UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/373,069	03/10/2006	Keith Holliday	018158-027700US	4750

73517 7590 02/04/2013
AMO / Kilpatrick Townsend and Stockton LLP
Two Embarcadero Center, Eighth Floor
San Francisco, CA 94111

EXAMINER
LIPITZ, JEFFREY BRIAN

ART UNIT	PAPER NUMBER
3769	

NOTIFICATION DATE	DELIVERY MODE
02/04/2013	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ipefiling@kilpatricktownsend.com
jlhice@kilpatrick.foundationip.com

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte KEITH HOLLIDAY

Appeal 2011-000424
Application 11/373,069
Technology Center 3700

Before LORA M. GREEN, JEFFREY N. FREDMAN, and JACQUELINE WRIGHT BONILLA, *Administrative Patent Judges*.

BONILLA, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134 involving claims directed to a method for controlling a pulsed laser, such as used during laser eye surgery. The Examiner has rejected the claims as indefinite, anticipated, and obvious. We have jurisdiction under 35 U.S.C. § 6(b). We affirm-in-part.

STATEMENT OF THE CASE

The Specification describes methods for controlling lasers, such as used during laser eye surgery (Spec. ¶ [0001]). The Specification discloses embodiments that "may be suitable for use in procedures in which a pulse rate of a pulsed laser varies during use, or in which other laser operation parameters (such as pulse energy) will vary during use" (*id*. at ¶ [0008]).

> By implementing a calibration laser mode in addition to a standard operating mode, and by accurately characterizing a relationship or correlation between laser energy pulses and a laser operation parameter such as the high voltage used to fire the pulse (V) throughout a range that encompasses a curve in the correlation, such embodiments may increase the accuracy of laser pulse energy control.

(*Id*.)

Claims 1-10 are on appeal. Independent claim 1 is representative:

> 1. A method for controlling a pulsed laser, the method comprising:
>
> firing the laser to produce a series of laser pulses, each pulse fired by applying an associated voltage of the laser;
>
> measuring energies of each laser pulse of the series of laser pulses;
>
> generating a correlation between the measured energies of the pulses and the associated voltages of the laser, the correlation defining differing rates of change in pulse energy with changes in voltage;
>
> generating a first laser pulse by applying a first voltage to the laser;
>
> measuring a first energy of the first pulse;
>
> determining a second voltage for the laser so as to generate a second pulse with a desired pulse energy using the correlation and the measured first energy of the first pulse; and
>
> firing the laser by applying the second voltage so as to produce the second pulse.

The claims stand rejected as follows:[1]

I. Claim 2 under 35 U.S.C. § 112, 2nd paragraph, as being indefinite;

II. Claims 1 and 3 under 35 U.S.C. § 102(b) as anticipated by Ruhl, Jr. et al. (U.S. Pat. No. 5,282,014, issued Jan. 25, 1994);

III. Claims 5-7 under 35 U.S.C. § 103(a) as obvious over Ruhl;

IV. Claim 2 under 35 U.S.C. § 103(a) as obvious over Ruhl in view of Suzuki (U.S. Pat. No. 5,097,291, issued Mar. 17, 1992); and

V. Claims 4 and 10 under 35 U.S.C. § 103(a) as obvious over Ruhl in view of Vogler et al. (U.S. Appl. Publ. No. 2002/0057724 A1, published May 16, 2002); and

VI. Claim 8 and 9 under 35 U.S.C. § 103(a) as obvious over Ruhl in view of LaHaye (U.S. Appl. Publ. No. 2005/0021011 A1, published Jan. 27, 2005).

I.

Claim 2, which depends on claim 1, recites that "the correlation comprises a quadratic relationship between a pulse energy E and a discharge high voltage V of the laser of the form $E = c_1 V^2 + c_2 V + c_3$ in which c_1, c_2, and c_3 are constants." In other words, when generating a correlation between energies of pulses and associated voltages of the laser as recited in

[1] We note that Appellant asserts that the Examiner improperly refused to enter an amendment filed in response to a Final Office Action (App. Br. 4). The Examiner's refusal to enter an amendment after final is a petitionable matter under 37 C.F.R. § 1.181, and not within the jurisdiction of the Board. 37 C.F.R. § 1.127; *In re Berger*, 279 F.3d 975, 984 (Fed. Cir. 2002) (citing *In re Hengehold*, 440 F.2d 1395, 1403 (CCPA 1971)).

claim 1, the correlation is a quadratic and determined according to the equation $E = c_1V^2 + c_2V + c_3$, where c_1, c_2, and c_3 are constants.

The Examiner rejects claim 2 as being indefinite, stating that "[i]t is unclear why the characterization of the relationship between energy and voltage is of any importance, and how this characterization will impact a step of the method" (Ans. 4). According to the Examiner, "[f]or instance, if the relationship were exponential, then the plotted points should be fitted with an exponential curve," and "[o]n the other hand, if all of the relationships between voltage and energy are quadratic, then this limitation is an inherent component of independent claim 1" (*id*.).

The definiteness requirement seeks to "ensure that the claims delineate the scope of the invention using language that adequately notifies the public of the patentee's right to exclude." *Datamize, LLC v. Plumtree Software, Inc*., 417 F.3d 1342, 1347 (Fed. Cir. 2005). Here, claim 2 specifies that the generated correlation of claim 1 is a quadratic relationship. Claim 2 differs from claim 1, which recites a correlation encompassing a quadratic, linear, or exponential relationship. Thus, we conclude that claim 2 is definite.

II.

The Examiner rejects claims 1 and 3 as anticipated by Ruhl, citing the reference's Summary of Invention, as well as Figures 7 and 8a, and discussions of those figures (Ans. 5). For example, the Examiner states:

> Ruhl further teaches the test procedure comprising firing or generating a laser pulse (108; Figure 8a) according to a summed voltage (44), which is the sum of the previously programmed voltage or output voltage (50) and the peak detector output

> voltage (51). The output voltage (50) is the first voltage, the summed voltage (44) is the second voltage, which is determined by identifying a desired change in energy correlating to the peak detector output voltage (51; Column 10, Lines 47-49; Column 12, Lines 35-69; Column 13, Lines 1-22). The pulse is again measured (109). This process is repeated based on the number of test shots originally set (Column 7, Lines 10-36; Column 14, Lines 8-14).

(*Id*.)

The elements of claim 1 at issue are "generating a correlation … defining differing rates of change in pulse energy with changes in voltage" and "determining a second voltage for the laser … using the correlation and the measured first energy of the first pulse" (Claim 1; *see also* Reply Br. 4). In this regard, Appellants refer to Figure 7, and state that because "*Ruhl teaches a single average 'proportionality' and only that single average proportionality of peak detector voltage to output energy is stored*," the reference does not anticipate claim 1, and therefore claim 3 (App. Br. 10-12). Appellants also state that the "*average* proportionality of peak detector voltage to output energy 'E/V_{100}' explicitly used by Ruhl is a single value and thus is not a correlation having differing rates of change" (Reply Br. 5). Appellants also argue that the "average proportionality of Ruhl used in calculating each new voltage during use of the laser is limited to a single slope, in contrast to the differing rates of the correlation of claim 1" (*id*.).

Ruhl as a whole, and particularly the portions cited by the Examiner, indicate that Ruhl does not teach only that a single average proportionality of peak detector voltage to output energy is stored. For example, the Summary of the Invention states:

> The present invention is a real time system, in that *when testing is performed on the laser rangefinder under test its output pulse energy is measured for each shot and compared to the anticipated average per pulse output energy as previously computed*. When the laser rangefinder under test is fired for the first test shot the simulated target's reflected energy will be based on the previously computed average output pulse's energy level. *The measured value of that first pulse will meanwhile be compared to the previously computed average per pulse energy and the differences between the measure and anticipated per pulse energies, if any, will be used as a correction factor to the average power level* of the simulated target's reflected energy.

(Ruhl, col. 3, l. 60 – col. 4, l. 5 (emphasis added); *see also* col. 7, ll. 23-30) (describing calculating a "correction factor," and thereafter programing a converter to deliver a voltage)).

Regarding the flow diagram depicted in Figure 7, Ruhl describes calculating and storing the following based on measured energies and applied voltages in a series of 100 laser pulses: "average output energy 'E_{avg}'" for 100 pulses (*see* (87) in Fig. 7), "proportionality of peak detector voltage 'V_i' to pulse output energy 'E_i'" for each pulse (*see* (88) in Fig. 7), and "average proportionality of peak detector voltage to output energy 'E/V_{100}'" for 100 pulses (*see* (89) in Fig. 7) (*id*. at col. 12, ll. 27-34). As shown in Figure 8a, Ruhl's system uses such calculations "to determine **104** the nominal output energy, 'E_{Rnom}' setting for the laser **27**," and thereafter "set[s] the nominal driver voltage 'V_{nom}' for the laser **27** to allow it to fire at this simulated nominal (target) reflected energy level 'E_{Rnom}'" (*id*. at col. 9, ll. 48-61; *see also* Figure 8a).

As further described in Ruhl regarding Figure 8a:

> The D/A converter **13** is programmed **103** to provide a dc sum voltage "$V_{D/A}$" **50** based on the average proportionality of peak detector voltage to output energy "E/V_{100}" and the average output energy "E_{avg}" of the laser rangefinder **1**. The program then calculates **104** the nominal simulate received energy or energies "$E_{R\text{-}nom}$" from the simulated target or targets specified in the test parameters….
>
> ***
>
> The shot counter 'i' is initialized **106** and the peak detector circuit **45** is reset **107**. … The laser rangefinder **1** fires and *the output energy "E_i" for that laser pulse "i" is measured **109*** by the energy detector **24**, its value is displayed for the operator on the energy display **14**, and the measured energy value is sent to the computer **6** for storage.
>
> *Simultaneous with this measurement, the summed voltage **44** of the peak detector output voltage **51** and the previously programmed D/A converter output voltage **50** is measured **110*** by the DMM **12** and sent to the computer **6** where it is stored. *The summed voltage **44** becomes the energy scaling factor "V_{si}" for shot "i" which modulates the output driver voltage **47** of the pulse generator **9** to take into consideration the pulse to pulse output variation* of the laser rangefinder under test **1**.

Ruhl, col. 12, l. 35 - col. 13, 1. 17 (emphasis added).

The above-mentioned teachings in Ruhl, along with other passages cited by the Examiner and the Examiner's factual findings (which we adopt as our own) establish that Ruhl discloses a system that determines a second voltage based on a correlation as generated based on changes in energies and voltages as measured in a series of laser pulses. Thus, the Examiner establishes anticipation of claim 1 by a preponderance of the evidence. Appellant's arguments, e.g., asserting that "*only that single average proportionality of peak detector voltage to output energy is stored*" (App.

Br. 10), do not persuade us otherwise. *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992).

We also note that Appellant's arguments regarding a "single slope" (Reply Br. 5), i.e., a linear relationship, are inapplicable to claim 1, which does not limit the recited correlation to non-linear relationship, such as a quadratic relationship.

III.

The Examiner rejects claims 5-7 as obvious over Ruhl. We adopt the Examiner's fact finding and conclusions as our own (Ans. 6-7).

In response to the Examiner's rejection, Appellant argues that "Ruhl describes storing and applying only a single proportionality despite firing a hundred different pulses (each at its own associated voltage)" (App. Br. 12). For the reasons discussed above, Appellant's position in this regard does not persuade us in relation to claim 1, and Appellant does not explain how such an argument applies differently to claims 5-7.

Appellant also argues that the Examiner does not identify a "*basis for modification of the actual disclosure of the cited art by varying the pulse rate of the Ruhl laser*," or "that varying of the pulse rate could alter the pulse energy during a very short series of pulses, nor that a multi-rate correlation be determined, stored and/or applied" (*id.*). We note that Appellant does not explain, and the Specification does not clarify, how claims 1, 5, and 6 involve a "pulse rate." These claims do not recite "pulse rate" or indicate how the method might take into account a "pulse rate" when generating a correlation or when determining a second voltage. To the extent that Appellant means to imply, however, that "changes in voltage" (recited in

claim 1) correspond to changes in "firing rate," Ruhl describe changes in voltages, as discussed above.

Claim 7 recites that "a firing rate of the laser varies while the laser is in the operating mode." As noted by the Examiner, Ruhl teaches that "[d]uring the operating mode, there are various firing rates or programmed delays" (Ans. 6 (citing Ruhl, col. 12, ll. 41-47)). Appellant does not dispute this finding.

Appellant further asserts that claim 1, and therefore dependent claims 5-7, require that the second voltage is determined using a "multi-rate correlation" (App. Br. 12). By referring to a "multi-rate correlation," Appellant again implies that claim 1 (and therefore claims 5-7) require generating a correlation comprising a non-linear relationship, i.e., a quadratic relationship. As discussed above, claim 1 encompasses generating a correlation comprising a linear relationship. Consistently, we agree with the Examiner's finding that data points in Appellant's exemplary Figure 6 in the instant Specification, albeit labeled a "quadratic fit," are best fit by a linear correlation (Ans. 10; compare Specification's Figure 6 to the quadratic relationship depicted in Figure 2 of Suzuki, discussed below).

For the above-mentioned reasons, we conclude that the Examiner establishes by a preponderance of the evidence that claims 5-7 are obvious over Ruhl. Appellant's arguments do not persuade us otherwise.

IV.

The Examiner rejects claim 2 as obvious over Ruhl in view of Suzuki (Ans. 7). As noted by the Examiner, Ruhl does not teach that the correlation is quadratic (*id.*). Suzuki describes "an energy amount control device" that

achieves "high precision by adjustment of the applied voltage even if the relation between the applied voltage of an energy generating source and the oscillation energy amount is changed over time" (Suzuki, col. 3, ll. 30-36). In a relevant embodiment, Suzuki describes that "the relation between the applied voltage and the energy amount of the emitted pulse under that applied voltage" is quadratic, citing to Figure 2 (*id*. at col. 8, ll. 3-31; Fig. 2). Suzuki also discloses the equation recited in claim 2 (*id*. at ll. 20-27).

Appellant argues that Suzuki "is concerned with increasing the voltage to compensate for deteriorating gas over a prolonged period of time" (App. Br. 13). Even assuming this assertion is factually correct, however, Appellant does not explain how such a fact undercuts Suzuki's teachings of the correlation recited in claim 2, or how such the fact impacts our analysis in relation to claims 1 and 2, which do not recite a time frame.

We agree with the Examiner that it would have been obvious to an ordinary artisan "to fit the data with a quadratic equation because doing so would result in the closest possible fit to the data obtained by measuring the pulse energies" (Ans. 7). Suzuki teaches that "the relationship between voltage and pulse energies can be quadratic," even if Ruhl does not expressly mention this fact in relation to its measured energies and voltages (*id*.). Notably, notwithstanding Appellant's assertions regarding Figure 6 of the Specification (App. Br. 13), the graph in Figure 6 (0-30,000 V v. mJ) mirrors the graph depicted in Figure 2 in Suzuki (0-30 KV v. mJ), except that the correlation in Figure 6 appears more linear and Suzuki's Figure 2 clearly depicts a quadratic relationship.

Appellant also argues that "*[n]o relationship between firing rate and how it impacts energy requirements is contemplated by Suzuki (or any of the other cited references)*" (App. Br. 14). As discussed above regarding claim 1, however, claim 2 does not recite a "firing rate" or designate how the method involves determining "firing rate." To the extent that Appellant means to imply that "changes in voltage" (claim 1) correspond to changes in "firing rate," however, both Ruhl and Suzuki describe changes in voltages (*see, e.g.*, Suzuki, Figure 2; *see also* Ans. 6 (noting that Ruhl teaches that "[d]uring the operating mode, there are various firing rates or programmed delays," citing Ruhl, col. 12, ll. 41-47).)

Thus, we conclude that the Examiner establishes by a preponderance of the evidence that claim 2 is obvious over Ruhl in view of Suzuki. Appellant's arguments do not persuade us otherwise.

V.

The Examiner rejects claims 4 and 10 as obvious over Ruhl in view of Vogler (Ans. 7-8; *see also id*. at 3 (regarding claim 8)). The Examiner notes that Ruhl does not teach that "there are damping variations in the voltage according to a damping factor" (*id*. at 7). The Examiner finds, however, that Vogler "teaches certain gas components such as F2 that can be observed from the decrease in the slope of the laser output energy verses driving voltage curve" (*id*. at 8 (citing Vogler ¶¶ [0036]-[0039]; Figures 3a and 3b)). The Examiner finds that "gas aging and subsequent transmission efficiency loss in such lasers" as described in Vogler corresponds to dumping variations in relevant voltages according to a dumping factor (*id*. at 8). The Examiner concludes that "incorporation of a known damping factor in the

determination of the second voltage would have been obvious in order to accurately calculate the second voltage" in Ruhl's method in view of Vogler (*id*.).

Claim 4 recites that the method of claim 1 further comprises "damping variations in the voltage according to a damping factor." Such language, which merely references damping variations and a damping factor, does not designate that claim 4 differs from claim 1. Thus, claim 4 is obvious over the cited art for the same reasons discussed above regarding claim 1. Along these lines, Appellant's arguments regarding the "variable slope voltage (pulse energy correlation of claim 1[)]" (App. Br. 15) do not persuade us otherwise for the reasons already discussed above. Moreover, claims 4 and 10 do not recite a "short running time" as argued by Appellant regarding claim 8, and therefore arguments relating to Vogler operating for "several days" also do not persuade us otherwise (*id*. at 15-17).

Claim 10 differs from claim 4, however, in that it recites that the second voltage is calculated "using a damping factor D and a desired change in energy ΔE" according to the equation:

$$V_{new} = V_{old} + D \cdot \frac{\Delta E}{2c_1 V_{old} + c_2}$$

where "generating a correlation comprises identifying constants cl and c2." The Examiner does not indicate where Vogler or any other cited reference discloses or suggests calculating a second voltage using the equation recited in claim 10 (Ans. 7-8, 12). Thus, we conclude that the Examiner fails to establish by a preponderance of the evidence that claim 10 is obvious over Ruhl in view of Vogler.

VI.

The Examiner rejects claims 8 and 9 as obvious over Ruhl in view of LaHaye (Ans. 8-9). Claim 8 is directed to operating the laser in an operating mode "for less than about 10 minutes." Claim 9 recites that "the target surface is disposed on a corneal tissue" and "the laser is operated in the calibration mode prior to treatment of each of a plurality of patients."

The Examiner finds that although Ruhl does not teach the time that the laser remains in operating mode, "it is well known [in] the art to expeditiously perform [corneal] surgeries to reduce risk of unwanted damage to ophthalmic tissue" (Ans. 8-9). In addition, although the Examiner finds that Ruhl does not teach the use of the method to treat the cornea, the Examiner finds that LaHaye "teaches a method and apparatus for monitoring laser surgery exemplified in an ophthalmic laser surgery system (Abstract)," as well as "using the controlled pulses on the cornea of a patient (Paragraph [0016]), and calibrating the laser prior to treating a patient (Paragraph [0036])" (*id*. at 9).

Appellant argues that "*LaHaye does not provide a method for controlling a laser by determining voltages from a correlation*," or teach determining a second voltage (App. Br. 17). Thus, according to Appellant, "any combination of LaHaye with Ruhl would indicate that no adjustment for variation of pulses rate would be required during a laser eye surgery treatment" (*id*. at 18). In addition, Appellant again argues that "if the Ruhl system were implemented, it would include only a single stored proportionality despite firing different pulses" and "Ruhl does not teach varying the pulse rate of the laser" (*id*.).

We adopt the factual findings and conclusion of the Examiner as our own (Ans. 8-9). We conclude that it would have been obvious to conduct the method of Ruhl when performing corneal laser surgery. For the reasons stated by the Examiner, we also conclude that elements recited in claims 8 and 9 would have been obvious to an ordinary artisan in this field. We note that Appellant's assertions regarding this rejection correspond to the same arguments addressed above regarding claim 1. Appellant does not explain why/how elements recited in claims 8 and 9 change the analysis as applied to claim 1. In addition, Appellants' assertion that LaHaye fails to teach determining voltages from a correlation or determining a second voltage does not persuade us that the Examiner fails to establish by a preponderance of the evidence that Ruhl teaches these elements and that it would have been obvious to apply the Ruhl method in the context of corneal surgery, as suggested by LaHaye.

SUMMARY

We reverse the rejection of claim 2 as being indefinite. We affirm the rejection of claims 1 and 3 as anticipated by Ruhl, as well as the obvious rejection of claims 5-7 over Ruhl. We also affirm the rejections of claim 2, claim 4, and claims 8, and 9 over Ruhl in view of Suzuki, Vogler, or LaHaye, respectively. We reverse the rejection of claim 10 over Ruhl in view Vogler.

TIME PERIOD FOR RESPONSE

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-IN-PART

cdc