

## PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1  
 Stylesheet Version v1.2

EPAS ID: PAT5474118

<b>SUBMISSION TYPE:</b>	NEW ASSIGNMENT	
<b>NATURE OF CONVEYANCE:</b>	SECURITY INTEREST	
<b>CONVEYING PARTY DATA</b>		
<b>Name</b>		<b>Execution Date</b>
OPEL INC.		03/26/2019
<b>RECEIVING PARTY DATA</b>		
<b>Name:</b>	ESPRESSO CAPITAL LTD.	
<b>Street Address:</b>	300-8 KING STREET EAST	
<b>City:</b>	TORONTO ONTARIO	
<b>State/Country:</b>	CANADA	
<b>Postal Code:</b>	M5C 1B5	
<b>PROPERTY NUMBERS Total: 71</b>		
<b>Property Type</b>	<b>Number</b>	
Application Number:	10084770	
Application Number:	09556285	
Application Number:	09798316	
Application Number:	10469649	
Application Number:	10512501	
Application Number:	10689019	
Application Number:	11780745	
Application Number:	11053350	
Application Number:	10200967	
Application Number:	11039559	
Application Number:	10292127	
Application Number:	10832223	
Application Number:	10280892	
Application Number:	10323390	
Application Number:	10323413	
Application Number:	10323389	
Application Number:	12033717	
Application Number:	10323388	
Application Number:	10383364	
Application Number:	10340942	

PATENT

Property Type	Number
Application Number:	11044636
Application Number:	10340941
Application Number:	10700016
Application Number:	11360759
Application Number:	11360756
Application Number:	10627043
Application Number:	10602217
Application Number:	11424012
Application Number:	12433719
Application Number:	12050321
Application Number:	14238649
Application Number:	13951578
Application Number:	14609064
Application Number:	13921311
Application Number:	14549369
Application Number:	14551619
Application Number:	14104230
Application Number:	14023525
Application Number:	14222841
Application Number:	14698087
Application Number:	14287388
Application Number:	14736494
Application Number:	14736552
Application Number:	14736624
Application Number:	14578756
Application Number:	14578805
Application Number:	14578893
Application Number:	14578950
Application Number:	14579066
Application Number:	14579151
Application Number:	14579404
Application Number:	14943502
Application Number:	14943599
Application Number:	14444629
Application Number:	14736421
Application Number:	14736460
Application Number:	15435413
Application Number:	15450351

Property Type	Number
Application Number:	15450282
Application Number:	15450400
Application Number:	15456915
Application Number:	16206673
Application Number:	62621659
Application Number:	15802009
Application Number:	16036151
Application Number:	16036179
Application Number:	16036208
Application Number:	16036234
Application Number:	16258292
Application Number:	62727538
Application Number:	16258308

#### CORRESPONDENCE DATA

**Fax Number:** (312)207-6400

***Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.***

**Phone:** 4156595924

**Email:** mbenson@reedsmith.com

**Correspondent Name:** JOHN KLINE

**Address Line 1:** REED SMITH LLP

**Address Line 2:** 101 SECOND STREET, SUITE 1800

**Address Line 4:** SAN FRANCISCO, CALIFORNIA 94105

<b>ATTORNEY DOCKET NUMBER:</b>	390192.20005
<b>NAME OF SUBMITTER:</b>	JOHN KLINE
<b>SIGNATURE:</b>	/John Kline/
<b>DATE SIGNED:</b>	04/15/2019

#### Total Attachments: 8

source=IP Security Agreement POET TECHNOLOGIES (OPEL Inc) 2019-03-26 v2 FINAL#page1.tif  
source=IP Security Agreement POET TECHNOLOGIES (OPEL Inc) 2019-03-26 v2 FINAL#page2.tif  
source=IP Security Agreement POET TECHNOLOGIES (OPEL Inc) 2019-03-26 v2 FINAL#page3.tif  
source=IP Security Agreement POET TECHNOLOGIES (OPEL Inc) 2019-03-26 v2 FINAL#page4.tif  
source=IP Security Agreement POET TECHNOLOGIES (OPEL Inc) 2019-03-26 v2 FINAL#page5.tif  
source=IP Security Agreement POET TECHNOLOGIES (OPEL Inc) 2019-03-26 v2 FINAL#page6.tif  
source=IP Security Agreement POET TECHNOLOGIES (OPEL Inc) 2019-03-26 v2 FINAL#page7.tif  
source=IP Security Agreement POET TECHNOLOGIES (OPEL Inc) 2019-03-26 v2 FINAL#page8.tif

## IP SECURITY AGREEMENT

THIS IP SECURITY AGREEMENT, dated as of March 26, 2019, is made by OPEL Inc. (the “*Grantor*”), in favor of ESPRESSO CAPITAL LTD. (the “*Lender*”).

### WITNESSETH:

WHEREAS, pursuant to the Credit Facility Agreement dated as of March 26, 2019 (as the same may be amended, modified, restated or replaced from time to time, the “*Credit Agreement*”) by the Grantor and the Lender, the Lender has agreed to make Advances (as defined in the Credit Agreement) to the Grantor upon the terms and subject to the conditions set forth therein;

WHEREAS, the Grantor is a party to the Security Agreement (made with effect March 26, 2019, as the same may be amended, modified, restated or replaced from time to time, the “*Security Agreement*”) by the Grantor and the Lender, pursuant to which the Grantor is required to execute and deliver this IP Security Agreement;

NOW, THEREFORE, in consideration of the premises and to induce the Lender to enter into the Credit Agreement and to induce the Lender to make Advances to the Grantor thereunder, Grantor hereby agrees with the Lender as follows:

**Section 1. Defined Terms.** Capitalized terms used herein without definition are used as defined in the Security Agreement.

**Section 2. Grant of Security Interest in Patent Collateral.** Grantor, as collateral security for the prompt and complete payment and performance when due (whether at stated maturity, by acceleration or otherwise) of the Obligations of such Grantor, hereby mortgages, pledges and hypothecates to the Lender, and grants to the Lender a Lien on and security interest in, all of its right, title and interest in, to and under the following Collateral of such Grantor (the “*Patent Collateral*”):

(a) all of its patents and all intellectual property licenses providing for the grant by or to such Grantor of any right under any patent, including, without limitation, those referred to on Schedule 1 hereto;

(b) all reissues, reexaminations, continuations, continuations-in-part, divisionals, renewals and extensions of the foregoing; and

(c) all income, royalties, proceeds and liabilities at any time due or payable or asserted under and with respect to any of the foregoing, including, without limitation, all rights to sue and recover at law or in equity for any past, present and future infringement, misappropriation, dilution, violation or other impairment thereof.

**Section 3. Guaranty and Security Agreement.** The security interest granted pursuant to this IP Security Agreement is granted in conjunction with the security interest granted to the Lender pursuant to the Security Agreement and Grantor hereby acknowledges and agrees that the rights and remedies of the Lender with respect to the security interest in the Patent Collateral made and granted hereby are more fully set forth in the Security Agreement, the terms and provisions of which are incorporated by reference herein as if fully set forth herein.

**Section 4. Grantor Remains Liable.** Grantor hereby agrees that, anything herein to the contrary notwithstanding, such Grantor shall assume full and complete responsibility for the

prosecution, defense, enforcement or any other necessary or desirable actions in connection with its Patent Collateral and intellectual property licenses subject to a security interest hereunder.

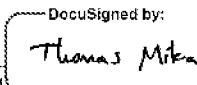
**Section 5. Counterparts.** This IP Security Agreement may be executed in any number of counterparts and by different parties in separate counterparts, each of which when so executed shall be deemed to be an original and all of which taken together shall constitute one and the same agreement. Signature pages may be detached from multiple separate counterparts and attached to a single counterpart.

**Section 6. Governing Law.** This IP Security Agreement and the rights and obligations of the parties hereto shall be governed by, and construed and interpreted in accordance with, the law of the State of New York.

IN WITNESS WHEREOF, Grantor has caused this IP Security Agreement to be executed and delivered by its duly authorized officer as of the date first set forth above.

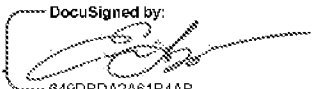
Very truly yours,

OPEL Inc., as Grantor

By  \_\_\_\_\_  
TI 508E24AEF895415... )

ACCEPTED AND AGREED  
as of the date first above written:

ESPRESSO CAPITAL LTD., as Lender

By  \_\_\_\_\_  
849DBDA2A61E4AB... )

**Schedule I  
To IP Security Agreement**

S.No	Ref#	Filing date	Application #	Publication #	Title of invention	Application stage	Date of issue as patent	Status	
1	OPE-001RE	02/26/2002	US10/084770	USRE3682E1	Grating coupled vertical cavity optoelectronic devices	Granted	04/01/2005	Active	OPEL
2	OPE-002	04/24/2000	US09/556285	US6870207B2	III-V charge coupled device suitable for visible, near and far infrared detection	Granted	03/22/2005	Active	OPEL
3	OPE-004	03/02/2001	US09/798316	US6479844B2	Modulation doped thyristor and complementary transistor combination for a monolithic optoelectronic integrated circuit	Granted	11/12/2002	Active	OPEL
4	OPE-004 US	08/29/2003	US10/469649	US7012274B2	Modulation doped thyristor and complementary transistors combination for a monolithic optoelectronic integrated circuit	Granted	03/14/2006	Active	OPEL
5	OPE-008	04/28/2004	US10/512501	US7262429B2	The detection employing modulation doped quantum well device structures	Granted	08/28/2007	Active	OPEL
6	OPE-007	10/20/2003	US10/689019	US7247892B2	Imaging array utilizing thyristor-based pixel elements	Granted	07/24/2007	Active	OPEL
7	OPE-007D1	07/20/2007	US11/780745	US7432539B2	Imaging method utilizing thyristor-based pixel elements	Granted	10/07/2008	Active	OPEL
8	OPE-004USC1	02/08/2005	US11/053350	US7385230B1	Modulation doped thyristor and complementary transistor combination for a monolithic optoelectronic integrated circuit	Granted	06/10/2008	Active	OPEL
9	OPE-005-CIP	07/23/2002	US10/209967	US6849866B2	High performance optoelectronic and electronic inversion channel quantum well devices suitable for monolithic integration	Granted	02/01/2005	Active	OPEL
10	OPE-005-CIPD1	01/20/2005	US11/039559	US7176046B2	Apparatus and a method of fabricating inversion channel devices with precision gate doping for a monolithic integrated circuit	Granted	02/13/2007	Active	OPEL
11	OPE-006C1	11/12/2002	US10/292127	US6936839B2	Monolithic integrated circuit including a waveguide and quantum well inversion channel devices and a method of fabricating same	Granted	08/30/2005	Active	OPEL
12	OPE-010	04/26/2004	US10/832223	US7333731B2	Multifunctional optoelectronic thyristor and integrated circuit and optical transceiver employing same	Granted	02/19/2008	Active	OPEL
13	OPE-012	10/25/2002	US10/280892	US6954473B2	Optoelectronic device employing at least one semiconductor heterojunction thyristor for producing variable electrical/optical delay	Granted	10/11/2005	Active	OPEL
14	OPE-013	12/19/2002	US10/323396	US6853014B2	Optoelectronic circuit employing a heterojunction thyristor device that performs high speed sampling	Granted	02/08/2005	Active	OPEL
15	OPE-018	12/19/2002	US10/323413	US6995407B2	Photonic digital-to-analog converter employing a plurality of heterojunction thyristor devices	Granted	02/07/2006	Active	OPEL
16	OPE-019	12/19/2002	US10/323389	US7332752B2	Optoelectronic circuit employing a heterojunction thyristor device to convert a digital optical signal to a digital electrical signal	Granted	02/19/2008	Active	OPEL



S.No	Ref#	Filing date	Application #	Publication #	Title of invention	Application stage	Date of issue as patent	Status	
17	OPE-019C1	02/19/2008	US12/033717	US7595516B2	Optoelectronic circuit employing a heterojunction thyristor device to convert a digital optical signal to a digital electrical signal	Granted	09/29/2009	Active	OPEL
18	OPE-020	12/19/2002	US10/323388	US6873273B2	Photonic serial digital-to-analog converter employing a heterojunction thyristor device	Granted	03/29/2005	Active	OPEL
19	OPE-015	03/07/2003	US10/383364	US7333733B2	Optoelectronic clock generator producing high frequency optoelectronic pulse trains with variable frequency and variable duty cycle and low jitter	Granted	02/19/2008	Active	OPEL
20	OPE-021	01/13/2003	US10/340942	US6841795B2	Semiconductor devices employing at least one modulation doped quantum well structure and one or more etch stop layers for accurate contact formation	Granted	07/11/2016	Active	OPEL
21	OPE-021D1	01/10/2005	US11/044636	US7173293B2	Semiconductor devices employing at least one modulation doped quantum well structure and one or more etch stop layers for accurate contact formation	Granted	02/06/2007	Active	OPEL
22	OPEL-022	01/13/2003	US10/340941	US7015120B2	Method of fabricating semiconductor devices employing at least one modulation doped quantum well structure and one or more etch stop layers for accurate contact formation	Granted	03/21/2006	Active	OPEL
23	OPE-026	11/03/2003	US10/700016	US6974969B2	P-type quantum-well-base bipolar transistor device employing interdigitated base and emitter formed with a capping layer	Granted	12/13/2005	Active	OPEL
24	OPE-022D1	02/23/2006	US11/360759	US7776783B2	Method of fabricating semiconductor devices employing at least one modulation doped quantum well structure and one or more etch stop layers for accurate contact formation	Granted	08/17/2010	Active	OPEL
25	OPE-022D2	02/23/2006	US11/360756	US7556976B2	Method of fabricating semiconductor devices employing at least one modulation doped quantum well structure and one or more etch stop layers for accurate contact formation	Granted	07/07/2009	Active	OPEL
26	OPE-023	07/25/2003	US10/627043	US6977954B2	Semiconductor laser array device employing modulation doped quantum well structures	Granted	12/20/2005	Active	OPEL
27	OPE-024	06/24/2003	US10/602217	US7064697B2	Photonic sigma delta analog-to-digital conversion employing dual heterojunction thyristors	Granted	06/26/2006	Active	OPEL
28	OPE-024D1	06/14/2006	US11/424012	US7409120B2	Integrated circuit for programmable optical delay	Granted	08/05/2008	Active	OPEL
29	OPE-043	04/30/2009	US12/433719	US7855336B2	Concentrated solar photovoltaic module with protective light shielding	Granted	12/21/2010	Active	OPEL
30	OPE-042	03/18/2008	US12/050321	US8080821B2	Thyristor radiation detector array and applications thereof	Granted	12/20/2011	Active	OPEL
31	OPE-069	02/12/2014	US14/238649	US9188798B2	Optical closed loop microresonator and thyristor memory device	Granted	11/17/2015	Active	OPEL
32	OPE-073	07/26/2013	US13/951578	US8947925B2	Thyristor memory cell integrated circuit	Granted	02/03/2015	Active	OPEL

S.No	Ref#	Filing date	Application #	Publication #	Title of invention	Application stage	Date of issue as patent	Status	
33	OPE-073C1	01/29/2015	US14/609064	US9281059B2	Thyristor memory cell integrated circuit	Granted	03/08/2016	Active	OPEL
34	OPE-072	06/19/2013	US13/921311	US9082637B2	Optoelectronic integrated circuit	Granted	07/14/2015	Active	OPEL
35	OPE-072C1	11/20/2014	US14/549369	US9490321B2	Optoelectronic integrated circuit	Granted	11/08/2016	Active	OPEL
36	OPE-072C2	11/24/2014	US14/551619	US9401400B2	Single electron transistor device	Granted	07/26/2016	Active	OPEL
37	OPE-070	12/12/2013	US14/104230	US9377587B2	Fiber optic coupler array	Granted	06/28/2016	Active	OPEL
38	OPE-074	09/11/2013	US14/023525	US9614112B2	Imaging cell array integrated circuit	Granted	04/04/2017	Active	OPEL
39	OPE-075	03/24/2014	US14/222841	US9625647B2	Optoelectronic integrated circuit	Granted	04/18/2017	Active	OPEL
40	OPE-076	04/28/2015	US14/698087	US9201287B1	Photonic analog-to-digital converter	Granted	11/11/2015	Active	OPEL
41	OPE-077	05/27/2014	US14/287388	US9276160B2	Power semiconductor device formed from a vertical thyristor epitaxial layer structure	Granted	03/01/2016	Active	OPEL
42	OPE-079C	06/11/2015	US14/736494	US9450124B1	Fabrication methodology for optoelectronic integrated circuits	Granted	09/20/2016	Active	OPEL
43	OPE-079D	06/11/2015	US14/736552	US9490336B1	Fabrication methodology for optoelectronic integrated circuits	Granted	11/08/2016	Active	OPEL
44	OPE-079E	06/11/2015	US14/736624	US9590136B2	Semiconductor device for optoelectronic integrated circuits	Granted	03/07/2017	Active	OPEL
45	OPE-080A	12/22/2014	US14/578756	US9544062B2	Coherent optical receiver	Granted	01/10/2017	Active	OPEL
46	OPE-080B	12/22/2014	US14/578805	US9590742B2	Thyristor-based optical XOR circuit	Granted	03/07/2017	Active	OPEL
47	OPE-080C	12/22/2014	US14/578893	US9590600B2	Thyristor-based optical flip-flop	Granted	03/07/2017	Active	OPEL
48	OPE-080D	12/22/2014	US14/578950	US9541945B2	Thyristor-based optical AND gate and thyristor-based electrical AND gate	Granted	01/10/2017	Active	OPEL
49	OPE-080E	12/22/2014	US14/579066	US9553715B2	Optical phase detector for an optical phase lock loop	Granted	01/24/2017	Active	OPEL
50	OPE-080F	12/22/2014	US14/579151	US9209815B1	Thyristor-based optical charge pump for an optical phase lock loop	Granted	12/08/2015	Active	OPEL
51	OPE-080G	12/22/2014	US14/579404	US9559636B2	Thyristor-based optoelectronic oscillator with tunable frequency and optical phase lock loop employing same	Granted	01/31/2017	Active	OPEL
52	OPE-069C1	11/17/2015	US14/943502	US9684192B2	Optical closed loop microresonator and thyristor memory device	Granted	06/20/2017	Active	OPEL
53	OPE-069C2	11/17/2015	US14/943599	US9684193B2	Optical closed loop microresonator and thyristor memory device	Granted	06/20/2017	Active	OPEL
54	OPE-078	07/28/2014	US14/444629	US9698457B2	Optoelectronic integrated circuitry for transmitting and/or receiving wavelength-division multiplexed optical signals	Granted	07/04/2017	Active	OPEL
55	OPE-079A	06/11/2015	US14/736421	US9679987B2	Fabrication methodology for optoelectronic integrated circuits	Granted	06/13/2017	Active	OPEL
56	OPE-079B	06/11/2015	US14/736460	US9160365284A1	Fabrication methodology for optoelectronic integrated circuits	Granted	05/09/2017	Active	OPEL

S.No	Ref#	Filing date	Application #	Publication #	Title of invention	Application stage	Date of issue as patent	Status	
57	OPE-074C	02/17/2017	US15/435413	US20170301809A1	Dual wavelength imaging cell array integrated circuit	Application	N/A	Published	OPEL
58	OPE-075C1	03/06/2017	US15/450351	US20170221995A1	Split-electrode vertical cavity optical device	Application	N/A	Published	OPEL
59	OPE-075C2	03/06/2017	US15/450282	US20170179684A1	Dual wavelength hybrid device	Application	N/A	Published	OPEL
60	OPE-075C3	03/06/2017	US15/450400	US16038302B2	Optoelectronic integrated circuit	Granted	07/31/2018	Active	OPEL
61	OPE-078D1	03/13/2017	US15/456915	US9904015B2	Optoelectronic integrated circuitry for transmitting and/or receiving wavelength-division multiplexed optical signals	Granted	02/27/2018	Active	OPEL
65	OPE-083	11-30-2018	US16/206673	N/A	Vertical Cavity Surface Emitting Laser	Application	N/A	Filed but not published	N/A
66	OPE-084P	01/25/2018	US62/621659	N/A	Optical Dielectric Interposer	Provisional application	N/A	Non-provisionals to be filed	N/A
68	OPE-086	11/02/2017	US15/802009	N/A	Water-level optoelectronic packaging imaging array utilizing thyristor-based pixel elements	Application	N/A	Filed but not published	N/A
70	OPE-007CA	10-20-2004	CA2542250	CA2542250C	Photonic integrated device with dielectric structure	Canadian patent	07/08/2014	Active	OPEL
71	OPE-082EP	06/08/2018	16865086.9	N/A	Photonic integrated device with dielectric structure	Application	N/A	Filed but not published	N/A
72	OPE-082CN	12/07/2018	201680078731	N/A	Optical Dielectric Waveguide Structures	Application	N/A	Filed but not published	N/A
72	OPE-101	07/16/18	16/036,151		METHODS FOR OPTICAL DIELECTRIC WAVEGUIDE STRUCTURES				N/A
73	OPE-102	07/16/18	16/036,179		OPTICAL DIELECTRIC WAVEGUIDE SUBASSEMBLY STRUCTURES				N/A
74	OPE-103	07/16/18	16/036,208		METHODS FOR OPTICAL DIELECTRIC WAVEGUIDE SUBASSEMBLY STRUCTURE				N/A
75	OPE-104	07/16/18	16/036,234		OPTICAL DIELECTRIC PLANAR WAVEGUIDE PROCESS				N/A
76	OPE-105	01/25/19	16/258,292		Hermetic Sealing Method for Capped Subassemblies				N/A
77	OPE-106 PRO	09/05/18	62/727,518		METHOD OF FORMING AN HERMETIC SEAL ON ELECTRONIC AND OPTOELECTRONIC PACKAGES				N/A
78	OPE-106	01/25/19	16/258,308						N/A
79	OPE-108				Dual Core Waveguide				N/A