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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE
THE PATENT TRIAL AND APPEAL BOARD

Ex parte GERT-JAN KOOLEN[1]

Appeal 2015-003531
Application 12/989,822
Technology Center 2800

Before MARK NAGUMO, N. WHITNEY WILSON, and
BRIAN D. RANGE, *Administrative Patent Judges*.

NAGUMO, *Administrative Patent Judge*.

DECISION ON APPEAL

Gert-Jan Koolen ("Koolen") timely appeals under 35 U.S.C. § 134(a) from the Final Rejection[2] of claims 1–7 and 9–20, which are all of the pending claims. We have jurisdiction. 35 U.S.C. § 6. We affirm.

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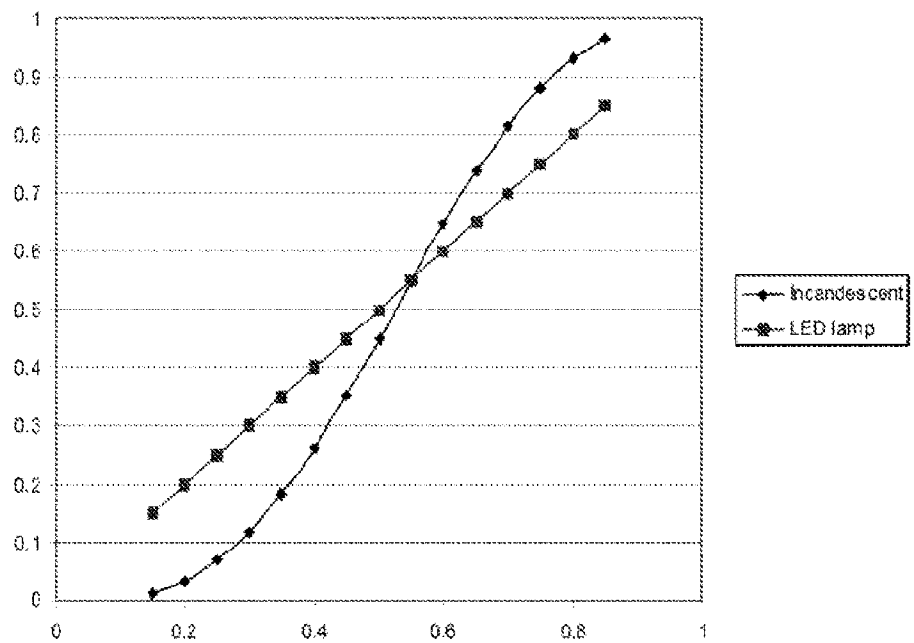
[1] The real party in interest is identified as NXP B.V. (Appeal Brief, filed 25 July 2014 ("Br."), 1.)

[2] Office action mailed 29 April 2014 ("Final Rejection"; cited as "FR").

OPINION

A. Introduction[3]

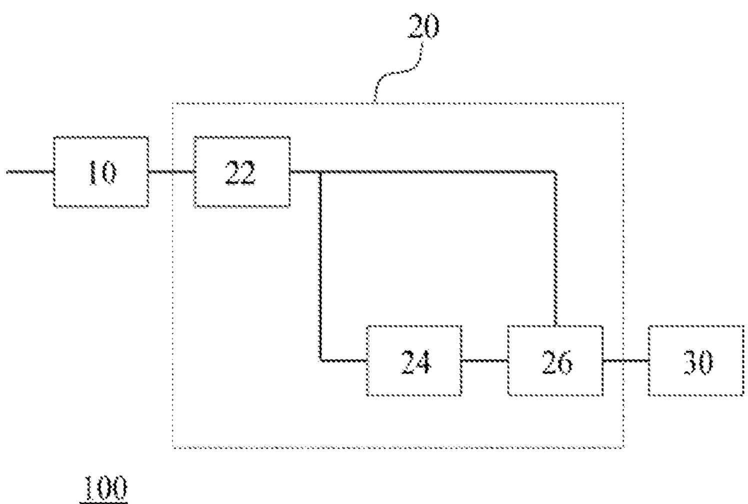
The subject matter on appeal relates to a driving circuit for LED lighting that provides a dimming curve for the LED lighting that has an exponential shape like that of an incandescent lamp, rather than the linear dimming curve characteristic of LEDs driven by conventional constant current drivers. The '822 Specification explains that an incandescent bulb controlled by a phase-cut dimmer, operating in a pulse width modulation (PWM) mode, does not have a constant light output throughout the 60 Hz phase provided by the AC mains. As shown in Figure 1, below,



{Figure 1 shows dimmer curves for incandescent (♦) and LED (■) lighting against dimmer knob settting}

[3] Application 12/989,822, *Dim range enhancement for LED driver connected to phase-cut dimmer*, filed 27 October 2010 as the national stage of PCT/IB2009/051760, filed 30 April 2009, claiming the benefit of an application filed 7 May 2008 in the EPO. We refer to the "'822 Specification," which we cite as "Spec."

the response of an incandescent lamp at dimmer settings below about 0.6 is exponential. The eye, however, is said to respond logarithmically to changes in light intensity, such that we perceive the exponential response of the incandescent light as linear. (Spec. 2, ll. 3–5.) For the same reason, we perceive the linear response of the LED as non-linear. An object of the invention is to provide a driver **100**[4] for LED lighting that provides "a dimming curve more compatible with the physiological sensitivity of the human eye." (*Id.* at ll. 11–13.) Such a driver is shown in the block diagram of Figure 5, below.



{Figure 5 shows a block diagram of an LED driving circuit}

Phase-cut dimmer **10** operates by cutting out or "chopping" a portion of each half-cycle of the 60 Hz AC power. (*See*, *e.g.*, Shteynberg[5] Figure 4, reproduced on the following page, showing the phase modulated output voltage from a standard dimmer switch (Shteynberg 4 [0032].)

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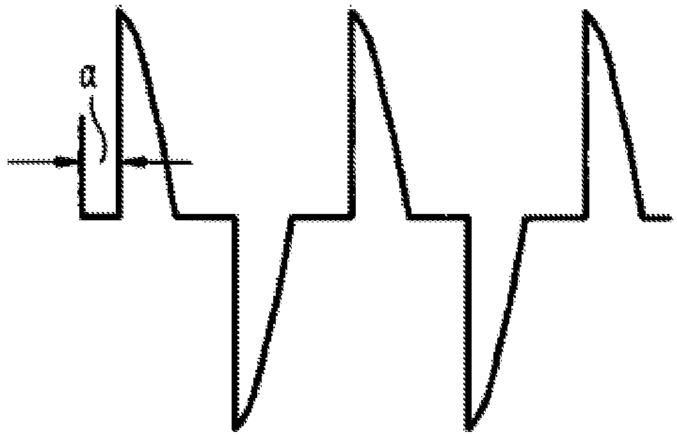
[4] Throughout this Opinion, for clarity, labels to elements are presented in bold font, regardless of their presentation in the original document.

[5] Full cite *infra* at 5 n.7.

{Shteynberg Figure 4 is shown below}



{Shteynberg Figure 4 shows the phase modulated ("chopped") output voltage from a standard dimmer switch; firing angle α = 0 corresponds to full power; α = 180 corresponds to no power delivered to the lamp}

The resulting chopped signal is rectified (made all positive) by rectifier **22**, and the rectified signal powers driver **26**. The average voltage of the chopped rectified signal is detected by sensor **24**, which provides a control signal to driver **26**, so the power sent to LEDs **30** is controlled appropriately.

Claim 1 is representative and reads:

> A driving circuit [**100**] configured to drive a LED light source [**30**], said driving circuit comprising:
>
> a rectifier [**22**] configured to rectify a signal supplied by a phase-cut dimmer [**10**];
>
> a sensor [**24**] configured to detect *an average voltage of the rectified signal*; and
>
> a switched mode power supply [**26**] configured to drive said LED light source
> *based on a signal that is output by said sensor* [**24**], *said signal having a voltage level proportional to said detected average voltage* and
>
> said switched mode power supply [**26**] being power-supplied by the rectified signal,

> wherein *said LED light source has a non-linear dimming curve and the detected average voltage is proportional to a dimmer knob level.*

(Claims App., Br. 11; some indentation, paragraphing, emphasis, and bracketed labels to elements shown in Figure 5 (shown *supra*) added.)

The Examiner maintains the following ground of rejection[6]:

> Claims 1–7 and 9–20 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Shteynberg,[7] Kriparos,[8] and Thrasher.[9]

B. Discussion

Findings of fact throughout this Opinion are supported by a preponderance of the evidence of record.

The Examiner finds that Shteynberg describes, in Figure 7, shown on the following page, a driving circuit for LEDs that includes all elements required by the claims but for specifying that: (a) LED light source [**140**] has a non-linear dimming curve; (b) that sensor [**165**] detects the average voltage of the rectified AC signal; and (c) that dimmer switch **75** comprises a dimmer knob. (FR 4–5.)

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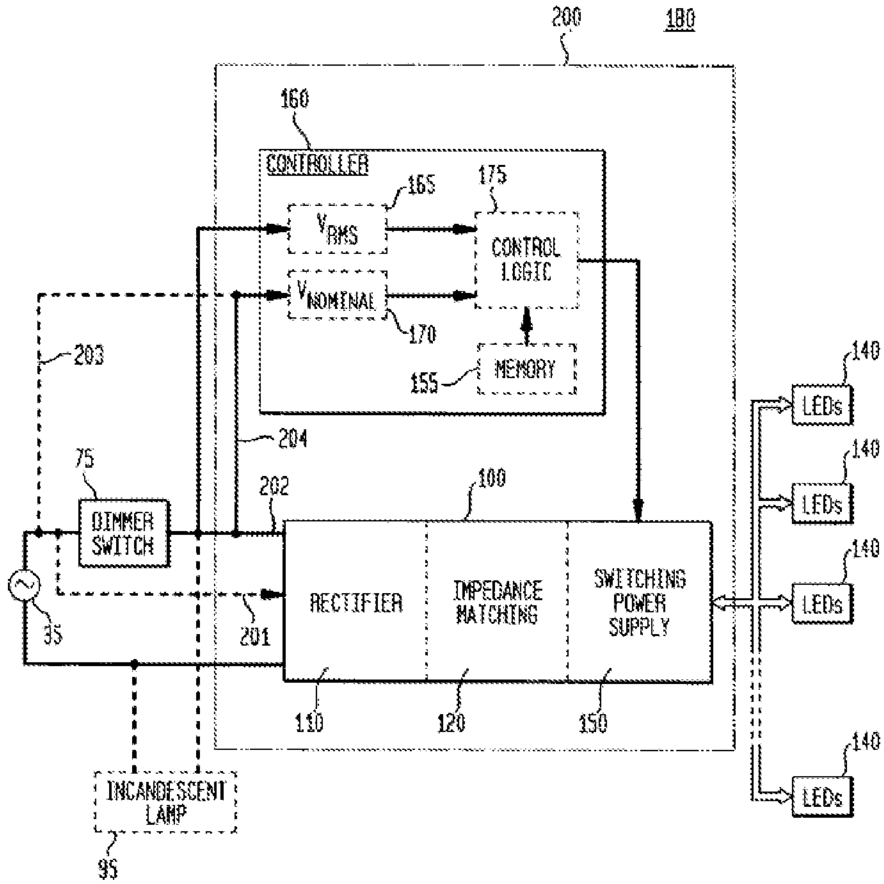
[6] Examiner's Answer mailed 5 December 2014 ("Ans.").

[7] Anatoly Shteynberg and Harry Rodriguez, *Current regulator for modulating brightness levels of solid state lighting*, U.S. Patent Application Publication 2007/0182338 A1 (2007).

[8] Daniel J. Kriparos, Electrical control for an LED light source, including dimming control, U.S. Patent No. 6,683,419 (2004).

[9] Larry E. Thrasher et al., *Lighting system, apparatus, and method*, U.S. Patent No. 6,174,067 B1 (2001).

{Shteynberg Figure 7, is reproduced below}



{Fig. 7: dimmer switch **75** with current regulator **200**, driving LEDs **140**}

More particularly, the Examiner finds (FR 4), that Shteynberg shows dimmer switch **75** connected to AC mains **35**. The output of dimmer switch **75** is rectified by rectifier **110**, and impedance-matched by unit **120** to switching power supply **150**, which drives LEDs **140**. In Shteynberg's words, "[t]he RMS and nominal voltage sensors **165**, **170** (and/or memory **155**) are utilized to provide emulation of the optical performance of an incandescent lamp **95**." (Shteynberg 5 [0049].)

The Examiner finds that Kriparos illustrates that the linear LED versus nonlinear incandescent bulb problem is known in the art, and that it is known to correct the response of the LED so "[t]he LED light source mimics an operation of an incandescent light source with respect to a dimming control" (Kriparos, Abstract, 2d sentence).

The Examiner finds further that Thrasher shows that it is known to sense either the output of the dimmer switch directly or the rectified output. (FR 4, last para., *citing* Thrasher, col. 13, ll. 53–57, which reads, "[o]ne of ordinary skill in the art will appreciate that linear-load circuit **250** can sense AC signal **204** directly or indirectly, for example, *by sensing first rectified signal* **208** *or second rectified signal* **209**" (italic emphasis added).)

Koolen urges that the Examiner fails to provide any articulated reasoning supporting application of Thrasher's teachings to Shteynberg. (Br. 5, 2d para.) Although rather terse, read in the context of Thrasher, we are not persuaded of harmful error in this aspect of the rejection. Thrasher, at column 13, describes the response of an electronic isolation transformer shown in Figure 4 (not reproduced here) to input AC signal **204**. Thrasher teaches that "AC signal **204** can be . . . an output signal of a dimmer switch." (Thrasher, col. 10, ll. 50–52.) Thus, Thrasher's AC signal **204** corresponds, in certain embodiments, to the output of Shteynberg's dimmer switch **75**. Shteynberg compares the output of dimmer switch **75** to the un-dimmed AC signal and controls the output of switching power supply **150**, which is driven by the rectified dimmer switch output, to power the LED lamps. Thus, Thrasher's teaching that either the output of the dimmer switch or the rectified output of the dimmer switch can be used for control purposes would have suggested that the rectified output of Shteynberg's dimmer **75** could be measured and used for the same purposes as the modulated but unrectified output.

The Examiner finds further that Thrasher teaches that dimmer switches "typically have a rotatable knob that adjusts the intensity of the lights" (Thrasher, col. 3, ll. 35–36). Koolen urges that "Thrasher fails to disclose a dimmer knob circuit configured to drive a LED light source." (Br. 5, last para.) Koolen urges further that Thrasher's knob is not compatible with Shteynberg's dimmer switch **75**, which "operates in the context of solid state lighting, wherein it performs the function of 'regulating brightness by phase modulation of the input AC voltage.'" (Br. 7, ll. 2–5.)

These arguments are not persuasive of harmful error. Thrasher teaches that "MO [manually operated] dimmer switches are installed on the power line leading to the light, and typically have a rotatable knob that adjusts the intensity of the lights." (Thrasher col. 3, ll. 35–37.) This is the same position occupied by Shteynberg dimmer switch **75**, and the same function of switch **75**. One of the objectives of Shteynberg (as well as of the '822 Specification) is to provide driving circuits that allow presently-used dimmer switches to be used with LED bulbs as well as with incandescent bulbs. (Shteynberg 5 [0049].)

Koolen argues that "Thrasher's teachings of using a **<u>manually operable</u>** dimmer switch would render Shteynberg unsatisfactory for its intended purpose because Shteynberg's dimmer switch needs to act as a phase modulator." (Br. 7, ll. 5–7.) Koolen appears to conflate the function of Thrasher's "manually operated" ("MO") dimmer switch with the entire driver circuit. Shteynberg does teach that "current regulator **100** is compatible with existing lighting infrastructure, and may be coupled directly to a dimmer switch **75** for receiving a phase-modulated AC voltage derived from the AC line voltage (AC mains)." (Shteynberg 5 [0045].) The phase modulated voltage from a standard dimmer switch is shown *supra* in Shteynberg Figure 4. Koolen has not directed our attention to any credible evidence that the standard dimmer switch differs in any substantial way from the dimmer switch mentioned by Thrasher. For essentially the same reasons, we find no persuasive merit in Koolen's arguments that Thrasher's MO switch is incompatible with Shteynberg because "it must be installed directly on a power line" and because "[i]t does not function by phase modulation" (Br. 7, last para.)

Finally, Koolen criticizes the Examiner's reliance on Kriparos and Thrasher. Kriparos, according to Koolen, teaches a specialized controller, not a manually operable dimmer switch (Br. 8, 1st para.), so the teachings are incompatible. These arguments are not persuasive because Kriparos stands as evidence that the nonlinear behavior of incandescent lamps was known, and further, that it was a known objective to provide drivers for LED light sources that provide the desired nonlinear response to dimmer control—an objective disclosed by Shteynberg, as discussed *supra* at 6.

C. Order

It is ORDERED that the rejection of claims 1–7 and 9–20 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED