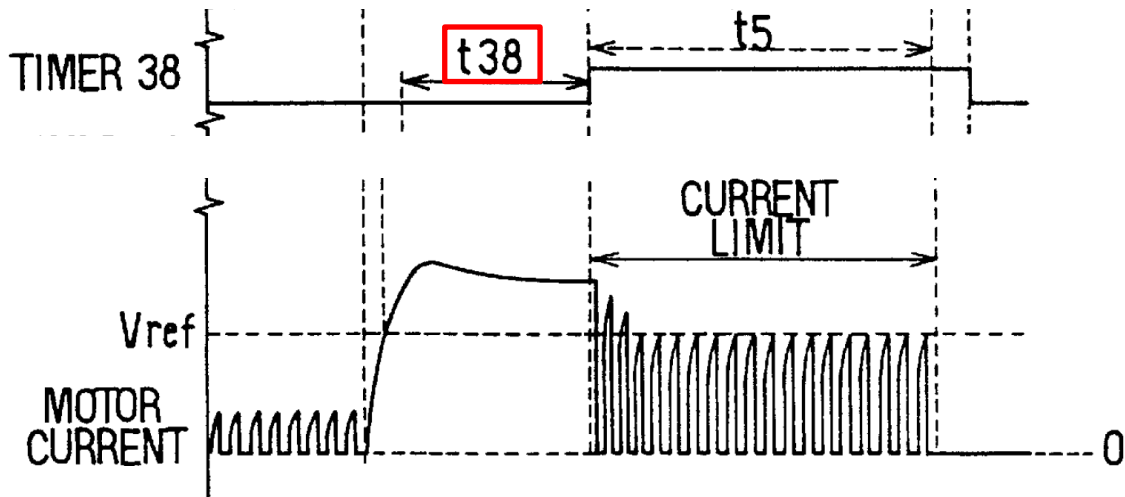
The drive control circuit 18 includes a current detection circuit 21 to determine whether the drive current for the motor is excessively high. *Id.*, 3:11-16, 3:48-51. Shown above, “[t]he current detection circuit 21 includes a resistor 27 and a differential amplifier circuit 28.” *Id.*, 3:42-44, FIG. 2. “The output signal of the current detection circuit 21 [is] indicative of the motor current flowing in the motor 13 [and] is applied to the drive logic circuit 19.” *Id.*, 3:44-47. Shown below, the current detection circuit 21 sends the current indicator to the drive logic circuit 19. *Id.*, 3:44-47, FIG. 2. “In the drive logic circuit 19, a comparator 30 is provided to compare the output signal of the current detection circuit 21 with a reference signal V_{ref} , which is set to correspond to the maximum limit level of the motor current.”

EX1007, 3:48-51. “[T]his limit level is set low to protect the MOSFETs 22-25
from breaking....” *Id.*, 3:52-55.



EX1007, FIG. 2 (annotated).

When the output signal of the current detection circuit 21 is higher than V_{ref} , the output of comparator 30 becomes high. *Id.*, 3:48-51, 3:58-59, FIG. 2. The output of comparator 30 is tied to a timing circuit. EX1003, ¶76. As Figure 4 shows below, the motor current exceeds V_{ref} for a predetermined time period t_{38} . EX1007, FIG. 4; EX1003, ¶¶76-78. After the predetermined time period, the system reduces the motor current to V_{ref} . EX1007, FIG. 4; EX1003, ¶¶76-78.



EX1007, FIG. 4 (excerpted and annotated).

Itabashi discloses the structure and functionality recited in the '804 patent. EX1003, ¶¶70, 80. And Itabashi uses its current detection circuit 21 for the same purpose as the '804 patent—as an overheat protection system: “[T]he current flowing in the MOSFETs 22-25 can be limited to the lower level to *reduce the heat generation* of the MOSFETs 22-25.”¹ EX1007, 8:25-30; EX1003, ¶¶79-80.

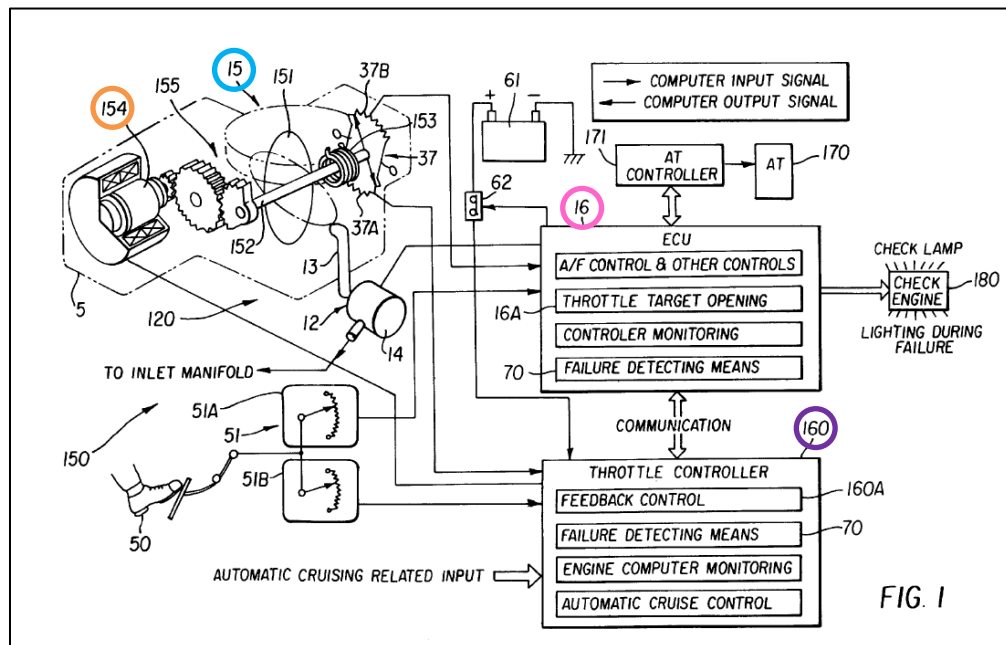
B. Matsumoto discloses a control system that detects when the throttle valve is stuck, such as in a fully open or closed position.

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

¹ Emphasis added throughout unless otherwise indicated.

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. Recognizing this problem, Matsumoto’s system detects when the throttle valve is stuck and takes corrective action. EX1003, ¶¶81, 85-90.

Matsumoto discloses the generic structure in the ’804 patent. *Id.*, ¶82. As Figure 1 shows below, Matsumoto’s system has: (1) an electronic controlled throttle valve 15; (2) an electric motor (throttle actuator) 154; and (3) an engine control computer (ECU) 16 and a throttle control computer (throttle controller) 160 to open/close the throttle valve 15. EX1008, 3:63-4:6, 4:60-67, 5:18-21, 6:62-7:3.

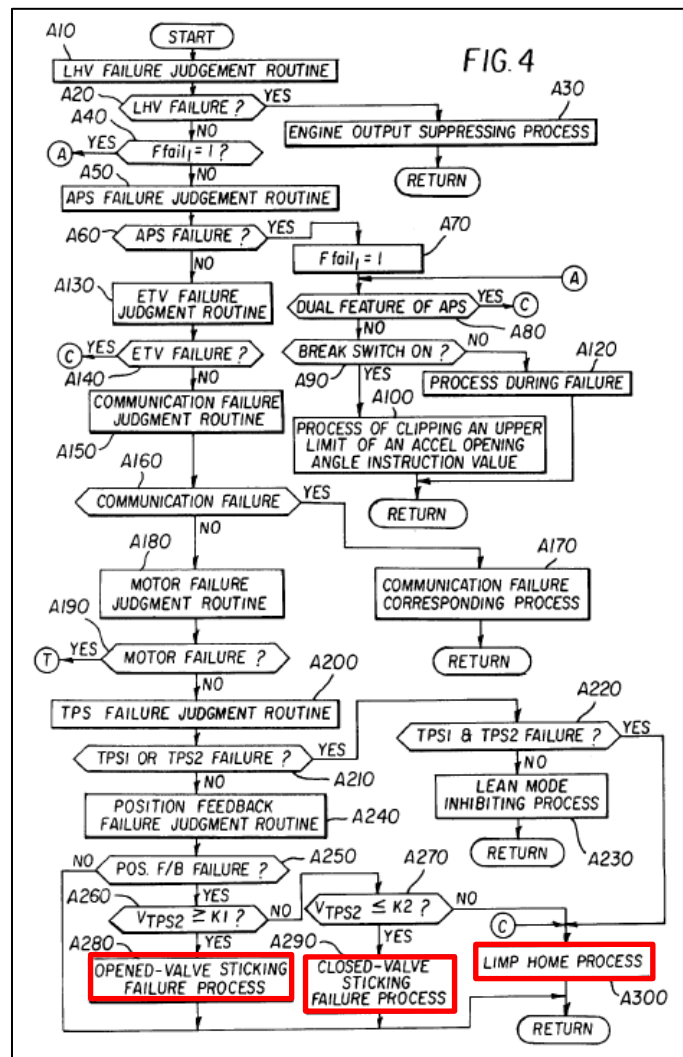


EX1008, FIG. 1 (annotated).

The throttle controller 160 has a failure detecting means 70 that detects whether the throttle is stuck. EX1008, 8:39-9:67, 14:35-39. The failure detecting

means 70 detects a failure when the difference between a target throttle opening and the actual throttle opening is “greater than a predetermined opening (for example 1°) over a predetermined time (for example, 500 ms).” *Id.*, 14:41-52.

When the failure detecting means 70 detects a failure in the throttle valve (step A250), the system performs an opened-valve sticking failure process (step A280), a closed-valve sticking failure process (step A290), or a limp home process (step A300) as shown below. *Id.*, 20:1-40, FIG. 4; EX1003, ¶¶85-90.



EX1008, FIG. 4 (annotated).

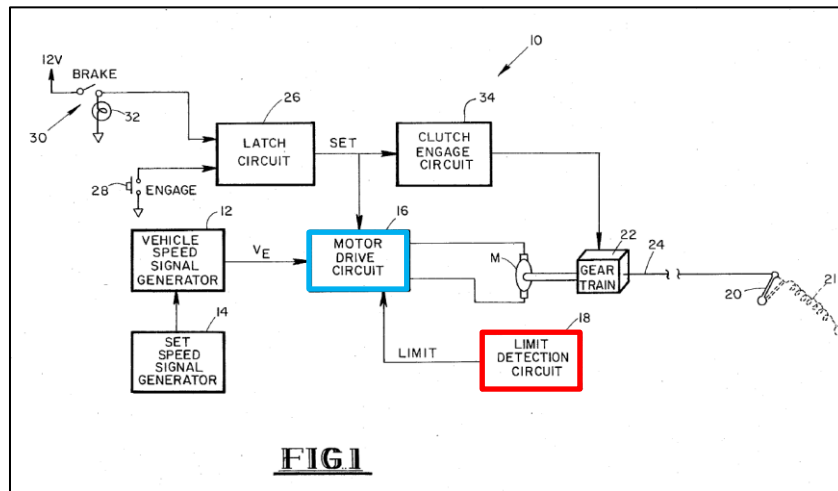
Matsumoto discloses the structure recited in the '804 patent claims and a process that detects when the throttle valve is stuck. EX1003, ¶¶82, 84-86. To the extent the system does not reduce a control effort when it exceeds a threshold for a predetermined time period, Burney and Ritenour provide this teaching.

C. Burney discloses a circuit that limits the control effort when the throttle motor stalls, including when the throttle is stuck.

Burney discloses a cruise control system with an electric motor for moving a throttle. EX1006, Burney, 1:6-15, 2:17-24; EX1003, ¶92. 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; EX1003, ¶¶95-96. “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. “A similar circuit may be provided to terminate the drive current when the servo is in the idle position....” EX1006, 3:30-35; EX1003, ¶98.

“FIG. 1 is a block diagram of [the] electric motor servo control system....” *Id.*, 4:32-33. When the motor is stalled, “[l]imit detection circuit 18 will sense this

condition, and generate the LIMIT signal.” *Id.*, 7:55-57; *see also id.*, 4:11-14, 5:7-10, FIG. 1. “Responding to the LIMIT signal, the motor driven circuit will terminate drive current to the motor M...” EX1006, 7:57-63.



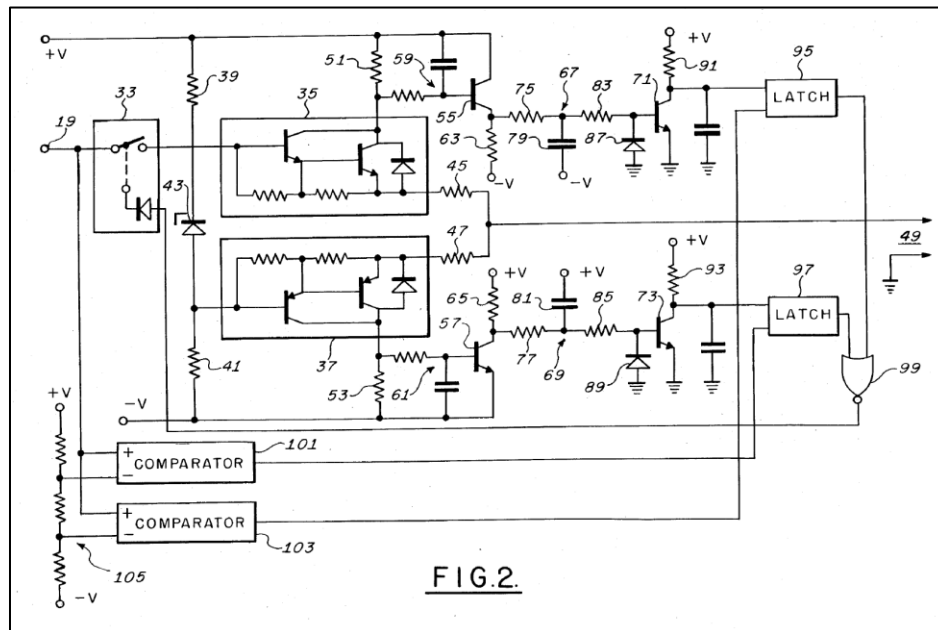
EX1006, FIG. 1 (annotated).

Burney’s system therefore limits the drive current (the control effort) when the drive current exceeds a threshold. EX1003, ¶¶94-99.

D. 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. As the circuit shows below, abnormally high current “will cause the transistor 55 [or 57] to conduct, thereby beginning to charge the timing capacitor 79 [or 81].” *Id.*, 3:33-35, FIG. 2. Once the capacitor is charged, the circuit terminates the current by opening switch 33. *Id.*,

3:35-39, FIG. 2. Ritenour therefore terminates the current when the current exceeds a threshold for a predetermined time period. EX1003, ¶100.



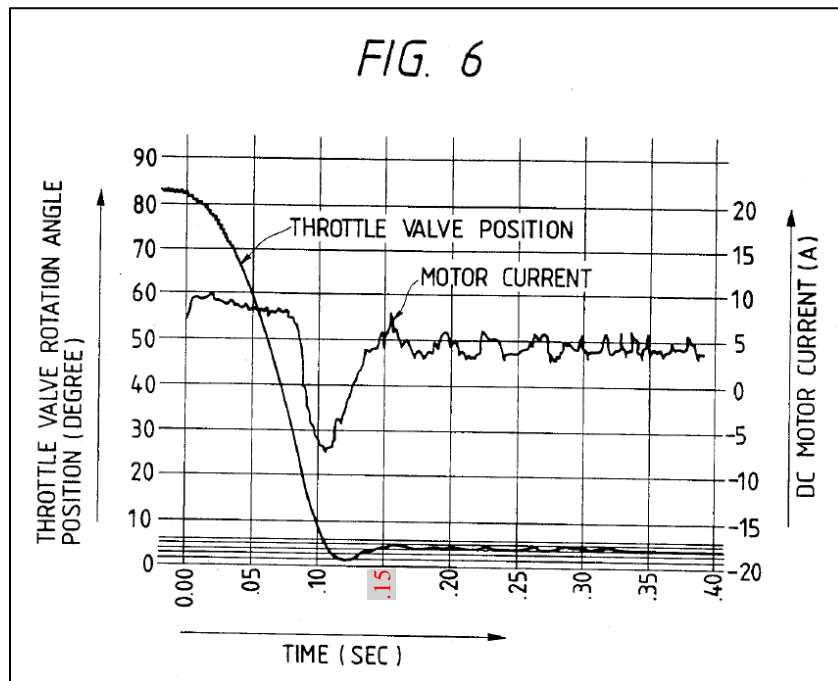
EX1027, FIG. 2.

E. The GM Manual and the Chrysler Manual show that a car battery typically supplied up to 14.5 volts.

Dependent claims recite the voltages used in the throttle control system. The GM Manual states that a car battery typically supplies up to 14.5 volts. EX1023, 94; EX1003, ¶101; *see also* EX1021, BMW Manual, 39. The Chrysler Manual states that a car battery supplies up to 14.6 volts. EX1024, 3-9; EX1003, ¶101.

F. Ohta discloses a graph showing the relationship between throttle position, current, and time.

Several dependent claims recite the time periods used in the throttle control system. Ohta discloses the time a throttle valve takes to move from an open position to a closed position. EX1020, Ohta, FIG. 6; EX1003, ¶103.



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

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

A. Independent Claim 1

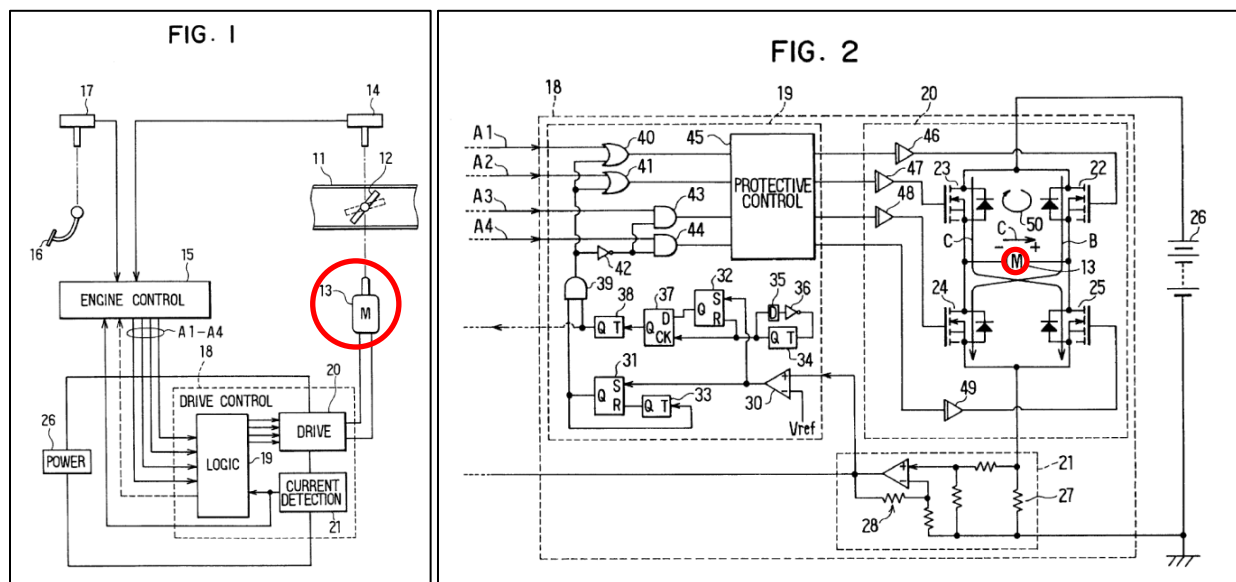
1. [1.P] “A method for controlling a positioning device of an internal combustion engine”

To the extent limiting, which Petitioner does not concede, Itabashi discloses the preamble because Itabashi “relates to a motor drive control apparatus and method having a motor current limit function, which can be applied to a motor

driven throttle valve control in an internal combustion engine.” EX1007, 1:13-16,
see also EX1007, 8:16-36; EX1003, ¶104.

2. [1.A] “providing an electric motor for actuating the positioning device”

Itabashi discloses this element. EX1003, ¶105. Itabashi provides “an electrically-driven direct current motor 13.” EX1007, 2:48-50. The motor 13 is for actuating the positioning device because the motor actuates the throttle valve 12. EX1007, 2:54-56, 3:7-10; EX1003, ¶105.



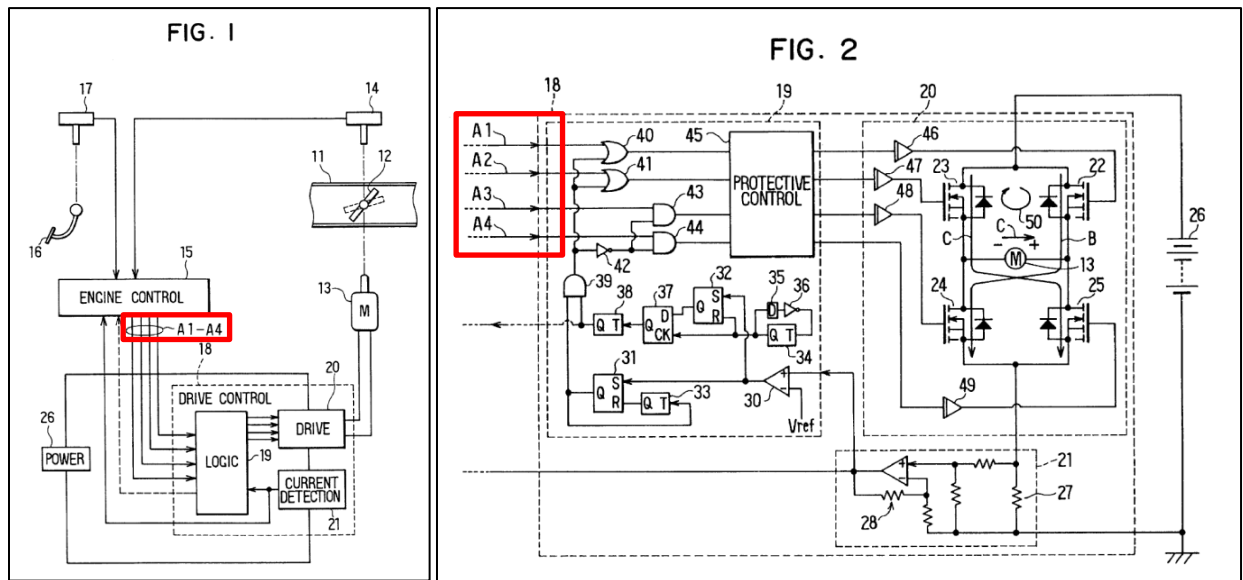
EX1007, FIG. 1 (annotated).

EX1007, FIG. 2 (annotated).

3. [1.B] “commanding the positioning device to change to a commanded position”

Itabashi discloses this element. EX1003, ¶106. Shown below, “[t]he engine control circuit 15 produces drive command signals A1-A4 to a drive control circuit 18 in correspondence with the output signals of the throttle sensor 14 and the

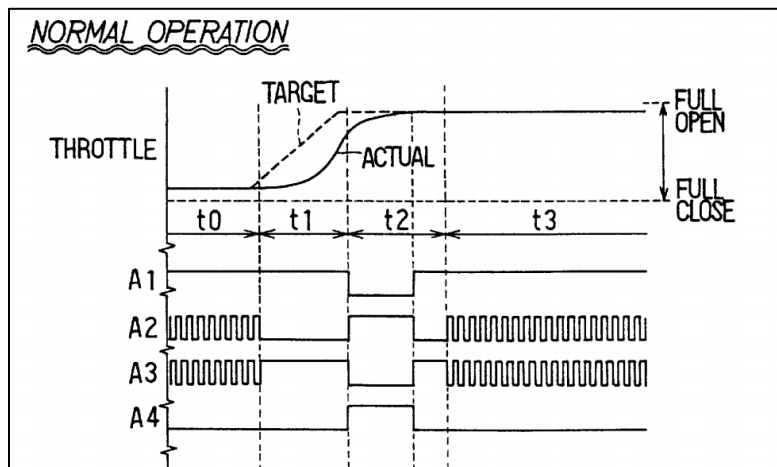
accelerator sensor 17.” EX1007, 3:4-7. The command signals A1-A4 command the throttle to move to a commanded position because “the drive control circuit 18 drives the motor 13 to rotate the throttle valve 12 *to a target position* corresponding to the detected actual accelerator position.” EX1007, 3:7-10; *see also* EX1007, 8:6-36; EX1003, ¶106.



EX1007, FIG. 1 (annotated).

EX1007, FIG. 2 (annotated).

During normal operation, command signals A1-A4 cause the throttle valve 12 to move to the target position, as the timing diagram shows. EX1007, 6:28-57; EX1003, ¶107.



EX1007, FIG. 3 (excerpted).

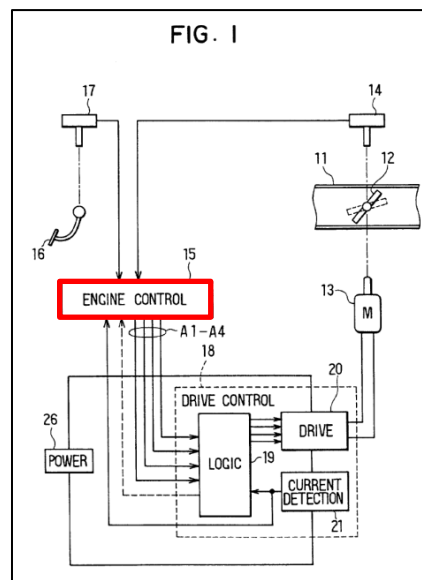
4. [1.C] “detecting a control effort required to change to said commanded position”

The '804 patent explains that “motor voltage, current, [and] duty cycle” are examples of a control effort: “Typically, the actuator or servomotor used to position the throttle plate is designed to have the maximum control effort available (*motor voltage, current, duty cycle*) to enhance throttle plate position response.”

EX1001, 1:36-39. With this understanding, Itabashi discloses this element in several different ways. EX1003, ¶¶108-12.

First, as Figure 1 shows below, Itabashi’s system has an engine control circuit 15 that detects control effort from the throttle sensor 14 and the accelerator sensor 17: “The output signals of the throttle sensor 14 and the accelerator sensor 17 are applied to an engine control circuit 15, which in turn controls the throttle valve 12 through the motor 13....” EX1007, 2:66-3:3; *see also* EX1003, ¶109. The

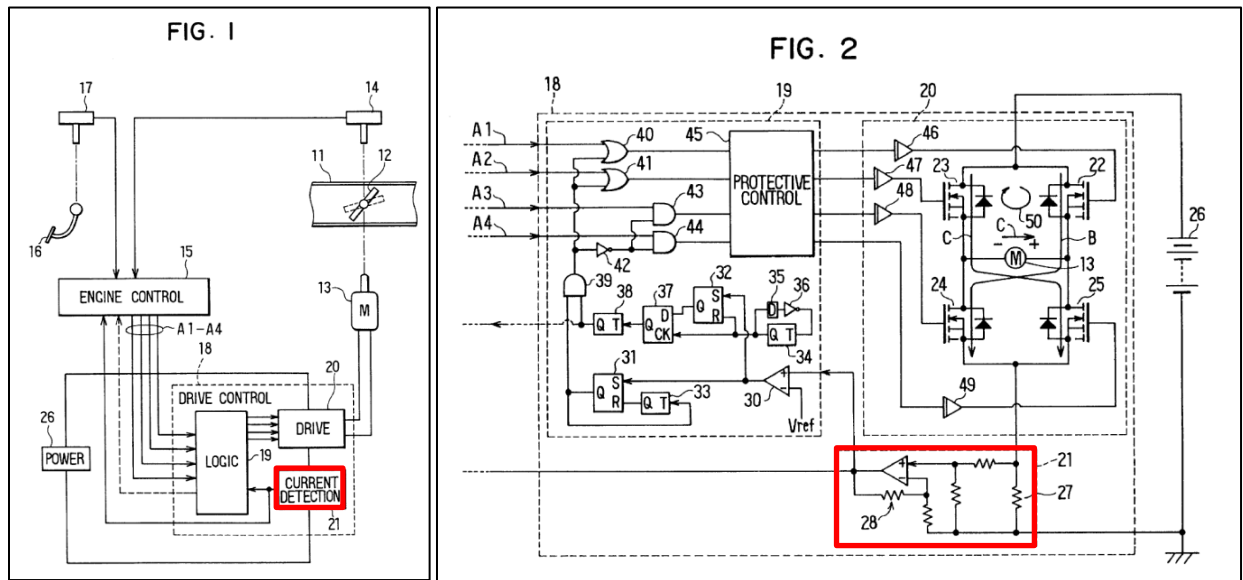
engine control circuit 15 then determines the control effort required to change the throttle to the commanded position: “The engine control circuit 15 produces drive command signals A1-A4 to a drive control circuit 18 in correspondence with the output signals of the throttle sensor 14 and the accelerator sensor 17.” EX1007, 3:4-7; *see also* EX1003, ¶109.



EX1007, FIG. 1 (annotated).

Second, as Figures 1 and 2 show below, Itabashi’s system has “a current detection circuit 21 which detects a motor current, i.e., an electric current supplied from the drive circuit 20 to the motor 13.” EX1007, 3:11-16. The detected motor current is required to move the throttle to the commanded position because “the engine control circuit 15 drives the motor 13 with the motor current of 100% duty ratio during the time period t1 so that the actual throttle position approaches the

target throttle position in a short period of time.” EX1007, 6:46-51; *see also* EX1007, 6:36-39; EX1003, ¶110.



EX1007, FIG. 1 (annotated).

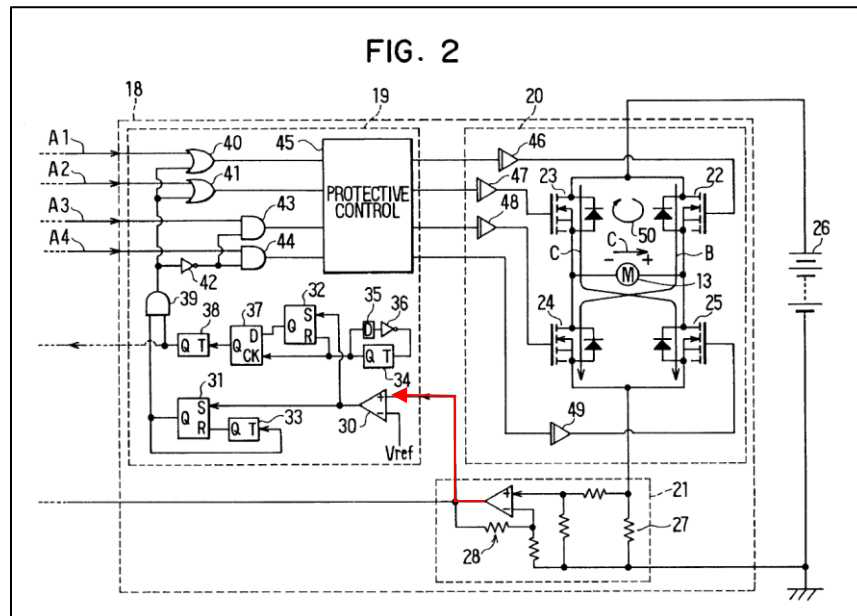
EX1007, FIG. 2 (annotated).

Third, the drive circuit 20 uses MOSFETs 22-25 to detect the control effort required to move the throttle to the commanded position. EX1003, ¶111. The MOSFETs detect the control effort from the drive logic circuit 19. EX1007, 3:33-42, 6:1-5, 6:66-7:3, FIGS. 2, 3; EX1003, ¶111; *see also* EX1007, 3:48-51, 6:19-24.

5. [1.D] “determining whether said control effort exceeds a threshold for a predetermined time period”

Itabashi discloses this element. EX1003, ¶¶113-18. As Section VI.A explains, Itabashi determines whether the motor current (the control effort) exceeds Vref (a threshold) for a predetermined time period (t38). *See also* EX1003, ¶¶73-78, 113-18.

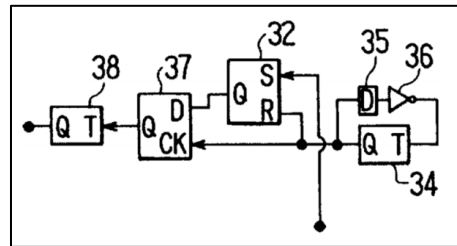
Figure 2 (annotated below) shows the current detection circuit 21 sending the current indicator to the drive logic circuit 19. EX1007, 3:44-47, FIG. 2; EX1003, ¶114. “The output signal of the current detection circuit 21 [is] indicative of the motor current flowing in the motor 13....” EX1007, 3:44-47. “In the drive logic circuit 19, a comparator 30 is provided to compare the output signal of the current detection circuit 21 with a reference signal V_{ref} , which is set to correspond to the maximum limit level of the motor current.” *Id.*, 3:48-51. When the output signal of the current detection circuit 21 is higher than V_{ref} , the output of comparator 30 becomes high. *Id.*, 3:48-51, 3:58-59, FIG. 2. When the output of comparator 30 becomes high, the drive logic circuit 19 determines that the motor current (the control effort) exceeds V_{ref} (a threshold). EX1003, ¶¶74-75, 114-15.



EX1007, FIG. 2 (annotated).

The drive logic circuit determines whether the motor drive current (the control effort) exceeds V_{ref} (a threshold) *for a predetermined time period*.

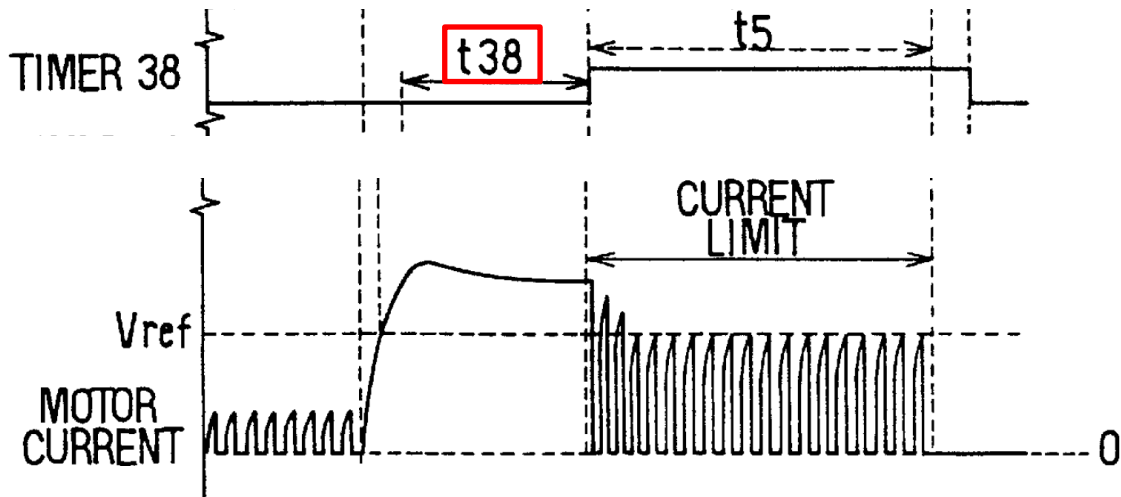
EX1003, ¶¶76-78, 116-17. The system does not immediately reduce the motor current when the motor current exceeds V_{ref} . *Id.* Rather, the system allows the motor current to exceed V_{ref} for a predetermined time period t_{38} . EX1007, 1:58-2:6, 5:21-35, 8:16-24, FIG. 4; EX1003, ¶¶76-78, 116. The predetermined time period t_{38} is defined by timer 38. EX1003, ¶¶76-78, 116.



EX1007, FIG. 2 (excerpted).

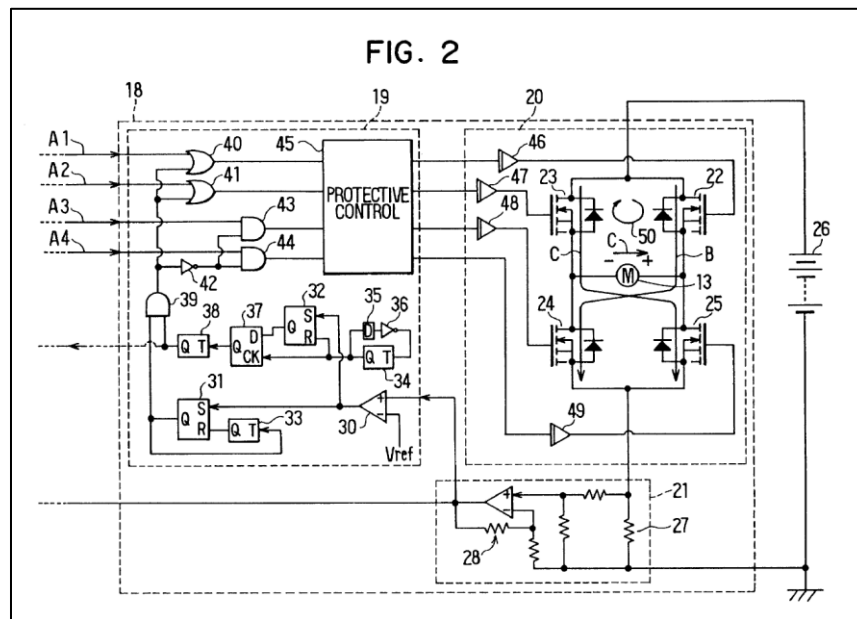
6. [1.E] “reducing said control effort when said control effort exceeds said threshold for said predetermined time period”

Itabashi discloses this element. EX1003, ¶¶119-21. After the motor current exceeds V_{ref} for predetermined time period t_{38} , Itabashi reduces the motor current as the timing diagram shows below. EX1007, FIG. 4; EX1003, ¶119.



EX1007, FIG. 4 (excerpted and annotated).

Figure 2 shows how Itabashi reduces the motor current when the motor current exceeds V_{ref} for time period t_{38} . EX1003, ¶¶77, 120. After time period t_{38} , the output of timer 38 becomes high, which causes AND gate 39 to turn high. EX1007, 5:36-38, 7:28-30, FIG. 4. The output of AND gate 39 then changes the commands A1-A4. *Id.*, 5:44-48, FIG. 4. When the output of AND gate 39 is high, the commands A1 and A2 cause MOSFETs 22 and 23 to turn on and MOSFETs 24 and 25 to turn off. *Id.*, 5:51-65, 7:31-48, FIG. 4. This triggers the “current limit operation,” which limits the current during t_5 (creating the sawtooth wave during “CURRENT LIMIT”). EX1007, 5:53-59, 6:6-18, 8:25-30 (“Further, the motor current is limited to a lower level, when the motor current continues to exceed the limit level for more than the predetermined period t_{38} during the period of the motor drive starting (or motor breaking.”), FIG. 4; EX1003, ¶120.



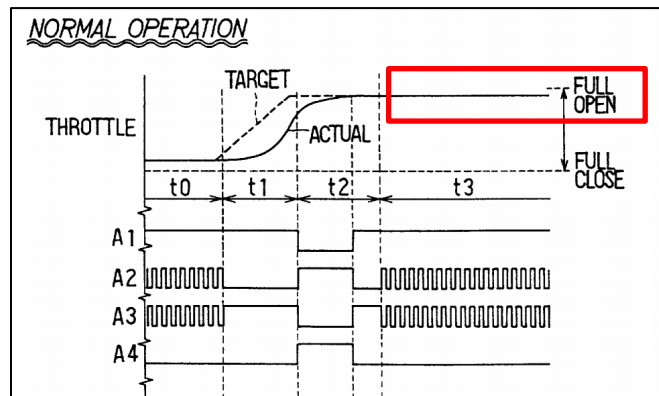
EX1007, FIG. 2.

For these reasons, Itabashi's system reduces the control effort when it exceeds the threshold V_{ref} for the predetermined time period t_{38} .

7. [1.F] “wherein commanding the positioning device to change to 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 dose [sic] to a hold close mode”

Itabashi discloses or suggests this element. EX1003, ¶¶122-30. As explained for [1.C], “[t]he engine control circuit 15 produces drive command signals A1-A4 to a drive control circuit 18 in correspondence with the output signals of the throttle sensor 14 and the accelerator sensor 17.” EX1007, 3:4-7. The command signals A1-A4 command the throttle to open to a hold open mode because the command signals A1-A4 command the throttle to move to and hold at the full open

position, as the timing diagram shows below. EX1003, ¶123. The command signals A1-A4 hold the throttle open because “[a]s long as the throttle valve 12 is maintained at the target position during the period t3, the motor 13 is driven with the duty-controlled motor current in the same manner as in the period t0.” EX1007, 7:10-13; *see also* EX1007, 6:28-57; EX1003, ¶¶123-24.

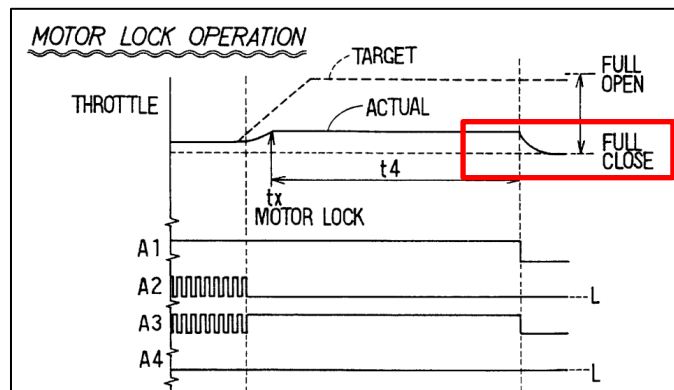


EX1007, FIG. 3 (excerpted and annotated).

Command signals A1-A4 can also command the throttle to close to a hold close mode because the range of movement of the throttle valve is from “FULL OPEN” to “FULL CLOSE.” EX1007, FIGS. 3, 4; EX1003, ¶125. Regarding the FULL CLOSE commands, Itabashi refers to moving the throttle from the open position to a closed position as “braking.” EX1007, 1:66-2:6, 5:21-35, 8:16-36; EX1003, ¶126. For example, Itabashi states that “[t]he motor 13 is driven with the motor current of 100% duty ratio *in the reverse direction* (C) to break the throttle valve 12.” EX1007, 7:57-59. Itabashi also explains that the current detection

circuit functions to reduce excessive motor current when commanding to close, and hold close, the throttle. EX1007, 8:11-15; EX1003, ¶126.

Should MMT argue that Itabashi does not explicitly state that the command signals A1-A4 command the throttle to close to a hold close mode, it would have been obvious to a POSA to command the throttle to close, and remain closed. EX1003, ¶¶127-29. Indeed, Itabashi itself shows that the throttle has a FULL CLOSE position, as Figure 4 shows below. *Id.*, ¶¶125-28.



EX1007, FIG. 4 (excerpted and annotated).

Not only does Itabashi's throttle already have a FULL CLOSE position, a POSA would have appreciated that conventional electronic throttle control systems commanded the throttle to close. EX1006, 11:7-11, 14:46-56; EX1016, Matsuda, 4:10-15, FIG. 2; EX1009, Murakami, 4:14-20, 4:51-63, 6:11-14, 6:27-32, 6:40-45, FIGS. 5, 6; EX1011, Pursifull, Abstract, FIGS. 4A-4D; EX1005, Abstract, 1:25-29; EX1003, ¶¶63-64, 128. For example, a POSA would have understood that a throttle control system would command the throttle to fully close when traveling

too fast down a steep decline. EX1006, 13:9-23; EX1003, ¶128. Because commanding throttles to close was well known, it would have been well within a POSA's skill to command Itabashi's throttle to close to a hold close mode. EX1003, ¶¶63-64, 128.

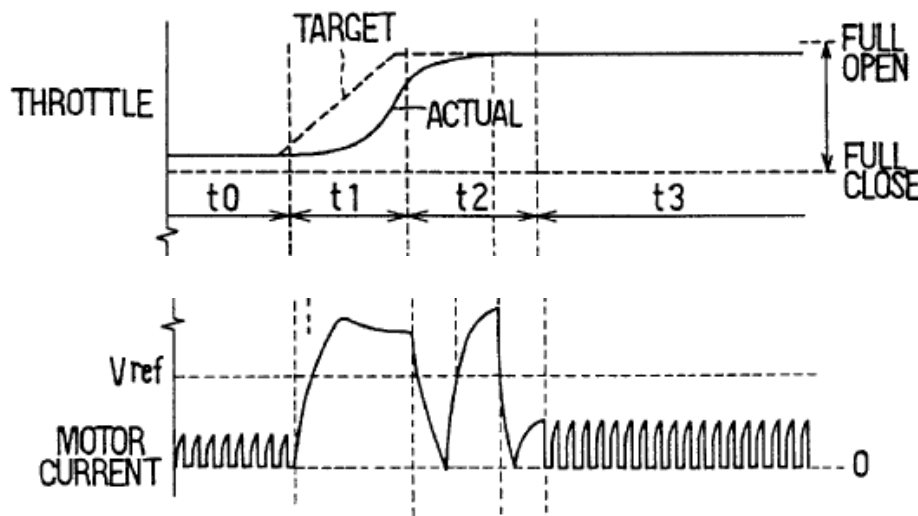
For these reasons, Itabashi discloses or suggests commanding the throttle to open to a hold open mode. Itabashi also discloses or suggests—and it would have been obvious to—command the throttle to close to a hold close mode.

Itabashi discloses or suggests every element of independent claim 1. Accordingly, Itabashi renders obvious claim 1. *Cf. Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983) (“[A] disclosure that anticipates under § 102 also renders the claim invalid under § 103, for anticipation is the epitome of obviousness.”) (quotation omitted); *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1373 (Fed. Cir. 2019) (affirming *Connell* in the IPR context).

B. Claim 4

Claim 4 recites “the step of applying a maximum control effort to the positioning device for a hard open time period.” Itabashi discloses this element because “the engine control circuit 15 drives the motor 13 with *the motor current of 100% duty ratio* during the time period t1 so that the actual throttle position approaches the target throttle position in a short period of time.” EX1007, 6:46-51;

see also EX1007, 9:6-8. The control effort include motor voltage, current, and duty cycle. EX1001, 1:36-39. Accordingly, as shown below, Itabashi applies a maximum control effort (the motor current of 100% duty cycle) for a hard open time period (t1) to move the throttle to FULL OPEN. EX1003, ¶¶132-35.



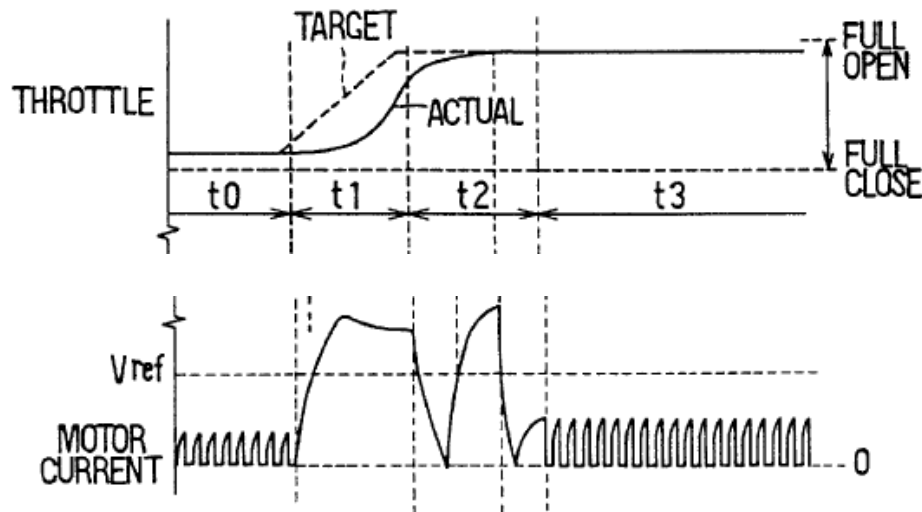
EX1007, FIG. 3 (excerpted).

C. Claim 7

Claim 7 recites “wherein the step of commanding the positioning device to change to said commanded position, comprises commanding the positioning device to close to said commanded position in a hold close mode.” Itabashi discloses or suggests this element for the same reasons Itabashi teaches the nearly identical language in [1.F]. *Supra* Section VII.A.7.

D. Claim 8

Claim 8 depends from claim 7 and recites “the step of applying a maximum control effort to the positioning device for a hard dose [sic] time period.” Itabashi not only uses its system to command the throttle to open but also to *close*: “A direct current motor for an engine throttle control is driven with a motor current of 100% duty ratio, when a throttle valve is to be moved from one throttle position to another or when the movement of the throttle valve is to be braked.” EX1007, Abstract, 6:63-7:3, 7:57-59, 8:11-15; EX1003, ¶¶125-28, 138. A POSA would have understood that when Itabashi tries to *close* the throttle, a maximum control effort (a motor current of 100% duty cycle) is applied to the throttle for a hard close time period t_1 . EX1003, ¶139. The timing diagram would be the inverse of the following timing diagram. *Id.*



EX1007, FIG. 3 (excerpted).

E. Independent Claim 11

1. [11.P] “A system for controlling a positioning device of an internal combustion engine to prevent overhear conditions”

Claim 11 recites a system analogous to the method of claim 1. [11.P] is similar to [1.P], which Itabashi discloses. *Supra* Section VII.A.1; EX1003, ¶141. The intended use of “to prevent overhear conditions” is not limiting. *See Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305 (Fed. Cir. 1999); *Rowe v. Dror*, 112 F.3d 473, 478 (Fed. Cir. 1997). Even if limiting, Itabashi’s system prevents overhear conditions because the system limits motor current “to reduce the heat generation of the MOSFETs 22-25.” EX1007, 8:25-30.

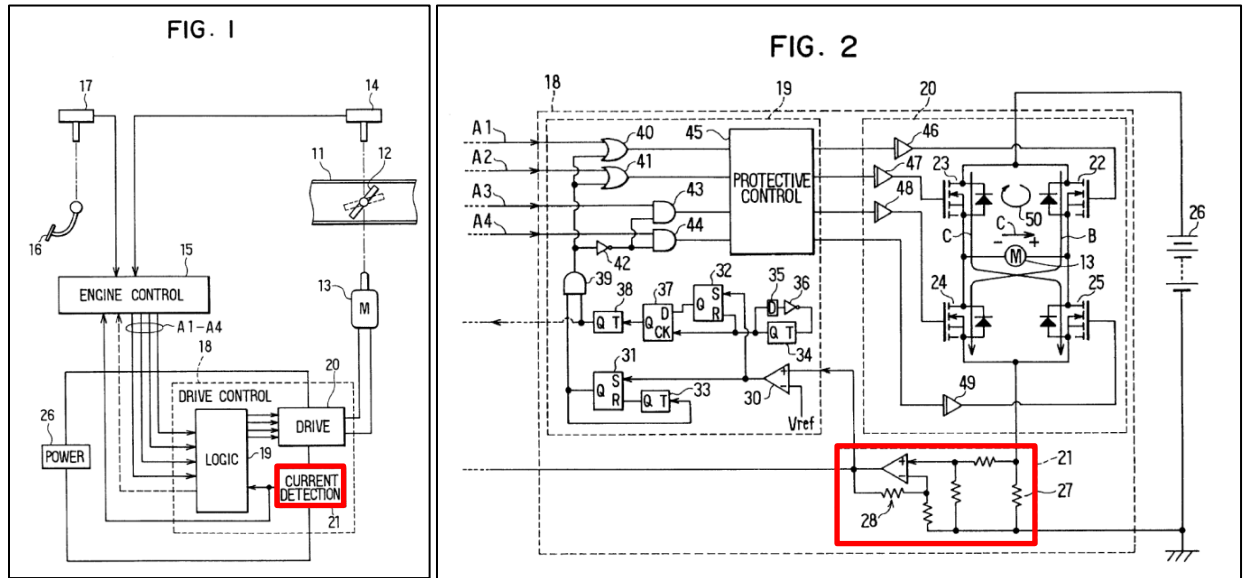
2. [11.A] “an electric motor for actuating the positioning device with a control effort”

[11.A] is nearly identical to [1.A], which Itabashi discloses. *Supra* Section VII.A.2; EX1003, ¶¶105, 142. Itabashi’s electric motor actuates the throttle with a control effort because the motor actuates the throttle with a motor current. EX1007, 2:48-3:10, FIGS. 1-4.

3. [11.B] “a control effort detector coupled to said electric motor and intended to detect said control effort”

Itabashi discloses this element for the same reasons Itabashi discloses [1.C]. *Supra* Section VII.A.4. The current detection circuit 21 outlined below in red is a control effort detector. EX1007, 3:11-16, 6:46-51; EX1003, ¶143. The current

detection circuit 21 (control effort detector) is coupled to the electric motor 13 via MOSFETs 24 and 25. EX1007, 3:32-42; EX1003, ¶144.



EX1007, FIG. 1 (annotated).

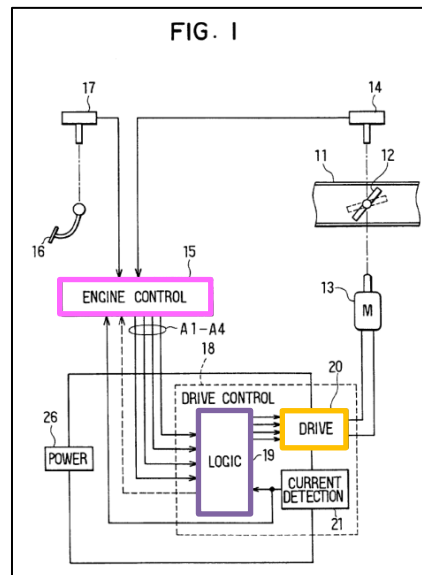
EX1007, FIG. 2 (annotated).

The drive circuit 20 is also a control effort detector coupled to the electric motor and intended to detect the control effort. EX1003, ¶145. MOSFETs 22-25 of the drive circuit 20 are coupled to the electric motor 13. EX1007, 3:32-42; EX1003, ¶145. And MOSFETs 22-25 detect the drive current because the MOSFETs 22-25 selectively turn on to supply the motor current to the electric motor 13. EX1007, 6:1-5, 6:66-7:3; EX1003, ¶145.

4. [11.C] “a controller coupled to said electric motor and said control effort detector, said controller including control logic operative to command the positioning device to change to a commanded position, detect a control effort required to change to said commanded position, determine whether said control effort exceeds a threshold for a predetermined

time period, and reduce said control effort when said control effort exceeds said threshold for said predetermined time period”

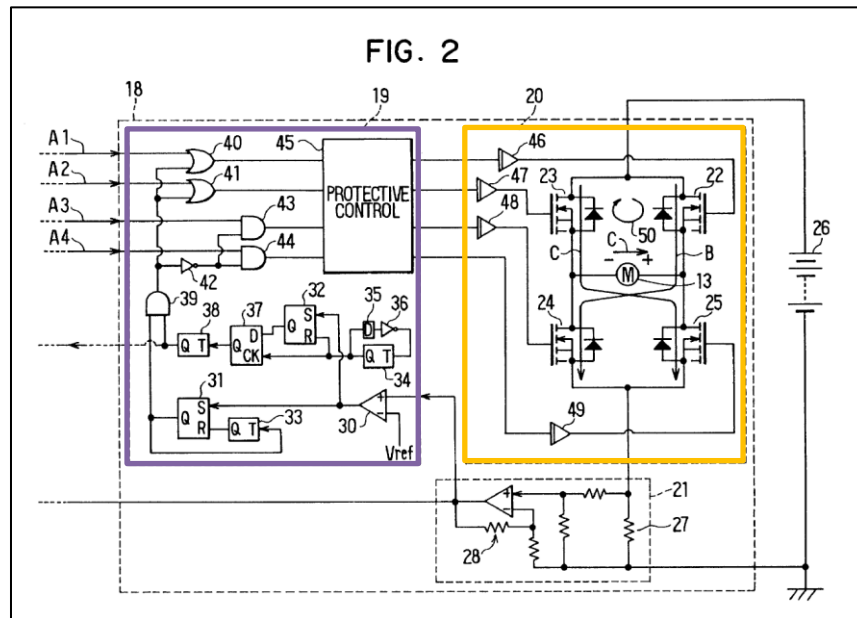
Itabashi discloses this element. EX1003, ¶¶147-50. As Sections VII.A.3-VII.A.6 explain, Itabashi has a control circuit with control logic. A POSA would have understood that the drive logic circuit 19 (alone or in combination with the engine control circuit 15 and the drive circuit 20) is a controller that has control logic. EX1007, 3:48-6:5; EX1003, ¶147.



EX1007, FIG. 1 (annotated).

The engine control circuit 15 and the drive logic circuit 19 are coupled to the electric motor 13 and the control effort detector (e.g., current detection circuit 21). EX1003, ¶148. The engine control circuit 15 is coupled to the drive logic circuit 19, and the drive logic circuit 19 is coupled to the electric motor 13 via drive circuit 20 (including MOSFETs 22-25). EX1007, 5:48-51, 5:60-62, FIG. 2. The

drive logic circuit 19 is also coupled to the control effort detector because “[i]n the drive logic circuit 19, a comparator 30 is provided to compare the output signal of the current detection circuit 21 with a reference signal V_{ref}” *Id.*, 3:48-51.²



EX1007, FIG. 2 (annotated).

The engine control circuit 15, the drive logic circuit 19, and the drive circuit 20 also have control logic to perform the “command” step (Section VII.A.3), “detect” step (Section VII.A.4), “determine” step (Section VII.A.5) and “reduce” step (Section VII.A.6). EX1003, ¶149. With respect to the “detect” step, the engine

² The “control effort detector” in element [11.B] can be within the controller in element [11.C] because the controller has “control logic operative to . . . detect a control effort required to change to said commanded position.”

control circuit 15 detects a control effort required to change to said commanded position. *Supra* Section VII.A.4. The drive circuit 20 uses MOSFETs 22-25 to detect a control effort required to change to said commanded position. *Supra* Section VII.A.4. The comparator 30 of the logic circuit 19 detects a control effort required to change to said commanded position. EX1007, 3:48-51; EX1003, ¶149. And the protective control circuit 45 of the logic circuit 19 detects a control effort required to change to said commanded position. EX1007, 6:19-24, EX1003, ¶149.

5. [11.D] “wherein said controller further includes control logic operative to command the positioning device to close to said commanded position in a hold close mode”

Itabashi discloses or suggests this element. EX1003, ¶151. As Section VII.A.7 explains, the control logic 19 commands the throttle to close to a hold close mode. To the extent Itabashi does not teach or suggest this element, a POSA would have found it obvious to command the throttle to close to the commanded position in a hold close mode. *Supra* Section VII.A.7.

F. Claim 14

Claim 14 recites “wherein said controller further includes control logic operative to command the positioning device to open to said commanded position in a hold open mode.” Itabashi discloses this element. *Supra* Section VII.A.7.

G. Claim 15

Claim 15 depends from claim 14 and recites “wherein said controller further includes control logic operative to apply a maximum control effort to the positioning device for said hard open time period.” Itabashi discloses this element. *Supra* Section VII.B.

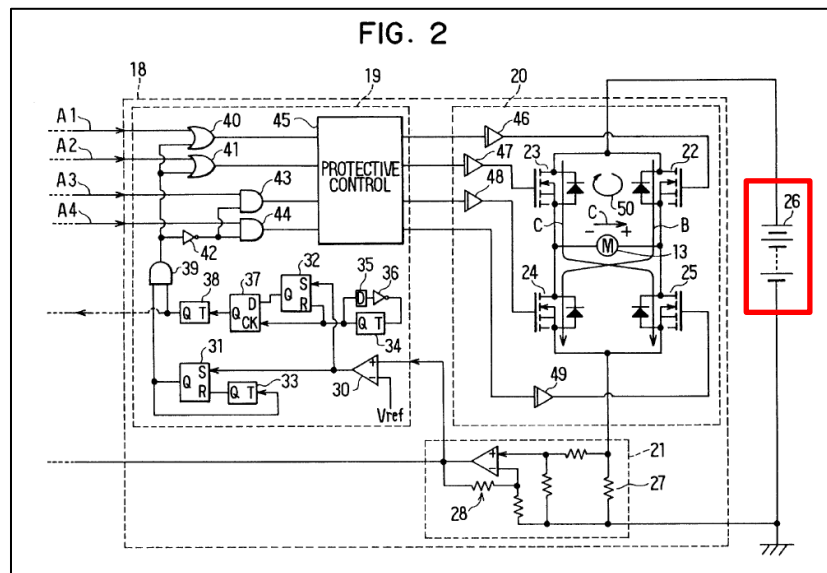
H. Claim 18

Claim 18 recites “wherein said controller further includes control logic operative to command application of a maximum control effort to the positioning device for a hard close time period.” Itabashi discloses this element. *Supra* Section VII.D.

VIII. Ground 2: Itabashi in view of the GM Manual and the Chrysler Manual renders obvious claims 2, 5, 9, 12, 16, and 19.

A. Rationale for Combining Itabashi, the GM Manual, and the Chrysler Manual

Figure 2 of Itabashi shows a storage battery 26 that supplies power to the drive circuit 20 and the current detection circuit 21. EX1007, 3:37-42, FIG. 2.



EX1007, FIG. 2.

Itabashi does not specify the voltage that the storage battery 26 provides to the motor drive circuit. EX1003, ¶158. A POSA would have therefore looked for the voltage levels of typical automobile power supplies from multiple major automobile manufacturers. EX1003, ¶158. The POSA would have been led to the GM Manual, which states that voltage during idle is typically 13.5 to 14.5 volts. EX1023, 94; *see also* EX1021, 39; EX1003, ¶158. The POSA would have also been led to the Chrysler Manual, which states that a typical voltage regulator supplied 13.9-14.6 volts. EX1024, 3-9; EX1003, ¶158. For cross compatibility, the POSA would have accounted for these overlapping ranges. EX1003, ¶158.

In the context of Itabashi, a POSA would have been motivated to use the maximum available voltage to unjam the throttle when stuck in a *closed* position. EX1003, ¶159. The maximum voltage would have provided the greatest chance of

quickly releasing the jam. *Id.* Given typical batteries reached a maximum voltage of around 14.5 volts, a POSA would have therefore been motivated to apply +14.5 volts for the hard open time period.

Likewise, when trying to unjam a throttle stuck in an *open* position, a POSA would have been motivated to use the maximum available voltage. *Id.*, ¶160. But when trying to close the throttle, the POSA would have used negative polarity with Itabashi's H-bridge circuit. EX1007, 3:11-21, 6:66-7:3, FIG. 2; EX1003, ¶¶160-61. Given typical batteries reached a maximum voltage of around 14.5 volts, a POSA would have therefore been motivated to apply –14.5 volts for the hard close time period. EX1003, ¶¶160-61.

Moreover, a POSA would have had a reasonable expectation of success in making this combination. *Id.*, ¶162. Using ± 14.5 volts as the maximum control effort would have combined prior art elements (a typical battery supply) according to known methods to yield predictable results. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007); EX1003, ¶162. It would have been trivial and well within the skill of a POSA to implement the known voltages disclosed by the GM Manual and the Chrysler Manual in Itabashi's system. EX1003, ¶¶162-163. Accordingly, it would have been obvious to combine the teachings of Itabashi, the GM Manual, and the Chrysler Manual. *Id.*

B. Claims 5, 9, 16, and 19

Claims 5 and 16 depend from claims 4 and 15, respectively, and recite “wherein said maximum control effort is +14.5 volts.” Claims 9 and 19 depend from claims 8 and 18, respectively, and recite “wherein said maximum control effort is –14.5 volts.” Itabashi in view of the GM Manual and the Chrysler Manual discloses or suggests these elements. EX1003, ¶156. Indeed, the GM Manual states that voltage during idle is typically 13.5 to 14.5 volts, and the Chrysler Manual states that a typical voltage regulator supplies 13.9-14.6 volts. EX1023, 94; *see also* EX1021, 39; EX1024, 3-9; EX1003, ¶158.

As Section VIII.A explains, a POSA would have been motivated to use ± 14.5 volts as the maximum control effort. Additionally, using ± 14.5 volts as the maximum control effort would have combined prior art elements (a typical battery supply) according to known methods to yield predictable results. EX1003, ¶¶159-162.

These specific voltages would have also been an obvious design choice. *Id.*, ¶162. In the '804 patent, the specific values provide no novel or unexpected result and solve no stated problem. *Id. Cf. In re Kuhle*, 526 F.2d 553, 555 (CCPA 1975). The specific voltages in the claims also do not define different structure or achieve a different purpose. EX1003, ¶162. *Cf. In re Gal*, 980 F.2d 717, 719 (Fed. Cir. 1992) (holding that a different structure to achieve a different purpose was not an

obvious design choice); *see also Ex parte Spangler*, Appeal No. 2018-003800, slip op. 6-9 (PTAB Feb. 20, 2019) (informative). And neither the '804 patent nor its prosecution history articulates a single benefit for selecting this value as the maximum control effort. EX1003, ¶162.

The '804 patent confirms $\pm 14.5\text{V}$ was an obvious design choice. It explains that a POSA would have understood the relationship between the amount of voltage applied to a servo motor and the duration such voltage could be applied without overheating the motor, and it provides a table of example voltage-duration pairs for “a given servo motor.” EX1001, 3:36-54; EX1003, ¶163. The '804 patent further admits: “*Obviously*, the magnitude of the effort may vary as required.” EX1001, 3:63-64. These admissions confirm a POSA would have understood the conditions (amount of control effort and duration) under which the motor could operate without overheating and that applying $\pm 14.5\text{V}$ was a design choice within known operating conditions. EX1003, ¶163.

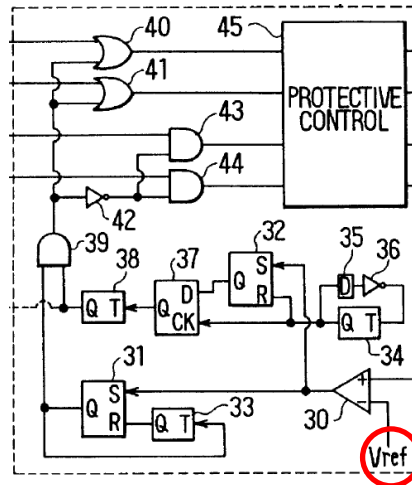
C. Claims 2 and 12

Claims 2 and 12 depend from claims 1 and 11, respectively, and recite “wherein said threshold has an absolute value of 6 volts.” Itabashi in view of the GM Manual and the Chrysler Manual discloses or suggests this element. EX1003, ¶¶164-67.

As Figure 2 of Itabashi shows below, a voltage V_{ref} is applied to comparator

30. EX1007, 3:48-51, FIG. 2. Itabashi does not specify the voltage of V_{ref} .

EX1003, ¶165.



EX1007, FIG. 2 (excerpted and annotated).

Given the typical supply voltage was 14.5 volts, a POSA would have at least configured V_{ref} to be less than 14.5 volts. EX1003, ¶166. Selecting |6| volts as the threshold would have been an obvious design choice. *Id.* In the '804 patent, this specific value provides no novel or unexpected result and solves no stated problem. *Id.*, ¶166. *Cf. Kuhle*, 526 F.2d at 555. The specific threshold voltage in the claims also does not define different structure or achieve a different purpose. EX1003, ¶166. *Cf. Gal*, 980 F.2d at 719; *Ex parte Spangler*, Appeal No. 2018-003800, slip op. 6-9. Indeed, the '804 patent admits |6| volts as a threshold was typical. EX1001, 3:28-30, 4:19-21. And neither the '804 patent nor its prosecution history articulates a single benefit for selecting |6| volts as the threshold voltage. EX1003, ¶166.

The '804 patent states: “Typically, an effort limit of approximately +6 volts and a contiguous time interval of about 300 milliseconds are used.” EX1001, 3:28-30, 4:19-21 (same statement but opposite polarity). To the extent this statement is an admission about what was “typical” in the industry, it follows that it was obvious to a POSA to use |6| volts. EX1003, ¶167. At the least, the next sentence, “[o]bviously, these values may vary as required,” confirms that |6| volts would have been an obvious design choice. EX1001, 3:30-31; EX1003, ¶167.

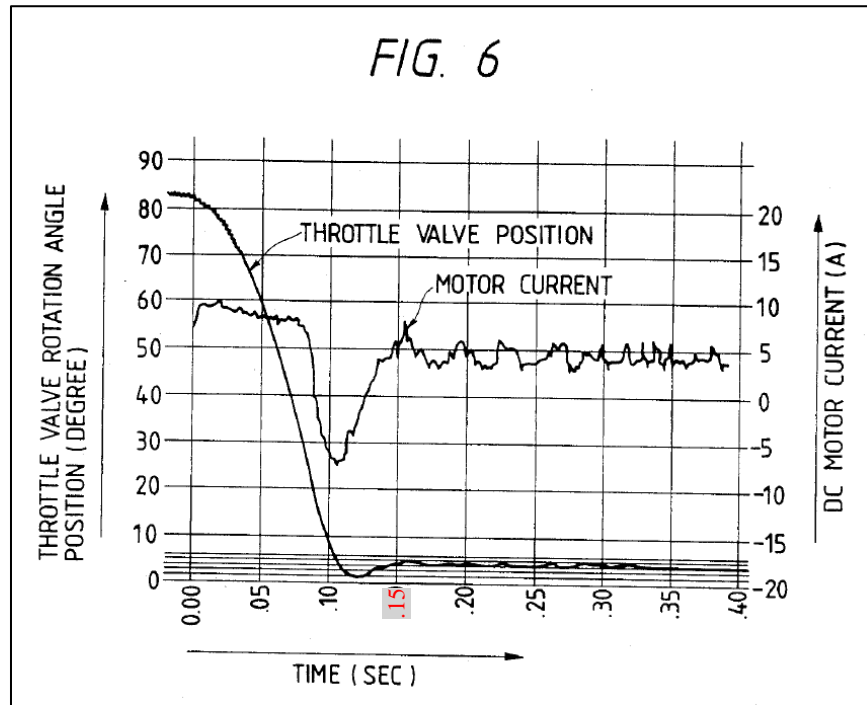
IX. Ground 3: Itabashi in view of Ohta renders obvious claims 3, 6, 10, 13, 17, and 20.

A. Rationale for Combining Itabashi and Ohta

As explained for [1.D], 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. Itabashi does not expressly state the number of milliseconds for timer 38. EX1003, ¶169. 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.

To 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. EX1003, ¶170. A POSA would have looked for this time period because, if the throttle valve is not moved

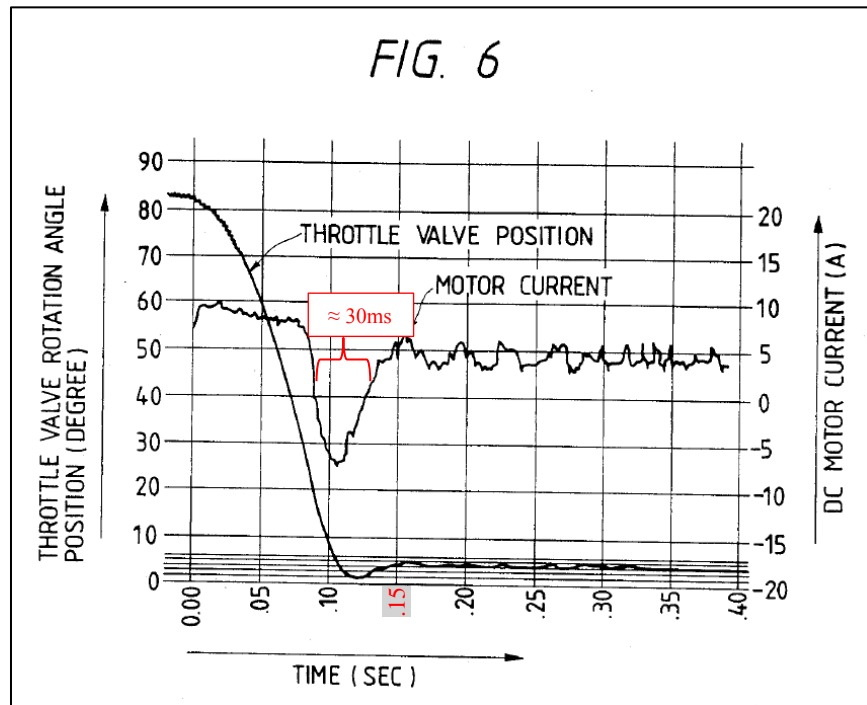
to the target position after this amount of time, the throttle valve is likely stuck. *Id.* Looking for this value, the POSA would have been led to Ohta, which shows that the normal time period for moving the throttle from open to close is approximately 150 milliseconds, as Figure 6 shows below. EX1020, Ohta, FIG. 6; EX1003, ¶170.



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

A POSA, however, would have been motivated to use a time *higher* than 150 milliseconds 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. EX1003, ¶171. Selecting 300 milliseconds would have been an obvious design choice. *Id.*, ¶172.

Additionally, as Figure 6 of Ohta shows below, approximately 30 milliseconds of maximum current is used to drive the throttle valve from a fully open position to a fully closed position. *Id.*, ¶174.



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

A POSA would have been motivated to use 30 milliseconds as the period for the hold open mode and the hold close mode because this is the minimum amount of time the control system needs to initiate throttle movement. EX1003, ¶175. The POSA would have understood that any additional time of applying maximum control effort would risk harming the motor circuit. *Id.* To avoid harming the motor circuit, the POSA would have used the minimum amount of time needed to initiate movement—30 milliseconds. *Id.*, ¶¶175-76

B. Claims 3 and 13

Claims 3 and 13 depend from claims 1 and 11, respectively, and recite “wherein said predetermined time period is 300 milliseconds.” Itabashi in view of Ohta discloses or suggests this element. EX1003, ¶¶168-73.

As Section IX.A explains, a POSA would have been motivated to use a predetermined time period of 300 milliseconds. Additionally, selecting 300 milliseconds would have been an obvious design choice. *Id.*, ¶172. In the ’804 patent, this specific value provides no novel or unexpected result and solves no stated problem. *Id. Cf. Kuhle*, 526 F.2d at 555. The specific time period in the claims also does not define different structure or achieve a different purpose. EX1003, ¶172. *Cf. Gal*, 980 F.2d at 719; *Ex parte Spangler*, Appeal No. 2018-003800, slip op. 6-9. Indeed, the ’804 patent admits 300 milliseconds was typical. EX1001, 3:28-30, 4:19-21. And neither the ’804 patent nor its prosecution history articulates a single benefit for selecting 300 milliseconds for the predetermined time period. EX1003, ¶172.

The ’804 patent states: “*Typically*, an effort limit of approximately +6 volts and a contiguous time interval of about 300 milliseconds are used.” EX1001, 3:28-30, 4:19-21. To the extent this statement is an admission about what was “typical” in the industry, it follows that it was obvious to a POSA to use 300 milliseconds. EX1003, ¶173. At the least, the next sentence, “[o]bviously, these values may vary

as required,” confirms that 300 milliseconds would have been an obvious design choice. EX1001, 3:30-31; EX1003, ¶173.

C. Claims 6, 10, 17, and 20

Claims 6 and 17 depend from claims 4 and 15, respectively, and recite “wherein said hard open time period is 30 milliseconds.” Claims 10 and 20 depend from claims 8 and 18, respectively, and recite “wherein said hard close time period is 30 milliseconds.” Itabashi in view of Ohta discloses or suggests this element. EX1003, ¶¶174-76.

As Section IX.A explains, a POSA would have been motivated to use a hard open and hard close time period of 30 milliseconds. Additionally, selecting 30 milliseconds for both the hard open time period and hard close time period would have been an obvious design choice. *Id.*, ¶176. In the ’804 patent, this specific value provides no novel or unexpected result and solves no stated problem. *Id.*, ¶176. *Cf. Kuhle*, 526 F.2d at 555. The specific time period in the claims also does not define different structure or achieve a different purpose. EX1003, ¶176. *Cf. Gal*, 980 F.2d at 719; *Ex parte Spangler*, Appeal No. 2018-003800, slip op. 6-9. Indeed, the ’804 patent admits 30 milliseconds was *typical*. EX1001, 4:26-27. And neither the ’804 patent nor its prosecution history articulates a single benefit for selecting 30 milliseconds for the hard open and hard close time periods. EX1003, ¶176. Accordingly, 30 milliseconds would have been an obvious design choice.

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

Ground 4 combines Matsumoto's throttle control system and Burney's limit detection circuit to reduce the control effort when the control effort exceeds a threshold. *Id.*, ¶¶177. Ritenour would have informed or rendered obvious to a POSA that Burney's limit detection circuit reduces the threshold after a *predetermined time period*. *Id.* And Ritenour's system from the 1980s shows how using a circuit to reduce current when current exceeds a threshold for a predetermined time period was well known and obvious by 2001. *Id.*

A. Rationale for Combining Matsumoto, Burney, and Ritenour

A POSA would have been motivated to use Burney's limit detection circuit to protect Matsumoto's throttle motor. *Id.*, ¶¶178-84. Matsumoto teaches that a throttle can become stuck. EX1008, 4:13-16, 9:1-5, 9:15-67, 14:53-15:11. When the throttle is stuck in the fully open position ($V_{TPS2} \geq K1$), Matsumoto's system enters an opened-valve sticking failure process (A280). *Id.*, 20:17-25, FIG. 4.

When the throttle is stuck in the fully closed position ($V_{TPS2} \leq K2$), Matsumoto's system enters a closed-valve sticking failure process (A290). *Id.*, 20:26-35, FIG. 4.

And when the throttle is stuck between fully open and fully closed ($K1 \geq V_{TPS2} \geq K2$), Matsumoto's system enters a limp home process (A300). EX1008, 20:36-39, FIG. 4. The opened-valve sticking failure process and the closed-valve sticking

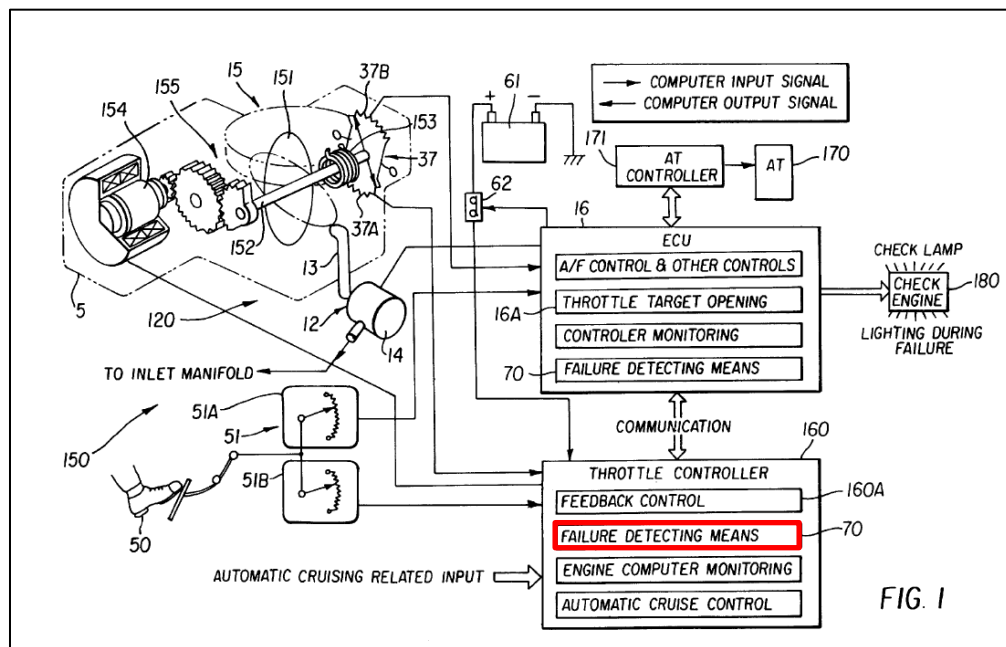
failure process include several remedial steps. *Id.*, 9:30-59, 20:41-22:8. But these remedial steps do not protect the motor from excessive current, which Matsumoto explains can damage the motor. *Id.*, 10:1-12, 19:16-23; EX1003, ¶178. To protect the motor in cases where the throttle is stuck in the fully open or fully closed position, a POSA would have looked for ways to limit excessive current. EX1003, ¶178. This would have led the POSA to Burney. EX1003, ¶178.

Like Matsumoto, Burney teaches that excessive current can damage the throttle motor. EX1006, 2:24-31, 4:7-11, 13:23-27; *see also* EX1027, Ritenour, 1:15-18. To prevent damage to the motor, Burney uses a limit detection circuit. EX1006, 3:24-35. Burney's limit detection circuit not only limits excessive current when the throttle is in a fully open or fully closed position but also limits the drive current when the throttle motor stalls between fully open and fully closed. EX1006, 4:1-14. Burney therefore discloses a way to protect the throttle motor in Matsumoto's steps A280, A290, and A300. EX1003, ¶179.

A POSA would have been motivated to use Burney's limit detection circuit to determine when the drive current exceeds a threshold for a predetermined time period. *Id.*, ¶180. Matsumoto's system already has a throttle controller with a failure detecting means 70 to determine when the target position for the throttle valve and the actual position exceeds 1° for a predetermined time period (e.g., 500ms)—i.e., when the throttle valve is stuck. EX1008, 14:35-52, FIG. 1. A POSA

would have been motivated to use Matsumoto's existing failure detecting means 70 not only to detect whether the throttle position exceeded a threshold (e.g., 1°) for a predetermined time period (e.g., 500ms) but also to determine whether *the control effort* exceeded a threshold for this predetermined time period. EX1003, ¶180.

Indeed, this protective measure of determining whether the control effort exceeds a threshold for a predetermined time period and thereafter reducing the control effort to protect the motor was well known. EX1027, 1:30-35; EX1007, 5:36-65, 6:6-18, 7:28-48, FIG. 4; EX1017, Boll, 4:23-27, 4:61-5:2, FIG. 1; EX1003, ¶¶62, 180.



EX1008, FIG. 1 (annotated).

A POSA would have been motivated to reduce the drive current when the drive current exceeds a threshold *for the predetermined time period* disclosed in Matsumoto to prevent the system from prematurely reducing the control effort.

EX1003, ¶181. Ritenour discloses that it was known in the art for systems to use a time period to monitor excessive current:

[T]he components in the network can be chosen to provide a considerable time delay thereby providing highly accurate identification of overload conditions in the signal being monitored.

EX1027, 2:34-40; *see also* EX1003, ¶181. Systems used a time period because, for example, during normal operation, current temporarily spikes when moving the throttle from a stationary position. EX1007, FIG. 3; EX1020, FIGS. 7, 11; EX1003, ¶181. To prevent Matsumoto's system from prematurely reducing or terminating the control effort to the motor, a POSA would have waited a predetermined time period before reducing current to the motor. EX1003, ¶181.

A POSA would have also been motivated to use Burney's limit detection circuit as a redundant safety measure. EX1003, ¶182. Matsumoto recognizes that automobile control systems included redundancy to protect passengers in cases of component malfunction. EX1008, 7:4-11, 7:61-67; EX1005, Imoehl, 2:41-52, 3:51-54; EX1003, ¶182. For example, Matsumoto uses two throttle position sensors (TPS1 and TPS2) because throttle position sensors were prone to failure over time. EX1008, 7:4-11; *see also* EX1009, 2:25-41; EX1003, ¶182. Matsumoto, however, does not have a backup if both throttle position sensors fail or are not calibrated correctly. EX1003, ¶182. As a suitable backup, Burney's limit detection

circuit can determine whether the throttle is stuck without using the throttle position sensors. EX1006, 4:1-14; EX1003, ¶182. Accordingly, a POSA would have been motivated to use Burney's limit detection circuit to determine whether Matsumoto's throttle is stuck in step A250, adding additional redundancy and safety to the system.

Using Burney's limit detection circuit in Matsumoto's system to reduce the drive current when the drive current exceeds a threshold for a predetermined time period would have combined prior art elements according to known methods to yield predictable results. *KSR*, 550 U.S. at 401; EX1003, ¶183. At the time of the alleged invention, the hardware for throttle control systems was well known and understood. EX1003, ¶¶56-66, 183. Adding Burney's limit detection circuit to Matsumoto's throttle control system would have used conventional electrical components to make a closed-loop servomotor with feedback from Burney's limit circuit. *Id.*, ¶¶62, 64-65, 183. Such a closed-loop system was conventional and well understood. EX1003, ¶183. Indeed, Matsumoto's throttle control system already includes feedback from position sensors. EX1008, 7:19-21, 7:51-60. Adding another feedback signal back to the failure detecting means 70 would have simply applied known techniques (feedback signaling) to a known device (a throttle control system) in the same way. *KSR*, 550 U.S. at 401; EX1003, ¶¶62, 65-66, 183.

A POSA would have also had a reasonable expectation of success. EX1003, ¶184. Not only are Matsumoto and Burney similar throttle control systems with similar hardware, but Burney also discloses its limit detection circuit with vast implementation details. *Id.* For example, Burney shows its amplifiers in the schematic diagram in Figure 3 and the transistor level in Figure 4. EX1006, 9:30-10:16, 9:16-29, FIGS. 3, 4. Burney also states that the amplifiers are “manufactured by National Semiconductor under the Part No. LM2877.” *Id.*, 9:30-32. The combination uses conventional servomotor techniques, Burney shows its circuitry in vast detail, a POSA would have known where to find the necessary components, and a POSA had the requisite knowledge, education, and experience to make this combination. EX1003, ¶184. For at least these reasons, a POSA would have a reasonable expectation of success in implementing Burney’s limit detection circuit in Matsumoto to reduce drive current to the motor when the drive current exceeds a threshold for a predetermined time period. EX1003, ¶¶178-84.

B. Independent Claim 1

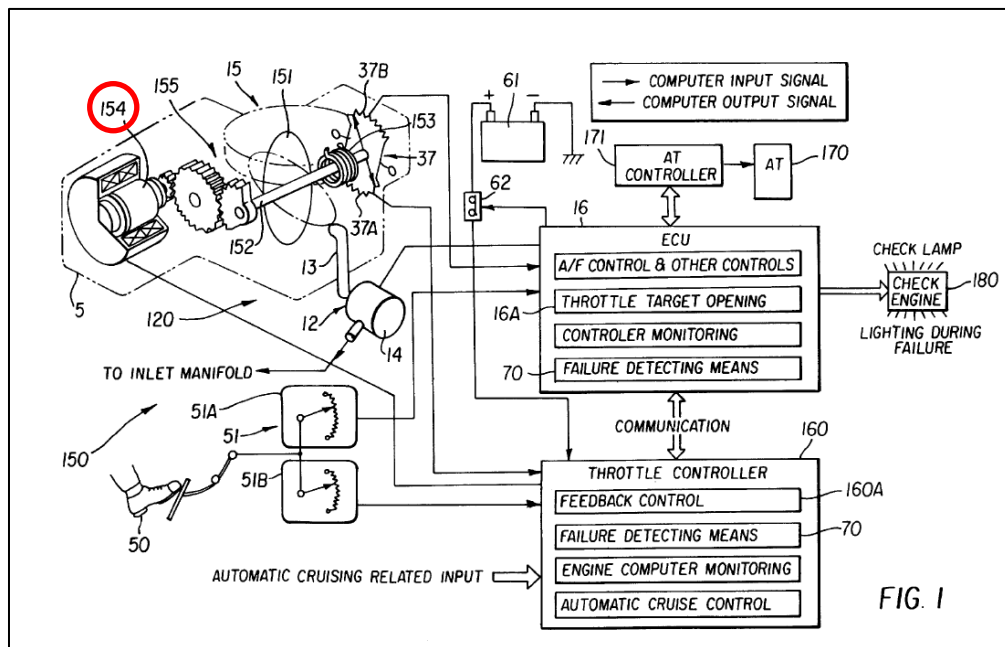
1. [1.P] “A method for controlling a positioning device of an internal combustion engine”

To the extent limiting, which Petitioner does not concede, Matsumoto discloses the preamble because Matsumoto discloses a throttle control system for

an internal combustion engine. EX1008, Abstract, Title, 1:7-12, 3:22-25, 3:37-41, 3:45-4:10; EX1003, ¶185. Burney also discloses [1.P]. EX1006, Abstract, 3:5-21.

2. [1.A] “providing an electric motor for actuating the positioning device”

Matsumoto discloses this element because Matsumoto’s system has an electric motor 154 for actuating the throttle (a positioning device). EX1008, 6:62-7:3; EX1003, ¶186.

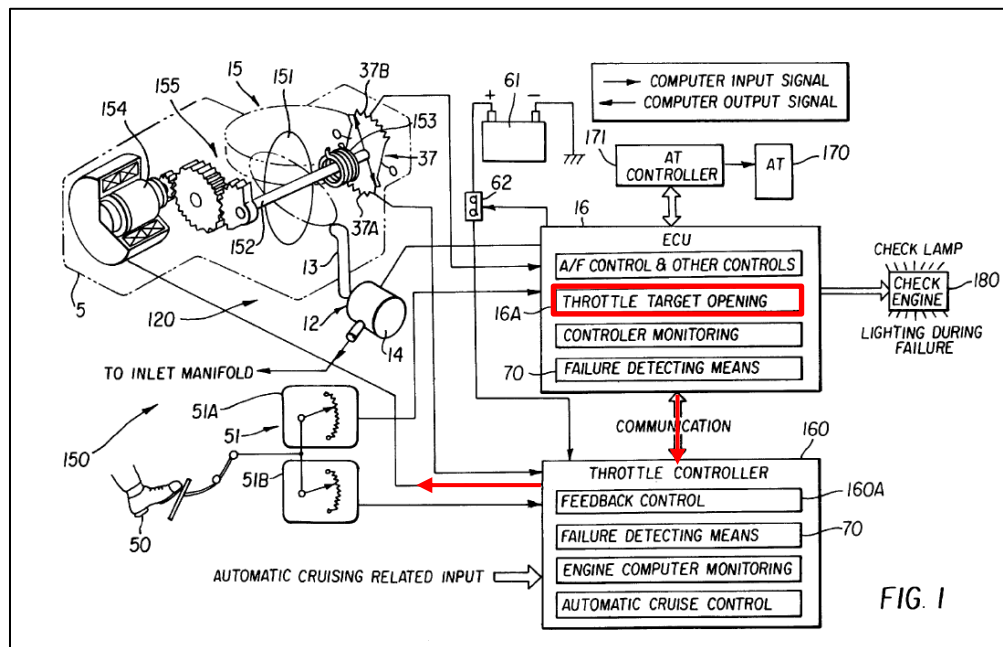


EX1008, FIG. 1 (annotated).

Burney and Ritenour also disclose [1.A]. EX1006, Abstract, 5:26-38, 7:45-63, FIG. 1; EX1027, 1:45-51, FIG. 1.

3. [1.B] “commanding the positioning device to change to a commanded position”

Matsumoto discloses this element because the engine control computer (ECU) commands the throttle controller to move the throttle to a target position. EX1003, ¶¶188-90. In Matsumoto, “the opening of this electronic controlled throttle valve 15 is controlled by means of a throttle control computer (throttle controller) 160.” EX1008, 3:63-67. An engine control computer (ECU) 16 sets the target throttle position based on the amount of depression of an accelerator pedal 60 and the operating conditions of the motor. *Id.*, 3:67-4:6. After the ECU 16 determines the throttle target opening, the ECU 16 communicates the target opening to the throttle controller 160 as shown below. EX1008, 7:12-60; EX1003, ¶188. The throttle controller 160 then drives the throttle actuator 154 to position the throttle to the commanded position. EX1008, 7:12-60; EX1003, ¶¶188-189.



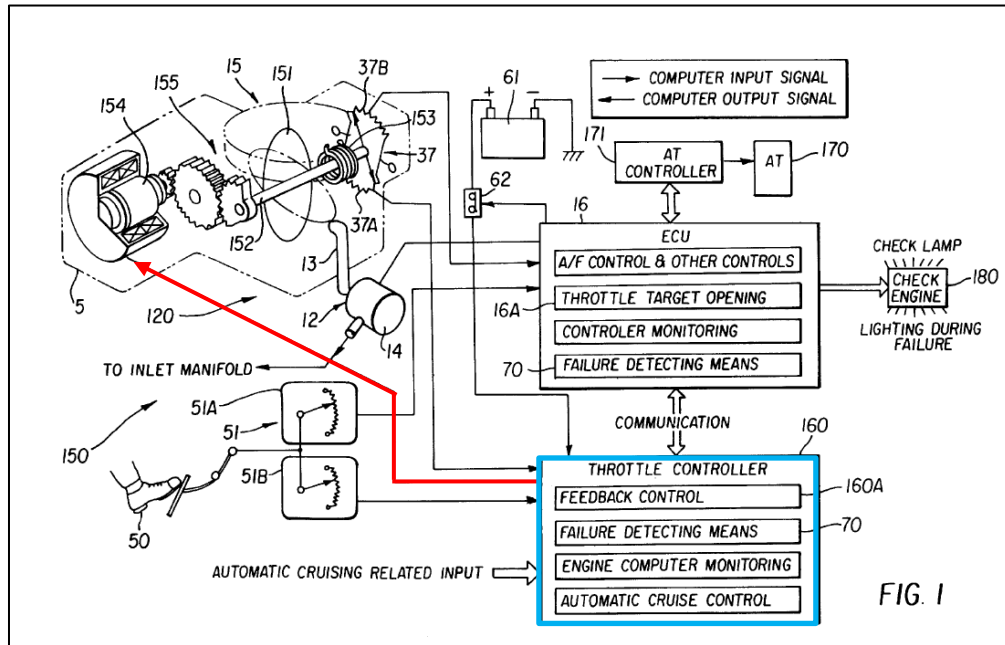
EX1008, FIG. 1 (annotated).

Burney and Ritenour also disclose [1.B]. EX1006, Abstract, 7:45-63, FIG. 3; EX1027, 1:52-59, FIG. 1. EX1003, ¶191.

4. [1.C] “detecting a control effort required to change to said commanded position”

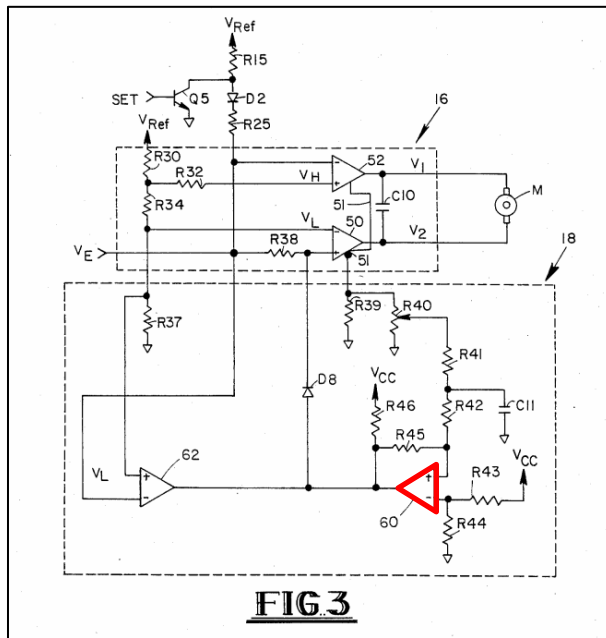
Matsumoto discloses this element because the servomotor detects the control effort required to move the throttle to the target position. *Id.*, ¶¶192-93. As Figure 1 shows below, “the opening of this electronic controlled throttle valve 15 is controlled by means of a throttle control computer (throttle controller 160). . . .” EX1008, 3:63-67; *see also* EX1008, 7:16-18. To control the opening of throttle valve 15, the throttle controller 160 drives the throttle actuator 154 with a drive current. EX1008, 7:51-56, FIGS. 1, 3. The throttle actuator 154 therefore “detects”

the presence and magnitude of the drive current and uses that current to move the throttle. EX1003, ¶193.



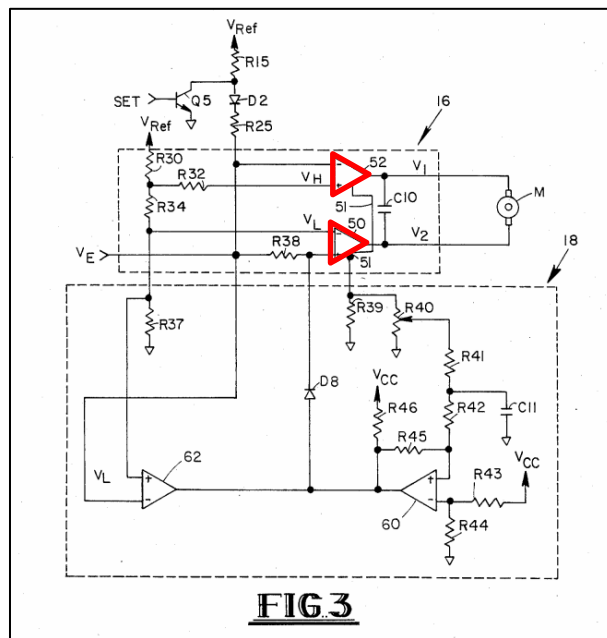
EX1008, FIG. 1 (annotated).

Burney's limit detection circuit 18 also detects a control effort required to change to said commanded position. EX1003, ¶194. For example, Burney's limit detection circuit 18 includes an amplifier 60. EX1006, 10:21-24, FIG. 3. Amplifier 60 detects the control effort required to change to said commanded position because the voltage applied to the noninverting (+) input "is directly related to the drive current of the motor M." EX1006, 10:29-34; EX1003, ¶194.



EX1006, FIG. 3 (annotated).

Burney’s amplifiers 50 and 52 also detect a control effort required to change to said commanded position. EX1003, ¶195. In Burney, “the error voltage V_E is received from R35 (FIG. 2) and is compared by each of the amplifiers 50 and 52 to DC voltage levels produced by a voltage divider....” EX1006, 9:16-23. When the error voltage V_E drops below the low voltage level V_L , “a motor current flows through the motor M to cause it to rotate.” *Id.*, 9:66-10:8. And when the error voltage V_E is greater than the high level voltage V_H , a motor current causes “motor M to rotate in an opposite direction.” *Id.*, 10:8-14. The amplifiers 50 and 52 therefore detect the motor current (the control effort) required to change the throttle to the commanded position. EX1003, ¶195.



EX1006, FIG. 3 (annotated).

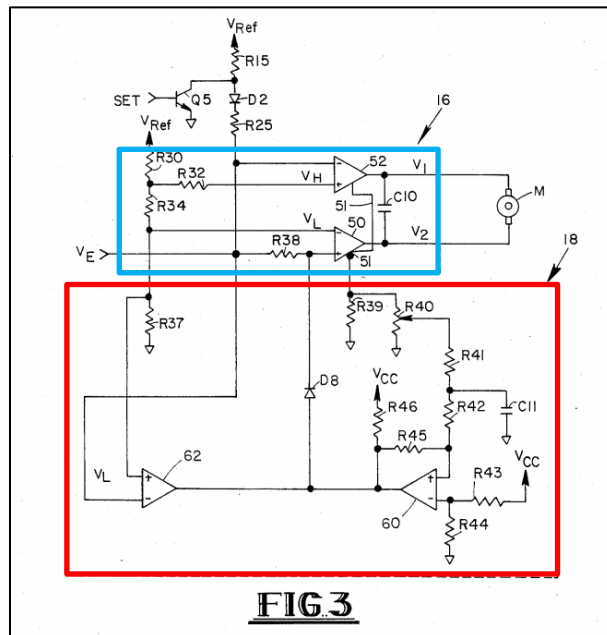
Ritenour also discloses [1.C]. EX1027, 1:30-35, 2:12-40; EX1003, ¶196.

5. [1.D] “determining whether said control effort exceeds a threshold for a predetermined time period”

Matsumoto in view of Burney and Ritenour discloses or suggests this element. EX1003, ¶¶198-205. Matsumoto's failure detecting means 70 determines that the throttle valve is stuck when the difference between the throttle's target position and the throttle's actual position remains greater than 1° for a predetermined time period. EX1008, 14:41-52. The failure detecting means 70 therefore determines whether a difference between the target throttle position and the actual throttle position exceeds a threshold for a predetermined time period. EX1008, 14:45-52; EX1003, ¶199.

EX1006, 3:24-35.

Figure 3 of Burney shows the motor drive circuit 16 (outlined in blue) and the limit detection circuit 18 (outlined in red). *Id.*, 9:16-23.

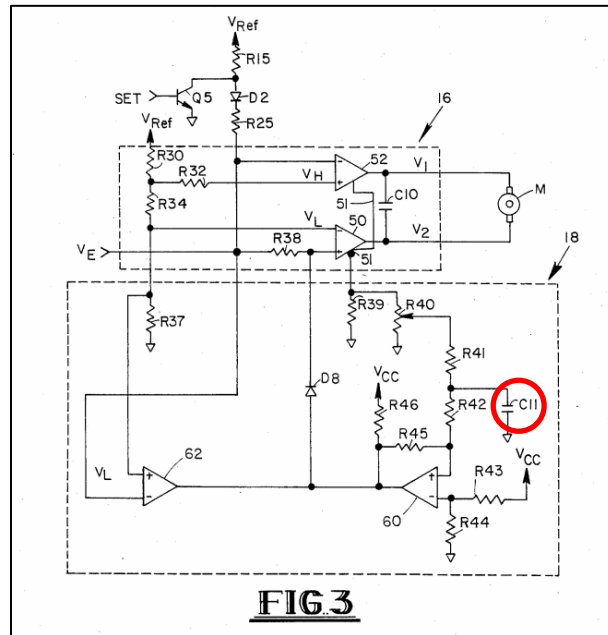


EX1006, FIG. 3 (annotated).

The limit detection circuit 18 determines whether the drive current exceeds a threshold. EX1003, ¶¶96, 202. Shown above, the limit detection circuit 18 includes an amplifier 60. EX1006, 10:21-24, FIG. 3. The noninverted (+) input of amplifier 60 is coupled, through a resistance network, to the ground terminal of amplifiers 50 and 52. *Id.*, 10:17-20. This noninverted (+) input “is directly related to the drive current of the motor M.” *Id.*, 10:29-34. Also shown above, a small voltage is applied to the inverted (-) input of amplifier 60 to create a normal output state of LOW. *Id.*, 10:25-29. When the drive current of the motor exceeds the drive current

threshold (i.e., the voltage at the inverted (–) input of amplifier 60), the output state of amplifier 60 switches from LOW to HIGH. EX1006, 10:34-39, 11:15-25, 13:5-27; EX1003, ¶¶96, 202.

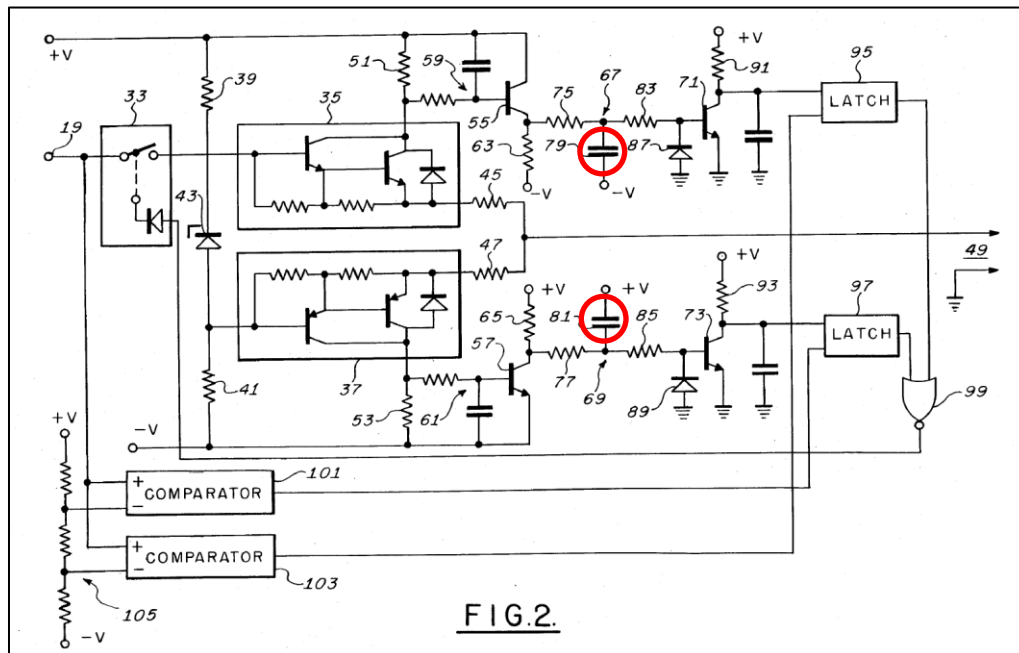
Burney also determines whether the drive current exceeds a threshold *for a predetermined time period* because the limit detection circuit 18 includes a timing capacitor c11 as outlined in red below. EX1003, ¶¶97, 203. The time period is the amount of time it takes to charge capacitor c11. *Id.*



EX1006, FIG. 3 (annotated).

Servomotor protection circuits had used timing capacitors like the one in Burney for decades. EX1003, ¶204. For example, Ritenour discloses “[a] servosystem drive circuit [that] includes means for sensing instances when the servomotor drive current exceeds a preset threshold level *for a given time*....”

EX1027, 1:30-35. Shown below, the circuit uses timing capacitors 79 and 81 to perform this function. *Id.*, 3:28-39, FIG. 2.



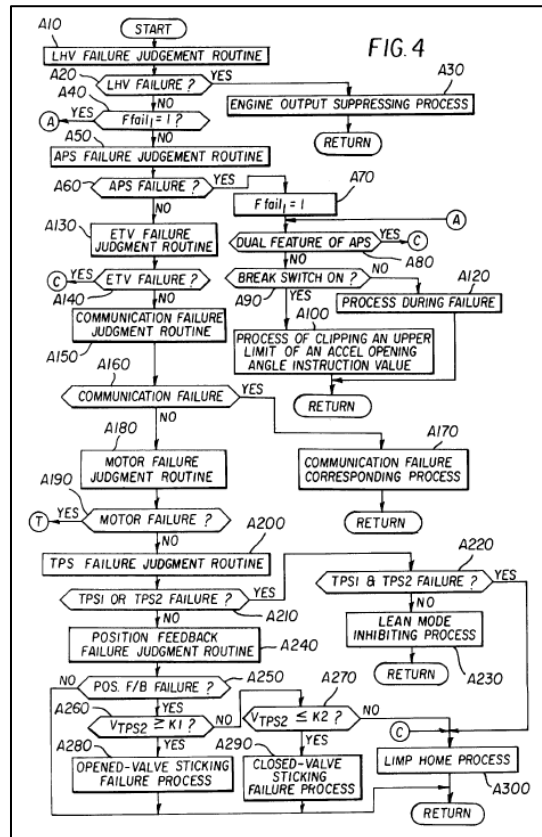
EX1027, FIG. 2 (annotated).

Accordingly, a POSA would have understood that Burney's limit detection circuit 18 determines whether the control effort exceeds a threshold for a predetermined time period. EX1003, ¶205. And as Section X.A explains, a POSA would have been motivated to combine Matsumoto and Burney to determine whether the control effort exceeds a threshold for the predetermined time period.

6. [1.E] “reducing said control effort when said control effort exceeds said threshold for said predetermined time period”

Matsumoto in view of Burney discloses or suggests this element. EX1003, ¶¶206-09. Figure 4 (reproduced below) shows Matsumoto's fail-safe operations.

EX1008, 3:33-36. When using Burney's limit detection circuit with a timing capacitor, a POSA would have understood that the determination of whether the control effort exceeds a threshold for the predetermined time period occurs in steps A280, A290, and A300. EX1003, ¶206.



EX1008, FIG. 4.

Shown above in Figure 4, Matsumoto's system performs an opened-valve sticking failure process (step A280), a closed-valve sticking failure process (step A290), and a limp home process (step A300). EX1008, 20:1-40, FIG. 4. When Matsumoto's system uses Burney's limit detection circuit with a timing capacitor,

Matsumoto's system reduces the control effort when the control effort exceeds the threshold for the predetermined time period. EX1003, ¶¶96, 207. For example, in step A280, "[w]hen 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. When the increased drive current surpasses the threshold for the predetermined time period, the control effort is reduced: "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. The combined system would also reduce the control effort when exceeding a threshold in step A290 because "[a] similar circuit may be provided to terminate the drive current when the servo is in the idle position...." EX1006, 3:30-35; *see also* EX1006, 10:39-43; EX1003, ¶¶98, 207. Also, like Matsumoto, the combination would reduce the drive current when the throttle valve is stuck between the open and closed positions in step A300. EX1006, 4:3-7, 10:39-43, 11:26-31, 14:19-15:2; EX1003, ¶¶207. Matsumoto in view of Burney therefore discloses this element. EX1003, ¶¶209. And as Section X.A explains, a POSA would have been motivated to reduce the control effort when the control effort exceeds a threshold for a predetermined time period to avoid damage to the motor.

Ritenour also discloses [1.E]. EX1027, 3:25-45, 3:57-62; EX1003, ¶¶208.

7. [1.F] “wherein commanding the positioning device to change to 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 close [sic] to a hold close mode”

Matsumoto, Burney, and Ritenour all disclose this element. EX1003, ¶¶210-13. As Section X.B.3 explains, Matsumoto’s ECU 16 determines the target throttle opening and commands the throttle controller 160 to position the throttle valve to the target opening. EX1008, 3:67-4:6, 5:31-35. Closed and open positions were standard positions for a throttle, so a POSA would have understood that the ECU 16 commands the throttle valve to move to a maximum open position (hold open mode) or a maximum closed position (hold close mode). EX1003, ¶¶63-64, 210. Indeed, the throttle valve can get stuck in its fully open position and its fully closed position, indicating, or at least suggesting, the ECU 16 commands the throttle valve to move to these positions. EX1008, 9:1-29; EX1003, ¶210. Additionally, a POSA would have known that typical controllers commanded the throttle valve to fully open and fully close, and nothing in Matsumoto suggests that its system deviates from the industry norm. EX1006, 7:57-63, 11:7-15, 13:5-23, 14:23-27, 14:46-56. EX1003, ¶210. Accordingly, Matsumoto discloses commanding the throttle to open to a hold open mode or close to a hold close mode. EX1003, ¶210.

Burney also discloses that the DC servo motor (M) moves the throttle to positions between, and including, the throttle valve’s mechanical limits (i.e., fully

open and fully closed). EX1006, Abstract, 5:65-6:2 (“when the throttle is full open or full closed”), 7:45-63; EX1003, ¶211.

Ritenour also discloses [1.F]. EX1027, 3:25-45 (high limit of travel), 3:57-62 (low limit of travel); EX1003, ¶212.

C. Claim 4

Claim 4 recites “the step of applying a maximum control effort to the positioning device for a hard open time period.” Matsumoto and Burney both disclose this element. EX1003, ¶¶215-18.

In Matsumoto, when the throttle controller 160 applies the control effort corresponding to the fully open position, this control effort is the “maximum” control effort the throttle actuator 154 applies to the throttle valve. EX1003, ¶217. To maintain this fully open position (e.g., when driving up a steep incline), the throttle actuator 154 applies this maximum control effort for a period of time—a hard open time period. *Id.* Otherwise the throttle valve would immediately move toward a closed position. EX1008, 6:62-7:3 (using a spring to bias the throttle valve to its closed position); EX1003, ¶217.

Burney also discloses this element. EX1003, ¶218. In Burney, “[i]f the error voltage V_E so developed is sufficiently large, the motor drive circuit will provide a motor current that causes the motor M to open the throttle valve (not shown) to the full-throttle position.” EX1006, 14:23-27; *see also* EX1006, 12:10-13:4 (the

system can modulate the pulses provided to the motor to control the motor's movement, confirming that Burney provides maximum control effort to effect maximum movement). A POSA would have understood that in such a situation the motor would apply a maximum control effort to the throttle for a period of time—a hard open time period. EX1003, ¶218. Accordingly, Matsumoto and Burney disclose the element in claim 4.

D. Claim 7

Claim 7 recites “wherein the step of commanding the positioning device to change to said commanded position, comprises commanding the positioning device to close to said commanded position in a hold close mode.” Matsumoto, Burney, and Ritenour disclose this element for the same reasons they disclose the nearly identical language in [1.F]. *Supra* Section X.B.7.

E. Claim 8

Claim 8 depends from claim 7 and recites “the step of applying a maximum control effort to the positioning device for a hard dose [sic] time period.” Matsumoto and Burney both disclose this element. EX1003, ¶¶220-23.

In Matsumoto, when the throttle controller 160 applies the control effort corresponding to the fully closed position, this control effort is the “maximum” control effort the throttle actuator 154 applies to the throttle valve. *Id.*, ¶222. To maintain this fully closed position (e.g., when idling), the throttle actuator 154

applies this maximum control effort for a period of time—a hard close time period. EX1003, ¶222.

Burney also discloses this element when the control system commands the throttle to fully close (e.g., when moving down a steep decline). *Id.*, ¶223. In Burney, “[t]he motor M will rotate in a direction that releases the throttle arm 20 (FIG. 1) toward the force of the bias spring 21, allowing the throttle valve (not shown) to move to the idle position.” EX1006, 13:16-19; *see also* EX1006, 12:10-13:4 (the system modulates the pulses provided to the motor to control the motor’s movement, confirming that Burney’s system provides maximum control effort to effect maximum movement).

F. Independent Claim 11

1. [11.P] “A system for controlling a positioning device of an internal combustion engine to prevent overhear conditions”

Claim 11 recites a system analogous to the method of claim 1. [11.P] is similar to [1.P], which Matsumoto discloses. *Supra* Section X.B.1. Even if this intended use of “to prevent overheating conditions” was limiting, Matsumoto in view of Burney and Ritenour would prevent overhear conditions because the system would prevent the electric motor from stalling, which would reduce heat and prevent the motor from getting damaged. EX1003, ¶224. Burney also discloses [11.P], as does Ritenour. *Supra* Section X.B.1; EX1027, 1:30-35, FIG. 1.

2. [11.A] “an electric motor for actuating the positioning device with a control effort”

[11.A] is nearly identical to [1.A], which Matsumoto discloses. *Supra* Section X.B.2; EX1003, ¶¶188-92, 226. Matsumoto’s electric motor actuates the throttle with a control effort. EX1008, 6:62-7:3, 7:51-56, FIG. 1 (throttle actuator 154 positions the throttle valve). EX1003, ¶226. Burney and Ritenour also disclose [11.A]. EX1006, Abstract, 5:26-38, 7:45-63, 9:16-10:14, FIGS. 1, 3; EX1027, 1:45-68; EX1003, ¶226.

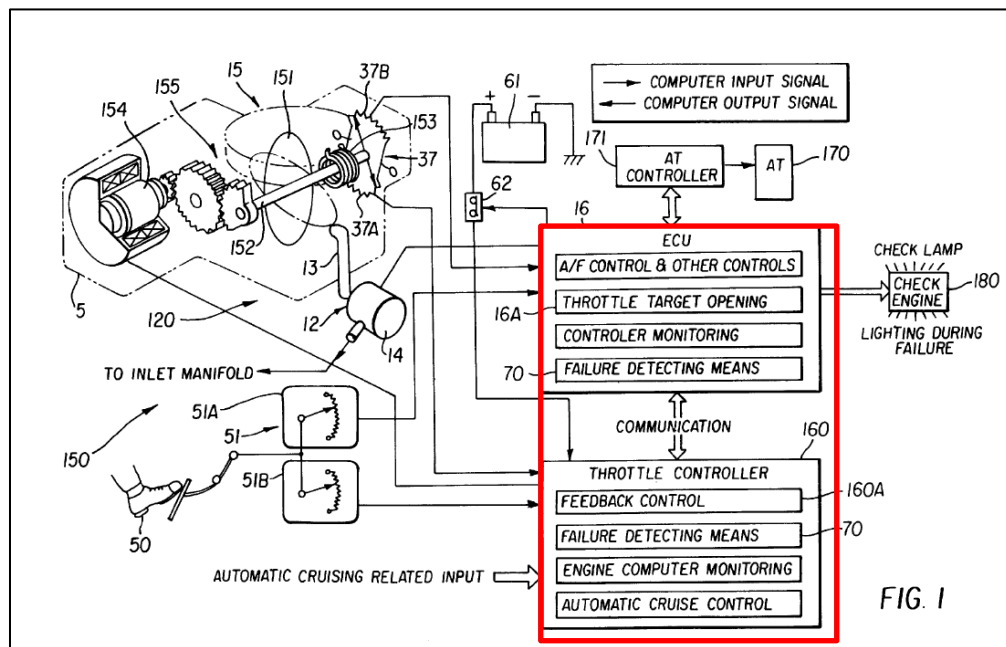
3. [11.B] “a control effort detector coupled to said electric motor and intended to detect said control effort”

Matsumoto discloses this element. EX1003, ¶227. As Section X.B.4 explains, Matsumoto’s throttle actuator 154 includes hardware to detect the presence and magnitude of the drive current and to use that current to move the throttle accordingly. *Id.*

Burney also discloses [11.B]. *Id.*, ¶228. As Section X.B.4 explains, Burney’s amplifiers 50, 52, and 60 detect a control effort for positioning a throttle and are coupled to the motor. *Supra* Section X.B.4. Ritenour also discloses [11.B]. EX1027, 1:30-35, 2:12-40; EX1003, ¶228. Matsumoto, Burney, and Ritenour therefore disclose this element. And as Section X.A explains, a POSA would have been motivated to combine these references to detect control efforts.

4. [11.C] “a controller coupled to said electric motor and said control effort detector, said controller including control logic operative to command the positioning device to change to a commanded position, detect a control effort required to change to said commanded position, determine whether said control effort exceeds a threshold for a predetermined time period, and reduce said control effort when said control effort exceeds said threshold for said predetermined time period”

Matsumoto in view of Burney and Ritenour discloses or suggests this element. As Sections X.B.3-X.B.6 explain, Matsumoto’s system includes an ECU 16 and a throttle controller 160. The ECU 16 and throttle controller 160 are a controller including control logic and are coupled to the electric motor—actuator 154. EX1008, 1:7-12, FIG. 1; EX1003, ¶229.



EX1008, FIG. 1 (annotated).

The ECU 16 and throttle controller 160 are also coupled to the control effort detector recited in [11.B]. EX1003, ¶231. The ECU 16 and throttle controller 160 are coupled to the hardware in actuator 154 that receives the drive current from the throttle controller 160. *Id.* When combined with Burney, this hardware comprises amplifiers 50 and 52. *Id.* And the ECU 16 and throttle controller 160 are coupled to the throttle opening feedback control portion 160A (and would be coupled to Burney’s amplifier 60) because the throttle opening feedback control portion 160A is located within the throttle controller 160. *Id.*

Finally, as Sections X.B.3-X.B.6 explain, Matsumoto in view of Burney and Ritenour discloses the controller having control logic to perform the “command,” “detect,” “determine,” and “reduce” steps. *Id.*

5. [11.D] “wherein said controller further includes control logic operative to command the positioning device to close to said commanded position in a hold close mode”

Matsumoto, Burney, and Ritenour each disclose this element. *Supra* Section X.B.7; EX1003, ¶232.

G. Claim 14

Claim 14 recites “wherein said controller further includes control logic operative to command the positioning device to open to said commanded position in a hold open mode.” Matsumoto, Burney, and Ritenour each disclose this element. *Supra* Section X.B.7.

H. Claim 15

Claim 15 depends from claim 14 and recites “wherein said controller further includes control logic operative to apply a maximum control effort to the positioning device for said hard open time period.” Matsumoto and Burney disclose this element. *Supra* Section X.C.

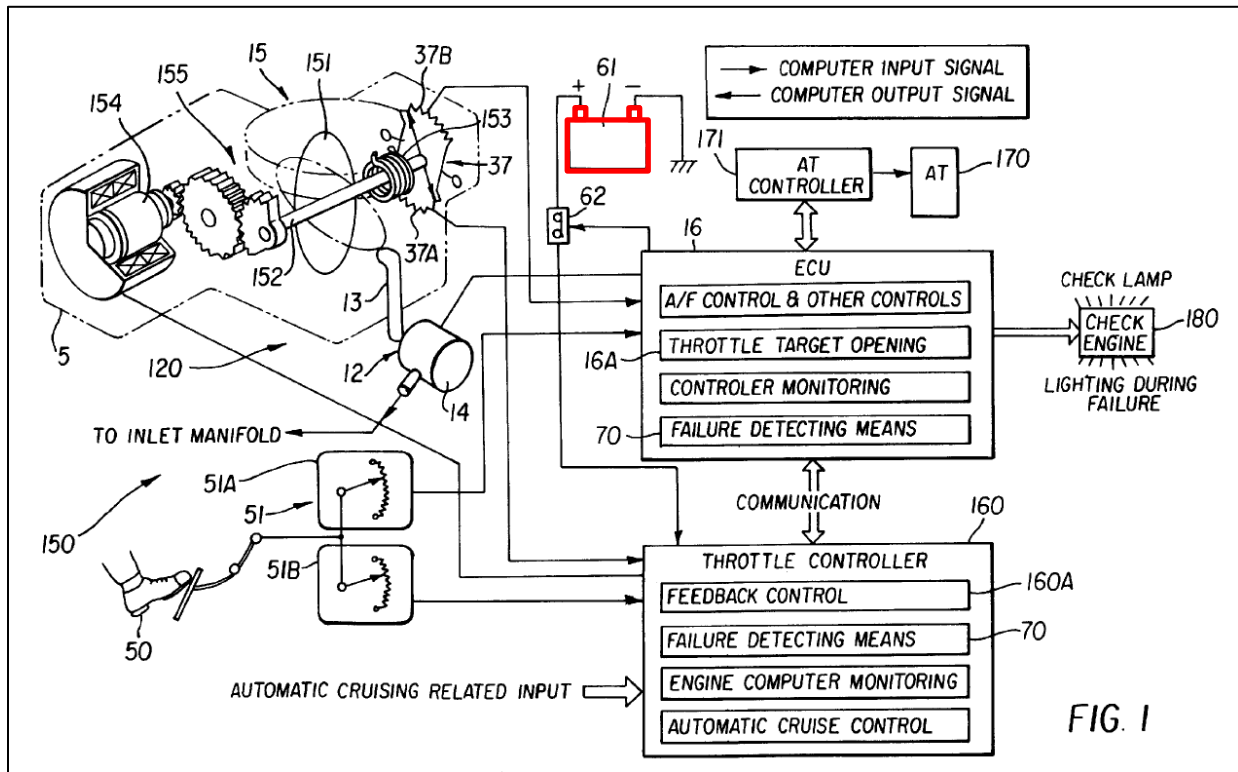
I. Claim 18

Claim 18 recites “wherein said controller further includes control logic operative to command application of a maximum control effort to the positioning device for a hard close time period.” Matsumoto and Burney disclose this element. *Supra* Section X.E.

XI. 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.

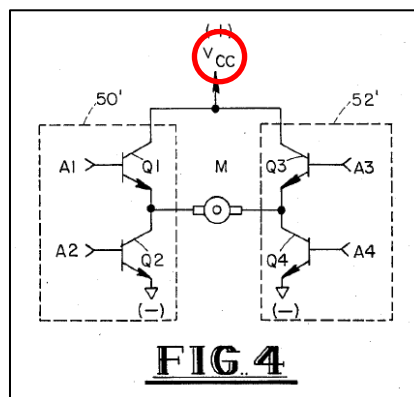
A. Rationale for Combining Matsumoto, Burney, Ritenour, the GM Manual, and the Chrysler Manual

Figure 1 of Matsumoto shows a battery 61 that supplies power to the throttle controller 160. EX1008, 8:46-53, FIG. 1.



EX1008, FIG. 1 (annotated).

Similarly, Burney uses a voltage V_{cc} to supply power to the motor drive circuit, as Figure 4 shows below. EX1006, 9:30-45, FIG. 4.



EX1008, FIG. 4 (annotated).

The rationale for combining Matsumoto, Burney, and Ritenour discussed in Section X.A equally applies here. Neither Matsumoto nor Burney (nor Ritenour) specifies the voltage that battery 61 or V_{cc} provides to the motor drive circuit. EX1003, ¶¶240. A POSA would have therefore looked for the voltage levels of typical automobile power supplies from multiple major automobile manufacturers. *Id.* The POSA would have been led to the GM Manual, which states that voltage during idle is typically 13.5 to 14.5 volts. EX1023, 94; *see also* EX1021, 39; EX1003, ¶240. The POSA would have also been led to the Chrysler Manual, which states that a typical voltage regulator supplied 13.9-14.6 volts. EX1024, 3-9; EX1003, ¶240. For cross compatibility, the POSA would have accounted for these overlapping ranges. EX1003, ¶240.

In the context of Matsumoto, Burney, and Ritenour, a POSA would have been motivated to use the maximum available voltage to unjam the throttle when stuck in a *closed* position. EX1003, ¶241. The maximum voltage would have provided the greatest chance of quickly releasing the jam. *Id.* Given typical batteries reached a maximum voltage of around 14.5 volts, a POSA would have therefore been motivated to apply +14.5 volts for the hard open time period.

Likewise, when trying to unjam a throttle stuck in an *open* position, a POSA would have been motivated to use the maximum available voltage. *Id.*, ¶242. But when trying to close the throttle, the POSA would have used negative polarity.

EX1006, FIG. 4; EX1027, FIG. 2; EX1003, ¶242. Given typical batteries reached a maximum voltage of around 14.5 volts, a POSA would have therefore been motivated to apply –14.5 volts for the hard close time period. EX1003, ¶242.

B. Claims 5, 9, 16, and 19

Claims 5 and 16 depend from claims 4 and 15, respectively, and recite “wherein said maximum control effort is +14.5 volts.” Claims 9 and 19 depend from claims 8 and 18, respectively, and recite “wherein said maximum control effort is –14.5 volts.” Matsumoto in view of Burney, Ritenour, the GM Manual, and the Chrysler Manual discloses or suggests these elements. *Id.*, ¶¶237-44.

As Section XI.A explains, a POSA would have been motivated to use ± 14.5 volts as the maximum control effort. Additionally, using ± 14.5 volts as the maximum control effort would have combined prior art elements (a typical battery supply) according to known methods to yield predictable results. *Id.*, ¶243. These specific voltages would have also been an obvious design choice. *Id.* In the ’804 patent, the specific values provide no novel or unexpected result and solve no stated problem. *Id. Cf. Kuhle*, 526 F.2d at 555. The specific voltages in the claims also do not define different structure or achieve a different purpose. EX1003, ¶243. *Gal*, 980 F.2d at 719; *Ex parte Spangler*, Appeal No. 2018-003800, slip op. 6-9. Indeed, the ’804 patent admits the voltage is an obvious design choice: “*Obviously*, the magnitude of the effort may vary as required.” EX1001, 3:63-64. Neither the

'804 patent nor its prosecution history articulates a single benefit for selecting this value as the maximum control effort. EX1003, ¶243.

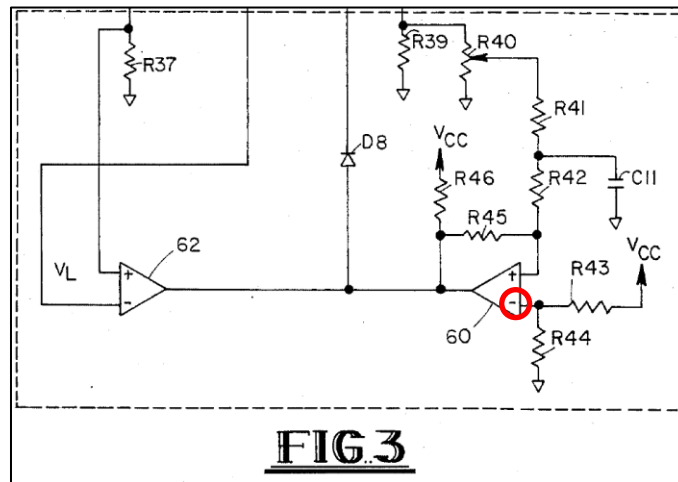
The '804 patent confirms $\pm 14.5\text{V}$ was an obvious design choice. EX1003, ¶244. It explains that a POSA would have understood the relationship between the amount of voltage applied to a servo motor and the duration such voltage could be applied without overheating the motor, and it provides a table of example voltage-duration pairs for “a given servo motor.” EX1001, 3:36-54. The patent further admits: “*Obviously*, the magnitude of the effort may vary as required.” *Id.*, 3:63-64. These admissions confirm a POSA would have understood the conditions (amount of control effort and duration) under which the motor could operate without overheating and that applying $\pm 14.5\text{V}$ was a design choice within known operating conditions. EX1003, ¶244.

C. Claims 2 and 12

Claims 2 and 12 depend from claims 1 and 11, respectively, and recite “wherein said threshold has an absolute value of 6 volts.” Matsumoto in view of Burney, Ritenour, the GM Manual, and the Chrysler Manual discloses or suggests this element. EX1003, ¶¶245-49.

Figure 3 of Burney shows the threshold voltage of the limit detection circuit 18 at the inverted (–) terminal of amplifier 60. *Id.*, ¶247. Burney, however, never

states what this voltage is, only that the voltage is relatively small. EX1006, 10:25-29; EX1003, ¶246.



EX1006, FIG. 3 (excerpted and annotated).

Given the threshold voltage at the negative (–) terminal of amplifier 60 would be relatively small and the typical V_{cc} would be 14.5 volts, a POSA would have at least configured the circuit such that the voltage at the inverted (–) terminal of amplifier 60 was less than half of V_{cc} —less than 7.25 volts. EX1003, ¶247.

Selecting |6| volts as the threshold would have been an obvious design choice. *Id.*, ¶248. In the '804 patent, this specific value provides no novel or unexpected result and solves no stated problem. *Id. Cf. Kuhle*, 526 F.2d at 555. The specific threshold voltage in the claims also does not define different structure or achieve a different purpose. EX1003, ¶248. *Cf. Gal*, 980 F.2d at 719; *Ex parte Spangler*, Appeal No. 2018-003800, slip op. 6-9. Indeed, the '804 patent admits |6| volts as a threshold was typical. EX1001, 3:28-30, 4:19-21. And neither the '804

patent nor its prosecution history articulates a single benefit for selecting |6| volts as the threshold voltage. EX1003, ¶248.

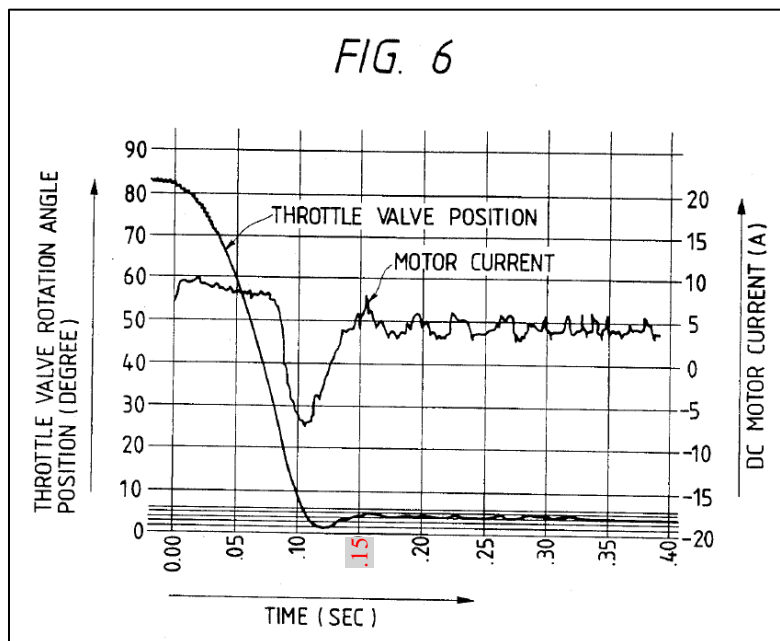
The '804 patent states: “*Typically*, an effort limit of approximately +6 volts and a contiguous time interval of about 300 milliseconds are used.” EX1001, 3:28-30, 4:19-21 (same statement but opposite polarity). To the extent this statement is an admission about what was “typical” in the industry, it follows that it was obvious to a POSA to use |6| volts. EX1003, ¶249. At the least, the next sentence, “[o]bviously, these values may vary as required,” confirms that |6| volts would have been an obvious design choice. EX1001, 3:30-31; EX1003, ¶249.

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

A. Rationale for Combining Matsumoto, Burney, Ritenour, and Ohta

The rationale for combining Matsumoto, Burney, and Ritenour is discussed in Section X.A and applies equally here. As explained for [1.D], Matsumoto determines a throttle failure after a predetermined time period of 500 milliseconds. EX1008, 14:41-52. Burney and Ritenour also determine whether the control effort exceeds a threshold for a predetermined time period. However, neither Burney nor Ritenour specifies the number of milliseconds the circuit takes before reducing the threshold based on exceeding the control effort. EX1003, ¶251.

To 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. EX1003, ¶252. 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.* Looking for this value, the POSA would have been led to Ohta, which shows that the normal time period for moving the throttle from open to close is approximately 150 milliseconds, as Figure 6 shows below. EX1020, FIG. 6; EX1003, ¶252.



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

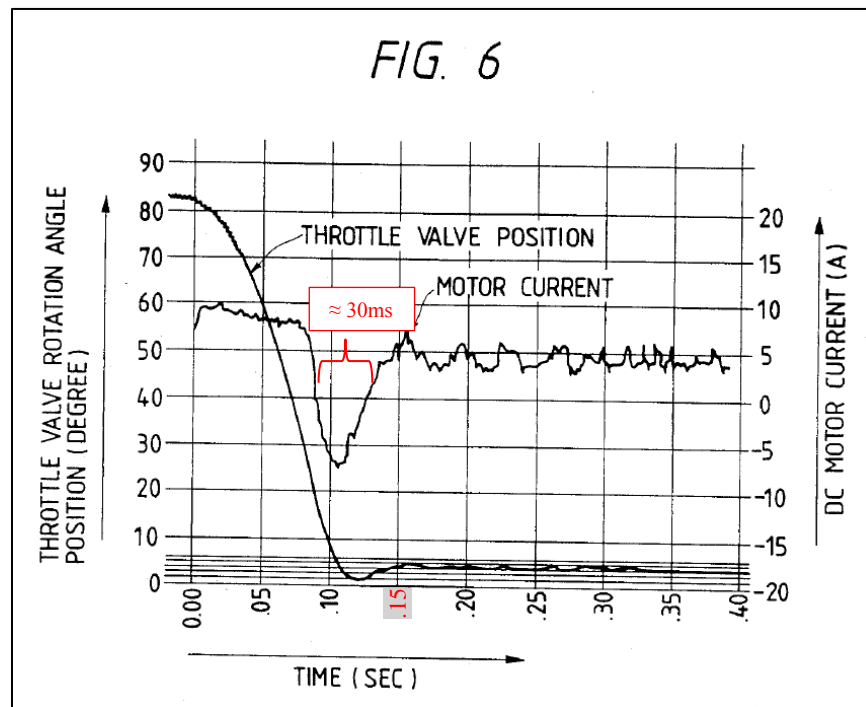
A POSA, however, would have been motivated to use a time *higher* than 150 milliseconds to build in tolerance, account for the additional time the system would take to move against the bias force of the throttle spring, and account for

instances where the system takes a while to unjam the throttle valve. EX1003,

¶253. Selecting 300 milliseconds would have been an obvious design choice. *Id.*,

¶254.

Additionally, as Figure 6 of Ohta shows below, approximately 30 milliseconds of maximum current is used to drive the throttle valve from a fully open position to a fully closed position. *Id.*, ¶256.



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

A POSA would have been motivated to use 30 milliseconds as the period for the hold open mode and the hold close mode because this is the minimum amount of time the control system needs to initiate throttle movement. *Id.*, ¶257. The POSA would have understood that any additional time of applying maximum

control effort would risk harming the motor circuit. EX1003, ¶257. To avoid harming the motor circuit, the POSA would have used the minimum amount of time needed to initiate movement—30 milliseconds. *Id.*

B. Claims 3 and 13

Claims 3 and 13 depend from claims 1 and 11, respectively, and recite “wherein said predetermined time period is 300 milliseconds.” Matsumoto in view of Burney, Ritenour, and Ohta discloses or suggests this element. *Id.*, ¶250.

As Section XII.A explains, a POSA would have been motivated to use a predetermined time period of 300 milliseconds. Additionally, selecting 300 milliseconds would have been an obvious design choice. *Id.*, ¶254. In the ’804 patent, this specific value provides no novel or unexpected result and solves no stated problem. *Id. Cf. Kuhle*, 526 F.2d at 555. The specific time period in the claims also does not define different structure or achieve a different purpose. EX1003, ¶254. *Cf. Gal*, 980 F.2d at 719; *Ex parte Spangler*, Appeal No. 2018-003800, slip op. 6-9. Indeed, the ’804 patent admits 300 milliseconds was typical. EX1001, 3:28-30, 4:19-21. And neither the ’804 patent nor its prosecution history articulates a single benefit for selecting 300 milliseconds for the predetermined time period. EX1003, ¶254.

The ’804 patent states: “*Typically*, an effort limit of approximately +6 volts and a contiguous time interval of about 300 milliseconds are used.” EX1001, 3:28-

30, 4:19-21 (same statement but opposite polarity). To the extent this statement is an admission about what was “typical” in the industry, it follows that it was obvious to a POSA to use 300 milliseconds. EX1003, ¶255. At the least, the next sentence, “[o]bviously, these values may vary as required,” confirms that 300 milliseconds would have been an obvious design choice. EX1001, 3:30-31; EX1003, ¶255.

C. Claims 6, 10, 17, and 20

Claims 6 and 17 depend from claims 4 and 15, respectively, and recite “wherein said hard open time period is 30 milliseconds.” Claims 10 and 20 depend from claims 8 and 18, respectively, and recite “wherein said hard close time period is 30 milliseconds.” Matsumoto in view of Burney, Ritenour, and Ohta discloses or suggests this element. EX1003, ¶256.

As Section XII.A explains, a POSA would have been motivated to use a hard open and hard close time period of 30 milliseconds. Additionally, selecting 30 milliseconds for both the hard open time period and hard close time period would have been an obvious design choice. *Id.*, ¶258. In the ’804 patent, this specific value provides no novel or unexpected result and solves no stated problem. *Id. Cf. Kuhle*, 526 F.2d at 555. The specific time period in the claims also does not define different structure or achieve a different purpose. EX1003, ¶258. *Cf. Gal*, 980 F.2d at 719; *Ex parte Spangler*, Appeal No. 2018-003800, slip op. 6-9. Indeed, the ’804

***Petition for Inter Partes Review of
U.S. Patent No. 6,763,804***

patent admits 30 milliseconds was *typical*. EX1001, 4:26-27. And neither the '804 patent nor its prosecution history articulates a single benefit for selecting 30 milliseconds for the hard open and hard close time periods. EX1003, ¶258. Accordingly, 30 milliseconds would have been an obvious design choice.

XIII. CONCLUSION

For the reasons above, *inter partes* review of claims 1-20 of U.S. Patent No. 6,763,804 is requested.

Respectfully submitted,

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Date: February 12, 2020

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**CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME
LIMITATION, TYPEFACE REQUIREMENTS, AND TYPE STYLE
REQUIREMENTS**

1. This Petition complies with the type-volume limitation of 14,000 words, comprising 13,976 words, excluding the parts exempted by 37 C.F.R. § 42.24(a).

2. This Petition complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word 2010 in 14-point Times New Roman.

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Date: February 12, 2020

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CERTIFICATION OF SERVICE (37 C.F.R. §§ 42.6(e), 42.105(a))

The undersigned hereby certifies that on February 12, 2020, true and correct copies of the foregoing **PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 6,763,804**, Petitioner's Power of Attorney, and all associated exhibits were served in their entirety on the following party via FedEx®:

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