

US010472938B2

(12) United States Patent

Parks et al.

(54) PERFORATION GUN COMPONENTS AND SYSTEM

- (71) Applicant: DynaEnergetics GmbH & Co. KG, Troisdorf (DE)
- Inventors: David C. Parks, Calgary (CA); Frank Haron Preiss, Bonn (DE); Liam McNelis, Bonn (DE); Eric Mulhern, Edmonton (CA); Thilo Scharf, Donegal (IE)
- (73) Assignees: DynaEnergetics GmbH & Co. KG, Troisdorf (DE); JDP Engineering and Machine Inc, Calgary (CA)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.
- (21) Appl. No.: 16/359,540
- (22) Filed: Mar. 20, 2019

(65) **Prior Publication Data**

US 2019/0219375 A1 Jul. 18, 2019

Related U.S. Application Data

(60) Continuation of application No. 15/920,812, filed on Mar. 14, 2018, which is a continuation of application (Continued)

(30) Foreign Application Priority Data

Jul. 18, 2013 (CA) 2821506

- (51) Int. Cl.
 - E21B
 43/1185
 (2006.01)

 F42D
 1/02
 (2006.01)

 (Continued)
 (Continued)

(10) Patent No.: US 10,472,938 B2

(45) **Date of Patent:** Nov. 12, 2019

- (52) U.S. Cl. CPC *E21B 43/1185* (2013.01); *E21B 43/119* (2013.01); *E21B 43/11855* (2013.01); (Continued)
- (58) Field of Classification Search CPC E21B 43/1185; E21B 43/11852; E21B 43/11855; E21B 43/117; F42D 1/041; F42D 1/043; F42D 1/045; F42C 19/06 See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,358,466 A	9/1944 Miller
2,889,775 A	6/1959 Owen
	(Continued)

FOREIGN PATENT DOCUMENTS

CA	2821506 A1	1/2015
CN	85107897 A	9/1986
	(Conti	nued)

OTHER PUBLICATIONS

Austin Powder Company, A—140 F & Block, Detonator & Block Assembly, 2 pgs.

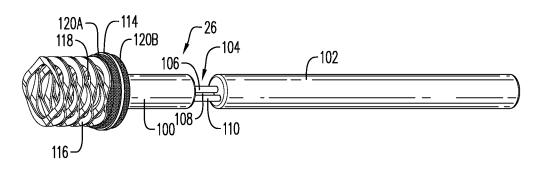
(Continued)

Primary Examiner — Joshua T Semick (74) Attorney, Agent, or Firm — Moyles IP, LLC

(57) **ABSTRACT**

Components for a perforation gun system are provided including combinations of components including a selfcentralizing charge holder system and a bottom connector that can double as a spacer. Any number of spacers can be used with any number of holders for any desired specific metric or imperial shot density, phase and length gun system.

20 Claims, 18 Drawing Sheets



Related U.S. Application Data

No. 15/617,344, filed on Jun. 8, 2017, which is a division of application No. 15/287,309, filed on Oct. 6, 2016, now Pat. No. 9,702,680, which is a division of application No. 14/904,788, filed as application No. PCT/CA2014/050673 on Jul. 16, 2014, now Pat. No. 9,494,021.

(51) Int. Cl.

DOCKE

F42D 1/04	(2006.01)
F42C 19/06	(2006.01)
E21B 43/119	(2006.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,170,400	Α	2/1965	Nelson
3,246,707	Α	4/1966	Bell
3,374,735	Α	3/1968	Moore
3,504,723	Α	4/1970	Cushman et al.
3,859,921	Α	1/1975	Stephenson
4,007,790	Α	2/1977	Henning
4,058,061	Α	11/1977	Mansur, Jr. et al.
4,182,216	Α	1/1980	DeCaro
4,491,185	Α	1/1985	McClure
4,496,008	Α	1/1985	Pottier et al.
4,574,892	Α	3/1986	Grigar et al.
4,598,775	Α	7/1986	Vann et al.
4,747,201	Α	5/1988	Donovan et al.
4,776,393	Α	10/1988	Forehand et al.
4,790,383	Α	12/1988	Savage et al.
4,889,183	Α	12/1989	Sommers et al.
5,027,708	A *	7/1991	Gonzalez E21B 43/1185
· · ·			102/202.1
5,052,489	Α	10/1991	Carisella et al.
5,088,413	Ā	2/1992	Huber
5,105,742	A	4/1992	Sumner
5,159,145	Ā	10/1992	Carisella et al.
5,322,019	Α	6/1994	Hyland
5,347,929	Α	9/1994	Lerche et al.
5,436,791	Α	7/1995	Turano et al.
5,703,319	Α	12/1997	Fritz et al.
5,775,426	Α	7/1998	Snider et al.
5,816,343	Α	10/1998	Markel et al.
6,006,833	Α	12/1999	Burleson et al.
6,012,525	Α	1/2000	Burleson et al.
6,085,659	Α	7/2000	Beukes et al.
6,112,666	Α	9/2000	Murray et al.
6,305,287	B1	10/2001	Capers et al.
6,354,374	B1	3/2002	Edwards et al.
6,418,853	B1	7/2002	Duguet et al.
6,651,747	B2	11/2003	Chen et al.
6,739,265	B1	5/2004	Badger et al.
6,742,602	B2	6/2004	Trotechaud
6,752,083	B1 *	6/2004	Lerche E21B 43/1185
			102/202.5
7,107,908	B2 *	9/2006	Forman F42D 1/055
			102/202.5
7,193,527	B2	3/2007	Hall
7,278,491	B2	10/2007	Scott
7,347,278	B2	3/2008	Lerche et al.
	B2	8/2009	Hummel et al.
7,762,172	B2	7/2010	Li et al.
7,762,351	B2	7/2010	Vidal
	B2	8/2010	Stewart et al.
	B2	10/2010	Chan et al.
7,908,970	B1	3/2011	Jakaboski et al.
7,929,270	B2	4/2011	Hummel et al.

8,074,737	B2	12/2011	Hill et al.
8,157,022	B2	4/2012	Bertoja et al.
8,181,718	B2	5/2012	Burleson et al.
8,182,212	B2	5/2012	Parcell
8,186,259	B2	5/2012	Burleson et al.
8,256,337	B2	9/2012	Hill
8,395,878	B2	3/2013	Stewart et al.
8,451,137	B2	5/2013	Bonavides et al.
8,695,506	B2 *	4/2014	Lanclos E21B 43/1185
0,055,500	D2	02011	102/206
8,875,787	B2	11/2014	Tassaroli
8,881,816	B2	11/2014	Glenn et al.
9,080,433	B2 B2	7/2014	Lanclos et al.
	B2 *	11/2015	McCann E21B 43/1185
9,175,553			McCann E21B 45/1185 Handasty E42D 1/05
9,194,219		11/2015	Hardesty F42D 1/05
9,494,021	B2	11/2016	Parks et al.
9,518,454	B2 *	12/2016	Current E21B 43/11
9,581,422	B2	2/2017	Preiss et al.
9,605,937	B2	3/2017	Eitschberger et al.
9,677,363	B2 *	6/2017	Schacherer E21B 29/02
9,689,223	B2	6/2017	Schacherer et al.
9,822,618	B2 *	11/2017	Eitschberger E21B 43/1185
10,077,641	B2	9/2018	Rogman et al.
10,190,398	B2 *	1/2019	Goodman E21B 43/1185
2002/0020320	A1	2/2002	Lebaudy et al.
2002/0062991	A1	5/2002	Farrant et al.
2003/0000411	A1	1/2003	Cernocky et al.
2003/0001753	A1	1/2003	Cernocky et al.
2005/0178282	A1	8/2005	Brooks et al.
2005/0194146	A1	9/2005	Barker et al.
2007/0158071	A1	7/2007	Mooney et al.
2008/0149338	A1	6/2008	Goodman et al.
2008/0173204	A1	7/2008	Anderson et al.
2008/0264639	A1	10/2008	Parrott et al.
2009/0050322	A1	2/2009	Hill et al.
2010/0230104	A1	9/2010	Noelke et al.
2012/0199031	A1	8/2012	Lanclos
2012/0242135	A1	9/2012	Thomson et al.
2012/0247769	Al	10/2012	Schacherer et al.
2012/0247771	Al	10/2012	Black et al.
2012/0298361	Al	11/2012	Sampson
2012/0290901	Al	1/2012	Tassaroli
2013/0118342	Al	5/2013	Tassaroli
2015/0226044	Al	8/2015	Ursi et al.
2016/0061572	Al	3/2015	Eitschberger et al.
2016/0084048	Al	3/2016	Harrigan et al.
	Al		Parks et al.
2016/0168961		6/2016	
2017/0030693	Al	2/2017	Preiss et al.
2017/0211363	A1*	7/2017	Bradley F42B 3/08

FOREIGN PATENT DOCUMENTS

CN	101397890 A	4/2009
CN	201620848 U	11/2010
RU	2633904 C1	10/2017
WO	2001059401 A1	8/2001
WO	2009091422 A2	7/2009
WO	2015006869 A1	1/2015
WO	2015134719 A1	9/2015

OTHER PUBLICATIONS

Owen Oil Tools & Pacific Scientific; Side Block for Side Initiation, 1 pg.

SIPO, Office Action dated Jun. 27, 2018: See Office Action for CN App. No. 201580011132.7, which is in the same family as PCT App. No. PCT/US2015/18906, 9 pgs. & 5 pgs.

Amit Govil, Selective Perforation: A Game Changer in Perforating Technology—Case Study, presented at the 2012 European and West African Perforating Symposium, Schlumberger, Nov. 7-9. 2012, 14 pgs.

Dynaenergetics, DYNAselect System, information downloaded from website, Jul. 3, 2013, 2 pgs., http://www.dynaenergetics.com/. GB Intellectual Property Office, Search Report for App. No. GB

(56) **References Cited**

OTHER PUBLICATIONS

International Search Report and Written Opinion of International Application No. PCT/US2015/018906, dated Jul. 10, 2015, 12 pgs. Dynaenergetics, Gun Assembly, Products Summary Sheet, May 7, 2004, 1 pg.

GB Intellectual Property Office, Office Action dated Feb. 27, 2018, See Office Action for App. No. GB 1717516.7, which is the same family as PCT App. No. PCT/CA2014/050673, 6 pg.

Dynaenergetics, Selective Perforating Switch, information downloaded from website, Jul. 3, 2013, 2 pgs., http://www.dynaenergetics. com/.

Hunting Titan, Wireline Top Fire Detonator Systems, Product Information Sheet, 1 pg.

Hunting Titan Inc., Petition for Inter Parties Review of U.S. Pat. No. 9,581,422, filed Feb. 16, 2018, 93 pgs.

Dynaenergetics GmbH & Co. KG, Patent Owner's Response to Hunting Titan's Petition for Inter Parties Review, filed Dec. 6, 2018, 73 pgs.

Dynaenergetics GmbH & Co. KG, Patent Owner's Motion to Amend, filed Dec. 6, 2018, 53 pgs.

U.S. Patent Trial and Appeal Board, Institution of Inter Partes Review, Case IPR2018-00600, issued on Aug. 21, 2018, 9 pgs.

International Written Opinion of International Application No. PCT/CA2014/050673, dated Oct. 9, 2014, 4 pgs.

International Search Report of International Application No. PCT/CA2014/050673, dated Oct. 9, 2014, 3 pgs.

UK Examination Report of United Kingdom Patent Application No. GB1600085.3, which is in the same family as U.S. Pat. No. 9,494,021, dated Mar. 9, 2016, 1 pg.

FIIP, Search Report dated Feb. 1, 2018, in Russian: See Search Report for RU App. No. 2016104882/03, which is in the same family as PCT App. No. PCT/CA2014/050673, 7 pgs.

FIIP, Search Report dated Feb. 1, 2018, in English See Search Report for RU App. No. 2016104882/03, which is in the same family as PCT App. No. PCT/CA2014/050673, 4 pages.

Norwegan Industrial Property Office, Office Action for NO Patent App. No. 20160017, which is in the same family as PCT App No. PCT/CA2014/050673, dated Jun. 15, 2017, 3 pgs.

Jet Research Center Inc., Red RF Safe Detonators Brochure, 2008, 2 pgs., www.jetresearch.com.

Jet Research Center Inc., JRC Catalog, 36 pgs., www.jetresearch. com.

DOCKE

RM

Horizontal Wireline Services, Presentation of a completion method of shale demonstrated through an example of Marcellus Shale, Pennsylvania, USA, Presented at 2012 International Perforating Symposium (Apr. 26-28, 2012), 17 pages.

Smylie, New Safe and Secure Detonators for the Industry's consideration, Presented at Explosives Safety & Security Conference Marathon Oil Co, Houston, Feb. 23-24, 2005, 20 pages.

Schlumberger, Combining and Customizing Technologies for Perforating Horizontal Wells in Algeria, Presented at 2011 MENAPS Middle East and North Africa Perforating Symposium, Nov. 28-30, 2011, 20 pages.

Baker Hughes, Long Gun Deployment Systems IPS-12-28, Presented at 2012 International Perforating Symposium, Apr. 26-28, 2011, 11 pages.

Owen Oil Tools, Recommended Practice for Oilfield Explosive Safety, Presented at 2011 Menaps Middle East and North Africa Perforating Symposium, Nov. 28-30, 2011, 6 pages.

Norwegan Industrial Property Office, Search Report for NO Patent App. No. 20160017, which is in the same family as PCT App No. PCT/CA2014/050673, dated Jun. 15, 2017, 2 pgs.

Dynaenergetics, Selection Perforating Switch, Product Information Sheet, May 27, 2011, 1 pg.

Dynaenergetics, Electronic Top Fire Detonator, Product Information Sheet, Jul. 30, 2013 1 pg.

German Patent Office, Office Action dated May 22, 2014, in German: See Office Action for German Patent Application No. 10 2013 109 227.6, which is in the same family as PCT Application No. PCT/EP2014/065752, 8 pgs.

PCT Search Report and Written Opinion, dated May 4, 2015: See Search Report and Written opinion for PCT Application No. PCT/ EP2014/065752, 12 pgs.

SIPO, Search Report dated Mar. 29, 2017, in Chinese: See Search Report for CN App. No. 201480040456.9, which is in the same family as PCT App. No. PCT/CA2014/050673, 12 & 3 pgs.

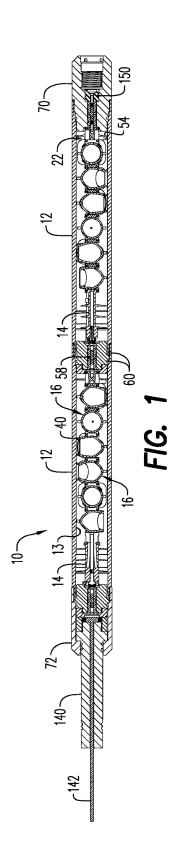
Jim Gilliat/Kaled Gasmi, New Select-Fire System, Baker Hughes, Presentation—2013 Asia-Pacific Perforating Symposium, Apr. 29, 2013, 16 pgs., http://www.perforators.org/presentations.php.

Dynaenergetics, DYNAselect Electronic Detonator 0015 SFDE RDX 1.4S, Product Information, Dec. 16, 2011, 1 pg.

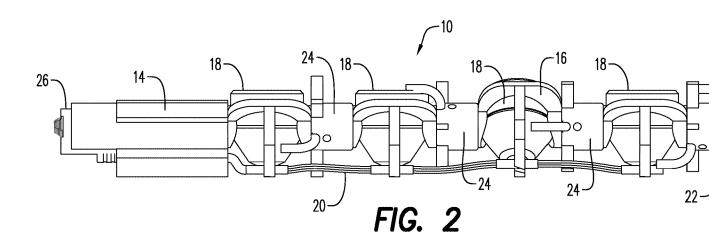
Dynaenergetics, DYNAselect Electronic Detonator 0015 SFDE RDX 1.4B, Product Information, Dec. 16, 2011, 1 pg.

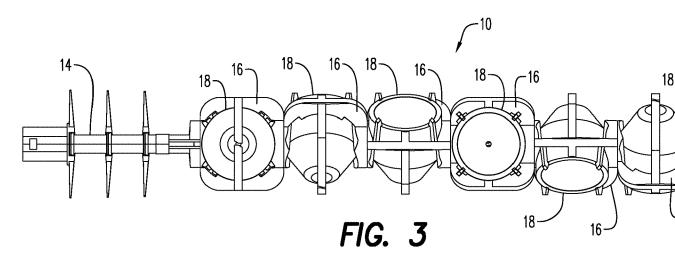
Intellectual Property India, Office Action of in Application No. 201647004496, dated Jun. 7, 2019, which is in the same family as U.S. Appl. No. 16/359,540, 6 pgs.

* cited by examiner



Find authenticated court documents without watermarks at <u>docketalarm.com</u>.





DOCKET A L A R M



Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.