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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* BRANDON L. VERBRUGGE, MATTHEW J. MERGENER,  
MATTHEW P. WYCKLENDT, JEFFREY C. HESSEBERGER, and  
DENNIS J. GRZYBOWSKI

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Appeal 2019-006201  
Application 13/838,126  
Technology Center 3700

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Before JENNIFER D. BAHR, DANIEL S. SONG, and  
MICHAEL J. FITZPATRICK, *Administrative Patent Judges*.

BAHR, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant<sup>1</sup> appeals from the Examiner's decision to reject claims 1–17, 21, 23, 25, and 28–39.<sup>2</sup> We have jurisdiction under 35 U.S.C. § 6(b). We AFFIRM IN PART.

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<sup>1</sup> We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42(a). Appellant identifies the real party in interest as Milwaukee Electric Tool Corporation. Appeal Br. 2.

<sup>2</sup> Claims 18–20, 24, and 26 have been withdrawn from consideration. Final Act. 1 (Office Action Summary); Appeal Br. 38, 40, 41 (Claims App.).

### CLAIMED SUBJECT MATTER

Appellant's invention is directed to "a hand-held power tool that includes a motor and is powered by a battery pack." Spec. ¶ 2. Claim 1, reproduced below, is illustrative of the claimed subject matter:

1. A hand-held power tool comprising:
  - a housing including a body and a handle portion;
  - a battery pack removably coupled to the housing, the battery pack including a plurality of lithium-based battery cells;
  - a trigger switch configured to generate a trigger signal;
  - a first battery terminal and a second battery terminal configured to electrically connect to the battery pack;
  - a brushless direct-current ("BLDC") motor;
  - a switching array including a plurality of switching field effect transistors (FETs) electrically connected between the BLDC motor and the first battery terminal and the second battery terminal, the plurality of switching FETs configured for controlling application of power to the BLDC motor, wherein the plurality of switching FETs have a drain-to-source resistance of below 3 milli-Ohms;
  - a controller configured to
    - receive the trigger signal from the trigger switch,
    - and
    - generate a control signal based on the trigger signal to selectively enable and disable each of the plurality of switches in the switching array to drive the BLDC motor with power provided from the battery pack;
    - and
    - an output shaft coupled to the BLDC motor to provide an output of the hand-held power tool,
  - wherein the hand-held power tool produces an average long-duration power output of at least 300 Watts and a maximum short-duration power output of at least 400 Watts, and wherein the average long-duration power output is the average power output over one discharge cycle of the battery pack continuously from a fully-charged level until the battery pack reaches a low-voltage cutoff.

## REFERENCES

The prior art relied upon by the Examiner is:

Name	Reference	Date
Peot	US 5,856,715	Jan. 5, 1999
Brotto	US 2007/0193761 A1	Aug. 23, 2007
Liebhard	US 2010/0218966 A1	Sept. 2, 2010
Toukairin	US 2010/0283332 A1	Nov. 11, 2010
Tanimoto	US 2011/0171887 A1	July 14, 2011
Yanagihara	US 2012/0152583 A1	June 21, 2012

## REJECTIONS<sup>3</sup>

Claim 39 stands rejected under 35 U.S.C. § 112, fourth paragraph, as being of improper dependent form for failing to further limit the subject matter of claim 1, from which it depends.

Claims 1–3, 6, 7, 10–12, and 39 stand rejected under 35 U.S.C. § 102(a) and (e) as anticipated by Yanagihara.

Claims 4, 5, 8, and 9 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Yanagihara and Peot.

Claims 21 and 23 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Yanagihara, Tanimoto, and Peot.

Claims 13, 14, 25, 28, and 30 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Yanagihara and Liebhard.

Claims 15, 16, and 29 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Yanagihara, Liebhard, and Peot.

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<sup>3</sup> The Examiner has withdrawn several other rejections set forth in the Final Action. *See* Ans. 5.

Claims 31–34 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Yanagihara and Toukairin.

Claims 35 and 36 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Yanagihara, Tanimoto, Peot, and Toukairin.

Claims 37 and 38 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Yanagihara, Liebhard, and Toukairin.

Claim 17 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Yanagihara and Brotto.

Claims 1–3, 6, 7, 10–14, 17, 25, 28, 30–34, 37, and 38 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Toukairin and Yanagihara.

Claims 1–3, 6, 7, 10–14, 17, 25, 28, 30–34, 37, and 38 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Toukairin, Yanagihara, and Liebhard.

#### OPINION

##### *Improper Dependent Form—35 U.S.C. § 112, fourth paragraph*

The Examiner accepts Appellant’s asserted definition of “‘low-voltage cutoff’ . . . as ‘the voltage at which discharge of the battery cell (or battery pack) is ceased to prevent damage from deep discharge to the battery cell (or a battery cell of the battery pack).’” Ans. 6 (acknowledging that this term “is a well-known term in the art of lithium ion batteries”); *see* Appeal Br. 8 (setting forth this definition). We discern no error in this interpretation and likewise adopt this interpretation, which appears consistent with the disclosure in paragraph 122 of Appellant’s Specification. However, given this interpretation of “low-voltage cutoff” in claim 1, the Examiner determines that claim 39, which depends from claim 1, does not further limit the scope of claim 1. Ans. 22.

Claim 1 recites that the “power tool produces an average long-duration power output of at least 300 Watts” and that “the average long-duration power output is the average power output over one discharge cycle of the battery pack continuously from a fully-charged level until the battery pack reaches a low-voltage cutoff.” Appeal Br. 35–36 (Claims App.). Claim 39 recites that “the battery pack reaches the low-voltage cutoff based on a battery cell of the plurality of lithium-based battery cells reaching a discharge voltage cutoff indicating a natural end of battery cell discharge.” *Id.* at 44.

Appellant’s only argument contesting the rejection of claim 39 under 35 U.S.C. § 112, fourth paragraph, as failing to further limit claim 1 from which it depends, is predicated on an assumption that the Examiner will continue to reject Appellant’s asserted definition of “low-voltage cutoff.” Appeal Br. 13 (contending that “in the event that the Examiner continues to do so, claim 39 provides further definition at least in this aspect” and that “[c]laim 39 provides a precise articulation of this point”). Given that the Examiner now accepts Appellant’s asserted interpretation, and we likewise adopt this interpretation, Appellant’s argument is moot and fails to apprise us of error in the Examiner’s rejection. Accordingly, we sustain the rejection of claim 39 under 35 U.S.C. § 112, fourth paragraph.

*Anticipation—Yanagihara*

In contesting the anticipation rejection, Appellant presents arguments for claim 1 and for claim 39. *See* Appeal Br. 16–21, 33. Appellant does not present any separate arguments for claims 2, 3, 6, 7, or 10–12 aside from their dependence from claim 1. We decide the rejection of claims 1–3, 6, 7, and 10–12 on the basis of claim 1, and we address claim 39 separately. *See*

37 C.F.R. § 41.37(c)(1)(iv) (permitting the Board to select a single claim to decide the appeal as to a single ground of rejection of a group of claims argued together).

*Claims 1–3, 6, 7, and 10–12*

Appellant argues that Yanagihara does not disclose, either expressly or inherently, that the “power tool produces an average long-duration power output of at least 300 Watts . . . wherein the average long-duration power output is the average power output over one discharge cycle of the battery pack continuously from a fully-charged level until the battery pack reaches a low-voltage cutoff,” as recited in claim 1. Appeal Br. 16–21. Appellant contends that the asserted “features are not intended use of the apparatus but, rather, structurally and functionally describe what the claimed hand-held power tool is.” *Id.* at 19. Further, Appellant submits that “[t]he Examiner appears to presume that, because the tool is disclosed as being capable of achieving certain outputs at certain times, it must be able to maintain such outputs through a complete discharge cycle.” *Id.* at 19. However, Appellant argues that the Declaration of inventor Matt Mergener, dated September 8, 2017 (entered into the electronic record on September 15, 2017, hereinafter “Mergener Declaration” or “Mergener Decl.”), shows that “merely because a power tool can, at times, produce a particular power output, it does not necessitate that such power tool can provide a long-duration power output at the same level over a discharge cycle.” *Id.* at 19–20.

We agree with Appellant that the “wherein the hand-held power tool produces . . . until the battery pack reaches a low-voltage cutoff” recitation in claim 1 constitutes a functional limitation of the claimed power tool. “A patent applicant is free to recite features of an apparatus either structurally or

functionally . . . Yet, choosing to define an element functionally, *i.e.*, by what it does, carries with it a risk.” *In re Schreiber*, 128 F.3d 1473, 1478 (Fed. Cir. 1997). Once the Examiner establishes a reasonable basis that the prior art is capable of performing the claimed function, the burden shifts to the applicant to show that the prior art structure is not capable of performing the claimed function. *In re Schreiber*, 128 F.3d 1473, 1478 (Fed. Cir. 1997).

We note that Appellant argues that the claim language in question “is directed to how the hand-held power tool is configured,” rather than to a manner in which it “is intended to be employed.” Reply Br. 3. However, claim 1 does not recite that the power tool is “configured to” produce such output. The only “configured to” language in claim 1 pertains to the “controller,” which is “configured to receive a trigger signal . . . and generate a control signal.” Appeal Br. 35 (Claims App.). Thus, the principle of *In re Giannelli*, 739 F.3d 1375 (Fed. Cir. 2014), under which the court looked to the written description of the application and determined that the phrase “adapted to” in view of the specification, has a narrower meaning than “capable of” or “suited for,” does not apply to the average long-duration power output limitation of claim 1.

In setting forth the basis for the determination that Yanagihara’s power tool is capable of producing an average long-duration power output of at least 300 Watts over one discharge cycle of the battery pack continuously from a fully-charged level until the battery pack reaches a low-voltage cutoff, the Examiner finds that, as evidenced by a data sheet referenced by the Examiner, cutoff voltages of lithium-ion batteries, which are the type of battery cells disclosed by Appellant, as well as the type of battery cells disclosed by Yanagihara (Yanagihara ¶ 33), are known to be in a range from



approximately 2.5–3.0 Volts and in some instances as low as 2.4 Volts. Final Act. 31. Appellant does not specifically contest this finding. *See* Appeal Br. 19 (acknowledging the low-voltage cutoff identified by the Examiner). The Examiner provides calculations to support the finding that, in permitting the tool to operate without reducing the maximum duty ratio as long as the applied current does not exceed 50 amps, Yanagihara provides an operating condition under which an average power output of 450 Watts, which is greater than 300 Watts as claimed, will be sustained throughout the discharge cycle as claimed. *See* Ans. 9–11. Based on the Examiner’s calculations, the Examiner concludes that even when Yanagihara’s battery pack reaches its lowest operational voltage (12 volts, assuming the lowest cutoff voltage of 2.4 Volts per cell for each of the five serially-connected pairs of cells),<sup>4</sup> as well as at higher operational voltage up to and including the fully charged nominal voltage of 18 volts, Yanagihara’s power tool “will clearly provide the claimed power outputs if the load applied to the tool requires the corresponding current draw.” *Id.* at 11. Further, the Examiner observes that Yanagihara discloses all of the recited structure of claim 1, and, thus, “is capable of performing the claimed functional outputs.” *Id.* The Examiner emphasizes that “Appellant has not pointed out any further structural limitations that are being implied by the claimed power limits.” *Id.* In this regard, we note that Appellant does not attribute the claimed power output capabilities to any structure beyond the structural elements

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<sup>4</sup> Notably, the Examiner’s assumption of 2.4 Volts for *each* of the cells of the battery pack leads to a conservative estimate of the voltage of the battery pack at “low-voltage cutoff” as defined by Appellant in claim 39, which requires only one of the cells to reach a discharge voltage cutoff level. *See* Appeal Br. 44 (Claims App.).

recited in the language of claim 1 preceding the “wherein” clause, all of which structural elements the Examiner finds disclosed in Yanagihara. *See, e.g.*, Spec. ¶ 11 (discussing reducing the internal resistance of one or more of the motor, battery pack, and electronics and improving the ability of the power tool to dissipate heat), ¶¶ 39–40 (disclosing the use of FETs having a drain-to-source resistance of below approximately 3.0 milli-Ohms to enable increased drive currents to be passed through the FETS and provided to the motor); Yanagihara ¶¶ 9–10 (disclosing MOS-FET resistance at or below 3 milliohm to increase overall electric efficiency), ¶ 44 (disclosing a gate driver and over-current detector for limiting the maximum duty ratio of the motor if current exceeds threshold values in order to prevent the motor from locking or the motor coil from burning out).

Appellant alleges that “the Examiner is interpreting the claim term ‘low-voltage cutoff’ to mean a cutoff when an overcurrent is detected.” Appeal Br. 20. This is not the case. *See* Ans. 6 (accepting Appellant’s asserted definition for “low-voltage cutoff”). The Examiner’s technical explanation, discussed above, mentions overcurrent detection only in the context of pointing out that Yanagihara’s controller will not limit the maximum duty ratio of the motor as long as the current supplied to the motor does not exceed 50 amps, so as to establish the type of operation the power tool will permit while current can still be drawn from the battery pack (i.e., before low-voltage cutoff), not to establish the conditions at which low-voltage cutoff will occur. Appellant does not specifically assert, much less provide any evidence or persuasive technical reasoning to show, that Yanagihara’s battery pack would be incapable of delivering the level of current required by the power tool load as discussed on pages 9–11 of the

Answer until substantially the point at which the low-voltage cutoff is reached. Nor does Appellant specifically contest the Examiner's calculations.

The Mergener Declaration merely establishes that the particular competitor power tools tested by Declarant did not produce the average long-duration power output recited in claim 1 when operated in a particular manner, and that Declarant is not aware of any hand-held power tools available on the market at the time of Appellant's invention that had such capability. *See* Mergener Decl. ¶¶ 6–8, 13–14, App. A. Appellant acknowledges that the Mergener Declaration is not asserted to show that Yanagihara's power tool is incapable of producing the claimed power outputs. Reply Br. 4. Notably, none of the power tools tested by Declarant achieved electric efficiency levels approaching 80 percent, like Yanagihara's power tool, nor is there any indication that the tools tested have controllers with overcurrent limiters or MOS-FET resistance at or below 3 milliohms as disclosed by Yanagihara. *See* Mergener Decl., App. A.

For the above reasons, based on the record before us, the Examiner establishes a reasonable basis that Yanagihara's tool is capable of being operated so as to produce the average long-duration power output recited in claim 1, and Appellant has not come forth with persuasive evidence or technical reasoning to show that Yanagihara's power tool structure is not capable of being so operated. Therefore, Appellant does not apprise us of error in the rejection of claim 1 as anticipated by Yanagihara. Accordingly, we sustain the rejection of claim 1, and of claims 2, 3, 6, 7, and 10–12, which fall with claim 1, as anticipated by Yanagihara.

*Claim 39*

Appellant relies on the arguments presented for claim 1 in contesting the rejection of claim 39. Appeal Br. 33. For the reasons discussed above, these arguments do not apprise us of error in the rejection of claim 1, and, likewise, fail to apprise us of error in the rejection of claim 39 as anticipated by Yanagihara, which we, thus, sustain.

*Obviousness—Yanagihara and one of Peot, Brotto, or Toukairin*

Appellant does not present any arguments specifically directed to the rejection of claims 4, 5, 8, and 9 as unpatentable over Yanagihara and Peot, the rejection of claim 17 as unpatentable over Yanagihara and Brotto, or the rejection of claims 31–34 as unpatentable over Yanagihara and Toukairin. *See* Appeal Br. 32 (merely stating that dependent claims 4, 5, 8, 9, and 17 are patentable by virtue of their dependency from claim 1). For the reasons discussed above, Appellant’s arguments do not apprise us of error in the rejection of claim 1 as anticipated by Yanagihara and, likewise, fail to apprise us of error in the rejections of claims 4, 5, 8, 9, 17, and 31–34. Accordingly, we sustain the rejection of claims 4, 5, 8, and 9 as unpatentable over Yanagihara and Peot, the rejection of claim 17 as unpatentable over Yanagihara and Brotto, and the rejection of claims 31–34 as unpatentable over Yanagihara and Toukairin.

*Obviousness—Yanagihara, Tanimoto, and Peot*

The Examiner finds that Yanagihara fails to explicitly disclose the motor having an outer diameter between 60 and 80 millimeters and a weight between 540 and 720 grams, as recited in claim 39. Final Act. 12. The Examiner finds that Tanimoto teaches that as the weight of the motor increases, the power consumption and output power also increase, and

further discloses motor weights from 100 g to 1800 g, as well as motor diameters between 15 mm and 60 mm. *Id.* at 13. The Examiner determines it would have been obvious to modify the size/weight of Yanagihara’s motor such that its weight is between 540 g and 720 g in order to achieve the desired power output, such as the output disclosed by Yanagihara for the intended use of the tool. *Id.* According to the Examiner, mere routine experimentation with different sizes and weights of brushless motor to achieve the desired power outputs would have been obvious and well within the reach of a person of ordinary skill in the art at the time of Appellant’s invention. *Id.*

The Examiner then finds that, although Tanimoto teaches the diameter can be up to 60 mm, Tanimoto also discloses such a diameter would not be desired because it hinders the ability of the tool to be gripped. Final Act. 14. Thus, the Examiner directs our attention to Peot’s teaching of a motor having a diameter ranging from 1.8 to 2.5 inches (approximately 45–63 mm) that can output up to 1.5 horsepower (approximately 1100 Watts). *Id.* (citing Peot 3:42–44; 5:26–45).

The Examiner finds that increasing the diameter of a brushless motor to increase power consumption and output is well known in the art and determines it would have been obvious to modify Yanagihara’s brushless motor to have a diameter within the range taught by Peot, thereby allowing the tool to have a more compact configuration while maintaining a high power output and optimizing functional and ergonomic performance as taught by Peot. Final Act. 14 (citing Peot 2:25–31). The Examiner adds that “discovering the optimal or workable ranges (i.e., the weight of the motor) involves only routine skill in the art.” *Id.* (citing *In re Aller*, 220 F.2d 454

(CCPA 1955)). The Examiner notes that Appellant has not disclosed any criticality for the claimed limitations and, thus, “mere routine experimentation with different sized/weights of brushless motor in order to achieve the desired outputs is viewed as obvious and would have been well within the reach of one of ordinary skill in the art at the time of the invention.” *Id.*

Appellant argues, in essence, that the combination of Yanagihara, Tanimoto, and Peot does not teach or suggest a motor having a weight between 540 grams and 720 grams that is capable of producing a maximum short-duration power output of at least 650 Watts as claimed. Appeal Br. 28. In particular, Appellant points out that the only correlation shown in the references between motor weight and power is in Figure 18 of Tanimoto, which includes a table showing motor weight and power *consumption*, not power output. *Id.* Assuming the correlation between power consumption and motor weight in Tanimoto’s Figure 18 is accurate, Appellant contends that, even with Yanagihara’s 70–80% electric efficiency (optimized for power output between 450 and 550 Watts), and Tanimoto’s power consumption of 540–720 Watts (the indicated power consumption for a motor between 540 and 720 g in Figure 18), “the power output cannot reach the short-term output of 650 watts (80% x 720 watts = 576 watts).” *Id.*; *see also* Reply Br. 8 (arguing same). According to Appellant,

One of ordinary skill in the art would therefore not have a reasonable expectation of success of achieving the recited power outputs when Tanimoto is combined with Yanagihara and Peot. Since there is a lack of a reasonable expectation of success, one of ordinary skill in the art would not combine the disclosures of Tanimoto with the disclosure of Yanagihara and Peot to arrive at the claimed feature.

Reply Br. 8.

The Examiner explains, however, that Tanimoto is not relied on for teaching the claimed power output, but, rather, is “relied upon for teaching a common range of BLDC motor weight.” Ans. 19 (boldface omitted). The Examiner relies on Peot “to teach the diameters of the motor.” *Id.* (boldface omitted). The Examiner also points out that Tanimoto’s teaching in paragraph 253 regarding a correlation between weight and power consumption also reasonably implies a correlation between weight and power output. *Id.*

The Examiner is correct that Tanimoto teaches a correlation between the weight of the motor and the motor power output. *See* Tanimoto ¶ 253. Specifically, although Tanimoto discloses that its motor 506 generates sufficient torque despite its reduced size, Tanimoto also teaches that “[g]enerally, weight of the motor is increased in accordance with an increase in power consumption” and that “output power of the motor is increased in accordance with the increase in power consumption to enhance workability or operability.” *Id.* Tanimoto also cautions that “if the power consumption of the motor is excessively increased, the motor becomes too heavy.” *Id.*

Tanimoto and Peot both appear to suggest that it is possible to reduce the size of a motor and still achieve a predetermined motor output, and that it is possible to achieve a power output of at least 650 Watts with a motor having a diameter within the claimed range. *See* Tanimoto ¶ 253, Peot 5:26–45. Further, Tanimoto teaches that the weight of the motor can be selected to achieve the desired output power. Tanimoto ¶ 253. However, as Tanimoto teaches, while it is possible to reduce the diameter of the motor without reducing its torque capacity, the weight of the motor increases with

an increase in power consumption and output. *Id.* Tanimoto gives no indication that the weight of the motor can be reduced while still maintaining the same output power capacity. Given the one-to-one correspondence between motor weight (in grams) and power consumption (in Watts) in Table 2 of Tanimoto's Figure 18, it appears that a motor having a weight within the range recited in claim 21 would be able to consume no more than 720 Watts of power and, thus, would be able to output no more than 576 Watts of power, even at the 80 percent electrical efficiency disclosed by Yanagihara. Therefore, although the Examiner's position that it would have been obvious to determine by routine experimentation the optimum weight and size motor to achieve the desired output power for the tool appears reasonable, based on the record before us, it is not apparent that a person having ordinary skill in the art would have had a reasonable expectation of success in designing a power tool with a motor within the claimed weight range that could produce an output power of greater than 650 Watts, as recited in claim 21.

Thus, the Examiner fails to establish that the subject matter of claim 21 would have been obvious at the time of Appellant's invention in view of the combined teachings of Yanagihara, Tanimoto, and Peot. Accordingly, we do not sustain the rejection of claim 21 or of claim 23, which depends from claim 21, as unpatentable over Yanagihara, Tanimoto, and Peot.

*Obviousness—Yanagihara, Tanimoto, Peot, and Toukairin*

The Examiner's application of Toukairin's teaching of incorporating cooling features does not make up for the aforementioned deficiency in the combination of Yanagihara, Tanimoto, and Peot with respect to claim 21, from which claims 35 and 36 depend. *See* Final Act. 20. Accordingly we



do not sustain the rejection of claims 35 and 36 as unpatentable over Yanagihara, Tanimoto, Peot, and Toukairin.

*Obviousness—Yanagihara and Liebhard*

*Claims 13 and 14*

Appellant relies on the arguments presented against the rejection of claim 1 as anticipated by Yanagihara in contesting the rejection of claims 13 and 14. *See* Appeal Br. 32. For the reasons discussed above, Appellant’s arguments do not apprise us of error in the rejection of claim 1 as anticipated by Yanagihara and, likewise, fail to apprise us of error in the rejection of claims 13 and 14 as unpatentable over Yanagihara and Liebhard, which we, thus, sustain.

*Claims 25, 28, and 30*

The Examiner finds that Yanagihara fails to disclose that the power tool is capable of producing a maximum short-duration power output of at least 950 Watts. Final Act. 16. The Examiner finds that Liebhard teaches a power tool comprising a brushless motor that is capable of producing anywhere from 500 to 5000 Watts with a battery pack having voltages ranging from 12 volts to 150 volts. *Id.* The Examiner also finds that altering a tool to increase its versatility and capabilities of handling higher loads is known. *Id.* at 17. The Examiner then determines it would have been obvious to modify Yanagihara’s tool for a higher output as taught by Liebhard because increasing the power rating/capacity of Yanagihara’s motor would achieve greater workability. *Id.*

Appellant argues that Liebhard “does not provide a correlation between particular battery pack voltages and power outputs such that one of ordinary skill in the art can conclude that a power tool including a power

pack having a nominal voltage of 16.2 Volts and 19.8 Volts produces a power output of 950 watts.” Appeal Br. 29; *see also* Reply Br. 9–10 (arguing same). According to Appellant, without a reasonable expectation of success, one of ordinary skill in the art would not combine Liebhard with Yanagihara’s tool to arrive at the claimed subject matter. *Id.* at 10.

In response, the Examiner explains that a battery pack can be modified to provide higher power to the motor either by increasing the voltage (by connecting more cells in series) or by increasing the current (by connecting more cells in parallel) without increasing the nominal voltage of the battery pack. Ans. 20. Liebhard supports the Examiner’s position in this regard, and teaches that the voltage of the battery pack needed depends on the particular configuration of the cells of the battery pack (serial or parallel connection). Liebhard ¶ 25. Thus, a person having ordinary skill in the art would have understood how to provide a battery pack capable of outputting the necessary wattage within the claimed voltage range.

Appellant additionally argues that paragraph 12 of the Mergener Declaration states that “Declarant is not aware of an 18 Volt battery-powered power tool available at the time of the present application that provided such maximum output levels.” Appeal Br. 29 (discussing the wattages of the three power tools tested and reported in Appendix A). This argument is not persuasive. Merely that Declarant was not aware of a commercially available power tool having such capacity at the time of Appellant’s invention does not suggest that a power tool having such capacity was beyond the technical grasp of a person having ordinary skill in the art at the time of Appellant’s invention who desired to design a tool having such capacity.

For the above reasons, Appellant does not apprise us of error in the rejection of claim 25 as unpatentable over Yanagihara and Liebhard. Accordingly, we sustain the rejection of claim 25, and of claims 28 and 30, which depend from claim 25 and for which Appellant does not present any separate arguments, as unpatentable over Yanagihara and Liebhard. *See* Appeal Br. 32 (relying solely on dependence from claim 25 in contesting the rejections of claims 28 and 30).

*Obviousness—Yanagihara and Liebhard, in view of either Peot or Toukairin*

In contesting these rejections of claims 15, 16, 29, 37, and 38, Appellant relies solely on the dependence of these claims from either claim 1 or claim 25. Appeal Br. 32. For the reasons discussed above, Appellant's arguments do not apprise us of error in the rejection of claims 1 and 25 as unpatentable over Yanagihara and Liebhard and, likewise, fail to apprise us of error in the rejection of claims 15, 16, and 29 as unpatentable over Yanagihara, Liebhard, and Peot or the rejection of claims 37 and 38 as unpatentable over Yanagihara, Liebhard, and Toukairin, which we, thus, sustain.

*Obviousness—Toukairin and Yanagihara*

*Claims 1–3, 6, 7, 10–14, 17, and 31–34*

In contesting this rejection as to these claims, Appellant does not present any separate arguments for claims 2, 3, 6, 7, 10–14, 17, and 31–34, aside from their dependence from claim 1. We decide the appeal of this rejection on the basis of claim 1, and claims 2, 3, 6, 7, 10–14, 17, and 31–34 stand or fall with claim 1. *See* 37 C.F.R. § 41.37(c)(1)(iv).

The Examiner relies on Yanagihara for its teachings with regard to using an 18 volt lithium based battery pack and switches having a small

drain-to-source resistance of below 3 milliohms. Final Act. 25–26.

According to the Examiner, because Toukairin, as modified in view of Yanagihara, discloses the claimed structure, including the heat sinks, PCB configuration, cooling fan, switching array, and battery configuration claimed, it can reasonably be assumed that Toukairin's tool can produce the power outputs (average long-duration power output of at least 300 Watts and maximum short-duration power output of at least 400 Watts) recited in claim 1. *Id.* at 26.

In contesting the rejection of claim 1, Appellant essentially reiterates the arguments presented against the rejection of claim 1 as anticipated by Yanagihara. Appeal Br. 24–25. These arguments are not persuasive for the reasons discussed above in addressing the anticipation rejection of claim 1. The modified Toukairin power tool appears to be equipped with all of the structural features to which Appellant appears to attribute the power output capability. *See, e.g.*, Spec. ¶ 11 (discussing reducing the internal resistance of one or more of the motor, battery pack, and electronics and improving the ability of the power tool to dissipate heat), ¶¶ 39–40 (disclosing the use of FETs having a drain-to-source resistance of below approximately 3.0 milli-Ohms in combination with, for example, heat sinking and cooling air flow, to enable increased drive currents to be passed through the FETS and provided to the motor); Toukairin ¶¶ 32–33 (disclosing a cooling fan for cooling the motor), ¶ 52 (disclosing a heat sink for heat dissipation); Yanagihara ¶¶ 9–10 (disclosing MOS-FET resistance at or below 3 milliohm to increase overall electric efficiency), ¶ 44 (disclosing a gate driver and over-current detector for limiting the maximum duty ratio of the motor if current exceeds threshold values in order to prevent the motor from locking

or the motor coil from burning out). Thus, the Examiner's determination that the modified tool of Toukairin would be capable of being operated so as to produce the claimed power outputs is reasonably supported by the evidence of record. Nothing in the Mergener Declaration effectively refutes the Examiner's findings. Notably, none of the power tools tested by Declarant achieved electric efficiency levels approaching 80 percent, like Yanagihara's power tool, nor is there any indication that the tools tested have controllers with heat sinking, air cooling, or overcurrent limiters or MOS-FET resistance at or below 3 milliohms as disclosed by Yanagihara. *See Mergener Decl., App. A.* Thus, the fact that the particular tools tested did not produce the claimed power output when operated in the manner used in the testing is not particularly germane to the issue of whether Toukairin's power tool, modified in view of Yanagihara as proposed by the Examiner, would be capable of being operated in a manner to produce such power outputs.

Appellant, therefore, fails to apprise us of error in the rejection of claim 1 as unpatentable over Toukairin and Yanagihara. Accordingly, we sustain the rejection of claim 1, and of claims 2, 3, 6, 7, 10–14, 17, and 31–34, which fall with claim 1, as unpatentable over Toukairin and Yanagihara. *Claims 25, 28, 30, 37, and 38*

In contesting this rejection as to these claims, Appellant does not present any separate arguments for claims 28, 30, 37, and 38, aside from their dependence from claim 25. Appeal Br. 32. Thus, we consider claim 25, and claims 28, 30, 37, and 38 stand or fall with claim 25. *See 37 C.F.R. § 41.37(c)(1)(iv).*

Significant differences between claim 25 and claim 1 include that claim 25 does not recite an average long-duration power output, but claims a higher maximum short-duration power output (at least 950 Watts) than claim 1, and claim 25 additionally recites that the nominal voltage of the battery pack is between 16.2 volts and 19.8 volts. *Compare* Appeal Br. 41 (Claims App.), *with id.* at 35. The Examiner determines that the “mere manipulation of size, weight and impedance of the battery, motor, and circuitry to obtain the claimed values of power output” would have been obvious because determination of optimum ranges/values of such variables to achieve a recognized result (higher power outputs) amounts to routine experimentation. Final Act. 27 (citing *In re Aller*, 220 F.2d 454, and *In re Antonie*, 559 F.2d 618 (CCPA 1977)).

Appellant argues that neither Toukairin nor Yanagihara discloses, either implicitly or inherently, a power tool that produces a maximum short-duration power output of at least 950 Watts, as recited in claim 25. Appeal Br. 30. This argument is not persuasive because it is not responsive to the rejection set forth by the Examiner. The Examiner does not find that either Toukairin or Yanagihara teaches or inherently discloses a power tool producing a maximum short-duration power output of at least 950 Watts. Rather, the Examiner determines that the claimed power output is not a patentable distinction over the Toukairin power tool modified in view of Yanagihara because, according to the Examiner, selecting the size, weight, and impedance of the motor and the battery to achieve the desired power output is an obvious matter of routine optimization.

Similarly, Appellant’s arguments that Declarant is not aware of a power tool available at the time of the present application that provided such

maximum output levels and that the power tools tested, as reported in Appendix A of the Mergener Declaration, produced power outputs lower than the claimed 950 Watts (Appeal Br. 31) are unavailing. The Examiner's rejection is not based on a determination that all power tools having the configuration of Toukairin, with an 18 volt battery pack and switches as taught by Yanagihara, will necessarily have the capacity to output at least 950 Watts. Rather, as discussed above, the Examiner determines that modifying the motor and battery to achieve a higher desired power output would have been obvious as a matter of routine optimization. To the extent that Appellant may be suggesting that a power tool having a battery pack with a nominal voltage of 18 volts, as taught by Yanagihara, would be insufficient to supply the current necessary to power Toukairin's power tool to produce the claimed power output of 950 Watts, we note that the Examiner explains that a battery pack can be modified to provide higher power to the motor either by increasing the voltage (by connecting more cells in series) or by increasing the current (by connecting more cells in parallel) without increasing the nominal voltage of the battery pack.

Ans. 20.

Appellant argues that “[d]iscovering an optimum range is only obvious when the prior art combination discloses overlapping, approaching, and similar ranges.” Reply Br. 10 (citing Manual of Patent Examining Procedure (MPEP) § 2144.05(I)). Appellant's reliance on this portion of the MPEP is misplaced because it does not address routine optimization, which is addressed in MPEP § 2144.05(II) (9th ed., rev. 08.2017, Jan. 2018) without any mention of a requirement that the prior art range be overlapping, approaching or similar to the claimed range. Merely by way of example, in

*Aller*, the claimed process performed at a concentration between 25% and 70% at temperatures between 40 degrees and 80 degrees was held to be unpatentable over a prior art process performed at a 10% concentration and at a temperature of 100 degrees. *See Aller*, 220 F.2d at 455–458. The prior art ranges of temperature and concentration are not approaching, overlapping, or similar to the claimed ranges.

Factors considered by the court in *Aller* included whether the particular ranges claimed produce a new and unexpected result that is different in kind and not merely in degree from the results of the prior art, and whether the modification was within the capabilities of one skilled in the art. *Id.* at 456. “More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” *Id.* Appellant does not assert, much less provide any evidence or persuasive technical reasoning to show, that increasing the capacity of the motor and/or battery pack of Toukairin, modified in view of Yanagihara, to achieve a higher power output would yield unexpected results or be beyond the technical grasp of a person having ordinary skill in the art.

Thus, Appellant does not apprise us of error in the rejection of claim 25. Accordingly, we sustain the rejection of claim 25, as well as claims 28, 30, 37, and 38, which fall with claim 25, as unpatentable over Toukairin and Yanagihara.

*Obviousness—Toukairin, Yanagihara, and Liebhard*

The Examiner articulates this rejection as an alternative to the rejection of claims 1–3, 6, 7, 10–14, 17, 25, 28, 30–34, 37, and 38 as unpatentable over Toukairin and Yanagihara. Final Act. 27–28. The



Examiner finds that Liebhard teaches a power tool comprising a brushless motor that can produce an output anywhere from 500 to 5000 Watts and a battery pack that can be configured with voltages ranging from 12 volts to 150 volts. *Id.* (citing Liebhard ¶¶ 23–24). The Examiner finds that altering a tool to increase its versatility and capabilities of handling higher loads is known and determines it would have been obvious to modify Toukairin’s motor further such that a higher power (i.e., above 950 Watts or 300 Watts over long duration) can be outputted, as taught by Liebhard, in order to increase the power rating/capacity of Toukairin’s motor to achieve greater workability. *Id.* at 28.

*Claims 1–3, 6, 7, 10–14, 17, and 31–34*

Appellant argues that Liebhard does not remedy the aforementioned deficiencies of the combination of Toukairin and Yanagihara. Appeal Br. 26–27. For the reasons discussed above, Appellant fails to apprise us of deficiencies in the combination of Toukairin and Yanagihara in regard to claim 1 and, likewise, fails to apprise us of error in the rejection of claim 1 as unpatentable over Toukairin, Yanagihara, and Liebhard. Accordingly, we sustain the rejection of claim 1, and of claims 2, 3, 6, 7, 10–14, 17, and 31–34, which depend from claim 1 and for which Appellant does not present any separate arguments, as unpatentable over Toukairin, Yanagihara, and Liebhard.

*Claims 25, 28, 30, 37, and 38*

In addition to arguing that Liebhard does not cure deficiencies in the combination of Toukairin and Yanagihara, Appellant also argues that Liebhard “does not provide a correlation between particular battery pack voltages and power outputs such that one of ordinary skill in the art can

conclude that a power tool including a battery pack having a nominal voltage of 18 V produces a power output of 950 watts.” Appeal Br. 32; *see* Reply Br. 11 (arguing same). Appellant contends that “because increasing the power provided to the motor requires additional battery packs connected in series to the battery packs of the tool disclosed by Yanagihara and Toukairin, Liebhard teaches against the combination of the higher power motor with the rest of the structure disclosed by Yanagihara and Toukairin.” Reply Br. 11. This argument is not persuasive because, as discussed above, the Examiner explains that a battery pack can be modified to provide higher power to the motor either by increasing the voltage (by connecting more cells in series) or by increasing the current (by connecting more cells in parallel) without increasing the nominal voltage of the battery pack. Ans. 20; *see* Liebhard ¶ 25 (teaching that the voltage of the battery pack needed depends on the particular configuration of the cells of the battery pack (serial or parallel connection)). Thus, a person having ordinary skill in the art would have understood how to provide a battery pack capable of outputting the necessary wattage within the claimed voltage range.

For the above reasons, Appellant does not apprise us of error in the rejection of claim 25 as unpatentable over Toukairin, Yanagihara, and Liebhard. Accordingly, we sustain the rejection of claim 25, and of claims 28, 30, 37, and 38, which depend from claim 25 and for which Appellant does not present any separate arguments, as unpatentable over Toukairin, Yanagihara, and Liebhard.

DECISION SUMMARY

In summary:

<b>Claims Rejected</b>	<b>35 U.S.C. §</b>	<b>Reference(s)/Basis</b>	<b>Affirmed</b>	<b>Reversed</b>
39	112, fourth paragraph	Improper Dependency	39	
1–3, 6, 7, 10–12, 39	102(a) and (e)	Yanagihara	1–3, 6, 7, 10–12, 39	
4, 5, 8, 9	103(a)	Yanagihara, Peot	4, 5, 8, 9	
21, 23	103(a)	Yanagihara, Tanimoto, Peot		21, 23
13, 14, 25, 28, 30	103(a)	Yanagihara, Liebhard	13, 14, 25, 28, 30	
15, 16, 29	103(a)	Yanagihara, Liebhard, Peot	15, 16, 29	
31–34	103(a)	Yanagihara, Toukairin	31–34	
35, 36	103(a)	Yanagihara, Tanimoto, Peot, Toukairin		35, 36
37, 38	103(a)	Yanagihara, Liebhard, Toukairin	37, 38	
17	103(a)	Yanagihara, Brotto	17	
1–3, 6, 7, 10–14, 17, 25, 28, 30–34, 37, 38	103(a)	Toukairin, Yanagihara	1–3, 6, 7, 10–14, 17, 25, 28, 30–34, 37, 38	
1–3, 6, 7, 10–14, 17, 25, 28, 30–34, 37, 38	103(a)	Toukairin, Yanagihara, Liebhard	1–3, 6, 7, 10–14, 17, 25, 28, 30–34, 37, 38	
<b>Overall Outcome</b>			1–17, 25, 28–34, 37–39	21, 23, 35, 36

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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). *See* 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED IN PART