UNITED STATES PATENT AND TRADEMARK OFFICE

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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 BYOUNG-HOON KIM, DAE WON LEE, BYEONGWOO
KANG, BONG HOE KIM, and YUJIN NOH

_____

Appeal 2022-002372
Reissue Application 15/369,177
Patent 9,167,573
Technology Center 3900

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Before JOHN A. JEFFERY, ERIC B. CHEN, and JENNIFER L.
McKEOWN, *Administrative Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

Under 35 U.S.C. § 134(a), Appellant[1] appeals from the Examiner's
decision to reject claims 1–5 and 14. We have jurisdiction under
35 U.S.C. § 6(b).

We AFFIRM.

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[1] We use the word "Appellant" to refer to "applicant" as defined in 37
C.F.R. § 1.42. Appellant identifies the real party in interest as LG
Electronics, Inc. Appeal Br. 3.

STATEMENT OF THE CASE

Appellant seeks to reissue U.S. Patent 9,167,573 B2 ("'573 patent") directed to transmitting a reference signal in a wireless communication system using multiple transmit antennas. In one implementation, user equipment (UE) can receive a single cyclic shift for a single transmit antenna, and derive cyclic shifts with respect to other transmit antennas. *See* '573 patent Abstract; col. 12, ll. 49–67. Claim 1 is illustrative:

> 1. A method of transmitting a signal in a mobile communication system, the method performed in a single user equipment (UE) and comprising:
>
> receiving, by a single user equipment (UE), a control information value via a physical downlink control channel (PDCCH);
>
> determining, by the single UE, one cyclic shift pair among available cyclic shift pairs based on the control information value, wherein each pair of the available cyclic shift pairs comprises a first cyclic shift n_1 for a first transmit antenna and a second cyclic shift n_2 for a second transmit antenna, wherein the n_1 and n_2 contained in one pair of the available cyclic shift pairs are different from cyclic shift n_1 and n_2 contained in another pair of the available cyclic shift pairs, respectively, and the available cyclic shift pairs are predetermined such that an interval between the n_1 and n_2 in each pair of the available cyclic shift pairs is set to a same value;
>
> generating, by the single UE, a first reference signal by applying the first cyclic shift n_1 of one cyclic shift pair and generating a second reference signal by applying the second cyclic shift n_2, wherein the single UE obtains the second cyclic shift n_2 by shifting the first cyclic shift n_1 by the interval that is the same for each of the available cyclic shift pairs; and
>
> transmitting, in response to the control information, the reference signals through a plurality of transmit antennas including a first transmit antenna and a second transmit antenna

using a plurality of cyclic shifts including at least one pair of available cyclic shift pairs, each pair of the available cyclic shift pairs comprising a first cyclic shift n_1 for the first transmit antenna and a second cyclic shift n_2 for the second transmit antenna, the plurality of transmit antennas being used by the single UE, wherein the first cyclic shift n_1 and the second cyclic shift n_2 in the single UE are determined based on the control information, n_1 and n_2 contained in one pair of the available cyclic shift pairs are different from cyclic shift n_1 and n_2 contained in another pair of the available cyclic shift pairs, respectively, and an interval between the n_1 and n_2 in each pair of the available cyclic shift pairs is set to a same value.

THE REJECTIONS

The Examiner rejected claims 1–5 and 14 under 35 U.S.C. § 112, first paragraph as failing to comply with the written description requirement. Final Act. 10–14.[2]

The Examiner rejected claim 1 under 35 U.S.C. § 102(e) as anticipated by Pajukoski (US 2009/0303978 A1; published Dec. 10, 2009). Final Act. 14–17.

The Examiner rejected claims 1–5 and 14 under 35 U.S.C. § 103 as unpatentable over Pajukoski and Bertrand (US 2008/0080472 A1; published Apr. 3, 2008). Final Act. 17–20.

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[2] Throughout this opinion, we refer to (1) the Final Rejection mailed September 14, 2020 ("Final Act."); (2) the Appeal Brief filed March 12, 2021 ("Appeal Br."); and (3) the Examiner's Answer mailed June 14, 2021 ("Ans.").

THE WRITTEN DESCRIPTION REJECTION

Regarding independent claim 1, the Examiner finds the original disclosure does not show that Appellant possessed (1) the recited determining step, and (2) a limitation from the recited generating step, namely the single UE obtaining the second cyclic shift n_2 by shifting the first cyclic shift n_1 by the interval that is the same for each available cyclic shift pair, where both limitations (1) and (2) are labeled collectively as the "Determining Function." *See* Final Act. 10–14. According to the Examiner, the recited "Determining Function," which is not in the '573 patent's claims, is merely directed to a result without reciting any acts to achieve that result, much less recite how the result is achieved. Final Act. 10–13. The Examiner adds that claim 1 effectively recites any way to achieve the result, and the '573 patent lacks an algorithm to achieve that result. *See* Final Act. 12–14.

Appellant argues that the Specification evidences possession of the elements of recited determining step, including the (1) control information value; and (2) available cyclic shift pair determination based on this value, particularly in view of the Specification's describing a complete procedure for carrying out the determining step. *See* Appeal Br. 8–15. According to Appellant, the Specification describes an example where eight cyclic shift values, namely 0 to 7, are defined. *Id.* at 10. Appellant explains that because two transmit antennas are used in this example, two cyclic shifts among these eight cyclic shifts are needed, where (1) a first cyclic shift is used for transmitting a reference signal on a first antenna, and (2) a second cyclic shift is used to transmit the reference signal on a second antenna. *Id.*

Because these two cyclic shifts are said to make up a pair of cyclic shifts, Appellant contends that ordinarily skilled artisans would have understood that given eight possible cyclic shifts, at least four cyclic shift pairs are available to the UE. *Id.* Appellant adds that, to minimize interference, the four available cyclic shift pairs would be represented by (0,4), (1,5), (2,6), and (4,7), and that the one cyclic shift pair determined by the UE can be represented by any one of these pairs, for example (0,4). *Id.* at 10–11. Therefore, the UE is said to determine one cyclic shift pair based on the received cyclic shift in addition to a specific rule. *Id.* at 11.

ISSUE

Under § 112, first paragraph, has the Examiner erred in rejecting claims 1–5 and 14 by finding that the recited subject matter fails to comply with the written description requirement? This issue turns on whether Appellant's original disclosure conveys with reasonable clarity to ordinarily skilled artisans that Appellant possessed the claimed invention as of the filing date.

ANALYSIS

As noted in our issue statement, the key question before us is whether Appellant's *original disclosure* conveys with reasonable clarity Appellant's possession of the claimed invention as of the filing date. We emphasize the term "original disclosure" here, for the disclosure of '573 patent is not the best source for determining whether the written description is satisfied, for it

does not necessarily reflect its *original disclosure*, namely that of its underlying application.

As indicated on its front page, the '573 patent's underlying Application 13/857,030 was filed on April 4, 2013, and is a continuation of Application 12/458,216 that was filed on July 2, 2009. The parent '216 application is, therefore, the original disclosure of the '573 patent and, thus, the appropriate source for determining whether Appellant possessed the '573 patent's claimed invention when the '216 application was filed.

Turning to the '573 patent's claimed invention, claim 1 recites, in pertinent part, that a single UE determines one cyclic shift pair among available cyclic shift pairs based on a control information value, where each pair comprises first and second cyclic shifts for respective first and second transmit antennas.

As noted on page 22 of the '216 application, a key constraint in the disclosed system is that a base station (BS) can transmit *only* a *single* cyclic shift to a UE for a *single* transmit antenna. The UE, however, can *derive* cyclic shifts with respect to *other* transmit antennas according to a specific rule. For example, if (1) a set of available cyclic shifts is a whole number ranging from 0 to 7, and (2) the UE uses two transmit antennas, the UE can set the cyclic shift for the first and second antennas as "2" and "3," respectively.

The '216 application explains, however, that a "sufficiently large" cyclic shift interval is advantageous for channel estimation to minimize interference in a multi-path channel. '216 Appl'n at 22. To this end, the pairs (0, 4), (1, 5), (2, 6), and (3, 7) can be set as available cyclic shift pairs.

Id. Therefore, when the UE uses two transmit antennas, both cyclic shift values of the cyclic shift pair are used. *Id.*

Given this functionality, ordinarily skilled artisans would have understood that a single UE can determine one cyclic shift pair, for example (0, 4), among available cyclic shift pairs, namely (0, 4), (1, 5), (2, 6), and (3, 7), where this determination is based at least partly on a "control information value," namely the value of the single cyclic shift that the UE receives from the base station on a *control* channel, namely the Physical Downlink Control Channel (PDCCH). *See id.* at 21–22.

Ordinarily skilled artisans would have also understood from page 22 of the '216 application's disclosure that the available cyclic shift pairs, namely (0, 4), (1, 5), (2, 6), and (3, 7), not only have different cyclic shift values for each pair, but the pairs are also predetermined such that the interval between each pair's values is set to the same value, namely four. *See id.* Given this fixed interval that is common to all pairs, the UE effectively obtains the second cyclic shift for each pair by shifting the first cyclic shift by that interval. *See id.*

That is, ordinarily skilled artisans would have understood from the '216 application that when the first cyclic shift has a value of zero, the second cyclic shift is obtained by shifting the first cyclic shift's value by the interval of four to obtain the value of four for the second cyclic shift, thus yielding the pair (0, 4). *See id.* Similarly, when the first cyclic shift has a value of one, the second cyclic shift is obtained by shifting the first cyclic shift's value by the interval of four to obtain the value of five for the second cyclic shift, thus yielding the pair (1, 5), etc. *See id.*

That neither the '573 patent's claims nor the associated disclosure in the '216 application explains specifically how, or by what means, the UE achieves this functionality as the Examiner indicates (Final Act. 11–13; Ans. 8–9, 12–13) is not fatal to possession. It is well settled that the written description requirement under § 112 does not demand any particular form of disclosure or require a verbatim recitation. *See Ariad Pharms., Inc. v. Eli Lilly and Co.*, 598 F.3d 1336, 1352 (Fed. Cir. 2010). Notably, a patent application disclosure is written for a person of skill in the art who, as Appellant indicates, is one with at least a few years of experience with the relevant industry standards, such as the 3GPP standards, where those standards include 4G (LTE) standards. *See* Appeal Br. 8 (noting this skill level). Such a person not only has a relatively high level of skill and expertise in electrical engineering and communications technology, but also comes to the patent and its underlying application with the knowledge of what has come before. *See LizardTech, Inc. v. Earth Resource Mapping, Inc.*, 424 F.3d 1336, 1345 (Fed. Cir. 2005). Therefore, it is unnecessary to spell out every detail of the invention in the Specification; only enough must be included to convince a person of ordinary skill in the art that the inventor possessed the invention and to enable such a person to make and use the invention without undue experimentation. *Id.*

That is the case here, at least with respect to the written description requirement of § 112 on which the rejection is based. To the extent the Examiner's rejection implicates the *enablement* requirement of that statute, we decline to speculate in that regard here, for the rejection is based solely on the claimed invention's failure to comply with the *written description*

requirement, not the *enablement* requirement which is a separate and distinct requirement under § 112. *See* Final Act. 10–14; *see also Ariad*, 598 F.3d at 1344–49; Manual of Patent Examining Procedure (MPEP) § 2164 (9th ed. rev. 10.2019 June 2020) (distinguishing the written description and enablement requirements). Nor will we speculate here in the first instance on appeal whether the '216 application teaches ordinarily skilled artisans how to make and use the *full scope* of the '573 patent's claimed invention without undue experimentation under *In re Wright*, 999 F.2d 1557, 1561 (Fed. Cir. 1993), despite the Examiner's apparent implications to the contrary. *See* Final Act. 12 (noting that the '573 patent's claim language "is directed to *any* way of getting the claimed result") (emphasis added); *see also* Ans. 9 (finding that the recited determining function is directed to *all ways* of achieving the claimed results). To the extent a scope of enablement analysis applies here, we leave that fact-intensive analysis, which includes considering all relevant factors under *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988) to determine whether any necessary experimentation would have been undue, to the Examiner after this decision.[3]

But what is apparent from the UE's cyclic shift pair determination functionality on page 22 of the '216 application is that the second cyclic

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[3] Determining whether any necessary experimentation is undue involves considering many relevant factors including, but not limited to: (1) the breadth of the claims; (2) the nature of the invention; (3) the state of the prior art; (4) the level of one of ordinary skill; (5) the level of predictability in the art; (6) the amount of direction provided by the inventor; (7) the existence of working examples; and (8) the quantity of experimentation needed to make or use the invention based on the content of the disclosure. *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988).

shift is determined by merely adding four to the value of the first cyclic shift.
Although there may be many ways to implement this functionality via a
processor or otherwise, the fact that it is a simple addition of two numbers—
adding four to the first cyclic shift value—underscores that implementing
this elementary summation via the UE's processor would have been well
within the level of ordinarily skilled artisans.

To be sure, although the written description requirement does not
demand any particular form of disclosure or require a verbatim recitation, a
description that merely renders the invention obvious does not satisfy the
requirement. *Ariad*, 598 F.3d at 1352. That exception, however, does not
apply here. Although the '216 application does not use the express
terminology in the '573 patent's recited determining and generating steps, it
is nonetheless apparent from the '216 application that the UE performs the
recited steps for the reasons noted previously.

On this record, then, we find Appellant's original disclosure conveys
with reasonable clarity to ordinarily skilled artisans that Appellant possessed
the claimed invention as of the filing date.

Therefore, we are persuaded that the Examiner's written description
rejection of claims 1–5 and 14 is erroneous.

THE ANTICIPATION REJECTION

Regarding independent claim 1, the Examiner finds that Pajukoski
discloses every recited element including a single UE that determines one
cyclic shift pair among available cyclic shift pairs based on a control
information value, where each pair comprises first and second cyclic shifts

for respective first and second transmit antennas. Final Act. 10–14.
According to the Examiner, the functionality associated with Pajukoski's
Figure 2 shows that first and second channels can use consecutive shifts
where, for example, a first shift "6" is signaled corresponding to j=4, and a
second shift "7" is applied by shifting the first shift. Final Act. 16. The
Examiner adds that the second shift is obtained by shifting the interval that is
the same for each available cyclic shift pair. Final Act. 17.

Appellant argues that Pajukoski does not disclose a UE determining
one cyclic shift pair among available cyclic shift pairs, where the available
cyclic shift pairs are predetermined such that an interval between the n_1 and
n_2 of each pair of available cyclic shift pairs is set to a same value as
claimed. Appeal Br. 16–18. According to Appellant, the Examiner's
reliance on Pajukoski's Figure 2 and paragraph 55 is misplaced, for none of
the disclosed embodiments disclose multiple available cyclic shift pairs,
much less the same predetermined fixed interval between cyclic shifts
associated with every available pair as claimed. *Id.* Appellant emphasizes
that not only is Pajukoski's cyclic shift index not a cyclic shift, the
difference between those index numbers is just a mathematical difference
between two abstract numbers—not an actual interval between the indices'
associated cyclic shifts. *Id.*

ISSUE

Under § 102, has the Examiner erred in rejecting claim 1 by finding
that Pajukoski discloses the recited determining and generating steps?

ANALYSIS

As noted above, claim 1 recites, in pertinent part, that a single UE determines one cyclic shift pair among available cyclic shift pairs based on a control information value, where each pair comprises (1) a first cyclic shift n_1 for a first transmit antenna, and (2) a second cyclic shift n_2 for a second transmit antenna, where n_1 and n_2 in one pair of available pairs are different from n_1 and n_2 in another pair of the available pairs. The claim also recites that the available cyclic shift pairs are predetermined such that an interval between cyclic shifts in each pair of the available pairs is set to a same value. The claim adds that the UE obtains the second cyclic shift by shifting the first cyclic shift by the interval that is the same for each of the available pairs.

On this record, we see no error in the Examiner's reliance on the functionality of Pajukoski's Figure 2 for anticipating these limitations. Pajukoski's Figure 2 is a table showing indices for CQI channel and cyclic shifts of those channels. Pajukoski ¶ 44. As explained in paragraph 55, radio resources on which CQI is signaled are indicated as the jth CQI channel having cyclic shifts (CS) given by the CS index.

In one embodiment, the eNodeB signals only one value for j and *different ones* of the UE antennas use *consecutive* shift resources starting from the allocated cyclic shift resources. Pajukoski ¶ 55. For example, when the eNodeB signals j=4, the UE's first antenna uses the fourth CQI channel with cyclic shift index "6," and the UE's second antenna uses the fourth CQI channel with cyclic shift index "7." *Id.*

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Although Pajukoski does not label these cyclic shift indices, namely "6" and "7," as a cyclic shift pair when j=4, these two indices nonetheless collectively constitute an available *pair* of cyclic shift indices—a cyclic shift index pair that fully meets the recited "cyclic shift pair" under the term's broadest reasonable interpretation.

That is, nothing in the claim when read in light of the Specification precludes the recited "cyclic shift" from including a cyclic shift *index*. Nor does the claim or Specification preclude the recited "cyclic shift pair" from including a "cyclic shift index pair." We reach these findings emphasizing the recited terms' scope and breadth, as well as the open-ended term "comprising" in the claim's preamble that does not preclude additional unrecited elements, including the term "index" modifying the term "cyclic shift." *See Genentech, Inc. v. Chiron Corp.*, 112 F.3d 495, 501 (Fed. Cir. 1997) ("'Comprising' is a term of art used in claim language which means that the named elements are essential, but other elements may be added and still form a construct within the scope of the claim.") (citation omitted). Notably, a cyclic shift index is not merely an "abstract" number as Appellant contends (Appeal Br. 17), but rather is a *cyclic shift* index that fully meets the recited "cyclic shift" as noted above. That cyclic shifts are *given* by a cyclic shift index as noted in Pajukoski's paragraph 55 only underscores this point.

In short, the scope and breadth of the term "cyclic shift pair" does not preclude a "cyclic shift *index* pair." To the extent Appellant contends that the terms "cyclic shift" and "cyclic shift pair" in claim 1 somehow exclude

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cyclic shift indices (*see* Appeal Br. 16–18), such arguments are unavailing
and not commensurate with the scope of the claim.

Given Pajukoski's technique in paragraph 55 described above,
Pajukoski discloses determining one cyclic shift pair from available cyclic
shift pairs. As Pajukoski's paragraph 55 explains, when the eNodeB signals
j=4, the UE's first antenna uses the fourth CQI channel with cyclic shift
index "6," and the UE's second antenna uses the fourth CQI channel with
cyclic shift index "7." Notably, with this technique, *different ones* of the UE
antennas use *consecutive* shift resources starting from the allocated cyclic
shift resources. Pajukoski ¶ 55.

That is, by determining the cyclic shift indices *consecutively* with
Pajukoski's technique in paragraph 55, when j=4, one cyclic shift index pair
(6, 7) is determined among available cyclic shift index pairs, namely those
associated with various values of "j" shown in Pajukoski's Figure 2: (1) the
cyclic shift index pair (0, 1) when j=1; (2) the cyclic shift index pair (2, 3)
when j=2; (3) the cyclic shift index pair (4, 5) when j=3; (4) the cyclic shift
index pair (6, 7) when j=4; (5) the cyclic shift index pair (8, 9) when j=5;
and (6) the cyclic shift index pair (10, 11) when j=6.

These available cyclic shift index pairs in Pajukoski's Figure 2,
namely (0, 1), (2, 3), (4, 5), (6, 7), (8, 9), and (10, 11), are effectively
predetermined such that an interval between the n_1 and n_2 of each pair is set
to the same whole number value, namely one. Moreover, by determining the
cyclic shift indices *consecutively* with Pajukoski's technique in paragraph
55, the second cyclic shift index value n_2, such as "7," is obtained by shifting
the first cyclic shift index value n_1, such as "6," by the same whole number

interval, namely one. *Accord* Final Act. 17 (noting that the shifts in Pajukoski's Figure 2 are consecutive—the same amount between channels); Ans. 22–23 (noting that the term "interval" simply means the difference between two numbers); Ans. 32 (noting that Pajukoski shifts the first cyclic shift such that second shift must be "adjacent and *one offset* shift from the first") (emphasis added).

That Pajukoski may not expressly state the value of this interval between cyclic shift index values, namely one, as Appellant contends (Appeal Br. 17), is of no consequence here. That is, despite not identifying an interval explicitly, a whole number interval, namely one, is nonetheless readily apparent from Pajukoski's Figure 2 and its cyclic shift index pairs resulting from the *consecutive* shifts applied to the cyclic shift indices for various values of "j" using the technique in paragraph 55 noted above. To the extent Appellant contends that the recited "interval" cannot be the difference between two numbers as the Examiner indicates (Ans. 22–23), we disagree, for such an argument is not commensurate with the scope of the claim that does not preclude the Examiner's construction. Nor is there any persuasive evidence on this record to prove otherwise.

Therefore, we are not persuaded that the Examiner erred in rejecting claim 1 as anticipated by Pajukoski.

THE OBVIOUSNESS REJECTION

Regarding independent claim 1, the Examiner finds that Pajukoski discloses every recited element, but nonetheless additionally cites Bertrand in concluding that predetermining the available cyclic shift pairs such that an

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interval between n_1 and n_2 of each pair of the available pairs is set to the same value as claimed would have been obvious. Final Act. 17–19.

Appellant argues that Bertrand does not expressly or inherently disclose (1) a UE determining one cyclic shift pair among available cyclic shift pairs, where the available cyclic shift pairs are predetermined such that an interval between the n_1 and n_2 in each pair of the available cyclic shift pairs is set to a same value, or (2) a UE obtaining the second cyclic shift, of the one determined cyclic shift pair, by shifting the first cyclic shift by the interval that is the same for each of the available cyclic shift pairs. Appeal Br. 19–20. According to Appellant, not only does a single UE in Bertrand fail to determine one cyclic shift pair among available cyclic shift pairs, Bertrand fails to disclose that each pair has the same interval between the first and second cyclic shifts that make up each pair as claimed. Appeal Br. 19–20.

<div align="center">ISSUE</div>

Under § 103, has the Examiner erred in rejecting claim 1 by finding that Pajukoski and Bertrand collectively would have taught or suggested the available cyclic shift pairs are predetermined such that an interval between n_1 and n_2 of each pair of the available cyclic shift pairs is set to the same value ("the cyclic shift pair interval limitation")?

<div align="center">ANALYSIS</div>

We begin by emphasizing that, as noted previously, Pajukoski discloses every recited element of claim 1, including the disputed cyclic shift

pair interval limitation in our issue statement above. Indeed, the Examiner reiterates this finding as the principal basis for the obviousness rejection. *See* Final Act. 17–18 (noting that the Examiner's *principal* position in the obviousness rejection is that Pajukoski discloses the cyclic shift pair interval limitation inherently). Given this principal reliance on Pajukoski, Bertrand is merely cumulative to Pajukoski here, at least with respect to claim 1, for anticipation is the epitome of obviousness. *See In re McDaniel*, 293 F.3d 1379, 1385 (Fed. Cir. 2002).

For that reason, and for the reasons noted previously, we are unpersuaded of error in the Examiner's obviousness rejection, for we may rely on fewer references than the Examiner in affirming a multiple-reference rejection under 35 U.S.C. § 103. *See In re Bush*, 296 F.2d 491, 495–96 (CCPA 1961) (noting that despite the Examiner's obviousness rejection being based on two references, the Board did not enter a new ground of rejection by relying only on one of the cited references); *accord* MPEP § 1207.03(a)(II) (citing *Bush* for this proposition).

We, therefore, need not address the Examiner's alternative reliance on Bertrand for teaching the the disputed cyclic shift pair interval limitation, for claim 1 would have been obvious over Pajukoski alone for the reasons noted previously.

Therefore, we are not persuaded that the Examiner erred in rejecting claim 1, and claims 2–5 and 14 not argued separately with particularity.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1–5, 14	112, first paragraph	Written Description		1–5, 14
1	102(e)	Pajukoski	1	
1–5, 14	103	Pajukoski, Bertrand	1–5, 14	
Overall Outcome			1–5, 14	

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)(1).

AFFIRMED