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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/451,616	06/13/2006	Bruce Hachtmann	7514-102	9431
22208	7590	12/26/2019	EXAMINER	
The Marbury Law Group, PLLC 11800 SUNRISE VALLEY DRIVE 15TH FLOOR RESTON, VA 20191			TRINH, THANH TRUC	
			ART UNIT	PAPER NUMBER
			1726	
			NOTIFICATION DATE	DELIVERY MODE
			12/26/2019	ELECTRONIC

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte BRUCE HACTMANN,
SHEFALI JAISWAL, PUTHUR PAULSON,
WILLIAM SANDERS, and BEN TARBELL

Appeal 2018-007456
Application 11/451,616
Technology Center 1700

Before JEFFREY T. SMITH, GEORGE C. BEST, and
JEFFREY R. SNAY, *Administrative Patent Judges*.

SMITH *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134(a), Appellant¹ appeals from the Examiner's decision to reject claims 1, 3, 9, 20, 21, and 29–31. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

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 Beijing Apollo Ding rong Solar Technology Co., Ltd.. Appeal Br. 3.

The following rejections are presented for appeal:

I. Claims 1, 3, 20, 21, and 29–31 are rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Luch (US 2006/0180195 A1, Aug. 17, 2006) and Cull (US 4,574,160, Mar. 4, 1986).

II. Claim 9 is rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Luch and Cull, and further in view of Lebrun (US 3,553,030, Jan. 5, 1971).

Appellant's invention relates to photovoltaic modules having an integrated current collection and interconnection configuration. (Spec. ¶ 1.) Claim 1 is illustrative of the subject matter on appeal and is reproduced from Appellant's Brief below:

1. A photovoltaic module, comprising:
 - a first photovoltaic cell having a first polarity electrode on a front side and a second polarity electrode on a back side;
 - a second photovoltaic cell having a first polarity electrode on a front side and a second polarity electrode on a back side; and
 - a collector-connector which is configured to collect current from the first photovoltaic cell and to electrically connect the first photovoltaic cell with the second photovoltaic cell;wherein:
 - the collector-connector comprises an electrically insulating carrier and at least one electrical conductor;
 - the at least one electrical conductor comprises at least one flexible, electrically conductive wire supported by the electrically insulating carrier;
 - the at least one flexible, electrically conductive wire has a first part located on a bottom surface of the electrically insulating carrier facing the first polarity electrode on the front side of the first photovoltaic cell, and a second part located on an opposite top surface of the electrically insulating carrier facing the second polarity electrode on the back side of the second photovoltaic cell, and a third part that is connected to the first part and the second part and extends through an opening in the electrically insulating carrier from the

bottom surface of the electrically insulating carrier to the top surface of the electrically insulating carrier;

a first part of the electrically insulating carrier is located over the front side of the first photovoltaic cell such that the first part of the at least one flexible, electrically conductive wire extends over, and physically and electrically contacts, a portion of a front surface of the first polarity electrode on the front side of the first photovoltaic cell to collect current from the first polarity electrode on the front side of the first photovoltaic cell;

a second part of the electrically insulating carrier extends between the first photovoltaic cell and the second photovoltaic cell and over the back side of the second photovoltaic cell, such that the second part of the at least one flexible, electrically conductive wire extends underneath, and physically and electrically contacts, a back surface of the second polarity electrode on the back side of the second photovoltaic cell to electrically connect the first polarity electrode on the front side of the first photovoltaic cell to the second polarity electrode on the back side of the second photovoltaic cell;

the at least flexible, electrically conductive wire is absent under the bottom surface of the electrically insulating carrier in an entire area of the second part of the electrically insulating carrier located under the back side of the second photovoltaic cell;

the first polarity electrode of the first photovoltaic cell comprises an optically transparent front side electrode which is adapted to face the Sun; and

the second polarity electrode of the second photovoltaic cell comprises a back side electrode which is adapted to face away from the Sun.

OPINION

Claims 1, 3, 20, 21, and 29–31 are rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Luch and Cull.² We limit our discussion to the independent claim 1 as argued by Appellant. 37 C.F.R.

² A complete statement of the Examiner's rejection appears in the Final action. (Final Act. 3–9.)

§ 41.37(c)(1)(iv). Claims 3, 20, 21, and 29–31 stand or fall with independent claim 1.

The Examiner finds Luch discloses photovoltaic modules comprising at least one electrical conductor comprising fingers and a bus that differs from the claimed invention in that Luch does not specifically state the at least one electrical conductor for the collector-connector (interconnect) comprises at least one flexible electrically conductive wire. (Final Act. 3–6; Luch figs. 4–8.) The Examiner finds Cull teaches an electrical conductor for an interconnect that comprises at least one flexible electrically conductive wire to provide highly conductive electrical interconnections which are resistant to normally experienced mechanical and thermal stresses. (Final Act. 6; Cull col. 3 ll. 31–38, col. 10 l. 50 through col. 11 l. 6.) The Examiner determines it would have been obvious to form the collector interconnect of Luch from flexible, electrically conductive wire to obtain the advantages taught by Cull. (Final Act. 6–7.)

Appellant argues neither Cull nor Luch teaches or suggests how the free standing wires of Cull can pass through openings in an electrically insulating carrier to arrive at the configuration of claim 1 without relying on impermissible hindsight. (App. Br. 9.) Appellant specifically argues Luch's material of elements 26 must be deposited on a surface and is present around the holes through the elements 10 to provide an electrical connection. (App. Br. 13.)

Appellant's arguments are not persuasive. The use of electrically conductive wires for connecting opposite surfaces of photovoltaic cells such as described by Luch is merely substituting one known element for another to yield predictable results. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398,

401 (2007). “Express suggestion to substitute one equivalent for another need not be present to render such substitution obvious.” *In re Fout*, 675 F.2d 297, 301 (CCPA 1982). The Examiner’s explanation of the reasons a person of ordinary skill in the art would have combined the teachings of Luch and Cull is sufficient when an allowance is made for “the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR*, 550 U.S. at 418.

Luch’s teachings regarding suitable electrical connections are not limited to the scope of Appellant’s argument. Luch teaches the electrical connection on opposite sides of the substrate is achieved by a variety of techniques including “fingers” and “straps.” (Luch ¶¶ 87–92.) Luch teaches the embodiment depicted in figure 13 is one method of combining interconnected straps depicted in the other figures. A person of ordinary skill would have reasonably expected that other well known techniques for making an electrical connection between photovoltaic cells would have been suitable for the invention of Luch.

Appellant has not directed us to evidence that establishes Luch only relies on the electrical connection being achieved by having electrically conductive material solely at the through hole portion. To the contrary, a person of ordinary skill in the art would have recognized the suitability of electrically connecting photovoltaic cells from opposite sides of the substrate as described by Luch utilizing recognized techniques. (*See Cull*). A person of ordinary skill in the art would have recognized that wires are suitable for connecting electrically photovoltaic cells from opposite sides of a substrate as described by Cull. A person of ordinary skill in the art would have had sufficient skill to determine the appropriate routing of electrically connecting

wires for photovoltaic cells. Appellant has not disputed that the use of electrically connecting wires were known to persons of ordinary skill in the art.

Appellant argues the combination of Luch and Cull does not teach all claim elements because the combined device of Luch and Cull would not have the feature of the “wire is absent under the bottom surface of the electrically insulating carrier in an entire area of the second part of the electrically insulating carrier located under the back side of the second photovoltaic cell” as in claim 1. (App. Br. 10.)

Appellant’s argument lacks persuasive merit. Luch teaches that the electrical connection is absent under the bottom surface of the electrically insulating carrier in an entire area of the second part of the electrically insulating carrier. (Luch Figure 13.) As discussed above, a person of ordinary skill in the art would have recognized the suitability of utilizing known wires appropriately routed for connecting electrically the opposite surfaces of photovoltaic cells. A person of ordinary skill in the art would have recognized the appropriate routing of wires for connecting photovoltaic cells. This would have included excluding routing wires under only portions of the insulating carrier. Appellant has not explained that the exclusion of wires under a portion of the insulating carrier provides unexpected results.

For the foregoing reasons and those the Examiner presents, we sustain the rejection of claims 1, 3, 20, 21, and 29–31.

The Examiner rejects claim 9 under 35 U.S.C. § 103(a) as unpatentable over the combination of Luch and Cull, and further in view of Lebrun.³ (Final Act. 8–9.)

The Examiner finds Luch discloses photovoltaic module comprising at least one electrical conductor comprising fingers and a bus that differs from the claimed invention in that Luch does not disclose the electrically insulating carrier comprising a sheet containing a plurality of slots such that the photovoltaic cells pass through the slots to make the interconnection. (Final Act. 8–9.) The Examiner finds Lebrun teaches interconnected photovoltaic cells connected through slots between the front interconnect pattern (metal zone at tag 30) and back interconnect pattern (hole 29) such that the first photovoltaic cell passes through a first slot and the second photovoltaic cell passes through the second slot to make interconnection (Final Act. 9; Lebrun figs. 8–10.) The Examiner determines it would have been obvious to modify the photovoltaic module of Luch by using an electrically insulating carrier comprising a sheet containing a plurality of slots and the interconnect patterns with the slots being located between the front interconnect pattern and the back interconnect pattern such that the first photovoltaic cell passes through a first slot and the second photovoltaic cell passes through a second slot to make the interconnection as taught by Lebrun. (Final Act. 9.)

Appellant argues there is no reason to import just the flexible sheet of Lebrun into the device of Luch without also substituting the conductive fingers 26 of Luch with the metallized tags of Lebrun. (App. Br. 22.)

³ A complete statement of the Examiner's rejection appears in the final action. (Final Act. 8–9.)

Appellant argues the Examiner has failed to explain how any increased mechanical independence of the solar cells or greater resistance to thermal shock would be imparted by the insulating carrier of Lebrun over the flexible fingers of Luch. (App. Br. 23.)

Contrary to Appellants' position, it is not necessary to physically incorporate the flexible sheet and metallized tags as described by Lebrun in the invention of Luch to render obvious the claimed invention. *See In re Sneed*, 710 F.2d 1544, 1550 (Fed. Cir. 1983); *see also In re Etter*, 756 F.2d 852, 859 (Fed. Cir. 1985) (en banc) ("Etter's assertions that Azure cannot be incorporated in Ambrosio are basically irrelevant, the criterion being not whether the references could be physically combined but whether the claimed inventions are rendered obvious by the teachings of the prior art as a whole."); "The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference. . . . Rather, the test is what the combined teachings of those references would have suggested to those of ordinary skill in the art." *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). *See also Sneed*, 710 F.2d at 1550 ("[I]t is not necessary that the inventions of the references be physically combinable to render obvious the invention under review."); *In re Nievelt*, 482 F.2d 965, 968 (CCPA 1973) ("Combining the teachings of references does not involve an ability to combine their specific structures.").

In the present case, Lebrun describes an electrically insulating flexible support material having incisions across the thickness of the support which allows the electric interconnection of the radiation-sensitive elements. Lebrun also discloses the mechanical fixation to the support are obtained in part by the tags and the metallized surface portions. (Lebrun col. 2 ll. 39–

48.) Lebrun further discloses the thickness of the flexible support can vary according to need (Lebrun col. 4 ll. 55–64.) This arrangement establishes that electrically insulating material can be disposed between photovoltaic modules (radiation sensitive elements). As explained above, the combination of Luch and Cull establishes the obviousness of utilizing wires to connect photovoltaic cells. A person of ordinary skill in the art would have reasonably expected that the connecting wires could pass through the openings within the insulating material. Consequently, the evidence of record supports the Examiner's position that it would have been obvious to a person of ordinary skill in the art to form the photovoltaic module of Luch by using an electrically insulating carrier comprising a sheet containing a plurality of slots wherein the slots allows for interconnected photovoltaic cells connected through the slots.

Lebrun discloses the insulating flexible support material has physical, chemical, and mechanical properties that are expected to remain constant over a wide temperature range. (Lebrun 2 ll. 49–54.) Photovoltaic cells separated by the inclusion of such an insulating flexible support material would have resulted in a combination that has the properties which are expected to remain constant over a wide temperature range. Consequently, a person of ordinary skill in the art would have reasonably expected thermal stability would have been imparted by the insulating carrier of Lebrun.

For the foregoing reasons and those the Examiner presents, we sustain the appealed rejection.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1, 3, 20, 21, 29–31	103(a)	Luch, Cull	1, 3, 20, 21, 29–31	
9	103(a)	Luch, Cull, Lebrun	9	
Overall Outcome			1, 3, 9, 20, 21, 29–31	

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

AFFIRMED