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THE MARBURY LAW GROUP, PLLC
11800 SUNRISE VALLEY DRIVE
15TH FLOOR
RESTON, VA 20191

EXAMINER
PADGETT, MARIANNE L

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte PAUL SHUFFLEBOTHAM, ROBERT MARTINSON, HEINRICH VON BUNAU, KEVIN LYNCH, and MATHEW SHEFFIELD

Appeal 2019-005928
Application 15/060,300
Technology Center 1700

Before LINDA M. GAUDETTE, FRANCISCO C. PRATS, and LILAN REN, *Administrative Patent Judges.*

GAUDETTE, *Administrative Patent Judge.*

DECISION ON APPEAL[1]

The Appellant[2] appeals under 35 U.S.C. § 134(a) from the Examiner's decision finally rejecting claims 1 and 4–8.[3]

We AFFIRM.

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[1] This Decision includes citations to the following documents: Specification filed Mar. 3, 2016 ("Spec."); Final Office Action dated Nov. 5, 2018 ("Final"); Appeal Brief filed Mar. 5, 2019 ("Appeal Br."); Examiner's Answer dated June 3, 2019 ("Ans."); and Reply Brief filed Aug. 5, 2019 ("Reply Br.").

[2] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. The Appellant identifies the real party in interest as Beijing Apollo Ding Rong Solar Technology Co. Appeal Br. 2.

[3] We have jurisdiction under 35 U.S.C. § 6(b).

CLAIMED SUBJECT MATTER

"The present invention is directed generally to a vacuum deposition apparatus and method . . . ." Spec. ¶ 1. In accordance with the inventive method, thin-film solar cells are made by continuously moving a web foil substrate layer "through one or more vacuum deposition chambers (referred to as process chambers) at a relatively constant rate without stopping while the web is fed from air into the process chambers under vacuum and while the web from one roll is spliced to the web from another roll." *Id.* ¶ 17. The apparatus used in the invention, as shown in Figure 2, includes process modules 40 (e.g., 40a–40d) positioned between input module 30 (e.g., a load module) and output module 34 (e.g., an unload module). *Id.* ¶ 20. A web substrate 12, such as a metal or polymer web foil, is moved throughout the apparatus by rollers 38, or other devices. *Id.* ¶ 21. Input module 30 includes input spool 32 on which substrate material roll 50 is placed, web splicing device 56, and accumulator 58. *Id.* ¶ 23. Web splicing device 56 splices a new roll's leading edge 54 and the overlapped old roll's trailing edge 52. *Id.* ¶ 24; *see* Fig. 4. Accumulator 58 allows substrate 12 to continue moving through process modules 40 at a relatively constant rate during splicing. *Id.* ¶ 25. More specifically accumulator 58 includes first and second sets of rollers 60, 62 that are interspaced and movable relative to one another so as to adjust the path length that substrate 12 must follow when travelling between entrance point 64 and exit point 66. *Id.* ¶ 26.

Claim 1, reproduced below, is illustrative of the claimed subject matter:

> 1. A layer deposition method, comprising:
>
> passing a first web substrate from an input module not under vacuum, through independently isolated, connected

process modules under vacuum, and to an output module not under vacuum, such that the first web substrate continuously extends from the input module to the output module while passing through an accumulator of the input module and the process modules;

wherein during the passing, the method further comprises:

removing a trailing edge of the first web substrate from an input spool in the input module;

mounting a second web substrate on the input spool;

attaching the trailing edge of the first web substrate to a leading edge of the second web substrate;

changing a length of a path of the first web substrate through the accumulator during the removing, the mounting and the attaching such that the first web substrate passes through the process modules during the removing, the mounting and the attaching without stopping; and

depositing, by sputtering in respective ones of the process modules, a first electrode, a copper indium gallium selenide p-type absorber layer, an n-type semiconductor layer and a transparent second electrode on the web substrate to form a solar cell, as the first web substrate moves through the process modules during the removing, the mounting and the attaching.

Appeal Br. 13 (Claims App.).

REJECTIONS

1. Claims 1 and 4–7 are rejected under 35 U.S.C. § 103(a) over Saida (US 4,763,601, iss. Aug. 16, 1988) and Kissell (US 4,460,430, iss. July 17, 1984) in view of Hollars (US 2009/0145746 Al, pub. June 11, 2009) and optionally Krengel (US 5,474,227, iss. Dec. 12, 1995).

2. Claim 8 is rejected under 35 U.S.C. § 103(a) over Saida and Kissell in view of Hollars and Kyoto Kikai (GB 1,069,862), and optionally

Krengel and Alexander (US 2,963,001, iss. Dec. 6, 1960) or Alexander (US 1,713,485, iss. May 14, 1929).

OPINION

As to the rejection of claims 1 and 4–7, the Appellant explicitly states that "dependent claims 2 and 4–7 stand or fall together with independent claim 1." Appeal Br. 4. The Appellant argues, in general, that the record evidence does not support the Examiner's finding that the ordinary artisan would have modified Saida's process to utilize an accumulator as taught by Kissell. *See generally id.* at 4–9. The Appellant's more specific arguments regarding the Examiner's combination of Saida and Kissell, discussed in detail below, are unpersuasive for the reasons given in the Final Office Action (e.g., pp. 3–8, 16–17), the Answer (e.g., pp. 3–8), and below.

Saida discloses "[a] continuous composite coating apparatus for coating a continuous strip." Saida Abstract. The apparatus includes at least two treating zones (e.g., a plasma chemical vapor deposition coating zone, an ion-plating coating zone, a sputtering coating zone, etc.), which are arranged in series between a pair of strip supply/take-up devices. *Id.* According to Saida, in known coating apparatuses, "[t]he treating zones are sealed by suitable sealing means from the exterior and from the adjacent treating zones, so that the strip which runs through these treating zones [is] treated under different types of treating atmosphere." *Id.* at 1:35–39. Saida discloses that the sealing means typically includes upper and lower sealing rolls that contact the strip's upper and lower surfaces. *Id.* at 1:39–42. According to Saida, a drawback of this configuration is that "the upper and/or the lower surface of the strip, which has just been coated or which is

just going to be treated in a treating zone tends to be undesirably damaged due to direct contact with the sealing roll or rolls." *Id.* at 1:46–51.

To eliminate damage to the coated strip surface, Saida utilizes guide rollers 19 that contact only the strip's upper, uncoated side. *See id.* at 4:24–31, 5:42–44. Guide rollers 19 are positioned in slits 18 in partition walls 14 that define the respective zones as well as in slits 18 in partition walls 21 within sealing zones 5, 5a, 5b. *Id.* at 4:10–24, 6:33–38, Fig. 2. Saida discloses that the devices within the treating zones are arranged in a common vacuum vessel 6. *Id.* at 2:49–50. Supply/take-up devices 1*a*, 1*b* may be inside or outside vacuum vessel 6. *Id.* at 2:49–50, 6:30–33, Figs. 1, 2. Saida discloses that when supply/take-up devices 1*a*, 1*b* are located outside vacuum vessel 6, sealing zones 5*a*, 5*b* preferably are provided with a pair of seal rolls 25 made of an elastic material and disposed adjacent to the slit in the partition wall on the atmosphere-side of the sealing zone to form an effective seal between the sealing zone interior and the atmosphere. *Id.* at 6:4–46. According to Saida, "[s]uch elastic sealing rolls do not have substantial risk of damaging the surface of the strip S or any coating layer formed thereon." *Id.* at 6:46–48.

Saida discloses that during operation of the continuous coating apparatus,

> it is often necessary to treat successive coils of the strip. In such a case, a subsequent coil is mounted on the supply/take-up device l*a* or l*b* on the supply side after the preceding coil has been exhausted, and the leading end of the strip uncoiled from the subsequent coil is connected to the trailing end of the preceding strip so as to be fed into the treating zones.

Saida 7:22–29. Saida discloses that this task is easier when supply/take-up devices 1*a*, 1*b* are located outside vacuum vessel 6 because it is unnecessary

to release and then reestablish the vacuum around supply/take-up devices 1*a*, 1*b*. *See id.* at 7:30–45.

The Examiner found, and the Appellant does not dispute, that Saida recognizes the importance of process speed, but does not disclose the particular means or techniques for connecting leading and tailing ends of strips. Final Act. 6; *see generally* Appeal Br. The Examiner determined that the ordinary artisan would have utilized an accumulator to join the strips' leading and tailing ends based on the advantages described by Kissell, for example, maintaining a constant processing rate. Final Act. 7–8.

The Appellant contends that the configuration of Kissell's accumulator is such that rollers contact both sides of a substrate multiple times. Appeal Br. 5–6. The Appellant argues that Saida teaches against contacting both sides of a strip and, therefore, the ordinary artisan would not have utilized Kissell's accumulator in Saida's method. *Id.* at 7. The Appellant acknowledges that Saida discloses embodiments (e.g., Fig. 2) wherein seal rolls 25 contact both surfaces of strip S, but argues that Saida's seal rolls 25 are made of a special elastic material that does not damage the strip's deposition surface. *Id.* at 7–8. "In contrast, the accumulator 33 of Kissell is not made of a special elastic material. Thus, the accumulator 33 of Kissell would likely damage the deposition surface of Saida." *Id.* at 8.

The Appellant's argument is not persuasive because it fails to address the Examiner's finding that the ordinary artisan would have modified Kissell's accumulator to use rollers comprising the same type of elastic material described by Saida as non-damaging. *See* Final Act. 8; Ans. 4; Reply Br. 2–3. Moreover, the Appellant's argument that Kissell's accumulator "would *likely* damage the deposition surface of Saida" (Appeal

Br. 8 (emphasis added)) is merely speculative as it is not supported by persuasive evidence. *See* Reply Br. 4–5 (arguing, without supporting evidence, that "even if the rubber or plastic rollers of Saida were employed in the apparatus of Kissell, a skilled artisan would reasonably conclude that the combination would significantly increase the likelihood of substrate damage, which would degrade the appearance and corrosion resistance benefits provided by the device of Saida"); Ans. 6.

The Appellant argues that the ordinary artisan would not have had a reason to use Kissell's accumulator because Saida does not utilize a constant substrate movement speed and does not move the strip in a single direction. Appeal Br. 8. Rather, Saida periodically stops moving the strip and then reverses its direction of movement. *Id.* The Appellant argues that the Examiner has not identified a benefit to modifying Saida to include an accumulator which is designed to move a substrate at a constant speed in a single direction. *Id.* at 9. The Appellant's argument is not persuasive because, as explained by the Examiner, Saida's disclosure of stopping the process and reversing the strip's movement direction is limited to a specific embodiment. Ans. 4. (citing Saida 5:16–29; Fig. 1).

In the Reply Brief, the Appellant argues that, in order to sputter a layer on a strip as required by the claim 1 method, Saida's apparatus must reverse the strip's direction of movement. Reply Br. 5–6 (citing Saida 5:10–29). This argument is not persuasive because, again, it is based on a specific embodiment in which ion-plating zone 2, sputtering zone 3, and plasma CVD zone 4 are arranged in the order shown in Figure 1 and a particular order of coating layers is desired. *See* Saida 5:10–29; Ans. 5. As found by the Examiner, Saida discloses that "[t]he order of arrangement of the ion-

plating zone 2, sputtering zone 3 and the plasma CVD zone 4 shown in FIG. 1 is only illustrative and may be altered as desired insofar as these zones are arranged in series" (Saida 3:64–67). Ans. 4–5.

The Appellant argues that Saida requires stopping movement of the strip in order to connect the leading edge of a second strip to the trailing edge of a first strip regardless of whether the supply/take-up devices 1*a*, 1*b* are located inside or outside vacuum vessel 6. Reply Br. 7 (citing Saida 7:22–41). The Appellant's argument is not persuasive because the Appellant fails to consider the method resulting from the combined teachings of the references. As noted above, *supra* pp. 5–6 (citing Saida 7:30–45), only when Saida's supply/take-up devices 1*a*, 1*b* are located inside vacuum vessel 6, is it necessary to stop the strip's movement to release and then reestablish the vacuum around supply/take-up devices 1*a*, 1*b*. Thus, even if Saida does not describe a means for connecting leading and trailing edges of strips without stopping the strip's movement, once modified to include an accumulator as taught by Kissell, it would be unnecessary to stop movement of the strip, as Kissell's accumulator would provide a means to attach leading and trailing edges yet allow the strip to continue moving through Saida's treating zones. *See, e.g.*, Kissell 2:66–3:20, 5:46–55.

The Appellant also argues that Krengel and Hollars do not remedy the deficiencies of Saida and Kissell, and that the Examiner has not explained why the ordinary artisan would have modified Saida's method to produce solar cells. *See* Appeal Br. 9–11. These arguments are not persuasive for the reasons stated by the Examiner in the Answer. *See* Ans. 8–9. In the Reply Brief, the Appellant argues that the ordinary artisan would not have used Saida's method to form solar cell layers because Hollars teaches moving the

substrates in one direction during sputter deposition of solar cell layers, whereas in Saida's method, the strips are moved in two different directions. Reply Br. 8–9. This argument is unpersuasive because, as discussed above, Saida does not require moving strips in different directions.

As to the rejection of claim 8, the Appellant argues that the Examiner relied on impermissible hindsight reconstruction in determining that the ordinary artisan would have modified Saida's method to pass strip S "through a pair of wiper seals . . . configured to provide second sealing surfaces between atmosphere and the vacuum" (claim 8) based on Kyoto Kikai's disclosure. Appeal Br. 11–12. The Appellant argues, more specifically, that Kyoto Kikai relates "to an apparatus for leading textiles in and out of a high pressure treating chamber" and there would have been no reason to apply these teachings "to a vacuum (i.e., low pressure) metal or plastic coating method of Saida." *Id.* The Appellant's argument is not persuasive because it fails to explain why it was erroneous or unreasonable for the Examiner to find that the ordinary artisan

> would reasonably consider means for providing the degree of pressure differentials as required in the process, regardless of whether or not the vacuum or pressure sealing means were employed for the same end-use, as it is the means & techniques of providing different pressures on different sides of a barrier (i.e. inside/outside of a chamber) that is relevant to . . . this issue of a vacuum seal structure, where the engineering involved therefore is independent of the particular process being performed.

Ans. 10; *see KSR Int'l Co. v. Teleflex, Inc.,* 550 U.S. 398, 420 (2007) ("[F]amiliar items may have obvious uses beyond their primary purposes, and a person of ordinary skill often will be able to fit the teachings of multiple patents together like pieces of a puzzle."); *In re Klein*, 647 F.3d

1343, 1348 (Fed. Cir. 2011) (citation omitted) ("Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed and, (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.").

CONCLUSION

Based on the Examiner's fact finding and reasoning in the Final Office Action and the Answer, and for the reasons discussed above, the Appellant has not convinced us of reversible error in the Examiner's conclusion of obviousness as to claims 1 and 4–8.

DECISION SUMMARY

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1, 4–7	103(a)	Saida, Kissell, Hollars, Krengel	1, 4–7	
8	103(a)	Saida, Kissell, Hollars, Krengel, Kyoto Kikai, Alexander '001, Alexander '485	8	
Overall Outcome:			1, 4–8	

TIME PERIOD FOR RESPONSE

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

AFFIRMED