

VIZIO, Inc.
v.
Polaris PowerLED Technologies, LLC

IPR2024-00073

U.S. Patent No. 7,843,148

Patent Owner's Demonstratives

December 5, 2024

Polaris EX2012
Vizio v. Polaris
IPR2024-00073

Instituted Grounds

IPR2024-00073 ('148 Patent)		
Claims Challenged	Basis	Applied References
1, 3, 7, 9, 10-12, 14, 17-18, 20-22	35 U.S.C. § 102	Thomas*
1, 3, 6, 7, 9-12, 14, 17-18, 20-22	35 U.S.C. § 103	Thomas
2, 13, 15	35 U.S.C. § 103	Thomas in view of the Applicant admitted prior art ("AAPA") and/or the knowledge of the POSITA
8, 19	35 U.S.C. § 103	Thomas in view of Tatewaki and the knowledge of a POSITA
1-4, 11, 12, 14, 17, 22	35 U.S.C. § 102	Zane**
1-4, 5, 11-17, 22	35 U.S.C. § 103	Zane

* Claims 4, 5, and 16 are not challenged under the *Thomas* grounds

** Claims 6-10 and 18-21 are not challenged under the *Zane* grounds

Petition at 17.

Instituted Grounds

- Claims 4, 5, and 16
 - Not covered by the *Thomas* grounds (Grounds 1-4)
 - Petitioner's obviousness analysis under *Zane* is the only challenge to claims 5 and 16
- Claims 6-10, 18-21
 - Not covered by the *Zane* grounds (Grounds 5, 6)
 - Petitioner's only relevant challenge to these claims is the *Thomas* anticipation challenge—the obviousness challenge fails to address the flaws in anticipation

Agenda

- ▶ **The '148 Patent**
- ▶ The Thomas Grounds
 - ▶ Thomas does not anticipate any claims
 - ▶ Thomas does not render obvious any claims
- ▶ The Zane Grounds
 - ▶ Zane fails to render claims 5 and 16 obvious
 - ▶ The Board should not credit Zane's testimony

The '148 Patent


US007843148B2

(12) **United States Patent**
Gater et al.

(10) **Patent No.:** **US 7,843,148 B2**
(45) **Date of Patent:** **Nov. 30, 2010**

(54) **DRIVING MULTIPLE PARALLEL LEDS WITH REDUCED POWER SUPPLY RIPPLE**
7,609,237 B2 * 10/2009 Ragonesi et al. 345/82

(75) **Inventors:** **Christian Gater**, Dunblane (GB); **Roel Van Ettinger**, Bathgate (GB)
* cited by examiner

(73) **Assignee:** **Micrel, Inc.**, San Jose, CA (US)
Primary Examiner—Douglas W Owens
Assistant Examiner—Jimmy T Vu
(74) *Attorney, Agent, or Firm*—Patent Law Group LLP, Brian D. Ogonowsky

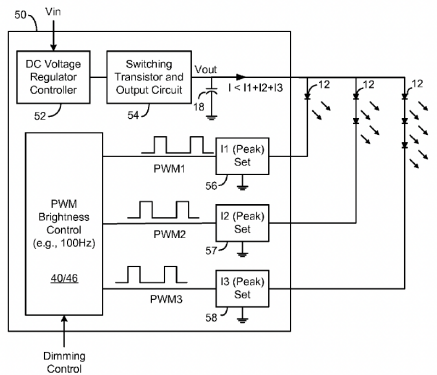
(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 423 days.

(21) **Appl. No.:** **12/099,729**
(22) **Filed:** **Apr. 8, 2008**
(65) **Prior Publication Data**
US 2009/0251071 A1 Oct. 8, 2009

(51) **Int. Cl.** **H05B 37/02** (2006.01)
(52) **U.S. Cl.** **315/291; 315/307**
(58) **Field of Classification Search** 315/185 R, 315/186-195, 209 R, 225, 226, 291, 307, 315/312, 361, 362
See application file for complete search history.

(56) **References Cited**
U.S. PATENT DOCUMENTS
6,812,776 B2 * 11/2004 Henry 327/536
7,358,681 B2 * 4/2008 Robinson et al. 315/224

22 Claims, 3 Drawing Sheets



(57)

ABSTRACT

An LED driver is disclosed that drives LEDs connected in parallel. Instead of applying current to all the parallel-connected LEDs at the same time, under control of a common PWM brightness control signal, the application of current to each parallel path is staggered by using staggered brightness control signals. The turning on of the LEDs in the different parallel paths will have the same duty cycle but will be out of phase. This reduces ripple in the power supply by reducing the magnitude of the instantaneous current sink. In one embodiment, a shift register contains a binary representation of the PWM duty cycle, and a clock shifts the bits along the shift register. The PWM brightness control signals for each parallel path of LEDs are tapped from different positions along the shift register so that the PWM brightness control signals are identical but staggered.

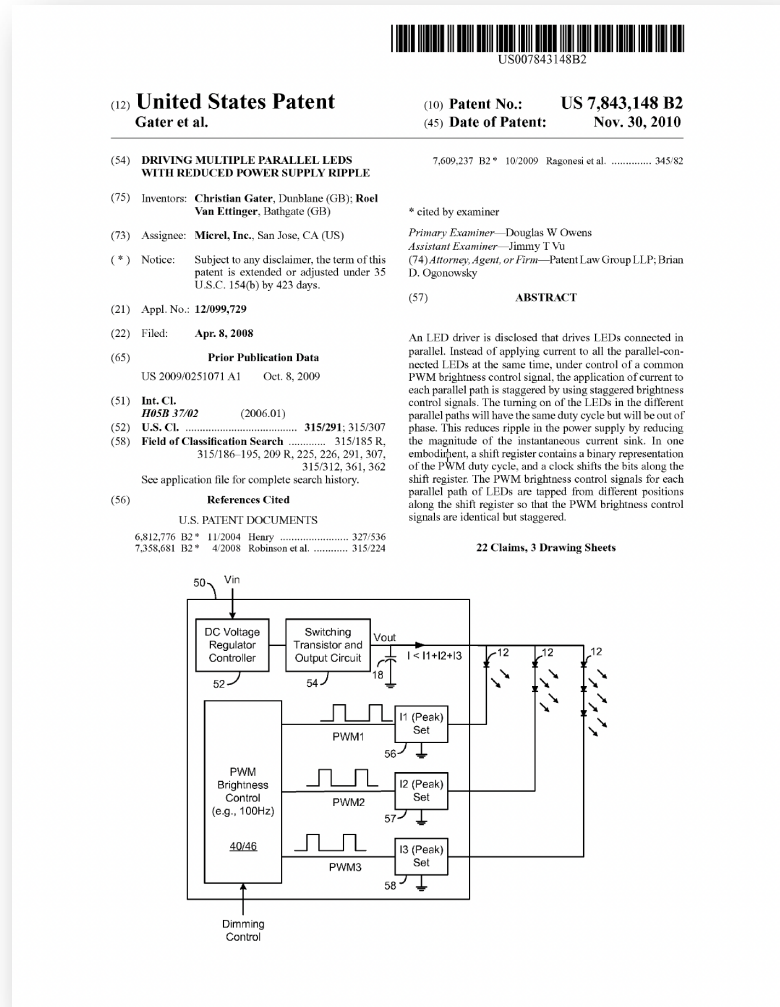
EX1001, Abstract

EX1001, 1

Patent Owner's Demonstrative Exhibit – Not Evidence

5

'148 Patent Exemplary Claim 1



EX1001, 1

What is claimed is:

1. A light emitting diode (LED) driver for driving LEDs connected to different parallel paths, the driver comprising:
a voltage source for connection to first ends of LEDs in a plurality of parallel paths;
a plurality of current set circuits, one current set circuit per parallel path, each current set circuit controlling a peak current through one or more LEDs connected in each parallel path; and
a pulse-width modulated (PWM) brightness control signal generator connected to the plurality of current set circuits, the brightness control signal generator being configured to generate staggered PWM brightness control signals to the plurality of current set circuits,
each current set circuit being configured to draw the peak current through its associated one or more LEDs at a duty cycle substantially corresponding to a duty cycle of a PWM brightness control signal applied to it, such that the plurality of current set circuits conduct current through their associated one or more LEDs at the same duty cycle but out of phase with each other.

EX1001, Claim 1

Agenda

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- ▶ **The Thomas Grounds**
 - ▶ Thomas does not anticipate any claims
 - ▶ Thomas does not render obvious any claims
- ▶ The Zane Grounds
 - ▶ Zane fails to render claims 5 and 16 obvious
 - ▶ The Board should not credit Zane's testimony

Thomas' single, passive resistor is not a current set circuit

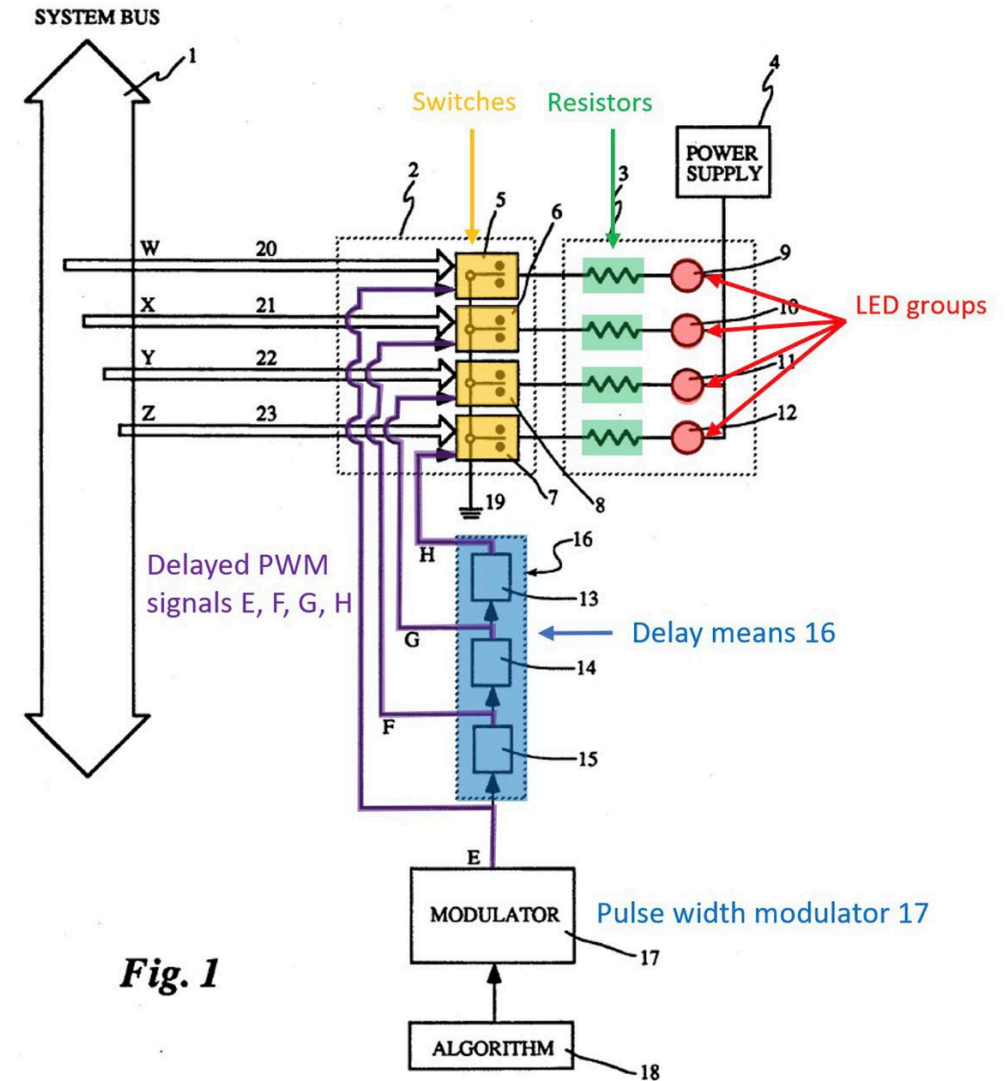
- Claim requires a “circuit” that is “controlling a peak current”
- Petitioner only identifies a resistor
- A single resistor is not a “circuit” under the plain meaning of that term
- Petitioner's identification is contrary to the specification

“a plurality of current set **circuits**, one current set circuit per parallel path, each current set circuit **controlling a peak current** through one or more LEDs connected in each parallel path”

EX1001, Claim 1

Thomas' single, passive resistor is not a current set circuit

- Petitioner points to a single resistor in each path as the “current set circuit”
- Petitioner argues on reply that they did not limit the “current set circuit” to the resistor (Reply, 14)
- Not so:
 - “the resistors shown in Thomas’ Figure 1 [...] are **each a current set circuit.**” (Pet., 26)
 - “[I]t is my opinion that those resistors are current set circuits.” (EX2004, 84:21-85:3, POR 8, Sur-Reply, 4)



Thomas' single, passive resistor is not a current set circuit

- A POSITA would understand a “circuit” to mean **two or more** components that are connected together
- Even Petitioner's expert identified a circuit as consisting of multiple components

“In my opinion, a POSITA would consider a ‘circuit’ to require multiple components that are connected by a conductive material, such as a wire or trace on a circuit board, in order to form a ‘circuit.’ That is, a single electronic component such as a wire, resistor, diode, or capacitor could not, by itself, comprise a ‘circuit.’”

EX2002, Credelle Declaration ¶34

Q What is an electric circuit?

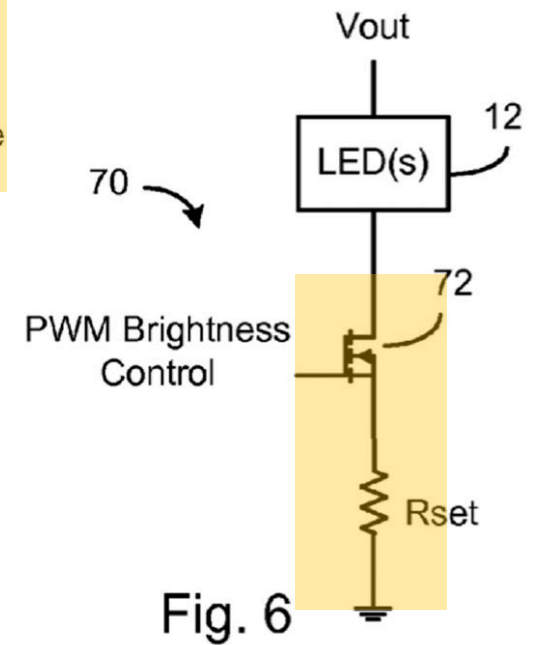
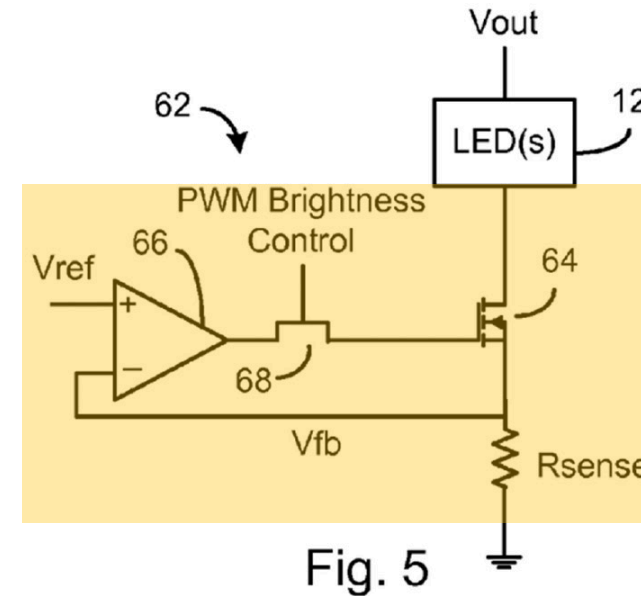
A Well, this is a very, you know, broad question.

But generally speaking, an electrical circuit would be a circuit made up of electrical components, such as resistors, transistors, capacitors, inductors, diodes, et cetera.

EX2004, Zane Deposition 35:10-16

Thomas' single, passive resistor is not a current set circuit

- The specification discloses multiple exemplary current set circuits
- None of these circuits are a **single** component
- Each includes multiple elements such as a resistor **and** a MOSFET (EX1001, 5:59-62, 6:9-11; POR, 10)
- Petitioner's new argument, adding to its "current set circuit," should be rejected



EX1001, FIGS. 5, 6 (annotated), POR, 10

Thomas does not disclose applying a PWM brightness control signal to a “current set circuit” under either of Petitioner’s theories

- Claim requires a “PWM brightness control signal” be “applied to [the current set circuit]”
- Petitioner identifies a resistor as the “current set circuit”
- PWM signal is **not** applied to the resistor in *Thomas*
- Petitioner agrees that the PWM signal is applied to the **input of the switches**, not the resistor

“each current set circuit being configured to draw the peak current through its associated one or more LEDs at a duty cycle substantially corresponding to a duty cycle of a **PWM brightness control signal applied to it**”

EX1001, Claim 1

Thomas does not disclose applying a PWM brightness control signal to Petitioner's new "current set circuit."

- Petition identifies resistors (in green) as the current set circuits
- Petition claims that "the staggered PWM signals E, F, G, and H are fed into activation switches 5, 6, 8, and 7, respectively." (Pet., 30)
- Petition never actually asserts that this signal moves through the switches to the resistors
- The signal, by design, *cannot* be applied to Thomas' resistors

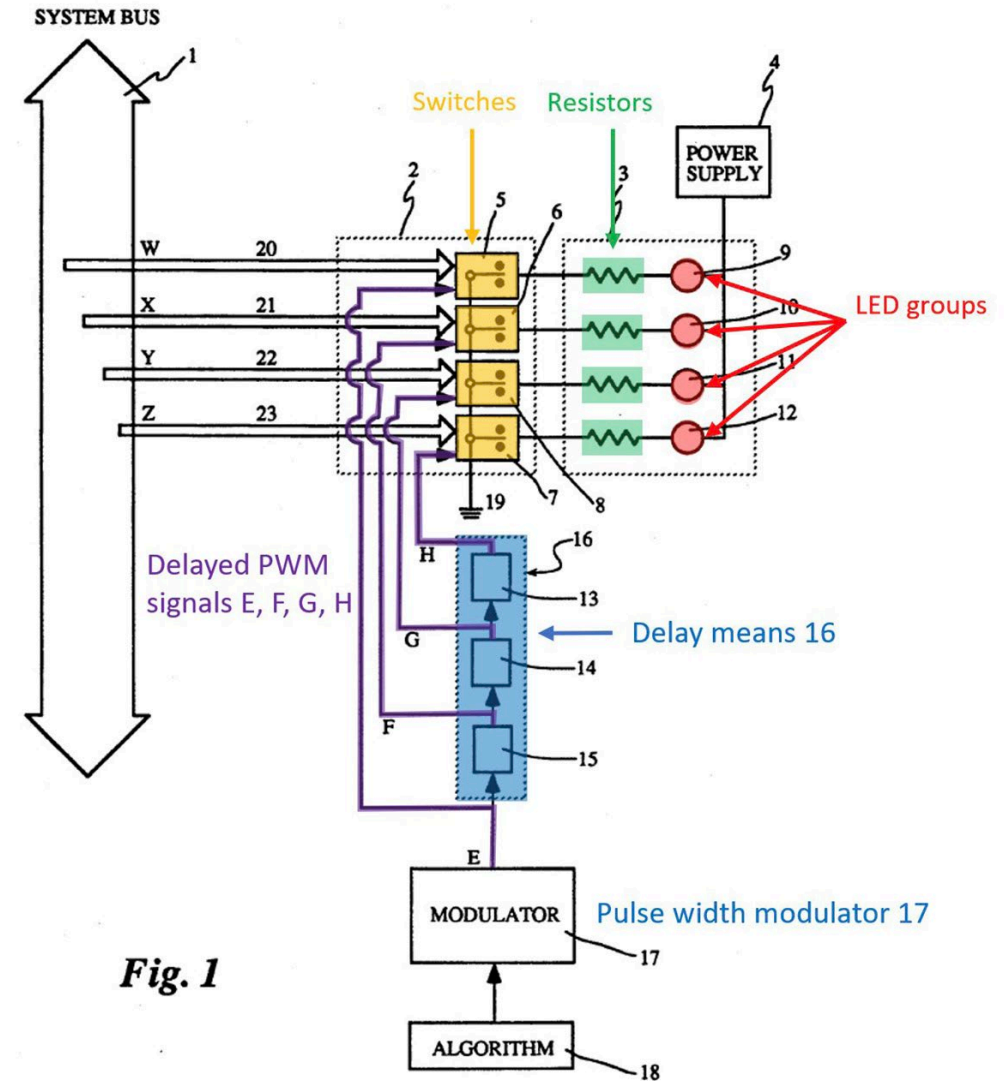


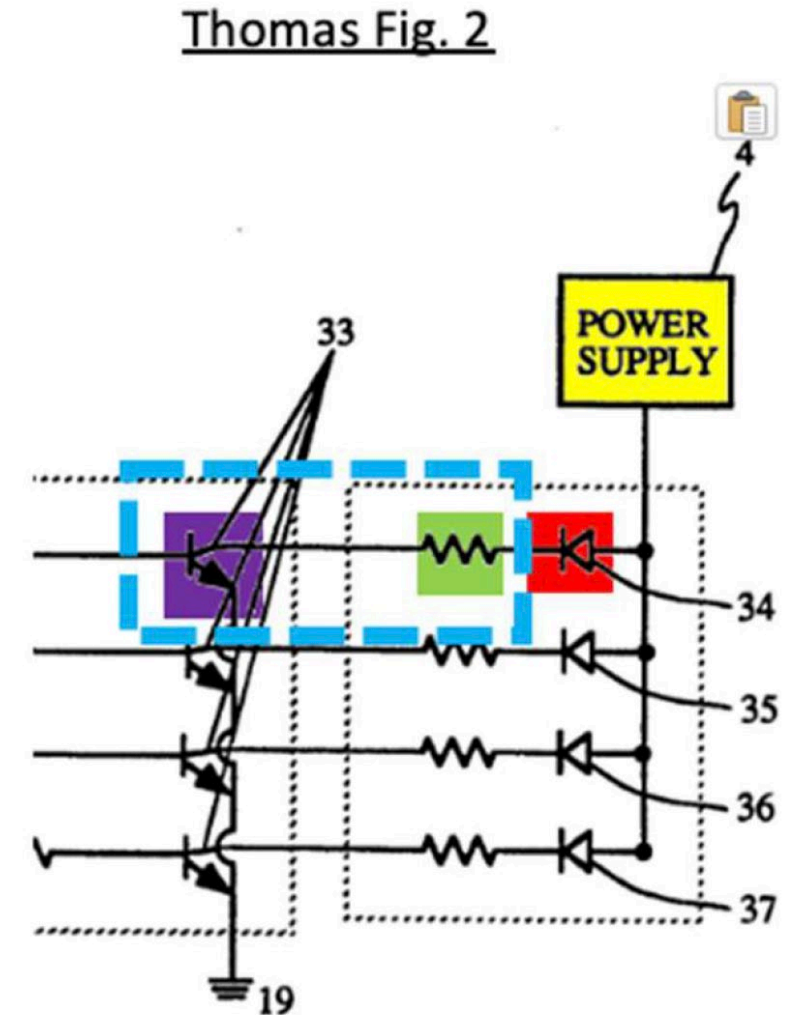
Fig. 1

Thomas does not disclose applying a PWM brightness control signal to Petitioner's new "current set circuit."

- On Reply, Petitioner asserts that the PWM signal is applied to the bipolar junction transistor ("BJT")
- "Petitioner tak[es] a second bite at the apple with an entirely new anticipation argument for Ground 1" (Sur-reply, 7)
- The Board should reject this attempt to retroactively change the Petition as filed – Petitioner must abide by the scope it defined (*FanDuel*, 996 F.3d at 1342; POR, 23)

POR, 12-17; Sur-reply, 6-11

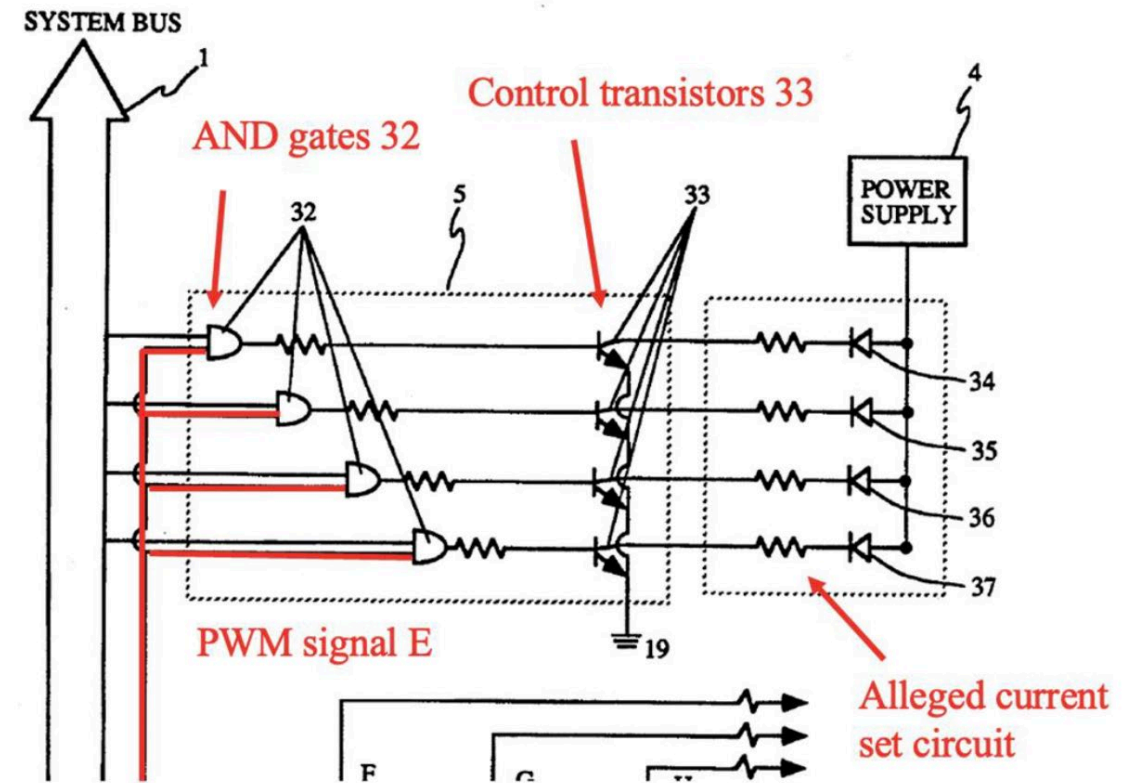
Patent Owner's Demonstrative Exhibit – Not Evidence



EX1001, FIG. 2 (Petitioner's Annotations), Reply, 16

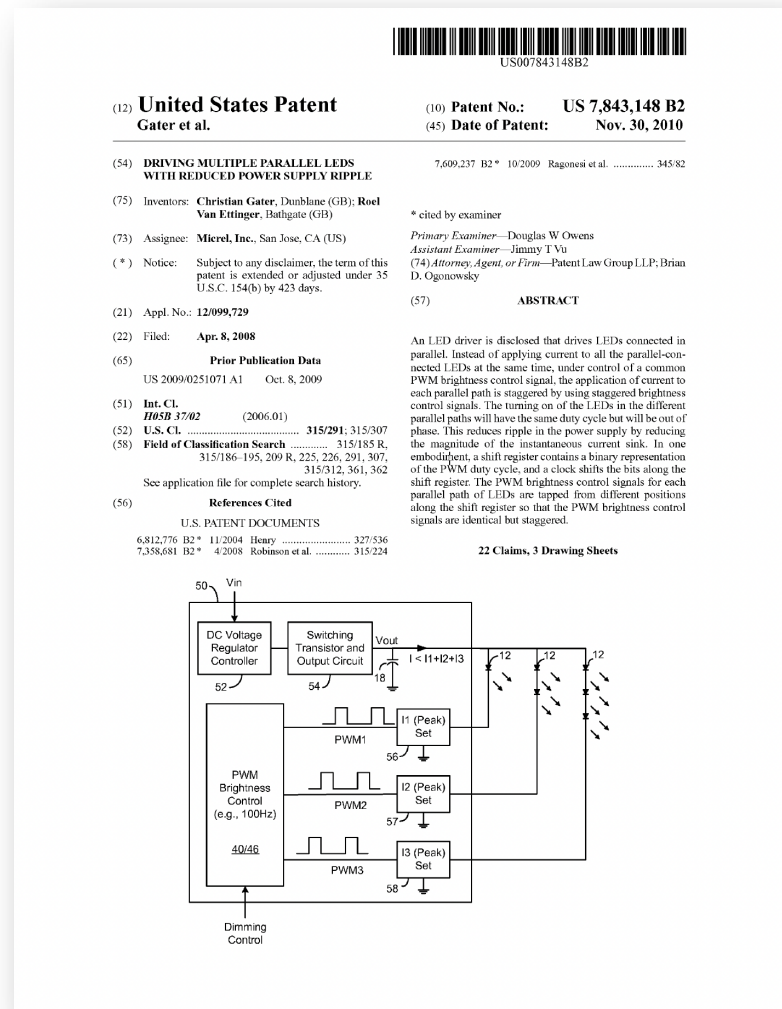
Thomas does not disclose applying a PWM brightness control signal to Petitioner's new "current set circuit."

- On Reply, Petitioner asserts that the PWM signal is applied to the bipolar junction transistor ("BJT")
- **Even under Petitioner's new argument,** the PWM signal is *never* applied to the BJT or the resistor
- Dr. Zane agreed that the PWM control signals are applied to the AND gates (EX2004, 82:5-8; POR, 15)



EX1001, FIG. 2 (Annotated), Sur-Reply, 9

'148 Patent Claim 3



3. The driver of claim 1 wherein each current set circuit is a current regulator.

EX1001, Claim 3

EX1001, 1

Thomas does not Anticipate Claim 3

- Thomas' failure to anticipate claims 1 and 14 applies similarly
- Petitioner repeats identification of passive resistor as “current regulator” of claim 3
- “current regulator” is narrower than “current set circuit”
- Petitioner gives **no** argument as to how a resistor is a “current regulator”
- In its Reply, Petitioner conflates the **prior art** in Thomas as disclosure of the Thomas invention, which is not anticipation

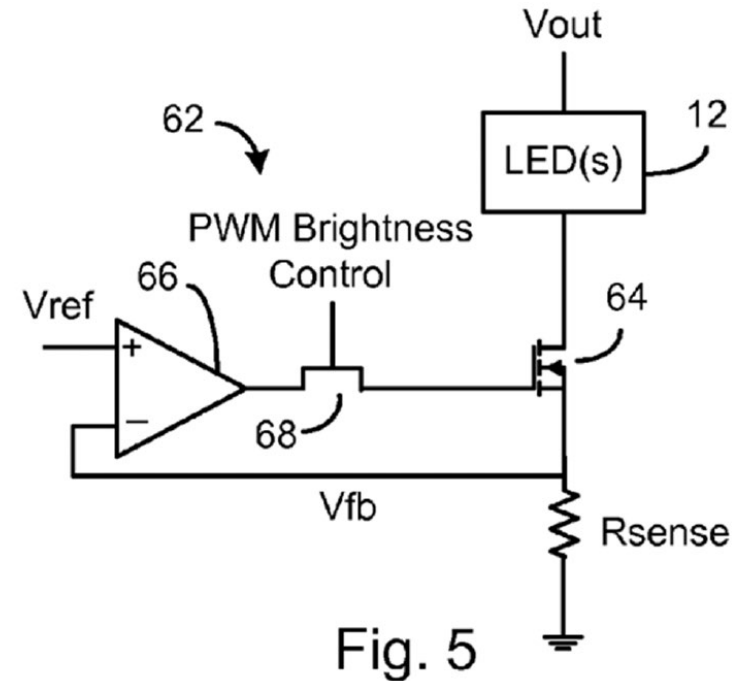


Fig. 5

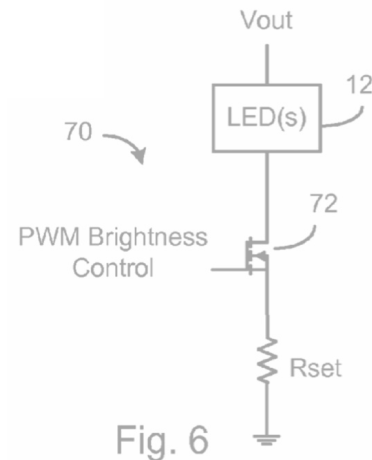


Fig. 6

EX1005, FIGS. 5, 6; POR, 10

'148 Patent Claim 7

US007843148B2

(12) **United States Patent**
Gater et al.

(10) **Patent No.:** **US 7,843,148 B2**
(45) **Date of Patent:** **Nov. 30, 2010**

(54) **DRIVING MULTIPLE PARALLEL LEDs WITH REDUCED POWER SUPPLY RIPPLE** 7,609,237 B2 * 10/2009 Ragonesi et al. 345/82

(75) **Inventors:** **Christian Gater**, Dunblane (GB); **Roel Van Ettinger**, Bathgate (GB) * cited by examiner

(73) **Assignee:** **Micrel, Inc.**, San Jose, CA (US) *Primary Examiner*—Douglas W Owens
Assistant Examiner—Jimmy T Vu

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(21) **Appl. No.:** **12/099,729** (57) **ABSTRACT**

(22) **Filed:** **Apr. 8, 2008** An LED driver is disclosed that drives LEDs connected in parallel. Instead of applying current to all the parallel-connected LEDs at the same time, under control of a common PWM brightness control signal, the application of current to each parallel path is staggered by using staggered brightness control signals. The turning on of the LEDs in the different parallel paths will have the same duty cycle but will be out of phase. This reduces ripple in the power supply by reducing the magnitude of the instantaneous current sink. In one embodiment, a shift register contains a binary representation of the PWM duty cycle, and a clock shifts the bits along the shift register. The PWM brightness control signals for each parallel path of LEDs are tapped from different positions along the shift register so that the PWM brightness control signals are identical but staggered.

(65) **Prior Publication Data** US 2009/0251071 A1 Oct. 8, 2009

(51) **Int. Cl.** **H05B 37/02** (2006.01)

(52) **U.S. Cl.** **315/291; 315/307**

(58) **Field of Classification Search** **315/185 R, 315/186-195, 209 R, 225, 226, 291, 307, 315/312, 361, 362**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,812,776 B2 * 11/2004 Henry 327/536

7,358,681 B2 * 4/2008 Robinson et al. 315/224

22 Claims, 3 Drawing Sheets

EX1001, 1

7. The driver of claim 1 wherein the PWM brightness control signal generator comprises:

- a shift register storing bits corresponding to a PWM duty cycle of a brightness control signal, the shift register having bit positions;
- a clock connected to the shift register for shifting the bits along the shift register; and
- taps off the shift register coupled to different bit positions of the shift register, each tap providing a different staggered PWM brightness control signal connected to an associated current set circuit.

EX1001, Claim 7

Thomas does not Anticipate Claim 7

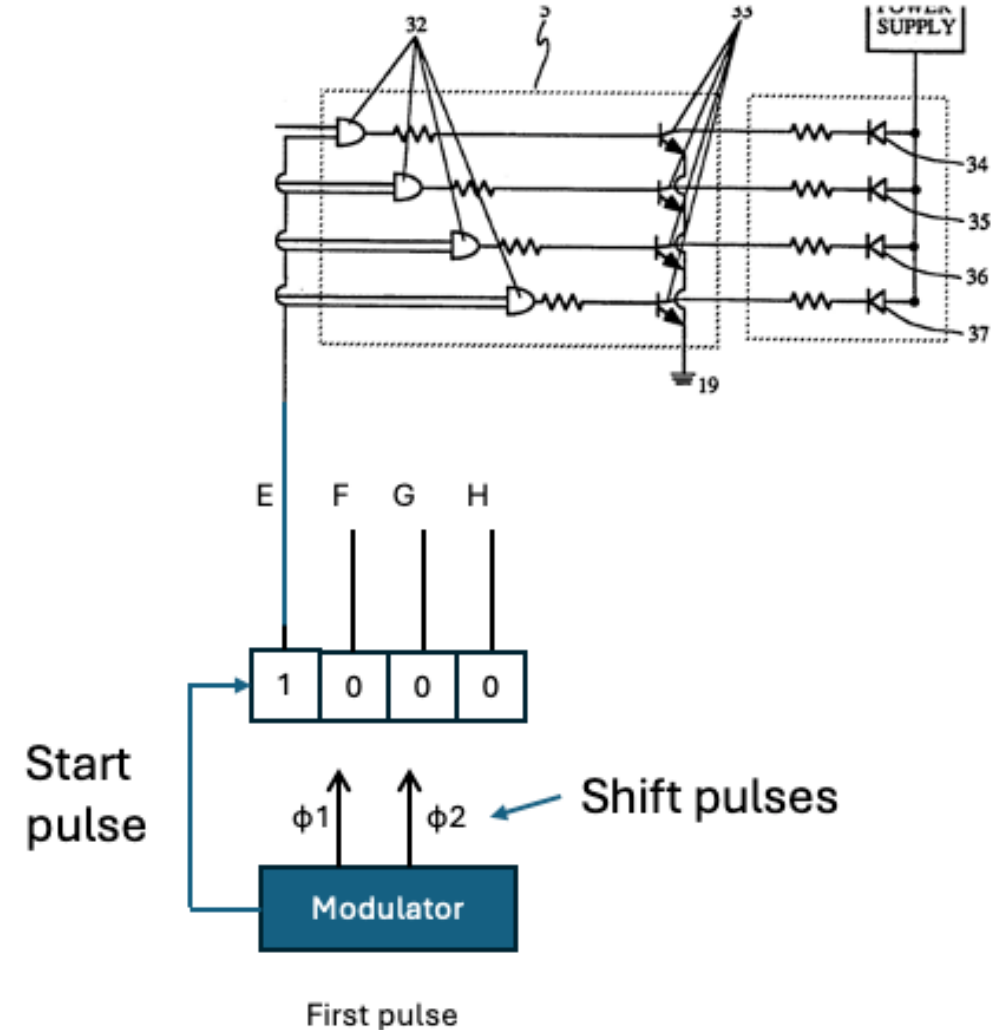
- Petitioner alleges Thomas inherently discloses a clock connected to the shift register
- No explicit disclosure that Thomas' shift register is synchronous (connected to clock and driven by clock signal) – Petitioner bases its argument on a misreading of Thomas
- Asynchronous shift registers typically not connected to a clock and are not driven by clock signal
- In Reply, Petitioner incorrectly alleges dynamic (asynchronous) shift registers utilize clock signals – with no support – but does **not** identify “a clock connected to the shift register”

7. The driver of claim 1 wherein the PWM brightness control signal generator comprises:
a shift register storing bits corresponding to a PWM duty cycle of a brightness control signal, the shift register having bit positions;
a clock connected to the shift register for shifting the bits along the shift register; and
taps off the shift register coupled to different bit positions of the shift register, each tap providing a different staggered PWM brightness control signal connected to an associated current set circuit.

EX1001, Claim 7

Thomas does not Anticipate Claim 7

- Thomas could readily be implemented using a dynamic shift register that does **not** use a clock
- “[T]hese pulses may be algorithmically derived, which Petitioner acknowledges. Reply, 22.” (Sur-reply, 17)
- Dynamic shift register advantageously allows real-time adjustment by the system



EX1005, FIG. 2
(modified to show dynamic shift register implementation)

Thomas does not Anticipate Claim 7

So it's more than just when data is available, but it is a requirement that there are predetermined intervals that are used by the shift register to generate, for example, equally dividing the period 40 by the number of signals being generated -- in this case, three additional signals -- which requires **a shift signal or a clock that is synchronous to the operation of the modulator**, which, in Thomas, means an operation with the modulator such as the pulse with modulator generating signal E.

EX2011, Zane Deposition 16:8-18

“The asynchronous register again might be – used in different context, it might actually refer to different circuitry, depending on the application, but generally speaking, is one that would effectively **derive the clock** or derive the decision to shift down the register from the data itself. In both cases, you know, it's necessary to make the decision to shift the data down the path. So **either the concept of the clock is embedded in the data** – and that's often what's used and what's broadly referred to as asynchronous shift registers – **or there's a dedicated clock** that shifts the data that's available.”

EX2004, Zane Deposition 98:6-20

Thomas does not render any claim of the '148 patent obvious

- “Petitioner did not provide *any* actual obviousness analysis, as required... aside from a single sentence regarding claim 1” (Sur-reply, 18)
- For claim 1, Petitioner’s only argument is essentially an anticipation argument
- Claim 6 obviousness ground suffers from same deficiencies as claim 1

A. Claim 1

As discussed above, Thomas anticipates Claim 1. To the extent that Thomas does not anticipate Claim 1, any differences between Thomas and Claim 1 are such that Claim 1 as a whole would have been obvious to a POSITA as of the time of the invention of Claim 1. EX1003, ¶106.

For example, a POSITA would have understood from Figures 1 and 2 based on the well-known functionality of resistors that these resistors are used to limit current to a peak current $I=(V-V_{LED})/R$, as discussed for Limitation [1.b]. *See supra* Section VI.A.3.; EX1003, ¶197. Accordingly, Claim 1 would have been obvious in view of Thomas. *Id.*

Petition at 45.

Claims 3, 7, and 9-12 depend directly or indirectly from Claim 1, and Claims 17, 18 and 20-22 depend directly or indirectly from Claim 14. EX1003, ¶109. As set forth above, the additional limitations recited by these claims are disclosed in Thomas. Therefore, to the extent that Claim 1 or 14 would have been obvious in view of Thomas, rather than anticipated by Thomas, then Claims 3, 7, 9-12, 17, 18, and 20-22 would have been obvious in view of Thomas. EX1003, ¶109.

Petition at 46.

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 - ▶ Thomas does not render obvious any claims
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'148 Patent Claims 5 and 16

US007843148B2

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7,358,681 B2 * 4/2008 Robinson et al. 315/224

22 Claims, 3 Drawing Sheets

Dimming Control

EX1001, 1

5. The driver of claim 4 wherein each current set circuit further comprises a PWM brightness control transistor connected between an output of the feedback circuit and a control terminal of the current control transistor, the PWM brightness control transistor being connected to the PWM brightness control signal generator for receiving a staggered PWM brightness control signal to couple the output of the feedback circuit to the control terminal of the current control transistor at a duty cycle of the staggered PWM brightness control signal.

16. The method of claim 14 wherein setting a peak current through one or more LEDs connected in each of the parallel paths comprises setting the peak current by controlling conductivity of a current control transistor in series with each parallel path, and wherein applying a different staggered PWM brightness control signal to each current set circuit comprises:

coupling each staggered PWM brightness control signal to a control terminal of an associated pass transistor, each pass transistor being connected between a control terminal of a respective current control transistor and a regulating control voltage, such that the current control transistor is turned on and off corresponding to a duty cycle of the associated pass transistor.

EX1001, Claims 5, 16

Zane Fails to Render Obvious Claims 5 and 16

- Zane does not include the claimed arrangement wherein the PWM brightness control transistor is “connected **between** an output of the feedback circuit and a control terminal of the current control transistor.”
- Petitioner bases obviousness claim on the idea that moving the PWM brightness control transistor is simply a “design choice”
- Mr. Credelle explained why such a change would vitiate the operating principles of Zane

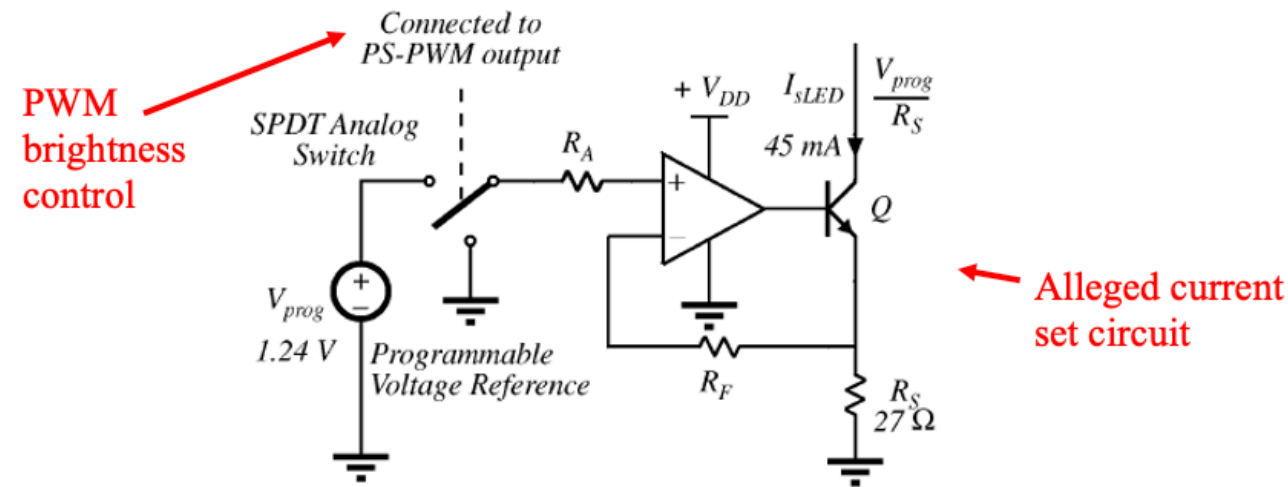


Figure. 4. An op-amp based precision programmable current sink with AM and PWM control options

EX1006, FIG. 4 (annotated)

Zane Fails to Render Obvious Claims 5 and 16

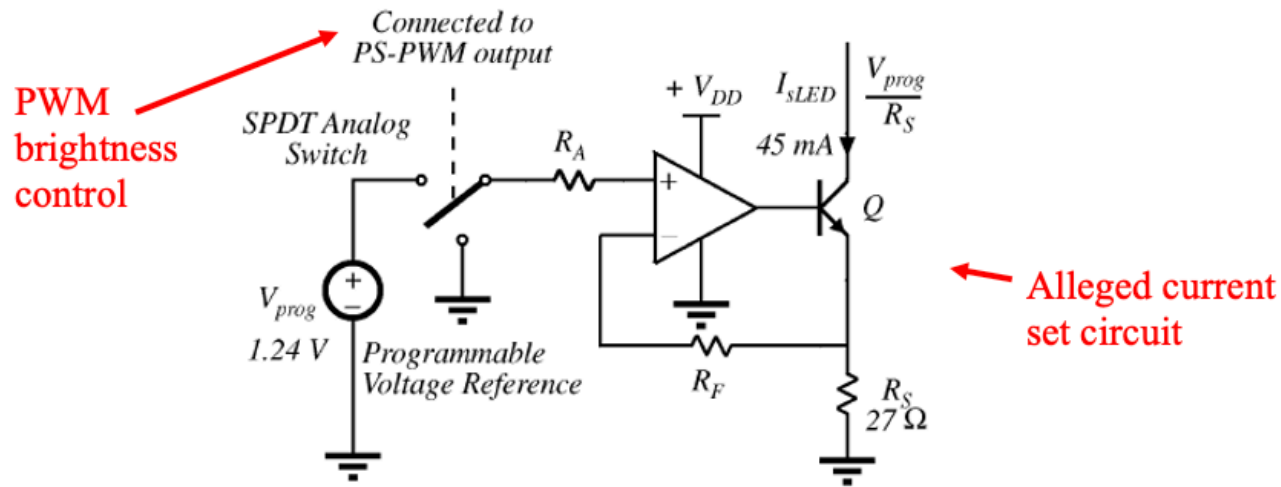
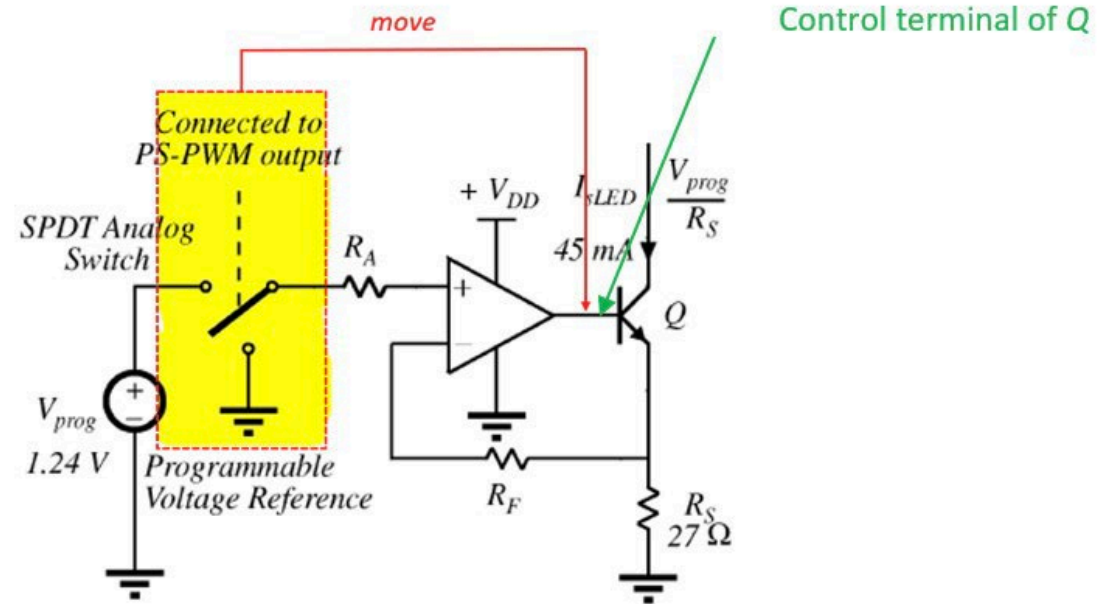


Figure. 4. An op-amp based precision programmable current sink with AM and PWM control options

EX1006, FIG. 4 (annotated)



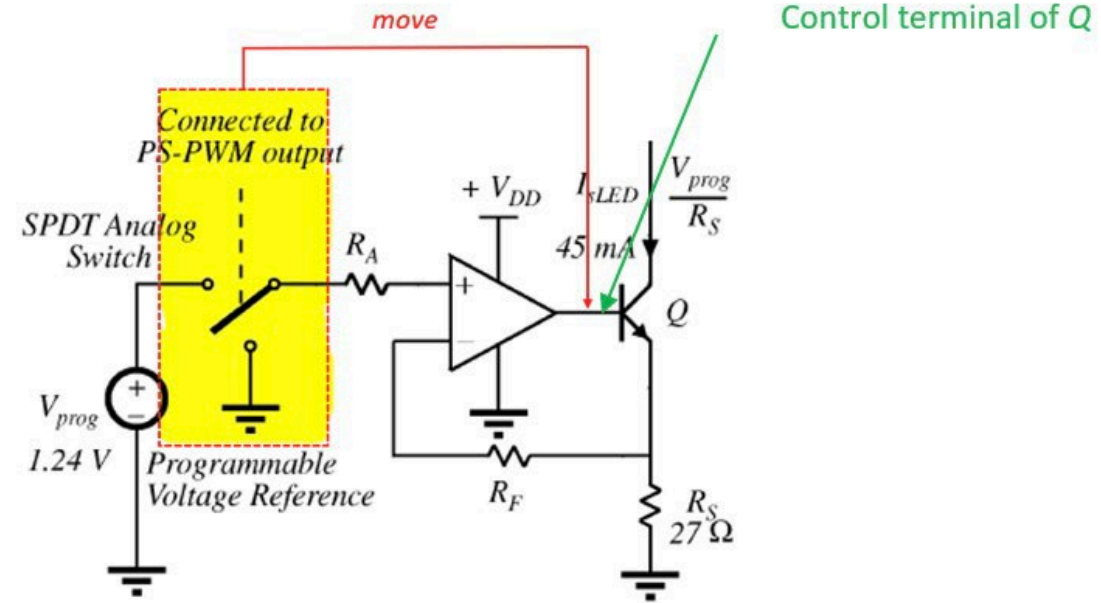
EX1006, FIG. 4 (Petitioner's annotations)

- Petitioner’s proposed change would affect the voltage on the base of transistor Q
- A POSITA would not be able to correctly set the desired precision current in this configuration (EX2002, ¶57, Sur-Reply, 25)

Zane Fails to Render Obvious Claims 5 and 16

“As I have discussed above, the analog SPDT switch characteristics are not disclosed by *Zane*, but it is clear that *Zane* has designed the analog SPDT switch to apply a precision voltage to the positive terminal of the op amp to achieve a precision current flow V_{prog}/R_S in the LED strings. If the precision voltage V_{prog} is simply applied to R_A , as would occur in the modification suggested by Dr. Zane, a POSITA would not know how to adjust the op amp settings to achieve the correct voltage on the base of transistor Q. Further, if the analog SPDT switch were placed after the op amp, a POSITA would not know if the precision voltage V_{prog} would still set the LED current to the desired current because the properties of the analog SPDT switch are unknown.”

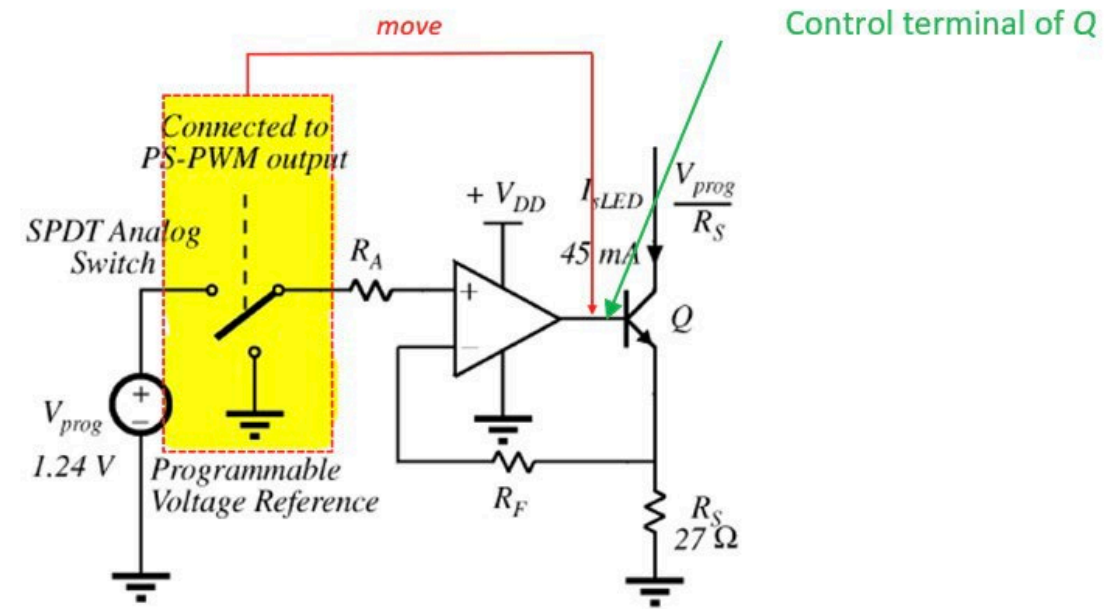
EX2002, Credelle Declaration ¶57



EX1006, FIG. 4 (Petitioner's annotations)

Zane Fails to Render Obvious Claims 5 and 16

- Petitioner provides no actual motivation to move the SPDT switch as proposed
- Question is not whether it *could* be done, but if it *would*. *InTouch Techs., Inc.*, 751 F.3d at 1352; *Polaris Indus., Inc.*, 882 F.3d at 1068-69.
- “[A] finding of obviousness based on design choice is precluded where the difference between the claimed feature and prior art results in a functional difference.” *Lumenis Be Ltd. v. BTL Healthcare Techs. A.S.*, IPR2021-01275, Paper 8, at 30 (P.T.A.B. Feb. 8, 2022)



EX1006, FIG. 4 (Petitioner's annotations)

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- ▶ The Thomas Grounds
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- ▶ The Zane Grounds
 - ▶ Zane fails to render claims 5 and 16 obvious
 - ▶ **The Board should not credit Zane's testimony**

The Board Should Not Credit Zane's Testimony

- Dr. Zane co-authored the *Zane* reference – and acknowledged the uniqueness of the situation
- Dr. Zane cannot give unbiased testimony
- Ground 4 consists of essentially entirely uncorroborated inventor testimony (obviousness over *Zane* alone)

“... just to reiterate, I don't recall applying any of my prior publications or patents in another case. I do recall, you know, my work coming up, but I don't – I don't recall it ever being ultimately applied.”

EX2004, Zane Deposition 49:18-50:1

Q: “So is it your opinion that you and Dr. Doshi developed the technology that's described in Claim 1 before the inventors of the '148 patent?”
A: “I believe that that's an appropriate characterization. I may not be, you know, understanding the full implications, but I believe that's a correct characterization.”

EX2004, Zane Deposition 62:3-14

The Board Should Not Credit Zane's Testimony

- Dr. Zane has personal motivations to invalidate claims that he believes cover his own patented technology, which he has attempted to commercialize
- Zane cannot not testify as a POSITA with respect to his own reference
 - *Glaxo Grp. Ltd. v. Apotex, Inc.*, 376 F.3d 1339, 1348-49 (Fed. Cir. 2004)

Q: "Did you ever try to develop the technology that's described in the '468 patent? Commercially. Sorry."

A: "Well, I believe the answer is yes, but certainly with caveats.

The purpose of developing the technology was to prove its feasibility and present it on a path for potential commercialization. That particular work, for example, was funded within industry. The work was, you know, presented to partners, including a broad base of industry partners that were within the research center that I was a part of at the University of Colorado at Boulder.

And many, if not most, of the students involved in the related work were hired into industry to do work in a similar – in a similar field..."

EX2004, Zane Deposition 71:1-18

Summary

- ▶ **Thomas does not anticipate any claims**
- ▶ **Thomas does not render obvious any claims**
- ▶ **Zane fails to render claims 5 and 16 obvious**
- ▶ **Zane's biased testimony should not be credited**

Petitioner's Motion to Strike should not be granted

- Patent Owner's Response properly rebutted Petitioner's statement that "[a]ll shift registers **must** have a clock connected to them for shifting the bits." (Pet., 34)
- It was Petitioner who changed its argument to:
 - Thomas cannot use an asynchronous shift register, and
 - Asynchronous shift registers, without a clock connected to them, also meet the definition of "clock"
- Deposition Exhibit 1 is a permissible exhibit
 - *Ascend Performance*: Deposition exhibits should be submitted to the Board for full context
 - *Netflix v. DivX* is inapposite, Exhibit 1 is a single dictionary definition from a relevant dictionary
 - Dr. Zane had the opportunity to respond on the record, and Petitioner chose not to perform re-direct

Thank You