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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* JOSH C. SWENSON, CHRISTIAN MILLER, and  
ROBERT C. COONEY

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Appeal 2019-002920  
Application 14/996,472  
Technology Center 2800

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Before CATHERINE Q. TIMM, ROMULO H. DELMENDO, and  
JAMES C. HOUSEL, *Administrative Patent Judges*.

HOUSEL, *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, 10, 17–19, and 21. We have jurisdiction under 35 U.S.C. § 6(b).

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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 Hamilton Sunstrand Corporation. Appeal Brief (“Appeal Br.”) filed November 30, 2018.

We AFFIRM, but designate NEW GROUNDS OF REJECTION pursuant to 37 C.F.R. § 41.50(b).<sup>2</sup>

#### CLAIMED SUBJECT MATTER

The invention is directed to immersion cooling of power electronic circuits. Spec. ¶ 1. More particularly, Appellant discloses a cooling arrangement having a circuit board and a plurality of electronic components thereon, wherein an enclosure attached to the circuit board retains a fluid around at least one of the components. *Id.* ¶ 8.

Claim 10, reproduced below from the Claims Appendix to the Appeal Brief, is illustrative of the claimed subject matter. The limitation at issue is italicized.

10. A control module comprising:  
a motherboard and a plurality of removable circuit boards, and at least one of said circuit boards being provided with immersion cooling of an electronic component surrounded by an enclosure, and others of said plurality of circuit boards not being provided with immersion cooling; and  
said at least one of said circuit board is enclosed entirely in said enclosure and said at least one circuit board including a transistor and a control circuit all received within said enclosure, with others of said plurality of circuit boards being outside said enclosure;  
*said enclosure is provided with a feature to allow expansion of a fluid within said enclosure.*

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<sup>2</sup> Our Decision refers to the Specification (“Spec.”) filed January 15, 2016, the Examiner’s Final Office Action (“Final Act.”) dated June 20, 2018, , the Examiner’s Answer (“Ans.”) dated December 20, 2018, and the Reply Brief (“Reply Br.”) filed February 20, 2019.

## REFERENCES

The Examiner relies upon the following prior art:

Name	Reference	Date
Beaulieu et al. ("Beaulieu")	US 3,851,221	Nov. 26, 1974
Andresen et al. ("Andresen")	US 5,305,184	Apr. 19, 1994
Chou	US 2010/0319902 A1	Dec. 23, 2010
Yamada <sup>3</sup>	JP 61-253843	Nov. 11, 1986

## REJECTIONS

The Examiner maintains, and Appellant requests our review of, the following grounds of rejection:

1. Claims 10 and 19 under 35 U.S.C. § 102(a)(1) as anticipated by Yamada;
2. Claim 17 under 35 U.S.C. § 103 as unpatentable over Yamada in view of Chou;
3. Claim 18 under 35 U.S.C. § 103 as unpatentable over Yamada in view of Andresen; and
4. Claims 1 and 21 under 35 U.S.C. § 103 as unpatentable over Beaulieu in view of Chou.

## OPINION

After review of the Examiner's and Appellant's opposing positions and the appeal record before us, we determine that Appellant's arguments are insufficient to identify reversible error in the Examiner's anticipation rejection. *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011). Accordingly, we

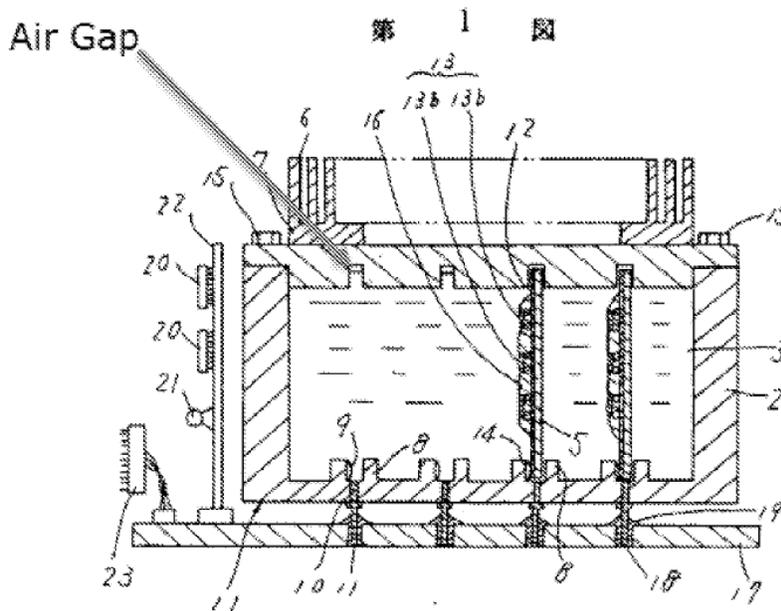
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<sup>3</sup> The Examiner relies, without objection, on a European Patent Office English-language machine translation of Yamada. We likewise rely on this translation document in our Decision which we refer to as "Yamada."

affirm the stated anticipation rejection for substantially the fact findings and the reasons set forth by the Examiner in the Examiner's Answer and the Final Office Action. We offer the following for emphasis only.

*Rejection 1: Anticipation by Yamada*

The Examiner rejects claims 10 and 19 under 35 U.S.C. § 102(a)(1) as anticipated by Yamada. Specifically, the Examiner finds that Yamada teaches a control module as recited in claim 10, wherein at least one circuit board is provided with an enclosure surrounding an electronic component and retaining a cooling fluid. Final Act. 3. The Examiner further finds that the enclosure is provided with a feature to allow expansion of fluid within the enclosure. *Id.* at 4. The Examiner states that this feature is an air gap within notches formed in the enclosure cover as seen in the annotated Figure A (*id.*) reproduced below.



Examiner's Figure A depicting a transverse view of the control module

The Examiner's Figure A is an annotated version of Yamada's Figure 1 and shows a motherboard 17, a plurality of circuit boards 12 within an enclosure 2 retaining a cooling fluid 3, and a circuit board 22 that is not within the enclosure. As seen in the above figure, circuit boards 12 are received in sockets 8 provided at the bottom of enclosure 2 and in the cover.

The Examiner points to the top portion of a socket in the cover as showing an air gap. Final Act. 4. The Examiner finds that there is a space between the top of fluid 3 and the underside of the cover that forms this air gap. Ans. 5. The Examiner finds that Yamada's Figure 1 shows that cross hatching from the cover does not carry over into this space, thereby setting it apart from the cover material. *Id.* The Examiner explains that the fluid will expand upon heating due to circuit boards 12 and, absent a means to relieve pressure within enclosure 2, would press against the enclosure walls and circuit boards, potentially causing catastrophic damage. *Id.* The Examiner, therefore, determines that it would make the most sense that the space is an air gap for fluid expansion. *Id.* at 6.

Appellant disputes the Examiner's finding that Yamada, explicitly or impliedly, teaches an air gap. Appeal Br. 3. Specifically, Appellant asserts that the lines in Yamada's Figure 1 within the top portion of the sockets in the cover is in the same approximate location as the tops of circuit boards 12. *Id.* Appellant argues that there is no disclosure as to what these lines were intended to indicate, if anything, and their presence may indicate nothing but a drafting error. *Id.* Appellant further contends that the Examiner relies upon Appellant's disclosure as the only basis for finding that Yamada must have an air gap. *Id.*; *see also* Reply Br. 1–2.

A claim is anticipated only where “each and every limitation is found either expressly or inherently in a single prior art reference.” *Celeritas Techs., Ltd. v. Rockwell Int’l. Corp.*, 150 F.3d 1354, 1361 (Fed. Cir. 1998). “[A] prior art reference without express reference to a claim limitation may nonetheless anticipate by inherency.” *In re Omeprazole Patent Litigation*, 483 F.3d 1364, 1373 (Fed. Cir. 2007). Past recognition of the inherent feature is not required. *Schering Corp. v. Geneva Pharm.*, 339 F.3d 1373, 1377 (Fed. Cir. 2003); *see also, e.g., Gen. Elec. Co. v. Jewel Incandescent Lamp Co.*, 326 U.S. 242, 249 (1945) (“It is not invention to perceive that the product which others had discovered had qualities they failed to detect.”). In general, a limitation is inherent “if it is the ‘natural result flowing from’ the explicit disclosure of the prior art.” *Schering Corp. v. Geneva Pharms.*, 339 F.3d 1373, 1379 (Fed. Cir. 2003) (quoting *Eli Lilly & Co. v. Barr Labs., Inc.*, 251 F.3d 955, 970 (Fed. Cir. 2001)). “Inherency ... may not be established by probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient.” *MEHL/Biophile Int’l Corp. v. Milgraum*, 192 F.3d 1362, 1365 (Fed. Cir. 1999) (quoting *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981)).

There is no dispute that Yamada’s written description, apart from Figure 1, is silent with regard to both the problem of fluid expansion within enclosure 2 and any solution to that problem. The Examiner implores us to resort to an implication of Yamada’s disclosure that, although providing no written description of this problem, nonetheless provides a drawing which must have an air gap. However, the Examiner fails to direct our attention to any support in the record, other than Appellant’s own disclosure, that those skill in the art would have known that fluid expansion in Yamada’s control

module is a problem and the solution is to provide an air gap in the cover of the enclosure. Although many fluids are known to expand upon heating, the amount of expansion is dependent on the material and the amount of heat the fluid absorbs. We cannot say, absent evidentiary support, that those skilled in the art would have necessarily expected the Yamada's fluid to expand upon heating by the circuit boards to such an extent as to cause catastrophic damage. Accordingly, a preponderance of the evidence does not support the Examiner's position that Yamada impliedly teaches an air gap.

We are thus presented here with a question that turns on whether a Yamada's Figure 1 alone teaches an air gap. It is well settled that "[d]escription for the purposes of anticipation can be by drawings alone as well as by words." *In re Bager*, 47 F.2d 951, 953 (CCPA 1931). Even "an accidental disclosure, if clearly made in a drawing, is available as a reference." *In re Seid*, 161 F.2d 229, 231 (CCPA 1947); (emphasis added); *see also In re Meng*, 492 F.2d 843, 847 (CCPA 1974) ("We are aware, of course, that a claimed invention may be anticipated or rendered obvious by a drawing in a reference, whether the drawing disclosure be accidental or intentional. But, as the solicitor correctly states, a drawing is available as a reference for all that it teaches a person of ordinary skill in the art."); *In re Wagner*, 63 F.2d 987, 988 (CCPA 1933) ("[I]f a drawing clearly suggests to one skilled in the art the way in which the result sought is accomplished by a later applicant, it is immaterial whether the prior patentee's showing was accidental or intentional.")

Here, we cannot say that Yamada's Figure 1 clearly shows or suggests an air gap at the top of the fluid in the cover sockets. The reliance on two small horizontal hatch lines in the two empty sockets alone for necessarily

teaching that an air gap must be present above these lines is simply speculative. Though the Examiner insists that the presence of an air gap makes the most sense, anticipation cannot rely on such a probabilistic approach—it must be the only possibility, not just the most likely.

*MEHL/Biophile*, 192 F.3d at 1365.

Accordingly, the Examiner’s finding of anticipation of claims 10 and 19 by Yamada is erroneous and cannot be sustained.

*Rejection 3: Obviousness over Yamada in view of Andresen*

Claim 18 depends from claim 10, and further requires that the enclosure includes at least one flexible wall that can expand to accommodate an increase in fluid volume. The Examiner rejects claim 18 under 35 U.S.C. § 103 as unpatentable over Yamada in view of Andresen. Specifically, the Examiner finds that Yamada teaches the control module of claim 10, but fails to teach that the enclosure includes a flexible wall. Final Act. 8. For this feature, the Examiner finds that Andresen teaches an enclosure holding a circuit board and retaining a cooling fluid therein, wherein the enclosure includes a flexible wall for expanding to accommodate an increase in fluid volume. *Id.* The Examiner concludes that it would have been obvious to have provided Yamada’s enclosure with a flexible wall to expand and contract without allowing excessive pressure build up. *Id.*

Appellant argues that the Examiner’s proposed combination of Yamada and Andresen contradicts the Examiner’s interpretation of Yamada as set forth in the anticipation rejection, discussed above. Appeal Br. 4. In Appellant’s view, if Yamada does teach a compressible gas (i.e., air gap), there would be no reason to add a flexible wall. *Id.*

Appellant’s argument is not persuasive of reversible error. As discussed above, we are not convinced that Yamada teaches an air gap. Therefore, our view is that Yamada lacks a feature that would allow for the expansion of fluid 3 in enclosure 2. Andresen teaches an immersion cooling arrangement similar to that of Yamada, but Andresen recognizes that the cooling fluid usually expands as it is heated. Andresen 4:20–26. Andresen teaches that the enclosure must be provided with a means for dealing with the thermal expansion of the fluid, such as a flexible wall (i.e., rubber diaphragm). *Id.* An ordinary artisan would have expected that Yamada’s enclosure would similarly encounter the problem of thermal expansion of the cooling fluid because Yamada, like Andresen, is an immersion cooling arrangement for circuit boards. Therefore, the ordinary artisan would have adopted Andresen’s solution, a flexible wall, to this problem in Yamada with a reasonable expectation of success. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 419–20 (2007) (“One of the ways in which a patent’s subject matter can be proved obvious is by noting that there existed at the time of [the] invention a known problem for which there was an obvious solution encompassed by the patent’s claims.”)

Appellant also argues that there is no “good” location to include a flexible wall in Yamada, given the other structures mounted all about the enclosure. *Id.* However, Appellant fails to explain in any detail why either of the two lateral walls shown in cross-section in Figure 2 could not be flexible. Neither of these walls has any structures mounted thereto. Also, Andresen, like Yamada, includes cooling fins mounted on or part of the cover of the enclosure without interfering with the flexible wall.

Accordingly, Appellant has not identified reversible error in the Examiner's obviousness rejection of claim 18 over the combination of Yamada and Andresen. Because claim 18 depends from claim 10, broader claim 10 must also have been obvious. *See Ormco Corp. v. Align Tech., Inc.*, 498 F.3d 1307, 1319 (Fed. Cir. 2007); *see also In re Muchmore*, 433 F.2d 824, 825 (CCPA 1970) ("Since we agree with the board's conclusion of obviousness as to these narrow claims, the broader claims must likewise be obvious."); *Ex Parte Janakiraman*, 2009 WL 1270322 (BPAI 2009) ("An affirmance of a conclusion of obviousness of an independent claim may be made when based on a prior determination of obviousness of a corresponding dependent claim.") Therefore, we extend the Examiner's obviousness rejection of claim 18 to include independent claim 10.

We further note that Andresen teaches another solution to the problem of thermal expansion of the cooling fluid, specifically an air gap above the cooling fluid, wherein the fluid is a liquid and the air is a compressible gas. Again, Andresen 4:38–43; Fig. 4B. Similarly to the obviousness modification of Yamada with a flexible wall, the ordinary artisan would have adopted Andresen's alternative solution, an air gap with a compressible gas, to solve the same problem in Yamada with a reasonable expectation of success.

We, therefore, sustain the Examiner's obviousness rejection of claim 18, but extend this rejection to claims 10 and 19. Because our inclusion of claim 19 in this rejection relies on additional findings beyond those of the Examiner, we designate this to be a new ground of rejection.

*Rejection 2: Obviousness over Yamada in view of Chou*

Independent claim 17 recites a control module similar to that of claim 10, but including a pressure relief valve allowing fluid out of the enclosure to a holding chamber, and the holding chamber communicating to an inlet allowing fluid back into the enclosure once the fluid has cooled. The Examiner rejects claims 17 under 35 U.S.C. § 103 as unpatentable over Yamada in view of Chou. Specifically, the Examiner finds that Yamada teaches the control module substantially as recited in claim 17, but fails to teach a pressure relief valve, holding chamber, and inlet. Final Act. 7. For this feature, the Examiner finds that Chou teaches a cooling system including a pressure relief valve to relieve fluid pressure in an enclosure and communicates fluid to a holding chamber which communicates with an inlet allowing fluid to pass back into the enclosure upon being sufficiently cooled. *Id.* The Examiner concludes that it would have been obvious to provide Yamada with a pressure relief valve and fluid return system as taught in Chou in order to provide a safety feature in Yamada to prevent excessive pressure buildup which could damage the device or its components, while returning the fluid back to the enclosure to protect other components. *Id.* at 8.

Appellant argues that there is no apparent reason that Yamada would want a pressure relief valve in the first place. Appeal Br. 4. Appellant also contends that Chou's cooling system is far too complex to incorporate into Yamada when there is no showing that Yamada has any problem requiring remedy. *Id.*

We agree with Appellant that the Examiner has failed to identify why one of ordinary skill in the art would have looked to Chou to address a problem that Yamada fails to recognize. However, we note that, as discussed

above, Andresen teaches the problem of thermal expansion of the cooling fluid in the same art as Yamada, and also teaches two specific solutions to that problem. Andresen also teaches that other schemes for accommodating the thermal expansion of the cooling fluid may be envisioned, thus recognizing that other solutions may be utilized. Andresen 4:44–45. Chou similarly recognizes the problem of excessive pressure buildup due to the increasing temperature of the cooling fluid, and provides another solution to this problem via a pressure relief valve, a holding chamber, and a fluid return system. Chou ¶¶ 7, 17, and 18. In light of Andresen’s recognition of the problem in the same art as Yamada, we agree with the Examiner that it would have been obvious to have provided Yamada’s control module with a pressure relief valve, a holding chamber, and a fluid return system as an additional solution to this problem. Merely because Chou’s solution is complex is insufficient reason to hold otherwise absent some reason why such a modification to Yamada was beyond the ordinary skill in the art or would not have had a reasonable expectation of success. Appellant fails to argue, much less persuasively demonstrate, either of these possibilities. Accordingly, we sustain the Examiner’s obviousness rejection of claim 17 over the combination of Yamada and Chou, in light of Andresen. Because our reliance on Andresen in this rejection is new, we designate this a new ground of rejection.

*Rejection 4: Obviousness over Beaulieu in view of Chou*

Independent claim 1 recites a cooling arrangement comprising a circuit board and a plurality of electronic components, an enclosure for retaining a fluid around at least one electronic component, a pressure relief

valve allowing fluid out of the enclosure to a holding chamber, and the holding chamber communicating to an inlet allowing fluid back into the enclosure once the fluid has cooled.

The Examiner rejects claims 1 and 21 under 35 U.S.C. § 103 as unpatentable over Beaulieu in view of Chou. Specifically, the Examiner finds that Beaulieu teaches the cooling arrangement substantially as recited in claim 1, but fails to teach a holding chamber to receive fluid from the pressure relief valve and an inlet to recycle fluid from the holding chamber back to the enclosure. Final Act. 5–6. For this feature, the Examiner finds that Chou teaches a cooling system including a pressure relief valve to relieve fluid pressure in an enclosure and communicates fluid to a holding chamber which communicates with an inlet allowing fluid to pass back into the enclosure upon being sufficiently cooled. *Id.* The Examiner concludes that it would have been obvious to provide Beaulieu with a pressure relief valve and fluid return system as taught in Chou in order to provide a safety feature in Yamada to allow fluid released from the pressure relief valve to be recycled back to the enclosure. *Id.* at 6.

Appellant argues that although Beaulieu discloses a pressure relief valve may be included, if desired, there is no discussion why such might be desired, nor is there any apparent indication of a need for such a valve in Beaulieu. Appeal Br. 3–4. Appellant also argues that Beaulieu is providing cooling to a much different and smaller system than Chou. *Id.* at 4. As such, Appellant contends that there is no proper motivation to combine and drastically complicate Beaulieu. *Id.*

Appellant’s arguments are not persuasive of reversible error. There is no dispute that Beaulieu teaches the inclusion of a pressure relief valve may

be desirable. Although Appellant urges that there is no discussion why such a valve might be desired, and no indication of a need for this valve, we disagree. By its very name, a pressure relief valve is a valve designed to relieve pressure within a space. In Beaulieu, clearly the enclosure provides the space and the pressure relief valve would be desired if the pressure in the enclosure is either problematic in any way or excessive.

We further note that Beaulieu also teaches that there should be an air space above the liquid coolant to allow gas compression from increased temperatures of the package in operation. Beaulieu 5:31–36. Thus, Beaulieu recognizes the same problem that Appellant is addressing.

Chou similarly recognizes the problem of excessive pressure buildup due to the increasing temperature of the cooling fluid, and provides another solution to this problem via a pressure relief valve, a holding chamber, and a fluid return system. Chou ¶¶ 7, 17, and 18. In light of Beaulieu’s recognition of the problem, we agree with the Examiner that it would have been obvious to have provided Beaulieu’s cooling arrangement with a holding chamber and a fluid return system to enable recycling of the coolant liquid. Merely because Chou’s solution is complex is insufficient reason to hold otherwise absent some reason why such a modification to Beaulieu was beyond the ordinary skill in the art or would not have had a reasonable expectation of success. Appellant fails to argue, much less persuasively demonstrate, either of these possibilities.

Appellant does not separately argue dependent claim 21. Accordingly, we sustain the Examiner’s obviousness rejection of both claims 1 and 21 over the combination of Beaulieu and Chou.

### CONCLUSION

Upon consideration of the record, and for the reasons given above and in the Final Office Action and the Examiner's Answer:

the rejection of claims 10 and 19 under 35 U.S.C. § 102(a)(1) as anticipated by Yamada is *reversed*;

the rejection of claim 17 under 35 U.S.C. § 103 as unpatentable over Yamada in view of Chou, is modified to include Andresen, and is *affirmed*, but designated a new ground of rejection;

the rejection of claim 18 under 35 U.S.C. § 103 as unpatentable over Yamada in view of Andresen is extended to include claims 10 and 19, and is *affirmed*, but designated a new ground of rejection as to claim 19; and

the rejection of claims 1 and 21 under 35 U.S.C. § 103 as unpatentable over Beaulieu in view of Chou is *affirmed*.

### DECISION SUMMARY

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed	New Ground
10, 19	102(a)(1)	Yamada		10, 19	
17	103	Yamada, Chou, Andresen	17		17
10, 18, 19	103	Yamada, Andresen	10, 18		19
1, 21	103	Beaulieu, Chou	1, 21		
<b>Overall Outcome</b>			1, 10, 18, 21		17, 19

### TIME PERIOD FOR RESPONSE

This decision contains a new ground of rejection pursuant to 37 CFR § 41.50(b) (effective September 13, 2004, 69 Fed. Reg. 49960 (August 12,

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2004), 1286 Off. Gaz. Pat. Office 21 (September 7, 2004)). 37 CFR § 41.50(b) provides “[a] new ground of rejection pursuant to this paragraph shall not be considered final for judicial review.”

37 CFR § 41.50(b) also provides that Appellant, WITHIN TWO MONTHS FROM THE DATE OF THE DECISION, must exercise one of the following two options with respect to the new ground of rejection to avoid termination of the appeal as to the rejected claims:

(1) *Reopen prosecution*. Submit an appropriate amendment of the claims so rejected or new evidence relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the proceeding will be remanded to the examiner. . . .

(2) *Request rehearing*. Request that the proceeding be reheard under § 41.52 by the Board upon the same Record. . . .

Further guidance on responding to a new ground of rejection can be found in the Manual of Patent Examining Procedure § 1214.01.

AFFIRMED  
37 C.F.R. § 41.50(b)