US00D913210S

(12) **United States Design Patent**
Morad et al.

(10) **Patent No.: US D913,210 S**
(45) **Date of Patent: ** Mar. 16, 2021**

(54) **SOLAR PANEL**

(71) Applicant: **SUNPOWER CORPORATION**, San Jose, CA (US)

(72) Inventors: **Ratson Morad**, Palo Alto, CA (US); **Gilad Almogy**, Palo Alto, CA (US); **Itai Suez**, Santa Cruz, CA (US); **Jean Hummel**, San Carlos, CA (US); **Nathan Beckett**, Oakland, CA (US)

(73) Assignee: **SUNPOWER CORPORATION**, San Jose, CA (US)

(**) Term: **15 Years**

(21) Appl. No.: **29/664,279**

(22) Filed: **Sep. 24, 2018**

Related U.S. Application Data

(63) Continuation of application No. 29/617,566, filed on Sep. 14, 2017, which is a continuation of application No. 15/359,326, filed on Nov. 22, 2016, now Pat. No. 10,090,430, which is a continuation of application No. PCT/US2015/032472, filed on May 26, 2015, which is a continuation-in-part of application No. 14/674,983, filed on Mar. 31, 2015, now Pat. No.
(Continued)

(51) **LOC (13) Cl.** **13-02**
(52) **U.S. Cl.**
USPC **D13/102**
(58) **Field of Classification Search**
USPC D13/102
CPC H01L 31/0508; H01L 31/0201; H01L 31/0504
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,938,938 A 5/1960 Dickson, Jr.
3,116,171 A 12/1963 Neilsen et al.
(Continued)

FOREIGN PATENT DOCUMENTS

DE 1030713 A1 4/1992
EM 000034350-0001 4/2003
(Continued)

OTHER PUBLICATIONS

Notice of Reasons for Rejection dated Jun. 25, 2019 in Japanese Patent Application No. 2019-000790, 1 page.
(Continued)

Primary Examiner — Jennifer O King
(74) *Attorney, Agent, or Firm* — Oblon, McClelland, Maier & Neustadt, L.L.P.

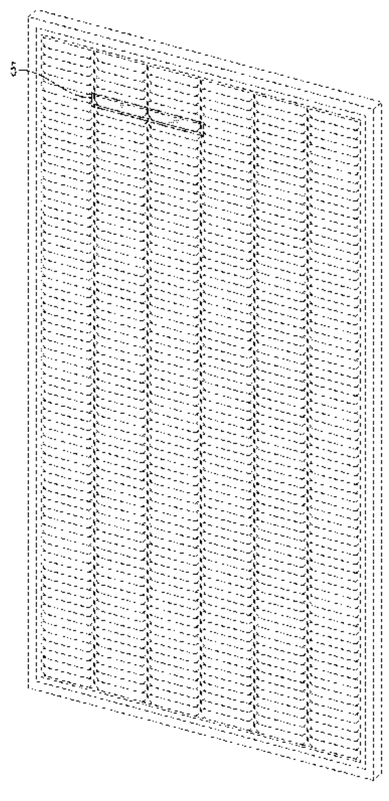
(57) **CLAIM**

The ornamental design for a solar panel, as shown and described.

DESCRIPTION

FIG. **1** is a front, top, and right side perspective view of a solar panel;
FIG. **2** is a front elevational view thereof, the rear elevational view forms no part of the claimed design;
FIG. **3** is a top plan view thereof, the bottom plan view being a mirror image of the top plan view shown;
FIG. **4** is a left side elevational view thereof, the right side elevational view being a mirror image of the left side elevational view shown;
FIG. **5** is a detail view of callout box **5** in FIG. **1**; and,
FIG. **6** is a detail view along line **6-6** in FIG. **2**.
The broken lines shown represent portions of the solar panel that form no part of the claimed design. Where the dot-dash broken lines abut the shaded surface it is understood that those broken lines represent an unclaimed boundary between claimed and unclaimed surfaces. None of the broken lines form any part of the claimed design.

1 Claim, 3 Drawing Sheets



Related U.S. Application Data

9,947,820, and a continuation-in-part of application No. 14/605,695, filed on Jan. 26, 2015, now Pat. No. 9,484,484, and a continuation-in-part of application No. 14/594,439, filed on Jan. 12, 2015, now Pat. No. 9,397,252, and a continuation-in-part of application No. 14/585,917, filed on Dec. 30, 2014, now abandoned, and a continuation-in-part of application No. 14/586,025, filed on Dec. 30, 2014, and a continuation-in-part of application No. 14/577,593, filed on Dec. 19, 2014, now Pat. No. 9,356,184, and a continuation-in-part of application No. 14/572,206, filed on Dec. 16, 2014, now Pat. No. 9,401,451, and a continuation-in-part of application No. 14/566,278, filed on Dec. 10, 2014, now abandoned, and a continuation-in-part of application No. 14/565,820, filed on Dec. 10, 2014, now abandoned, and a continuation-in-part of application No. 14/560,577, filed on Dec. 4, 2014, now Pat. No. 9,876,132, and a continuation-in-part of application No. 14/552,761, filed on Nov. 25, 2014, now abandoned, and a continuation-in-part of application No. 14/550,676, filed on Nov. 21, 2014, now abandoned, and a continuation-in-part of application No. 29/509,588, filed on Nov. 19, 2014, now Pat. No. Des. 767,484, and a continuation-in-part of application No. 14/548,081, filed on Nov. 19, 2014, now abandoned, and a continuation-in-part of application No. 29/509,586, filed on Nov. 19, 2014, now Pat. No. Des. 750,556, and a continuation-in-part of application No. 14/543,580, filed on Nov. 17, 2014, now Pat. No. 9,882,077, and a continuation-in-part of application No. 14/539,546, filed on Nov. 12, 2014, now abandoned, and a continuation-in-part of application No. 14/536,486, filed on Nov. 7, 2014, now abandoned, and a continuation-in-part of application No. 29/508,323, filed on Nov. 5, 2014, now abandoned, and a continuation-in-part of application No. 14/532,293, filed on Nov. 4, 2014, now abandoned, and a continuation-in-part of application No. 14/530,405, filed on Oct. 31, 2014, now Pat. No. 9,780,253, and a continuation-in-part of application No. 29/506,755, filed on Oct. 20, 2014, now abandoned, and a continuation-in-part of application No. 29/506,415, filed on Oct. 15, 2014, now abandoned.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,340,096	A		9/1967	Mann et al.
3,369,939	A	*	2/1968	Myer H01L 31/052 136/246
3,459,597	A		8/1969	Baron
3,575,721	A	*	4/1971	Mann H01L 31/0508 136/244
3,769,091	A		10/1973	Leinkram et al.
3,811,181	A		5/1974	Leinkram et al.
3,837,924	A		9/1974	Baron
4,097,310	A		6/1978	Lindmayer
4,257,821	A		3/1981	Kelly et al.
4,362,128	A		12/1982	Downey
4,449,514	A		5/1984	Selcuk
4,617,420	A		10/1986	Dilts et al.
4,617,421	A		10/1986	Nath et al.
4,652,693	A		3/1987	Baron
4,805,006	A		2/1989	Yamaguchi et al.
4,836,861	A		6/1989	Peltzer et al.
4,877,460	A		10/1989	Flodl
5,171,717	A		12/1992	Broom et al.
D332,509	S		1/1993	Kovatch
D353,129	S		12/1994	Ricaud et al.
5,590,495	A		1/1997	Bressler et al.
5,610,919	A		3/1997	Willard et al.
5,616,185	A		4/1997	Kukula
D389,817	S		1/1998	Umetsu
D391,921	S		3/1998	Zimmer et al.
D397,990	S		9/1998	Fukuhara et al.
6,017,123	A		1/2000	Bleha et al.
6,018,123	A		1/2000	Takada et al.
6,034,322	A		3/2000	Pollard
6,180,868	B1		1/2001	Yoshino et al.
6,218,605	B1		4/2001	Dally et al.
D442,915	S		5/2001	Sasaoka
6,232,545	B1		5/2001	Samaras et al.
6,288,323	B1		9/2001	Hayashi et al.
6,303,853	B1		10/2001	Fraas et al.
6,315,575	B1		11/2001	Kajimoto
6,353,175	B1		3/2002	Fraas
6,414,235	B1		7/2002	Luch
6,441,297	B1		8/2002	Keller et al.
6,489,553	B1		12/2002	Fraas et al.
D469,058	S		1/2003	Shugar
6,525,262	B1		2/2003	Makita et al.
6,538,193	B1		3/2003	Fraas
6,563,289	B1		5/2003	Cross
6,573,445	B1		6/2003	Burgers
6,583,522	B1		6/2003	McNulty et al.
D479,191	S		9/2003	Peress et al.
6,653,550	B2		11/2003	Hayashi et al.
6,670,787	B2		12/2003	Tachibana
D487,884	S		3/2004	Peress et al.
6,770,544	B2		8/2004	Sawada
6,803,513	B2		10/2004	Beemink et al.
D501,563	S		2/2005	Miller et al.
D543,502	S		5/2007	Yamashita et al.
7,238,872	B1		7/2007	Gonsiorawski
7,271,333	B2		9/2007	Fabick et al.
7,334,451	B1		2/2008	Fauveau
7,388,146	B2		6/2008	Fraas et al.
7,390,961	B2		6/2008	Aschenbrenner et al.
D582,842	S		12/2008	Wei
D588,534	S		3/2009	Sharma et al.
7,507,903	B2		3/2009	Luch
7,534,699	B2		5/2009	Wong et al.
7,635,810	B2		12/2009	Luch
7,772,484	B2		8/2010	Li et al.
7,777,128	B2		8/2010	Montello et al.
7,781,672	B2		8/2010	Gaudiana et al.
7,825,329	B2		11/2010	Basol
7,829,781	B2		11/2010	Montello et al.
7,829,785	B2		11/2010	Basol
7,851,700	B2		12/2010	Luch
7,868,249	B2		1/2011	Luch
7,872,192	B1		1/2011	Fraas et al.
7,910,822	B1		3/2011	Funcell
7,989,692	B2		8/2011	Luch
7,989,693	B2		8/2011	Luch
D652,376	S		1/2012	Nomi et al.
8,110,737	B2		2/2012	Luch
8,138,413	B2		3/2012	Luch et al.
D658,119	S		4/2012	Bamberg et al.
8,207,440	B2		6/2012	Basol
8,222,513	B2		7/2012	Loch
8,304,646	B2		11/2012	Luch
8,319,097	B2		11/2012	Luch
8,373,059	B2	*	2/2013	Yamaguchi H01L 31/0508 136/244
8,378,209	B2		2/2013	Masson et al.
8,450,596	B2	*	5/2013	Boulanger B64G 1/443 136/244
8,513,095	B1		8/2013	Funcell et al.
D694,175	S		11/2013	Kannou et al.
8,574,943	B2		11/2013	Murray et al.
8,586,875	B2		11/2013	Morita et al.
D696,186	S		12/2013	Kannou et al.
8,729,385	B2		5/2014	Loch
8,766,090	B2		7/2014	Sewell et al.
8,829,330	B2		9/2014	Meyer et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

D716,219	S *	10/2014	Quinlan	D13/102
8,907,203	B2	12/2014	Nasuno et al.	
D724,012	S	3/2015	Zhan	
9,006,559	B2	4/2015	Kobamoto et al.	
9,099,588	B2	8/2015	Letocart et al.	
9,100,868	B2	8/2015	Pedersen et al.	
9,147,788	B2	9/2015	DeGroot et al.	
D741,793	S	10/2015	Lim et al.	
9,216,607	B2	12/2015	Endo et al.	
D750,556	S	3/2016	Morad et al.	
9,343,595	B2	5/2016	Fu et al.	
9,356,184	B2 *	5/2016	Morad	H01L 31/0488
D762,163	S	7/2016	Parilla et al.	
9,397,252	B2	7/2016	Morad et al.	
9,412,884	B2 *	8/2016	Heng	H01L 31/0504
D767,484	S	9/2016	Morad et al.	
9,484,484	B2	11/2016	Morad et al.	
D778,234	S *	2/2017	Cheung	D13/102
9,793,421	B2 *	10/2017	Gonzalez	H01L 31/0516
9,935,221	B1 *	4/2018	Zhou	H02S 40/34
D832,203	S *	10/2018	Caswell	D13/102
D835,031	S *	12/2018	Steinfeldt	D13/102
10,298,171	B2 *	5/2019	Almy	H02S 30/10
D869,002	S *	12/2019	Labesque	D25/140
10,560,049	B2 *	2/2020	Yang	E04D 1/26
D887,967	S *	6/2020	Chang	D13/102
10,734,938	B2 *	8/2020	Yang	E04D 1/30
D894,825	S *	9/2020	Zhou	D13/102
10,763,383	B2 *	9/2020	Rehder	H01L 31/035281
2001/0050101	A1	12/2001	Makita et al.	
2001/0054262	A1	12/2001	Nath et al.	
2003/0029494	A1	2/2003	Ohkubo	
2003/0121228	A1	7/2003	Stoehr et al.	
2004/0097012	A1	5/2004	Weber et al.	
2004/0123895	A1	7/2004	Kardauskas et al.	
2004/0261836	A1	12/2004	Kataoka et al.	
2005/0126619	A1	6/2005	Abe et al.	
2005/0133079	A1	6/2005	Boulanger et al.	
2005/0217717	A1	10/2005	Faris	
2005/0263178	A1	12/2005	Montello et al.	
2006/0042682	A1	3/2006	Wolfe et al.	
2006/0276420	A1	12/2006	Keller et al.	
2007/0045831	A1	3/2007	Wong et al.	
2007/0107766	A1	5/2007	Langley, II et al.	
2007/0181175	A1	8/2007	Landis	
2007/0281355	A1	12/2007	Dalton et al.	
2007/0283996	A1	12/2007	Hachtmann et al.	
2007/0283997	A1	12/2007	Hachtmann et al.	
2008/0156365	A1	7/2008	Scholz et al.	
2008/0216887	A1	9/2008	Hacke et al.	
2009/0000221	A1	1/2009	Jacobs et al.	
2009/0014058	A1	1/2009	Croft et al.	
2009/0014505	A1	1/2009	Croft et al.	
2009/0038671	A1	2/2009	Yamaguchi	
2009/0114279	A1	5/2009	Zhao et al.	
2009/0229596	A1	9/2009	Shin et al.	
2009/0229663	A1	9/2009	Appadurai	
2010/0001587	A1	1/2010	Casey et al.	
2010/0012172	A1	1/2010	Meakin et al.	
2010/0043863	A1	2/2010	Wudu et al.	
2010/0071752	A1	3/2010	Vellore et al.	
2010/0075151	A1	3/2010	Weingord et al.	
2010/0078057	A1	4/2010	Karg et al.	
2010/0078064	A1	4/2010	Coakly	
2010/0084004	A1	4/2010	Ortabasi	
2010/0126554	A1	5/2010	Morgan et al.	
2010/0131108	A1	5/2010	Meyer	
2010/0136748	A1	6/2010	Autry	
2010/0139734	A1	6/2010	Hadar et al.	
2010/0144033	A1	6/2010	Mandalam et al.	
2010/0147364	A1	6/2010	Gonzalez et al.	
2010/0175743	A1	7/2010	Gonzalez et al.	
2010/0218799	A1	9/2010	Stefani	
2010/0218824	A1	9/2010	Luch	
2010/0224230	A1	9/2010	Luch et al.	
2010/0243024	A1	9/2010	Hashimoto et al.	
2010/0308662	A1	12/2010	Schatz et al.	
2011/0005572	A1	1/2011	Shimizu	
2011/0017257	A1	1/2011	Lee et al.	
2011/0030761	A1 *	2/2011	Kalkanoglu	H01L 31/048 136/245
2011/0036390	A1	2/2011	Nelson et al.	
2011/0048501	A1	3/2011	Jaus et al.	
2011/0079263	A1	4/2011	Avrutsky	
2011/0114157	A1	5/2011	Meissner	
2011/0114158	A1	5/2011	Lenox	
2011/0114165	A1	5/2011	Chang	
2011/0146750	A1	6/2011	Nasuno et al.	
2011/0151561	A1	6/2011	Davis et al.	
2011/0155209	A1	6/2011	Tober et al.	
2011/0168237	A1	7/2011	Takeda et al.	
2011/0168238	A1	7/2011	Metin et al.	
2011/0192448	A1	8/2011	Croft et al.	
2011/0214714	A1	9/2011	Aberle et al.	
2011/0240337	A1	10/2011	Motello et al.	
2011/0259417	A1	10/2011	Toyokawa et al.	
2011/0271999	A1	11/2011	Almogy et al.	
2011/0272004	A1	11/2011	Davis et al.	
2011/0275175	A1	11/2011	Minsek et al.	
2011/0315184	A1	12/2011	Kabade	
2012/0000502	A1	1/2012	Wiedeman et al.	
2012/0031457	A1	2/2012	Taira et al.	
2012/0031470	A1	2/2012	Dimov et al.	
2012/0037206	A1	2/2012	Norman et al.	
2012/0048349	A1	3/2012	Metin et al.	
2012/0118355	A1	5/2012	Rudolfs	
2012/0125391	A1	5/2012	Pinarbasi et al.	
2012/0149110	A1	6/2012	Kitamura et al.	
2012/0152327	A1	6/2012	Pinarbasi et al.	
2012/0152349	A1	6/2012	Cao et al.	
2012/0204927	A1 *	8/2012	Peterson	H01L 31/048 136/244
2012/0204935	A1	8/2012	Meyer et al.	
2012/0211049	A1	8/2012	Kobamoto et al.	
2012/0234388	A1	9/2012	Stancel et al.	
2012/0244656	A1	9/2012	Kim et al.	
2012/0268087	A1	10/2012	Kemahan	
2012/0279548	A1	11/2012	Munch et al.	
2012/0298166	A1	11/2012	Chen et al.	
2012/0318318	A1	12/2012	Metin et al.	
2012/0318319	A1	12/2012	Pinarbasi et al.	
2012/0325282	A1	12/2012	Snow et al.	
2013/0048046	A1	2/2013	Domsic et al.	
2013/0068279	A1	3/2013	Buller et al.	
2013/0096710	A1	4/2013	Pinarbasi et al.	
2013/0133743	A1	5/2013	Grah	
2013/0152996	A1	6/2013	DeGroot et al.	
2013/0156743	A1	6/2013	Vallier et al.	
2013/0160823	A1	6/2013	Khouri et al.	
2013/0160824	A1	6/2013	Khouri et al.	
2013/0164266	A1	6/2013	Jensen	
2013/0203206	A1	8/2013	Umeda et al.	
2013/0206203	A1	8/2013	Lommasson et al.	
2013/0206206	A1	8/2013	Bjorneklett et al.	
2013/0206210	A1	8/2013	Niinobe et al.	
2013/0206213	A1	8/2013	He et al.	
2013/0206221	A1	8/2013	Gannon et al.	
2013/0213469	A1	8/2013	Kramer et al.	
2013/0269748	A1	10/2013	Wiedeman et al.	
2014/0060610	A1	3/2014	Moslehi et al.	
2014/0060638	A1	3/2014	Oh et al.	
2014/0102519	A1	4/2014	Rodrigues et al.	
2014/0102537	A1	4/2014	Malik, Jr.	
2014/0116495	A1	5/2014	Kim et al.	
2014/0124014	A1	5/2014	Morad et al.	
2014/0124027	A1	5/2014	Teshima et al.	
2014/0158201	A1	6/2014	Aitken et al.	
2014/0213013	A1	7/2014	Britt et al.	
2014/0271566	A1	9/2014	Agulnick	
2014/0318613	A1	10/2014	Von Campe et al.	
2014/0326295	A1	11/2014	Moslehi	
2014/0329321	A1	11/2014	Rajesh et al.	
2014/0352765	A1	12/2014	Nakamura	
2014/0352773	A1	12/2014	Chuang et al.	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2014/0367887	A1	12/2014	Sachs et al.
2015/0007883	A1	1/2015	Ikenaga et al.
2015/0027513	A1	1/2015	Ring et al.
2015/0068592	A1	3/2015	Kommera et al.
2015/0136221	A1	5/2015	Miyazaki et al.
2015/0171239	A1	6/2015	Tanaka et al.
2015/0243534	A1	8/2015	Osenbach
2015/0349162	A1	12/2015	Morad et al.
2016/0158890	A1	6/2016	Gonzalez et al.
2016/0163888	A1	6/2016	Reddy
2016/0163903	A1	6/2016	Yang et al.
2016/0163907	A1	6/2016	Gonzalez et al.
2016/0163908	A1	6/2016	Gonzalez et al.
2016/0163909	A1	6/2016	Gonzalez et al.
2016/0163910	A1	6/2016	Gonzalez et al.
2016/0163912	A1	6/2016	Gonzalez et al.
2016/0163913	A1	6/2016	Gonzalez et al.
2016/0163914	A1	6/2016	Gonzalez et al.

FOREIGN PATENT DOCUMENTS

EM	001955030-0002		11/2011
EM	002032581-0005		4/2012
EM	D02032581-0005		4/2012
EM	001386056-0001		10/2013
EP	2284908	A1	2/2011
EP	2362430	A1	8/2011
ES	2146182	A1	7/2000
FR	910321-001		1/1991
JE	4017933	A1	12/1991
JE	102009026027	A1	1/2011
JP	11-350685	A	12/1999
JP	2013-12575	A	1/2013
JP	2014017447	A	1/2014
WO	2009047815	A1	4/2009
WO	2010095583	A1	8/2010
WO	2012033657	A2	3/2012
WO	2012099705	A1	7/2012
WO	2013020590	A1	2/2013
WO	2014074826	A2	5/2014
WO	2014098771	A1	6/2014
WO	2014192272	A1	12/2014
WO	2015001413	A1	1/2015
WO	2015/183827	A2	12/2015

OTHER PUBLICATIONS

Japanese Office Action dated Apr. 7. 2020 in Japanese Design Application No. 2019-000790 (with unedited computer generated English translation), 8 pages.
Japanese Office Action dated Dec. 3, 2019 in Patent Application No. 2019-000790.
Creative Materials, "124-08 NB Electrically Conductive Epoxy Adhesive", www.creativematerials.c,om, Apr. 22, 2010, Revision: E, 1 page.
Herrmann, W. et al. "Hot Spot Investigations on PV Modules—New Concepts for a Test Standard and Consequences for Module Design with Respect to Bypass Diodes", TUV Rheinland Sicherheit und Umweltschutz GmbH, 4 pages.
Yang, et al., "Investigation of the Relationship between Reverse Current of Crystalline Silicon Solar Cells and Conduction of Bypass Diode", Hindawi Publishing Corporation International Journal of Photoenergy, vol. 2012, Article ID 357218, 6 pages.
Breitenstein, 0. et al., "Shunts due to laser scribing of solar cells evaluated by highly sensitive lock-in : hermography", 11th International Photovoltaic Science and Engineering Conference (PVSEC-11), Sep. 20-24, 1999 Sapporo, Japan, 9 pages.
Kyocera, News Releases 2009, "Kyocera Explains Innovations Used in Solar Panel for New Toyota Prius", http://global.kyocera.com/new/2009/0902/fpri.htnnl, Dec. 21, 2014, 2 pages.
Hermann, W. et al., "Hot Spot Investigations on PV Modules—New Concepts for a Test Standard and consequences for Module Design with Respect to Bypass Diodes," TUV Rheinland Sicherheit and Umweltschutz GmbH, http://ieeexplore.ieee.org, Dec. 20, 2014, 6 pages.
Viaki, et al., "Power Losses in Long String and Parallel-Connected Short Strings of Series-Connected Silicon-Based Photovoltaic Modules Due to Partial Shading Conditions", IEEE Transactions on Energy Conversion, vol. 27, No. 1, Mar. 2012, pp. 173-183.
Halavani, et al., "Results of Pressue-Only Cell Interconnections in High Voltage PV-Modules", 29th European Photovoltaic Solar Energy Conference and Exhibition, Vienna University of Technology, pp. 64-68.
Heimann, M., et al., "Ultrasonic Bonding of Aluminum Ribbons to Interconnect High-Efficiency Crystalline-Silicon Solar Cells", Energy Procedia 27 (2012) pp. 670-675.
Silvestre S., et al., "Study of bypass diodes configuration on PV modules", Applied Energy 86 (2009) pp. 1632-1640.
Scholten, "Silicone Encapsulation of c-Si Photovoltaic Modules", Solar Novus Today, Feb. 10, 2014, 5 pages, lttp://www.solarnovus.com.
3Mtm "Thermally Conductive Heat Spreading Tape, 9876B-05, 9876B-08, 9876-10, 9876-15"; Nov. 2012, pp. 1-4.
STMicroelectronics, "How to choose a bypass diode for a silicon panel junction box", Sep. 2011, pp. 1-24.
Kray, D., et al., "Reducing AG Cost and Increasing Efficiency. Multicrystalline Silicon Solar Cells With Direct Plated .,1;ontacts Exceeding 17% Efficiency", 26th EU PVSEC Proceedings, pp. 1199-1202.
Viatula, J. Phys. Chem. Ref. Daa, vol. 8, No. 4, 1979.
Japanese Office Action dated Dec. 17, 2019 in Patent Application No. 2019-000792.
Japanese Office Action dated Dec. 17, 2019 in Patent Application No. 2019-000794.
Notice of Reasons for Rejection dated Jul. 23, 2019, in Japanese Application No. 2019-000792, 2 pages.
Office Action dated Feb. 1, 2016, corresponding to U.S. Appl. No. 14/565,820, 62 pages.
R.A. Matula, "Electrical Resistivity of Copper, Gold, Palladium, and Silver" J. Phys. Chem. Ref. Data, vol. 8, No. 4, 1979.
3M TM Thermally Conductive Heat Spreading Tape 98768-05 98768-08 9876-10 9876-15, pp. 1-4.
D.W.K. Eikelboom, "Conductive Adhesives for Low-Stress Interconnection of Thin Back-Contact Solar Cells", 29th IEEE Photovoltaic Specialists Conference, May 20-24, 2002, New Orleans, USA.
Geoffrey R. Walker, "Cascaded DC-DC Converter Connection of Photovoltaic Modules", IEEE Transactions on Dower Electronics, vol. 19. No. 4, Jul. 2004.
F.C. Nix, Phys. Rev. 57, 744 (1940).
"ST Microelectronics, How to choose a bypass diode for a silicon panel junction box", AN3432, 24 pages.
F.C. Nix et al., "The Thermal Expansion of Pure Metals: Copper, Gold, Aluminum, Nickel, and Iron", Oct. 15, 2914, vol. 60, 9 pages.
Goldberg, Lee H., "Active Bypass Diodes Improve Solar Panel Efficiency and Performance", Digi-Key Corporation, ittp://www.digikey.com/en/articles/techzone/2012/dec/ctivebypassdiodesimprovesolarpanelefficiencyandperformance, Dec. 12, 2012, 8 pages.
Hermann, W. et al., "Operational Behaviour of Commercial Solar Cells Under Reverse Biased Conditins", TON./Rheinland Sicherheit und Umweltschutz GmbH, 3 pages.
Creative Materials, "Product Announcement: Flexible Electrically Conductive Adhesive Family As Solder Replacements in Solar Cells", hffp://www.creativematerials.com/news/pr-conductive-3dhesive-for-solar-cells.php, Feb. 9, 2015, 2 pages.

* cited by examiner

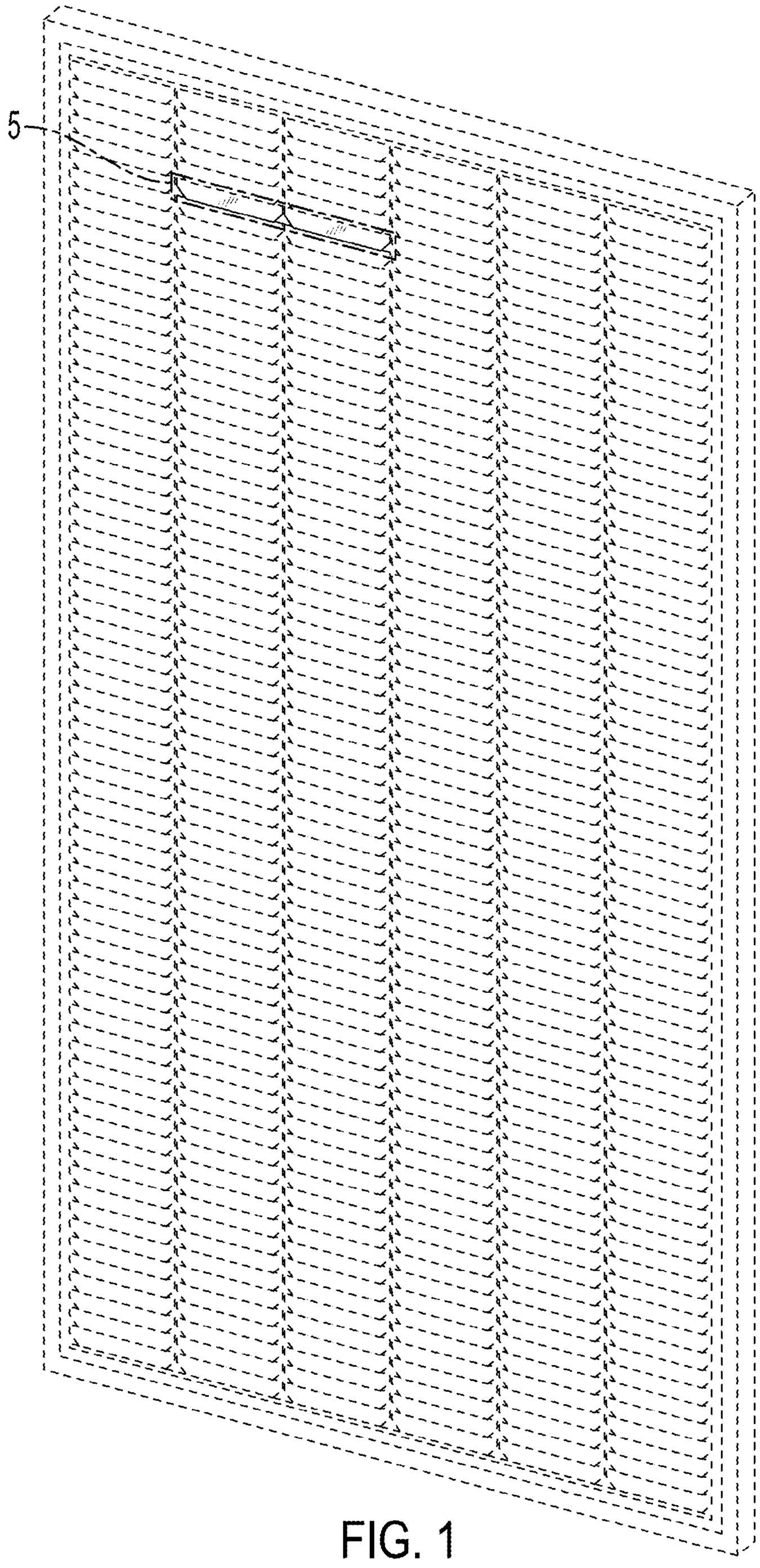


FIG. 1

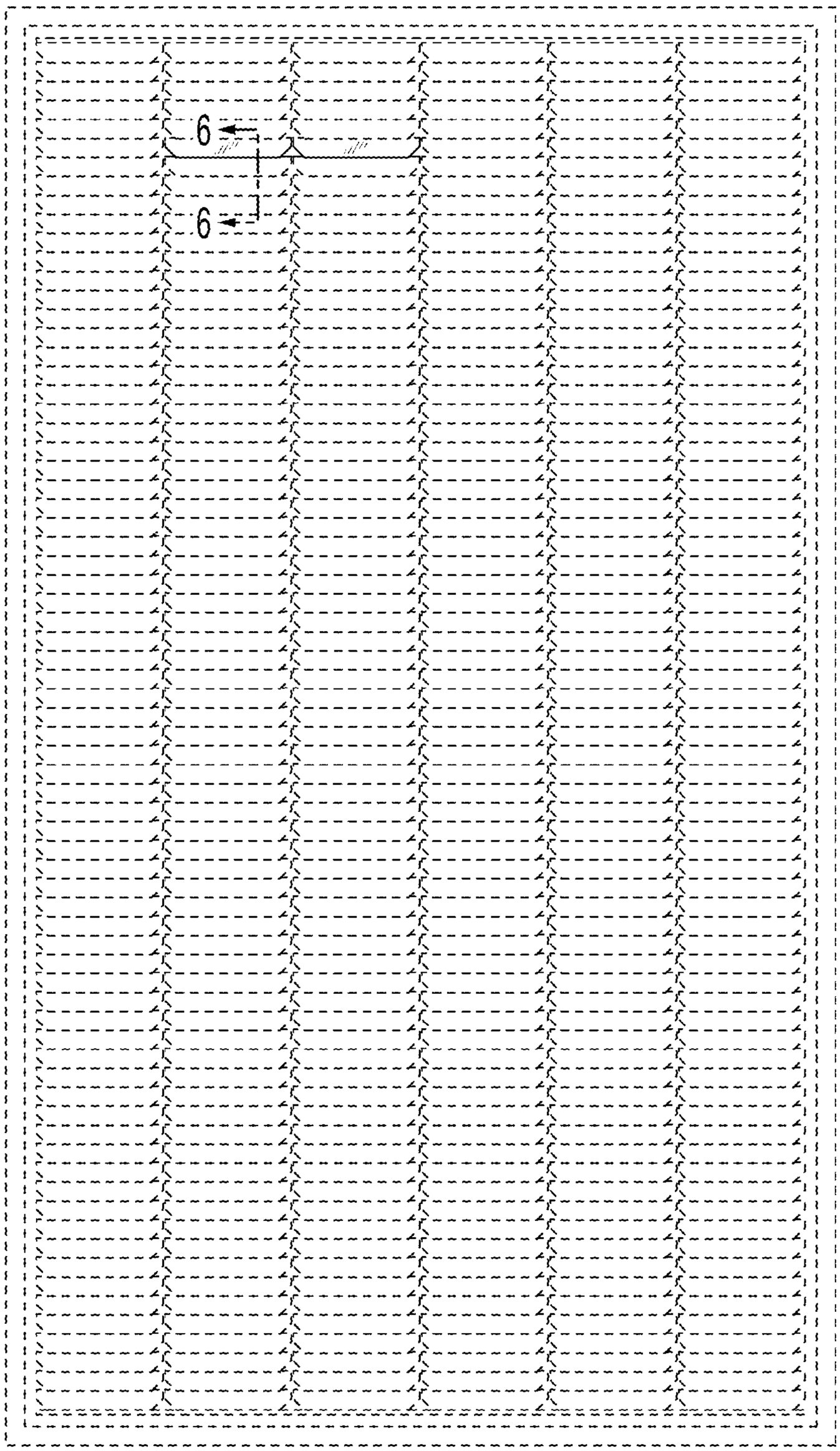


FIG. 2

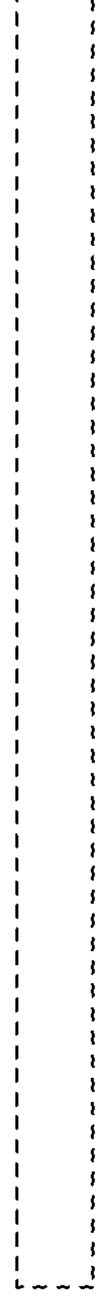


FIG. 4

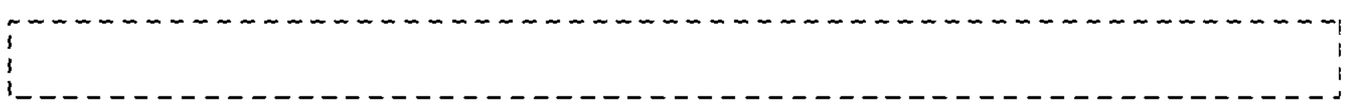


FIG. 3

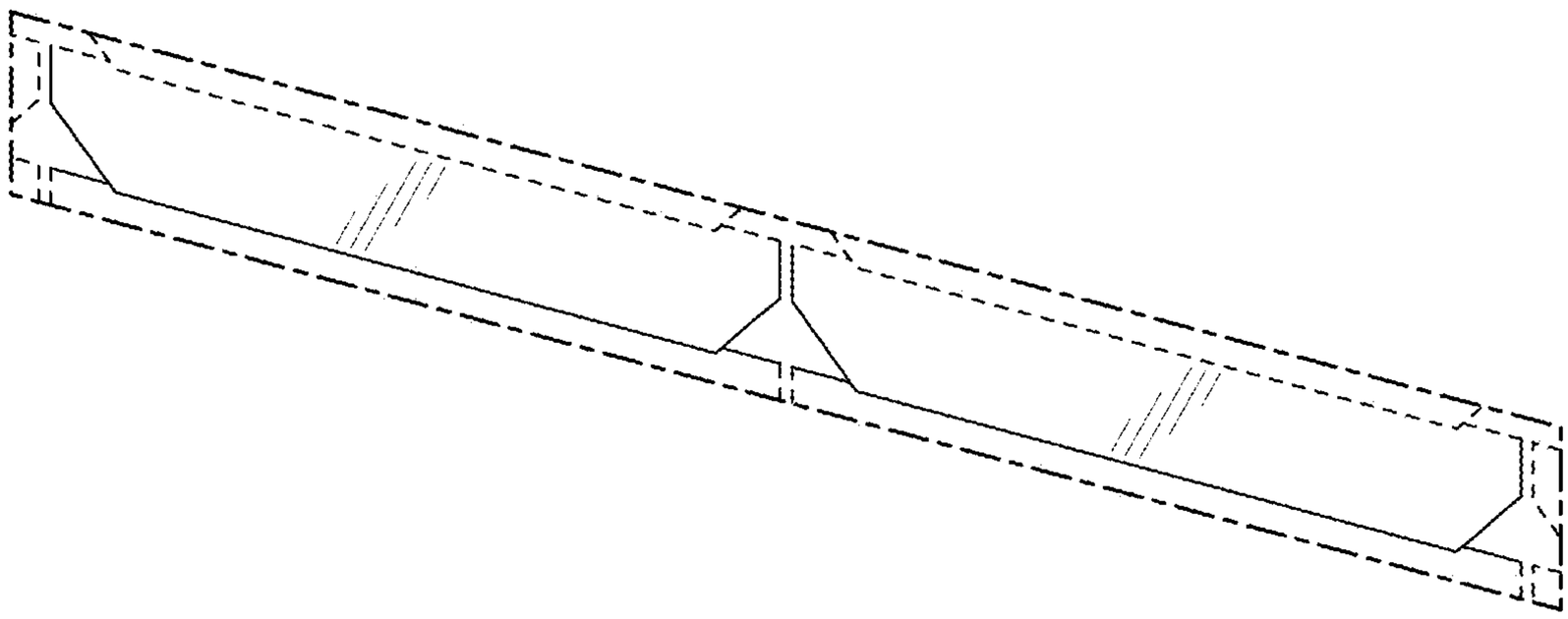


FIG. 5

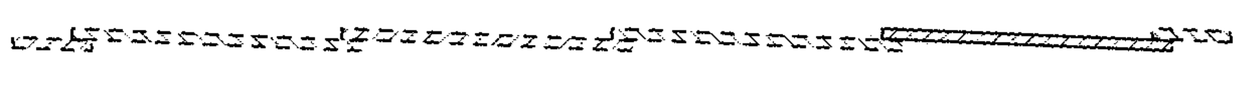


FIG. 6