UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HUNTING TITAN, INC.,

Petitioner

vs.

DYNAENERGETICS EUROPE GMBH, and

DYNAENERGETICS US, INC.,

Patent Owner

Case PGR 2020-00080 U.S. Patent No. 10,472,938

DECLARATION OF ROBERT A. PARROTT

My name is Robert Parrott. I am of sound mind and capable of making this sworn statement. I have personal knowledge of the facts written in this declaration.

I. Statement of Relevant Experience

1. Education and Background

1. I have worked in oilfield perforating technology for approximately 37 years at Schlumberger Limited companies. My experience includes working with perforating products, Product Manager in Rosharon, Texas, USA; Product Engineering Manager Perforating Systems in Novosibirsk, Russia; Engineering Manager in NPD Perforating Guns & Materials, SRC, in Russia and China; Engineering Manager for Perforating Systems in Tyumen, Russia; Perforating Technology Manager in Schlumberger Russia; Principal Engineer in Rosharon, Texas, USA; Field Engineer for Schlumberger in Red Deer and Edmonton (Frontier District), Alberta and north regions, Canada.
2. I have provided Inter Partes Review (IPR) and Post Grant Review (PGR) expert consulting services for petitioner Hunting Titan, Inc. All 15 Claims of US Patent 9,581,422 B2 were invalidated by case IPR 2018-00600. I have provided expert consulting services for two PGRs, Case PGR 2020-00072 for US Patent 10,429,161 which has been filed and

Case PGR 2020-00080 for US Patent 10,472,938 (this case), both of which are in process.

3. My education includes a Master of Business Administration from Houston Baptist University, 1986, and a Bachelor of Science, Mechanical Engineering from the University of Manitoba, 1977.

4. A detailed Resume is attached as Exhibit A and incorporated herein.

2. Publications – I have authored papers for the following publications:

1. "Well Perforating Solutions Redefine Sand Management Strategies," Offshore Magazine, July 2001, Authors: Bob Parrott, Ian Walton.

2. "A Step Change in Perforating Technology Improves Productivity of Horizontal Wells in the North Sea," SPE Paper 84910, Society of Petroleum Engineers (SPE), October 20, 2003, Authors: Bob Parrott, Morten Stenhaug, Leif Erichsen, Fokko H.C. Doornbosch. The paper was presented at the SPE International Improved Oil Recovery Conference in Asia Pacific in Kuala Lumpur, Malaysia, 20-21 October 2003.

3. <u>Patents</u> – I have been a named inventor on the following patents and publications which, including corresponding foreign publications and grants, number over 100:

1. United States Patent 10,400,557 "Method and Apparatus for completing a multi-stage well," also published as CN103339346B, RU2541965C1, CA2823127C, WO2012091926A2, AR084628A1.
2. United States Patent US 10,138,706 "Completing a multi-stage well," also published as: MX342914B, AU2012309073B2, CA2846203A1, WO2013039670A1, AR087837A1.
3. United States Patent US 9,546,534 "Technique and apparatus to form a downhole fluid barrier."
4. United States Patent US 9,382,790 "Method and apparatus for completing a multi-stage well," also published as: CN103339346B, RU2541965C1, CA2823127C, WO2012091926A2, AR084628A1.
5. Brazil BR 102013015566 "Cannon reusable, replaceable cap opening for single use a reusable gun and loading sleeve for disposal in a carrier of a cannon."
6. United States Patent US 9,033,041 "Completing a multi-stage well," also published as: MX342914B, AU2012309073B2, CA2846203A1, WO2013039670A1, AR087837A1.

7. United States Patent US 8,944,171 "Method and apparatus for completing a multi-stage well."
8. United States Publication 2013 0340599 "Reusable perforating gun and port plug," also published as: RU2013128245A.
9. United States Patent US 8,439,114 "Method and Apparatus for Orienting Perforating Devices," also published as: GB2401383B, RU2280150C2, NO20041888L.
10. Canada Patent CA 2,599,056 "Perforating gun having a plurality of charges."
11. Canada Patent CA 2,354,453 "Impermeable and Composite Perforating Gun Assembly Components," also published as: GB2365468B, NO20013807L, BR0103217A.
12. United States Patent US 7,213,655 "System for Connecting Downhole Tools," also published as: GB2410046B, NO334528B1, NO336745B1.
13. United States Patent US 7,159,657 "Shaped Charge Loading Tube for Perforating Gun," also published as: CA2500536C, RU2295027C2.
14. United States Patent US 7,114,564 "Method and Apparatus for Orienting Perforating Devices," also published as: GB2401383B, RU2280150C2, NO20041888L.

15. United States Patent US 7,000,699 “Method and apparatus for orienting perforating devices and confirming their orientation,” also published as: GB2374887B, NO334632B1, SG104318A1, NO20130950L.
16. United Kingdom Patent GB 2,399,583 “Method of orienting perforating devices.”
17. United Kingdom Patent GB 2,394,242 “Brake system.”
18. United States Patent US 6,817,598 “Gun Brake Device,” also published as: GB2381282B, NO327167B1.
19. United Kingdom Patent GB 2,390,627 “Mapping downhole equipment using a gyroscope.”
20. United Kingdom Patent GB 2,390,624 “Methods and apparatus for confirming the orientation of perforating devices on firing.”
21. United Kingdom Patent GB 2,390,625 “Methods of orienting gun string components.”
22. United Kingdom Patent GB 2,390,623 “Perforating guns.”
23. United Kingdom Patent GB 2,390,626 “Downhole tool connector for maintaining the tools in a fixed relative orientation.”
24. United States Patent US 6,702,039 “Perforating Guns and Their Methods of Manufacture,” also published as: GB2374820B.

25. United States Patent US 6,588,508 "Method and Apparatus to Reduce Trapped Pressure in a Downhole Tool."
26. United States Patent US 6,523,474 "Shaped Recesses in Explosive Carrier Housings that Provide for Improved Explosive Performance in a Well," also published as: AU763218B2, GB2375383B, WO2001058832A2, CA2398740C.
27. United States Patent US 6,523,449 "Perforating Gun System with New Shaped Charge Pattern for Fracture Jobs," also published as: CA2367231C.
28. Norway Patent NO 20140776 L "Method and apparatus for orienting perforating and confirm their orientation."
29. United States Patent US 6,460,463 "Shaped Recesses in Explosive Carrier Housings that Provide for Improved Explosive Performance in a Well," also published as: AU763218B2, GB2375383B, WO2001058832A2, CA2398740C.
30. United States Publication 2002 0129940 "High temperature explosives for downhole well applications."
31. United States Patent US 6,422,148 "Impermeable and Composite Perforating Gun Assembly Components."

32. United States Patent US 6,397,752 “Method and Apparatus for Coupling Explosive Devices,” also published as: GB2363449B, AU2412100A, WO2000042289A1, NO331115B1.
33. United States Patent US 6,397,947 “Optimum Charge Phasing of a Perforating Gun,” also published as: WO2000066881A1, GB2367350B, AU4698500A, NO331252B1, GB0404934D0.
34. United States Patent US 6,336,408 “Cooling System for Downhole Tools,” also published as: AU2626400A, WO2000045099A2.
35. United Kingdom Patent GB 2,332,745 “Apparatus and method for measuring formation density in rugose boreholes,” also published as: US5910654A, AU4071597A, EP0920644B1, CA2263704C, WO1998008116A1, NO321371B1.
36. United States Patent US 6,021,714 “Shaped Charge Having Reduced Slug Creation,” also published as: GB2333825B, NO322281B1.
37. United States Patent US 5,952,603 “Insert and twist method and apparatus for securing a shaped charge to a loading tube of a perforating gun.”
38. United States Patent US 5,862,758 “Insert and twist method and apparatus for securing a shaped charge to a loading tube of a perforating gun.”

39. United States Patent US 5,673,760 "Perforating gun including a unique high shot density packing arrangement," also published as: GB2308427B, NO311813B1.

40. United States Patent US 5,505,134 "Perforating gun having a plurality of charges including a corresponding plurality of exploding foil or exploding bridgewire initiator apparatus responsive to a pulse of current for simultaneously detonating the plurality of charges," also published as: AU697672B2, CA2145740C, GB2288005B, DE69513319T2, EP0675262B1, DE69513319D1.

41. United States Patent US 5,249,461 "Method for testing perforating and testing an open wellbore."

42. United States Patent 4,960,171 "Charge phasing arrangements in a perforating gun"

4. Retention and Compensation for this Activity – I have been retained by Hunting Titan, Inc., ("Hunting Titan") to provide my opinions as to certain issues in connection with this Petition requesting *Post Grant Review* in the United States Patent and Trademark Office of Claims 1-20 of U.S. Patent No. 10,472,938. (Hereinafter referred to as "the '938 Patent", (Ex. 1001).) I am being compensated for the time that I work on this matter on a per hour basis ($250.00 per hour). I have no other affiliations with Hunting Titan. I also have no other financial interest in the

outcome of this request for *Post Grant Review*, and my compensation does not depend on the outcome of these proceedings.

5. In forming the opinions expressed in this Declaration, I have reviewed the following documents:

Ex. 1001, U.S. Patent 10,472,938 ("'938 Patent");

Ex. 1002, U.S. Patent Publication 20120247771 ("Black");

Ex. 1003, U.S. Patent 4,744,424 ("Lendermon");

Ex. 1004, U.S. Patent 9,689,223 ("Schacherer");

Ex. 1005, Schlumberger 2008 Perforating Services Catalog ("SLB Catalog");

Ex. 1006, Infringement Contentions ("Infringement Contentions");

Ex. 1008, USPTO File History of U.S. Patent 10,472,938 ("File History");

Ex. 1009, U.S. Patent 5,241,891 ("Hayes");

Ex. 1010, Final Written Decision on Case IPR2018-00600; Patent 9,581,422 B2; "HUNTING TITAN, INC., Petitioner, versus DYNAENERGETICS GMBH & CO. KG, Patent Owner ("Final Written Decision");

Ex. 1011, U.S. Patent 7,347,278 ("Lerche '278");

Ex. 1012, U.S. Patent Publication 20160084048 ("Harrigan");

Ex. 1013, EWAPS-2012-Selective-Perforation-a-game-changer-in-perfor… ("EWAPS");

Ex. 1014, U.S. Patent Publication 20150330192 ("Rogman");

Ex. 1015, U.S. Patent 9,080,433 ("Lanclos");

Ex. 1016, U.S. Patent 5,347,929 ("Lerche '929");

Ex. 1017, U.S. Patent 8,451,137 ("Bonavides");

Ex. 1018, U.S. Patent Publication 20080149338 ("Goodman");

Ex. 1019, U.S. Patent 5,159,146 ("Carisella");

Ex. 1020, U.S. Provisional 61/733129 ("Rogman Prov.");

Ex. 1021, U.S. Patent 8,091,477 ("Brooks");

Ex. 1022, U.S. Patent Publication 20090272529 ("Crawford");

Ex. 1023, U.S. Patent 8,689,868 ("Lerche '868");

Ex. 1024, U.S. Patent 8,576,090 ("Lerche '090");

Ex. 1025, U.S. Patent 438,305 ("Thomas A. Edison");

Ex. 1026, U.S. Patent 4,670,729 ("Seibang Oh");

Ex. 1027, U.S. Patent 8,165,714 (“Mier”); and

Ex. 1028, U.S. Provisional 61/819196 (“Harrigan Prov.”).

Where I have relied on those documents will be indicated by the text and citations below. Otherwise I have relied on my education and experience.

II. Technology Background

6. The alleged inventions in the ‘938 Patent are components for a perforation gun system including combinations of components including a self-centralizing 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. At the time that the application for the patent claims priority, which I understand is July 18, 2013, the industry was well aware of this technology.

7. The alleged inventions in the ‘938 Patent include a perforating gun, comprising: an outer gun carrier; a charge holder positioned within the outer gun carrier and including at least one shaped charge; a detonator contained entirely within the outer gun carrier, the detonator including a detonator body containing detonator components, a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, and an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector; and, a bulkhead, wherein the bulkhead includes a contact pin in wireless electrical contact with the wireless signal-in connector, wherein at least a portion of the bulkhead is contained within a tandem seal adapter, and the wireless ground contact connector is in wireless electrical contact with the tandem seal adapter. A POSITA would find

that these components and features are common knowledge in the industry and combining these in various configurations is inherently obvious.

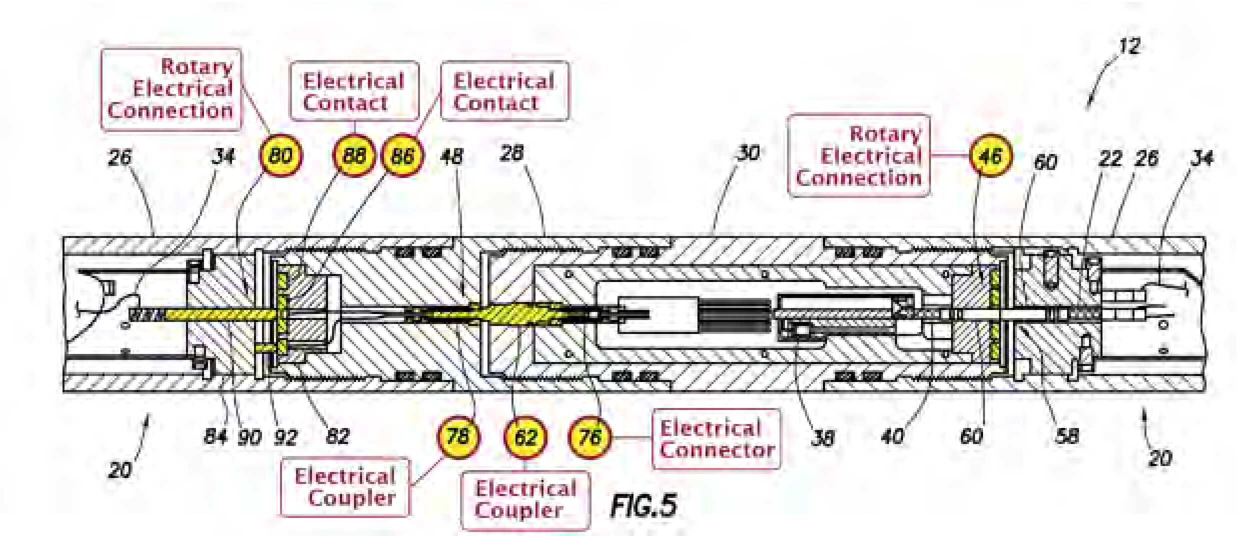
III. Prior Art Summary

8. The prior art includes United States Patent Publication 20120247771 to Black et al., (Ex. 1002, Black), assigned to Schlumberger, which was filed on March 23, 2012, and published on October 4, 2012. Accordingly, Black is prior art to the ‘938 Patent because it was filed and published before the priority date claimed by the ‘938 Patent. Black teaches bulkheads, electrical connections with coaxial conduits, detonators inside guns, among other things.

9. The prior art includes United States Patent 4,744,424 to Lendermon et al., (Ex. 1003, Lendermon), assigned to Schlumberger, which was filed on August 21, 1986, and published on May 17, 1988. Accordingly, Lendermon is prior art to the ‘938 Patent because it was filed and published before the priority date claimed by the ‘938 Patent. Lendermon teaches detonators inside guns, injection molded plastic components, top connectors, energetic coupling, charge holders, among other things.

10. The prior art includes United States Patent No. 9,689,223 to Schacherer et al., (Ex. 1004, Schacherer), assigned to Halliburton, which was filed on April 1, 2011 and published on October 4, 2012. Accordingly, Schacherer is prior art to the ‘938 Patent because it was filed and published before the priority date claimed by the ‘938 Patent. Schacherer teaches a selective perforating gun system where selective

detonator assemblies are connected between perforating guns using rotating electrical contacts as shown in Figure 5 below.



11. The prior art includes the Schlumberger 2008 Perforating Services Catalog, (Ex. 1005, SLB Catalog.) I personally have had a copy of the Schlumberger Perforating Services Catalog 2008 since its publication and Ex. 1005 is a true and correct copy of the selected pages from that document. The publicly available SLB Catalog contains over 500 pages and was/is intended to educate professionals in the industry regarding the wide variety of perforating techniques and related tools and devices available from Schlumberger circa 2008. Accordingly, SLB Catalog is prior art to the ‘938 Patent because it was published before the priority date claimed by the ‘938 Patent. The SLB Catalog teaches explosives safety, transportation of perforating guns, energetically coupled detonators and detonating cord, detonators inside perforating guns, bulkheads, transferring electrical signals, etc.

12. The prior art includes United States Patent 5,241,891 to Hayes et al., (Ex. 1009, Hayes), assigned to Ensign Bickford, which was filed on September 17, 1992, and published on September 7, 1993. Accordingly, Hayes is prior art to the '938 Patent because it was filed and published before the priority date claimed by the '938 Patent. Hayes teaches a phaseable link downhole perforating system to hold and aim shaped charges in a preferred direction.

13. The prior art includes United States Patent 7,347,278 to Lerche et al., (Ex. 1011, Lerche '278), assigned to Schlumberger, which was filed on August 27, 2004, and published on March 25, 2008. Accordingly, Lerche '278 is prior art to the '938 Patent because it was filed and published before the priority date claimed by the '938 Patent. Lerche '278 teaches controlling downhole tools with addressable microprocessors, or addressable switches, in great detail.

14. The prior art includes United States Patent Publication 20160084048 to Harrigan et al., (Ex. 1012, Harrigan), assigned to Schlumberger which was filed on May 2, 2014, and published on March 24, 2016. Harrigan claims priority to the U.S. Provisional Application 61/819196, filed on May 3, 2013. (Ex. 1028, Harrigan Prov.) Accordingly, Harrigan is prior art to the '938 Patent because it was filed and published before the priority date claimed by the '938 Patent. Harrigan teaches modular detonators inside gun carriers completing their electrical connections without manually attaching wires, or "wirelessly."

15. The prior art includes the presentation, "Selective Perforation: A Game Changer in Perforating Technology – Case Study," EWAPS-12-22, Presented at 2012 European and West African Perforating Symposium from November 7 to 9, 2012, (Ex. 1013, EWAPS). Accordingly, EWAPS is prior art to the '938 Patent because it published before the priority date claimed by the '938 Patent. EWAPS teaches modular detonators inside gun carriers completing their electrical connections without manually attaching wires, or "wirelessly."

16. The prior art includes United States Patent Publication 20150330192 to Rogman et al., (Ex. 1014, Rogman), assigned to Schlumberger, which was filed on December 4, 2013, and published on November 19, 2015. Rogman claims priority to the US Provisional 61/733129, filed on Dec. 4, 2012 (Ex. 1020, Rogman Prov.) Accordingly, Rogman is prior art to the '938 Patent because it was filed and published before the priority date claimed by the '938 Patent. Rogman teaches modular detonators inside gun carriers completing their electrical connections without manually attaching wires, or "wirelessly."

17. The prior art includes United States Patent 9,080,433 to Lanclos et al., (Ex. 1015, Lanclos), assigned to Baker Hughes, which was filed on February 3, 2012, and published on July 14, 2015. Accordingly, Lanclos is prior art to the '938 Patent because it was filed and published before the priority date claimed by the '938

Patent. Lanclos teaches modular detonators completing their electrical connections by contact without manually attaching wires, or “wirelessly.”

18. The prior art includes United States Patent 5,347,929 to Lerche et al., (Ex. 1016, Lerche ‘929), assigned to Schlumberger, which was filed on September 1, 1993, and published on September 20, 1994. Accordingly, Lerche ‘929 is prior art to the ‘938 Patent because it was filed and published before the priority date claimed by the ‘938 Patent. Lerche ‘929 teaches detonators which make their electrical and ground connections by contact without a wired connection, or “wireless.”

19. The prior art includes United States Patent 8,451,137 to Bonavides et al., (Ex. 1017, Bonavides), assigned to Halliburton, which was filed on October 2, 2008, and published on May 28, 2013. Accordingly, Bonavides is prior art to the ‘938 Patent because it was filed and published before the priority date claimed by the ‘938 Patent. Bonavides teaches controlling selective switches with tones, and subs and housings carrying the electrical ground of downhole tools.

20. The prior art includes United States Patent Publication 20080149338 to Goodman et al., (Ex. 1018, Goodman), assigned to Schlumberger, which was filed on December 21, 2006, and published on June 26, 2008. Accordingly, Goodman is prior art to the ‘938 Patent because it was filed and published before the priority date claimed by the ‘938 Patent. Goodman teaches transportation of perforating guns, detonators

contained insider perforating guns, bulkheads, electrical feedthroughs, among other things.

21. The prior art includes United States Patent 5,159,146 to Carisella et al., (Ex. 1019, Carisella), assigned to Carisella, which was filed on September 4, 1991, and published on October 27, 1992. Accordingly, Carisella is prior art to the ‘938 Patent because it was filed and published before the priority date claimed by the ‘938 Patent. Carisella teaches energetically coupling a detonator to detonating cord.

22. The prior art includes United States Patent 8,091,477 to Brooks et al., (Ex. 1021, Brooks), assigned to Schlumberger, which was filed on October 6, 2004, and published on January 10, 2012. Accordingly, Brooks is prior art to the ‘938 Patent because it was filed and published before the priority date claimed by the ‘938 Patent. Brooks teaches integrated or modular detonators in great detail.

23. The prior art includes United States Patent Publication 20090272529 to Crawford, (Ex. 1022, Crawford), assigned to Halliburton, which was filed on April 30, 2008, and published on November 5, 2009. Accordingly, Crawford is prior art to the ‘938 Patent because it was filed and published before the priority date claimed by the ‘938 Patent. Crawford teaches confirming electrical integrity or continuity testing of multiple perforating gun assemblies.

24. The prior art includes United States Patent 8,689,868 to Lerche et al., (Ex. 1023, Lerche ‘868), assigned to Hunting Titan, which was filed on January 7, 2008, and

published on April 8, 2014. Accordingly, Lerche ‘868 is prior art to the ‘938 Patent because it was filed and published before the priority date claimed by the ‘938 Patent. Lerche ‘868 teaches transmitting electrical power and control signals and communications downhole and between downhole tools including perforating gun assemblies.

25. The prior art includes United States Patent 8,576,090 to Lerche et al., (Ex. 1024, Lerche ‘090), assigned to Hunting Titan, which was filed on August 5, 2008, and published on November 5, 2013. Accordingly, Lerche ‘090 is prior art to the ‘938 Patent because it was filed and published before the priority date claimed by the ‘938 Patent. Lerche ‘090 teaches transmitting electrical power and control signals and communications downhole and between downhole tools including perforating gun switches and assemblies.

26. The prior art includes US Patent 438,305 “Fuse Block” to Thomas A. Edison, (Ex. 1025, Thomas A. Edison), filed October 14, 1885, published / granted October 14, 1890. Thomas A. Edison teaches a non-wired or “wireless” connection with a Fuse Block, circa 1885.

27. The prior art includes US Patent 4,670,729 “Electrical Fuse” to Seibang Oh, (Ex. 1026, Seibang Oh), assigned to Littlefuse Inc., filed June 3, 1986, published June 2, 1987, with priority to June 3, 1986. Seibang Oh teaches a non-wired or “wireless” connection used by modern automotive fuses.

28. The prior art includes US Patent 8,165,714 “Controller for Controlling Combination of Hot-Runner System and Mold Assembly” to Mier et al., (Ex. 1027, Mier), filed January 25, 2010, published April 24, 2012, with Priority Date January 25, 2010. Mier teaches that the injection molding manufacturing process has been known and practiced since at least 1872. Injection molding is a manufacturing process taught to engineering students in college. Injection molding is therefore within the realm of a POSITA’s common knowledge.

IV. POSITA Definition

29. It is my opinion that a person working in the oil & gas perforating business would find it beneficial to use the components and methods claimed in the ‘938 Patent “Perforating Gun Components and System.” A POSITA in the oil & gas perforating business prior to July 18, 2013, would have needed no more than a Bachelor of Science Degree in Mechanical Engineering or Electrical Engineering and/or related post-graduate or industry work experience specifically related to assembling, operating, and/or designing perforating tools. Individuals would have at least 2-5 years of industry experience working with perforating tools. Individuals with additional education or additional industrial experience could still be of ordinary skill in the art if that additional aspect compensates for a deficit in one of the other aspects of the requirements stated above.

V. **The Claim 1 limitation of "[a] perforating gun, comprising...." The Claim 9 limitation of "[a] modular detonator, comprising:... when the modular detonator is received within a gun assembly of a perforating gun system…." The Claim 13 limitation of "[a] method for assembling a perforation gun system, comprising:…."**

30. Claim 1 of the '938 Patent includes the limitation of "**[a] perforating gun, comprising....**" (Ex. 1001, the '938 Patent, 11:16.) Claim 9 includes the limitation of "[**a] modular detonator, comprising:... when the modular detonator is received within a gun assembly of a perforating gun system….**" (Ex. 1001, the '938 Patent, 11:63, 12:10-12.) Claim 13 includes the limitation of "**[a] method for assembling a perforation gun system, comprising:….**" (Ex. 1001, the '938 Patent, 12:34-35.) The '938 Patent teaches:

> Perforation gun systems are used in well bore perforating in the oil and natural gas industries to tie a bore hole with a storage horizon within which a storage reservoir of oil or natural gas is located. A typical perforation gun system consists of an outer gun carrier, arranged in the interior of which there are perforators-usually hollow or projectile charges—that shoot radially outwards through the gun carrier after detonation.

(Ex. 1001, the '938 Patent, 1:31-38.)

A. Indefiniteness of perforating gun system and gun assembly

31. The term "perforation gun system" is variously used in the specification to describe anything used "to tie a borehole with a storage horizon," (Ex. 1001, the '938 Patent, 1:31-34) "an outer gun carrier" containing other components (Ex. 1001, the '938

Patent, 1:35-38, 5:38-39), components for assembly within an outer gun carrier (Ex. 1001, the ‘938 Patent, 2:19-22, 9:20-22), and the system shown in FIG. 1 (including: electrical connector 142, quick change assembly 140, top sub 72, two top connectors 14, two gun carriers 12, 6 stackable charge holders 16 in each of the gun carriers 12 separated by a bulkhead 58 and top connector 14, and bottom sub 70. (Ex. 1001, the ‘938 Patent, 3:54-55, 9:7, 5: 38-44; and 9:1-10) The term “perforating gun system” is used interchangeably with perforation gun system both using reference numeral 10. (Ex. 1001, the ‘938 Patent, 5:38-39, 8:10-12.) Reference numeral 10 is also described as “gun system,” (Ex. 1001, the ‘938 Patent, 5:40.)

32. The ‘938 Patent does not use the phrase “a gun assembly of a perforating gun system.” The ‘938 Patent uses perforating gun system and perforation gun system interchangeably, therefore, those terms should be interpreted as having the same meaning. The ‘938 Patent does not explain what the difference is between a perforating/perforation gun system and a “perforating gun” or “gun assembly”. The ‘938 specification does not use the term “perforating gun” without the word “system” appended to it. Because the ‘938 Patent uses the terms perforating gun, perforating gun system, and perforation gun system interchangeably, a POSITA would understand them to have the same meaning in the claims. In accordance with the background of the invention in the ‘938 Patent, a POSITA would understand the

terms “perforating gun”, “perforating gun system”, and “perforation gun system” to mean a device, assembly, or system for well bore perforating.

33. Claim 9 and its dependent claims do not provide any clarity as to what is meant by a “gun assembly,” other than it is perhaps something different than a “perforating gun system.” The specification provides a circular description of a gun assembly: “Hence, the top connector 14 and bulkhead 58 accommodate electrical and ballistic transfer to the charges of the next gun assembly for as many gun assembly units as required, <u>each gun assembly unit having all the components of a gun assembly</u>.” (Ex. 1001, the ‘938 Patent, 7:63-67.) But the ‘938 Patent does not tell us what “all the components of a gun assembly” are. The closest the ‘938 Patent comes to telling us what constitute “components of a gun assembly” is the phrase “assembling a plurality of the stackable charge holders in a predetermined phase to form a first gun assembly;” (Ex. 1001, the ‘938 Patent, 2:59-60, 9:47-48.) From this, it is not clear what a “gun assembly” is. It could be a gun system, or it could be just a plurality of charge holders. A POSITA would not have an inherent understanding of what the term “gun assembly” means and the specification of the ‘938 Patent provides no clear meaning. Because of this, the limitation of “when the modular detonator is received within a gun assembly of a perforating gun system,” is indefinite because the patent fails to inform, with reasonable certainty, a POSITA about the scope of the invention. Although the meaning of “gun assembly” is unclear, a POSITA’s most

likely understanding or best guess would be a device, assembly, or system for well bore perforating.

34. The ‘938 Patent admits in its background that the prior art teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations. (Ex. 1001, the ‘938 Patent, 1:31-58.) In accordance with the background of the invention in the ‘938 Patent, a POSITA would understand the terms “perforating gun”, “perforating gun system”, and “perforation gun system” to mean a device, assembly, or system for well bore perforating.

B. Schacherer teaches a perforating gun, perforating/perforation gun system, and gun assembly

35. Schacherer teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1004, Schacherer, 1:7-16, 2:35-38, 7:5-15, 8:51-9:22, FIG. 1.)

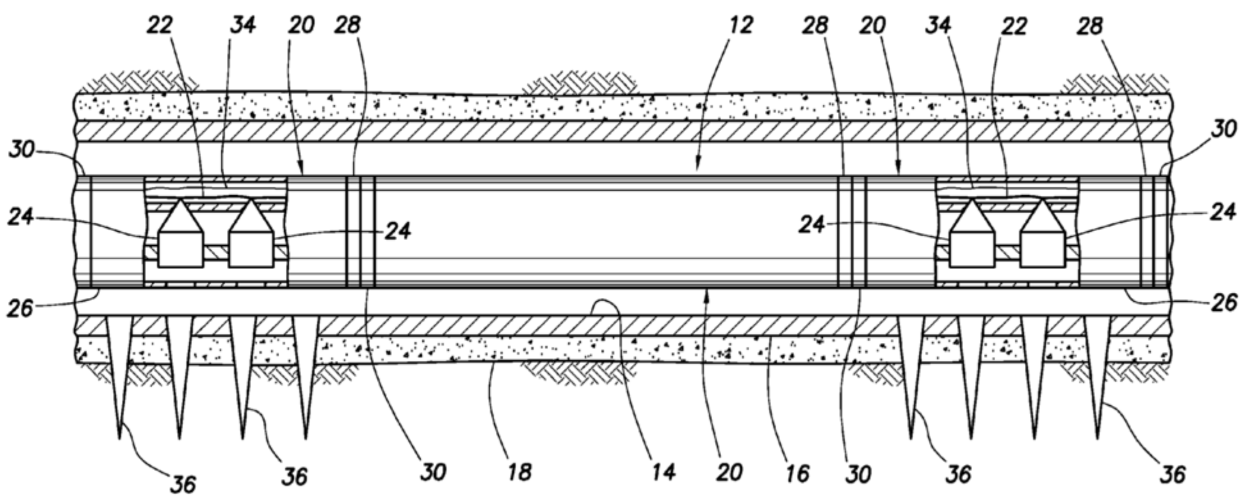


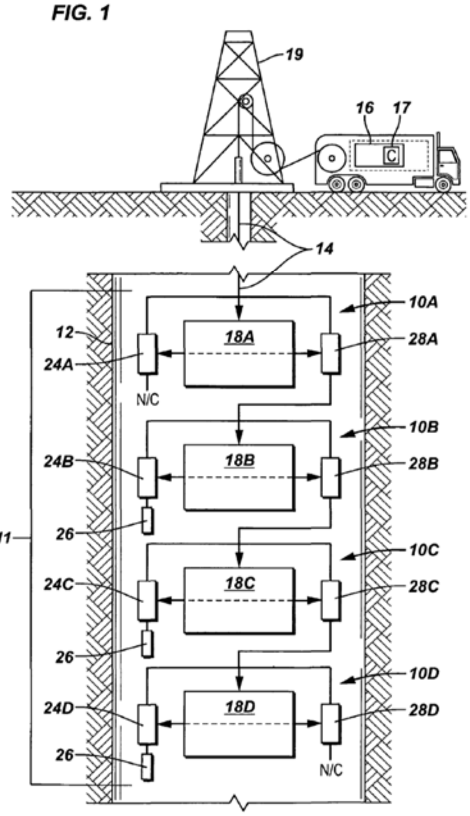
FIG. 1

36. Ex. 1004, Schacherer teaches "the explosive assemblies 20 are perforating guns, the explosive components 22, 24 are detonating cords and perforating charges, respectively, and the outer housings 26 are outer gun bodies." (Ex. 1004, Schacherer, 2:35-38, FIG. 1.) Therefore, Schacherer teaches to a POSITA the preamble of Claim 1.

C. Lerche '278 and '929 teach a perforating gun, perforating/perforation gun system, and gun assembly

37. Lerche '278 and '929 teach the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1011, Lerche '278, 1:27-42, 2:58-67, 3:32-48, FIG. 1; Ex. 1016, Lerche '929, FIGS. 1, 1:8-17, 1:18-2:1, 3:55-4:33.)

FIG. 1



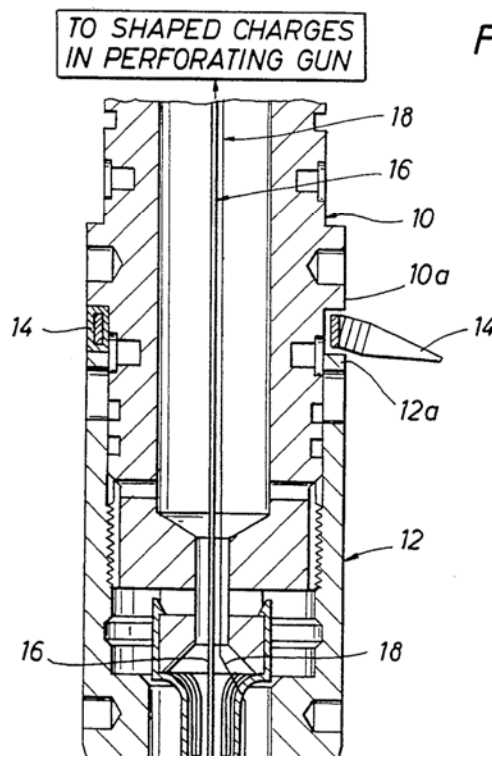


FIG. 1

D. Harrigan teaches a perforating gun, perforating/perforation gun system, and gun assembly

38. Harrigan teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1012, Harrigan, Abstract, FIGS. 1A, 1B, 2A, 4B, ¶¶ 0004, 0005, 0010-12, 0021-31, 0036, 0045; Ex. 1028, Harrigan Prov., p. 3.)

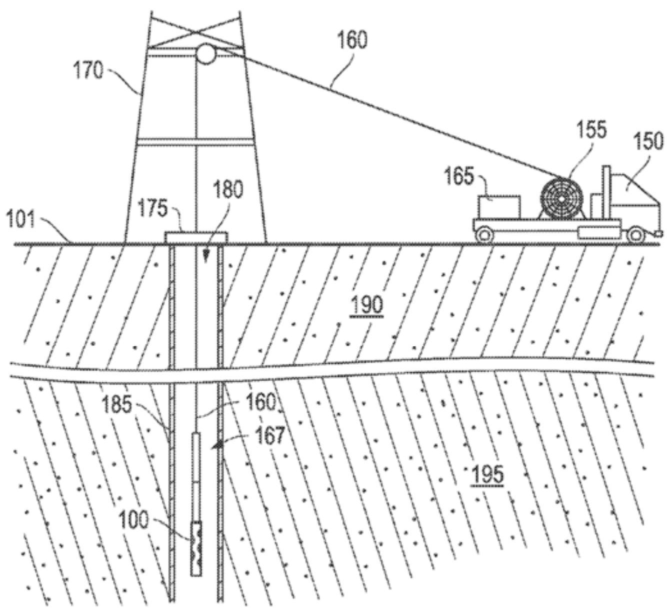


FIG. 1B

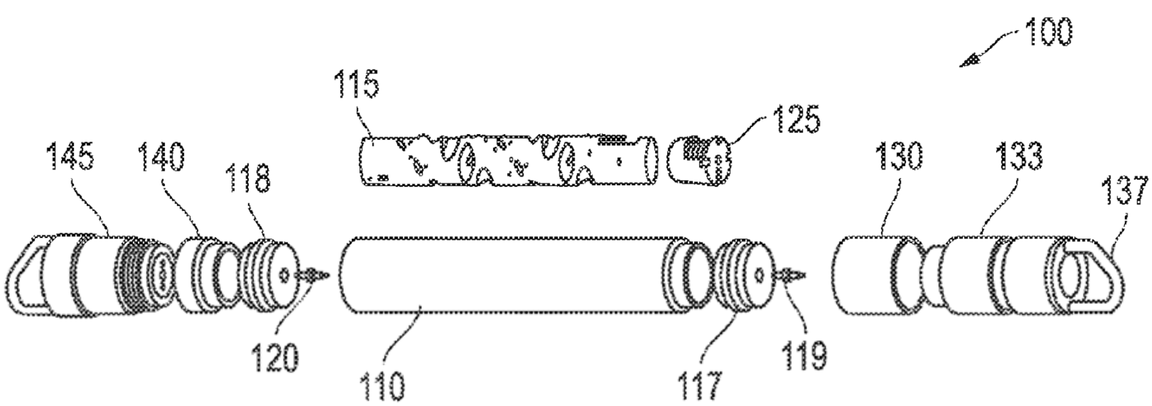


FIG. 1A

E. Rogman teaches a perforating gun, perforating/perforation gun system, and gun assembly

39. Rogman and Rogman Prov. teach the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1014, Rogman, Abstract, FIG. 3, ¶¶ 0001, 0005-7, 0011, 0015, 0018-0022, 0027, 0035-36; Ex. 1020, Rogman Prov., pp. 1, 2, 6-8.)

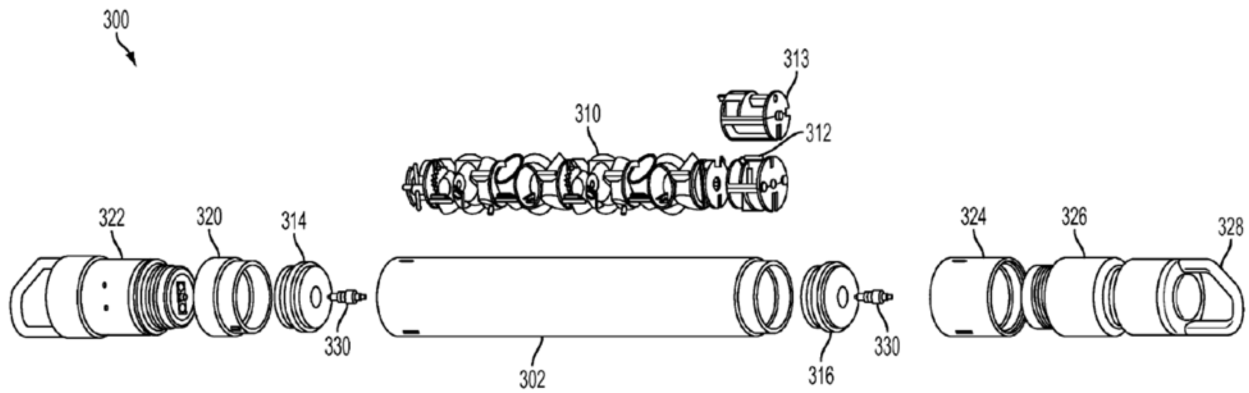


FIG. 3

40. Claim 1 of the '938 Patent includes the limitation of "**an outer gun carrier....**" (Ex. 1001, the '938 Patent, 11:17.) The '938 Patent discloses "an outer gun carrier 12." (Ex. 1001, the '938 Patent, 5:39.) The plain and ordinary meaning of the term "an outer gun carrier" to a person of ordinary skill in the art at the time of the invention is a tubular housing.

F. Lanclos teaches a perforating gun, perforating/perforation gun system, and gun assembly

41. Lanclos teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1015, Lanclos, Abstract, FIGS. 1-5, 1:35-2:43, 4:44-60, 7:12-53.)

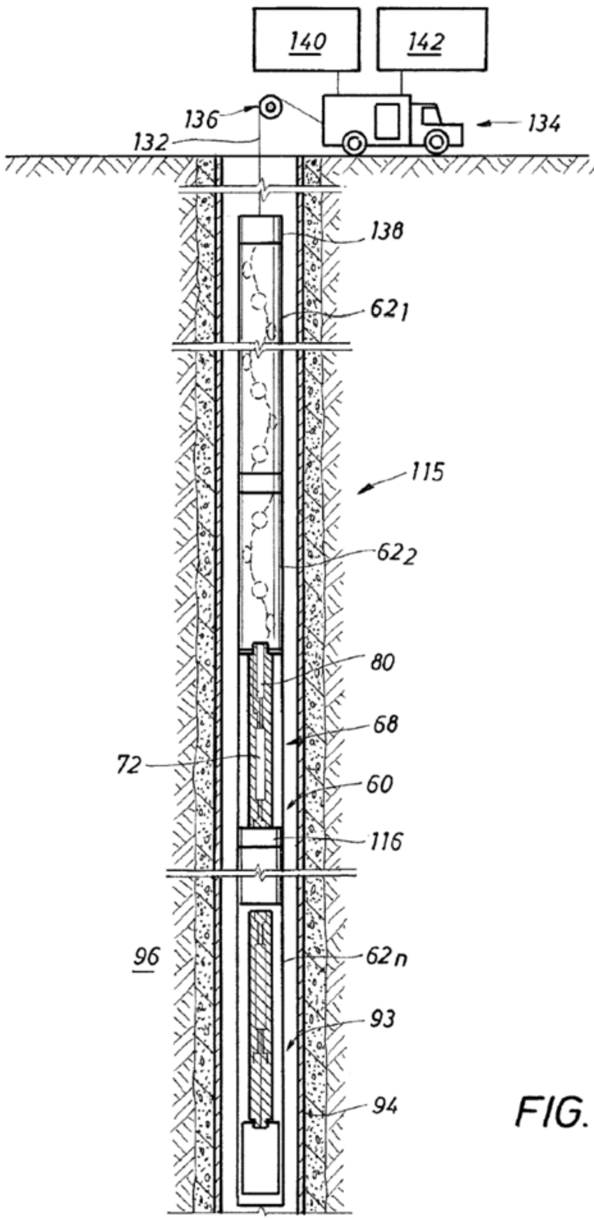


FIG. 5

G. Bonavides teaches a perforating gun, perforating/perforation gun system, and gun assembly

42. Bonavides teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1017, Bonavides, FIG. 1, 1:18-41, 3:61-66, 9:59-65.)

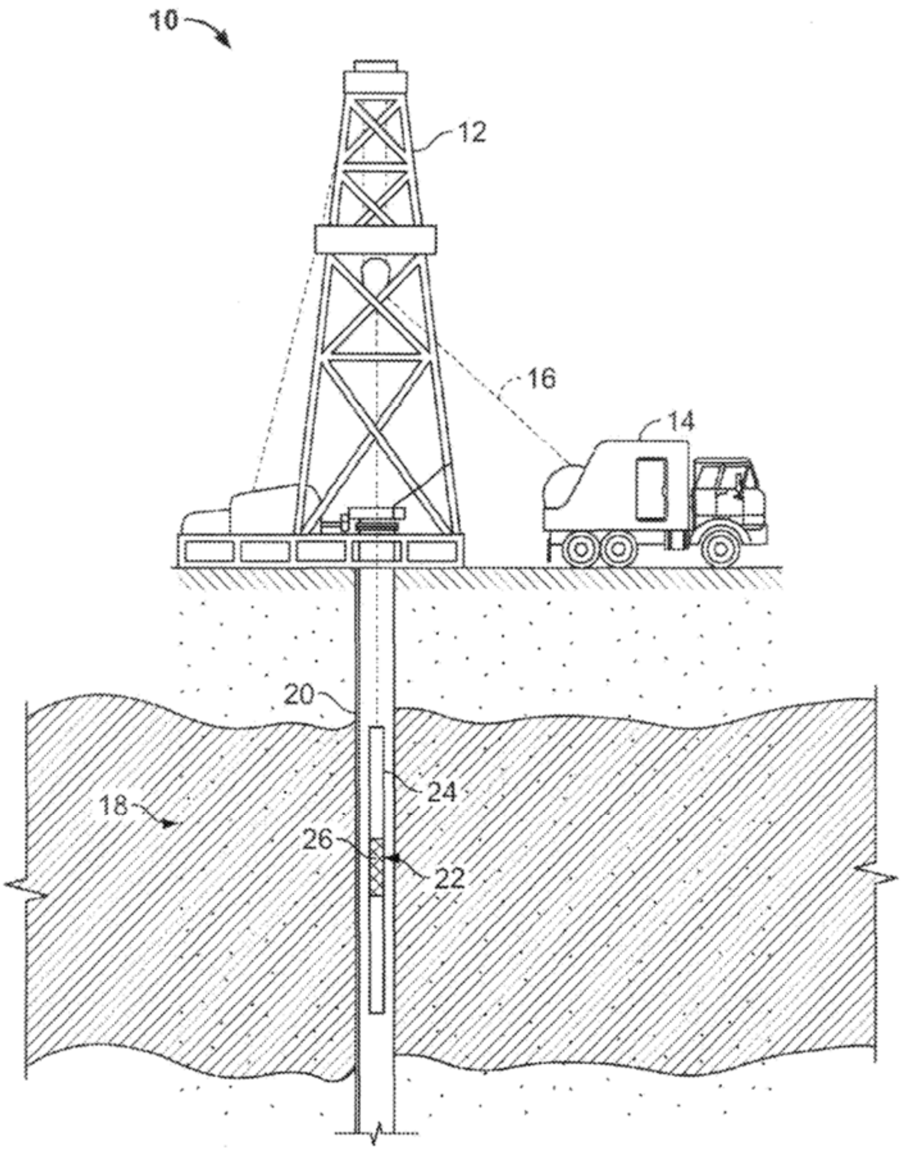
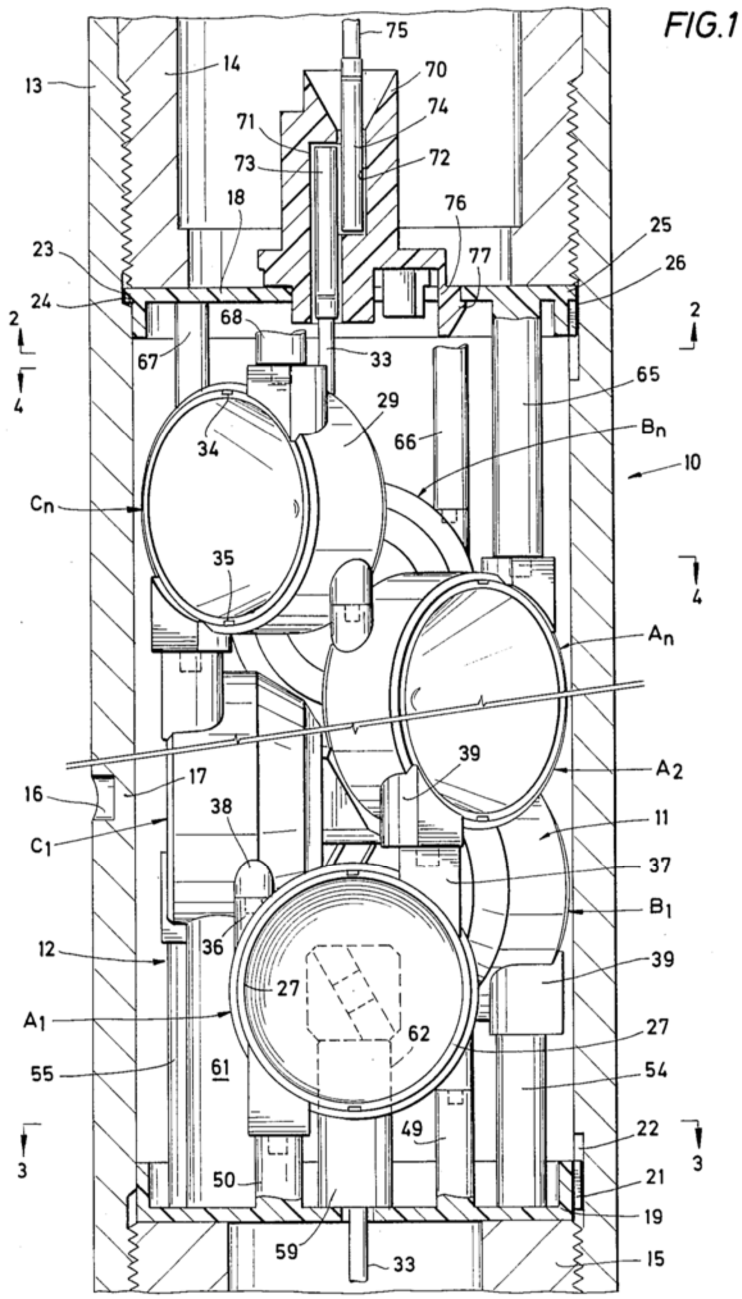


FIG. 1

H. Lendermon teaches a perforating gun, perforating/perforation gun system, and gun assembly

43. Lendermon teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1003, Lendermon, Abstract, FIG. 1, 1:5-36, 1:68-2:55, 4:33-38, 4:58-5:5.)



I. Goodman teaches a perforating gun, perforating/perforation gun system, and gun assembly

44. Goodman teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1018, Goodman, Abstract, ¶¶ 2, 4-7, 16, 17, 21, 22, 24-27, FIGS. 2-5, Claims 1, 4, 5, 9, 13, 20-22.)

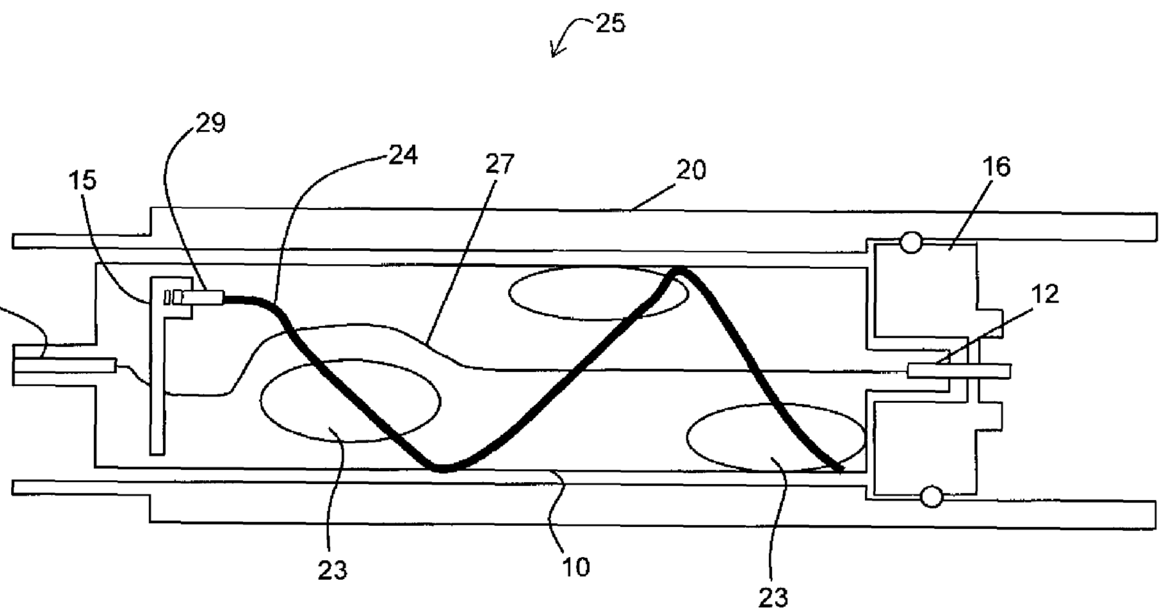
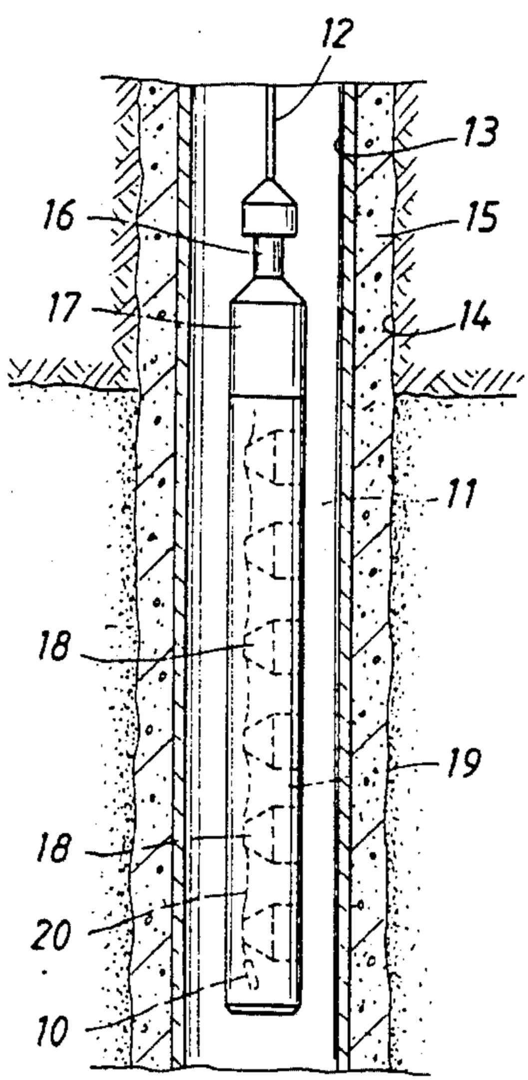


FIG. 2

J. Carisella teaches a perforating gun, perforating/perforation gun system, and gun assembly

45. Carisella teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1019, Carisella, Abstract, FIGS. 1, 1:6-11, 2:10-19, 5:20-65, 10:59-6, 14:12-29.)

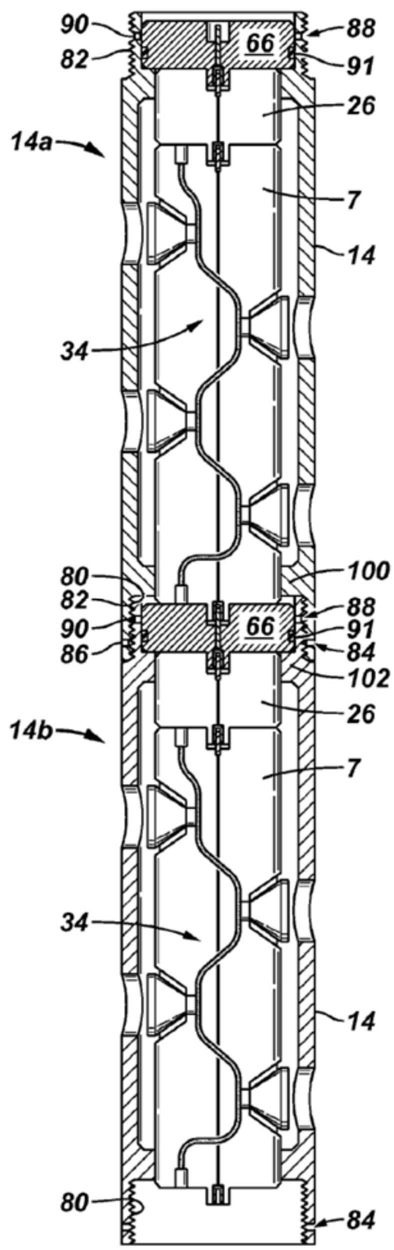
FIG.1



K. Black teaches a perforating gun, perforating/perforation gun system, and gun assembly

46. Black teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1002, Black, Abstract, FIGS. 1-7, 10, ¶¶ 0004-8, 0011-20, 0023-25, 0035, 0040-41.)

FIG. 10



L. Brooks teaches a perforating gun, perforating/perforation gun system, and gun assembly

47. Brooks teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1021, Brooks, FIGS. 1A, 1B, 14A, 1:27-35, 3:26-4:19.)

FIG. 1A

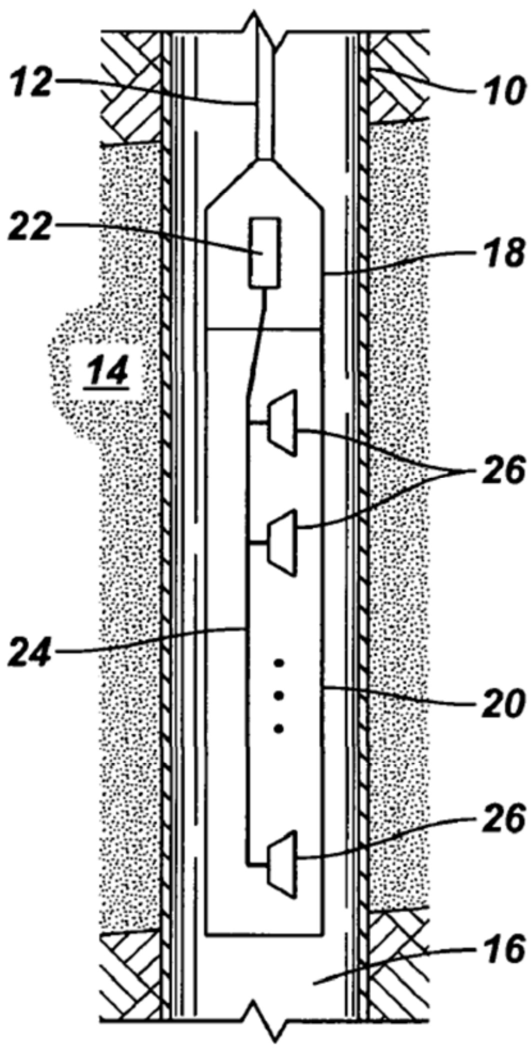
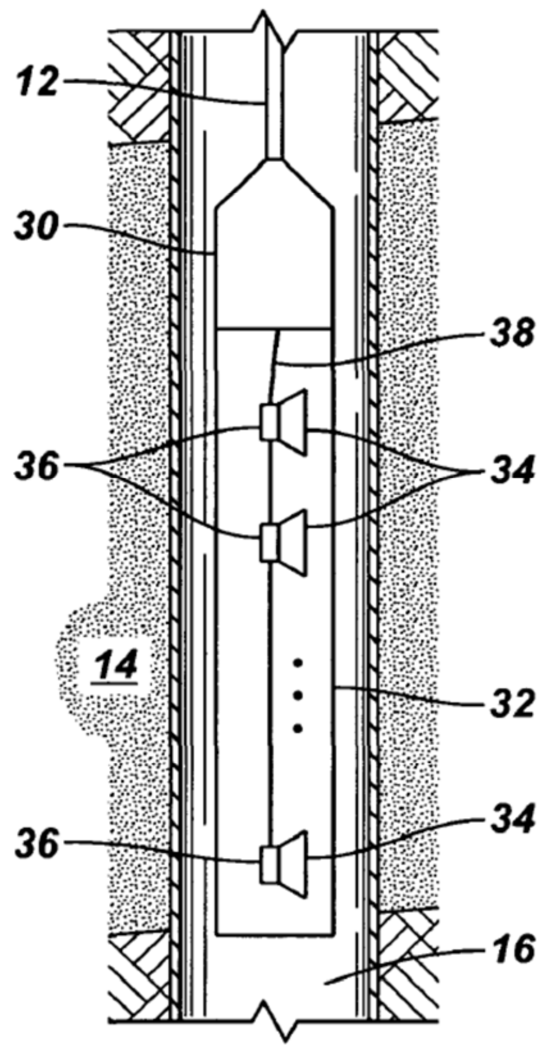
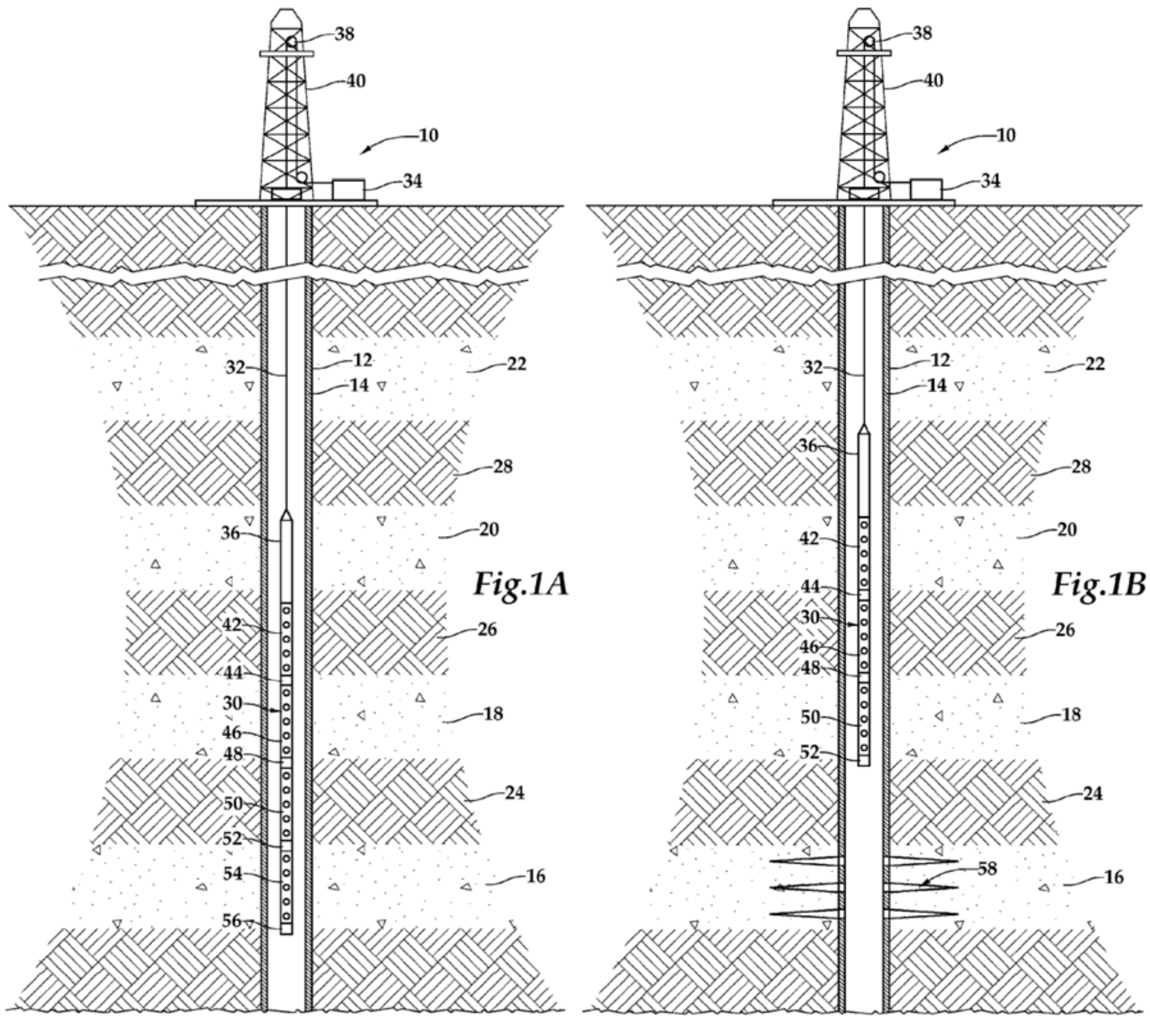


FIG. 1B



M. Crawford teaches a perforating gun, perforating/perforation gun system, and gun assembly

48. Crawford teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1022, Crawford, FIGS. 1A, 1B, ¶¶ 0002-5, 0009, 0013, 0015, 0027-28, 0032, 0034, 0038, 0044-45.)



N. EWAPS teaches a perforating gun, perforating/perforation gun system, and gun assembly

49. EWAPS teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1013, EWAPS, pp. 3-6, 8-10, 12.)

O. SLB Catalog teaches a perforating gun, perforating/perforation gun system, and gun assembly

50. The SLB 2008 Perforating Catalog teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations throughout. (Ex. 1005, SLB Catalog, pp. 22-32, 43-45, 117-123, 174-233.)

P. POSITA Common Knowledge includes a perforating gun, perforating/perforation gun system, and gun assembly

51. A POSITA's common knowledge includes the design, operation, and construction of perforating guns and their many common interchangeable variations in design, operation, and construction. A POSITA's common knowledge includes a variety of devices, assemblies, and systems for well bore perforating. Therefore, A POSITA's common knowledge teaches the perforating gun, perforating/perforation gun system, and gun assembly limitations.

VI. <u>Claim 1 limitation of “outer gun carrier…” and Claim 13 “a hollow interior of an outer gun carrier…”</u>

52. Claim 1 of the ‘938 Patent includes the limitation of “**outer gun carrier....**” (Ex. 1001, the ‘938 Patent, 11:17.) Claim 13 of the ‘938 Patent includes the limitation of “**a hollow interior of an outer gun carrier....**” (Ex. 1001, the ‘938 Patent, 12:36-37.)

A. Claim construction of “outer gun carrier…” and “a hollow interior of an outer gun carrier…”

53. The ‘938 Patent discloses “an outer gun carrier 12.” (Ex. 1001, the ‘938 Patent, 5:39.) The plain and ordinary meaning for a POSITA of an outer gun carrier is a tubular housing. A tubular housing would necessarily include a hollow interior.

54. Ex. 1004, Schacherer teaches “the outer housings 26 are outer gun bodies.” (Ex. 1004, Schacherer, 2:38.) A POSITA would understand that Schacherer teaches an outer gun carrier as claimed.

55. Nothing in the ‘938 Patent provides any limiting definition of what an outer gun carrier is. The ‘938 Patent specifically refers to two separate pieces together as “an outer gun carrier” of a perforation gun system. FIG. 1 of the ‘938 Patent has two reference numeral 12 items, described as “an outer gun carrier 12” in “a perforation gun system 10.” (Ex. 1001, the ‘938 Patent, FIG. 1, 5:38-39.) The ‘938 Patent also discloses “[t]he gun system 10 includes at least one bottom connector 22.” (Ex. 1001,

the ‘938 Patent, 5:45-46.) FIG. 1 includes only one reference numeral 22. (Ex. 1001, the ‘938 Patent, FIG. 1.)

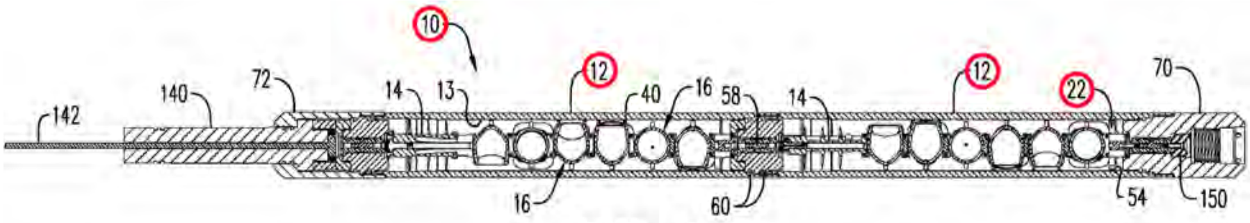


FIG. 1

56. This is also consistent with how the PTAB interpreted the similar limitation “a perforating gun housing” in IPR 2018-00600. (Ex. 1010, Final Written Decision, pp. 26-28.)

57. A POSITA would understand the term “an outer gun carrier” in the claims of the ‘938 Patent to include both single piece and multiple piece tubular housings.

58. The ‘938 Patent admits in its background that the prior art teaches an outer gun carrier with a hollow interior. (Ex. 1001, the ‘938 Patent, 1:35-36.)

B. Schacherer teaches an outer gun carrier

59. Schacherer teaches a well tool system 12 with explosive assemblies 20 with outer housings 26. (Ex. 1004, Schacherer, FIG. 1, 2:25-40.)

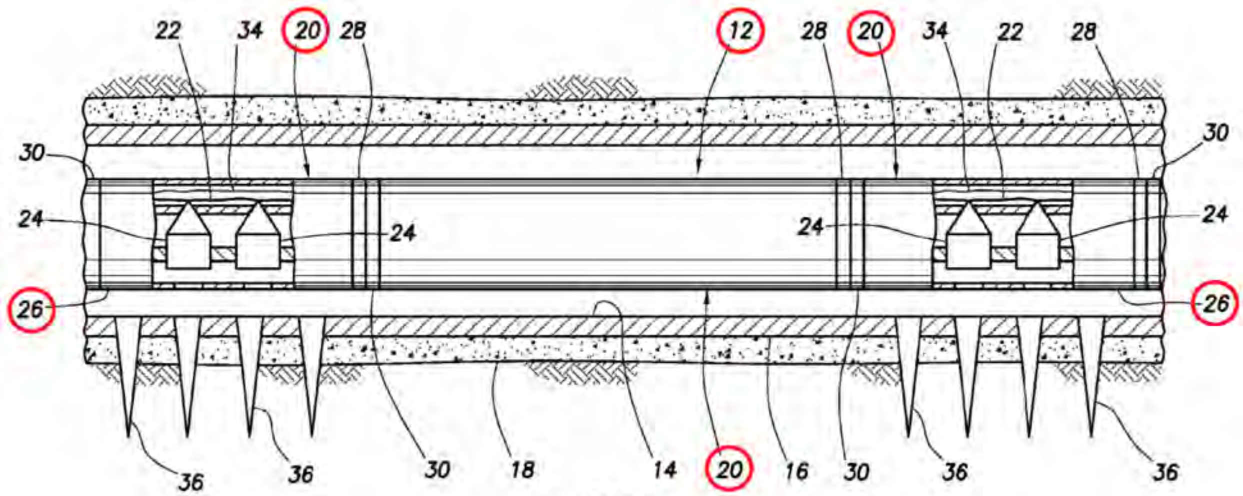


FIG. 1

60. Schacherer teaches that, when assembled, Schacherer's outer housing 26 and connector 30 together serve as a perforating gun housing for encapsulating not only perforating charges 24, but also detonator assembly 32, 38, 40, 60. (Ex. 1004, Schacherer, FIGS. 2, 4, 5.) Schacherer refers to the combination of housing 26 and connector 30 as "explosive assemblies 20" (*Id*. at 8:10–13), states that "explosive assemblies 20 are perforating guns" (*Id*. at 2:35–36), and explains that "explosive assemblies 20 can be transported to a well location with each explosive assembly being already assembled…." (*Id*. at 3:30–43.) Those disclosures support that outer housing 26 and connector 30 act as a single housing for "transporting the explosive

assemblies 20 from the remote location 110 to the well location 112." (*Id*. at 8:4–14, FIG. 8.)

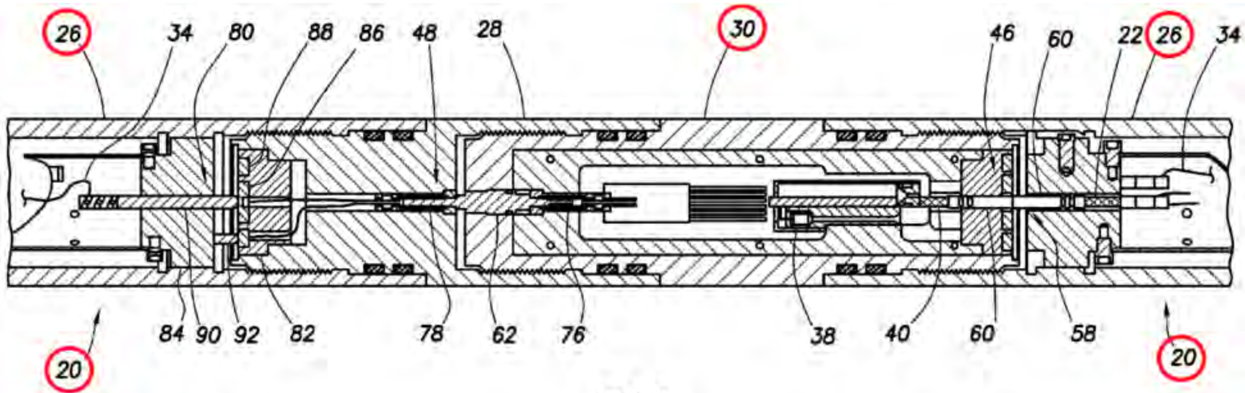
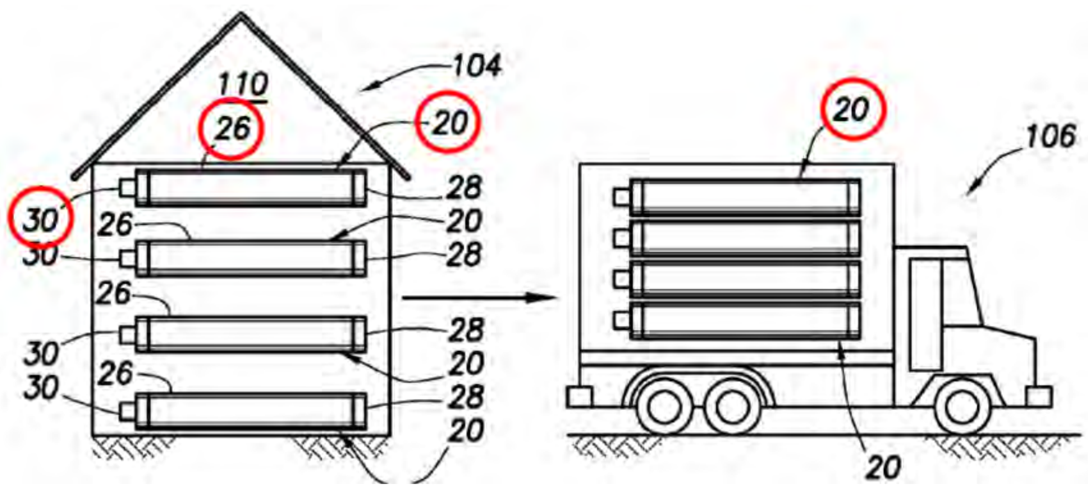


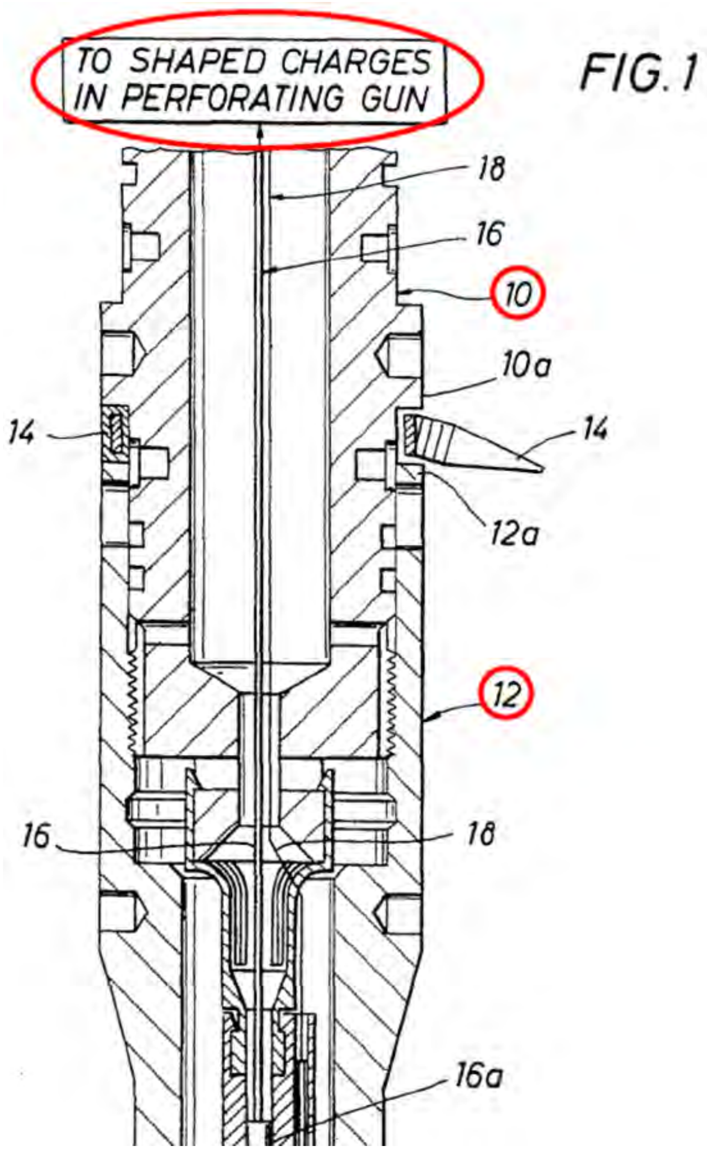
FIG.5



61. A POSITA would understand that Schacherer teaches an outer gun carrier with a hollow interior as claimed.

A. Lerche '929 teaches an outer gun carrier

62. Lerche '929 teaches a first housing 10 and a second housing 12 of a perforating gun with a hollow interior as claimed. (Ex. 1016, Lerche '929, 3:59-4:10.)



B. Harrigan teaches an outer gun carrier

63. Harrigan teaches a perforating gun 100 with a tubular carrier 110 having a hollow interior as claimed. (Ex. 1012, Harrigan, ¶¶ 0007, 0010, 0022, 0033, 0036, FIGS. 1A, 2A; Ex. 1028, Harrigan Prov., p. 3.)

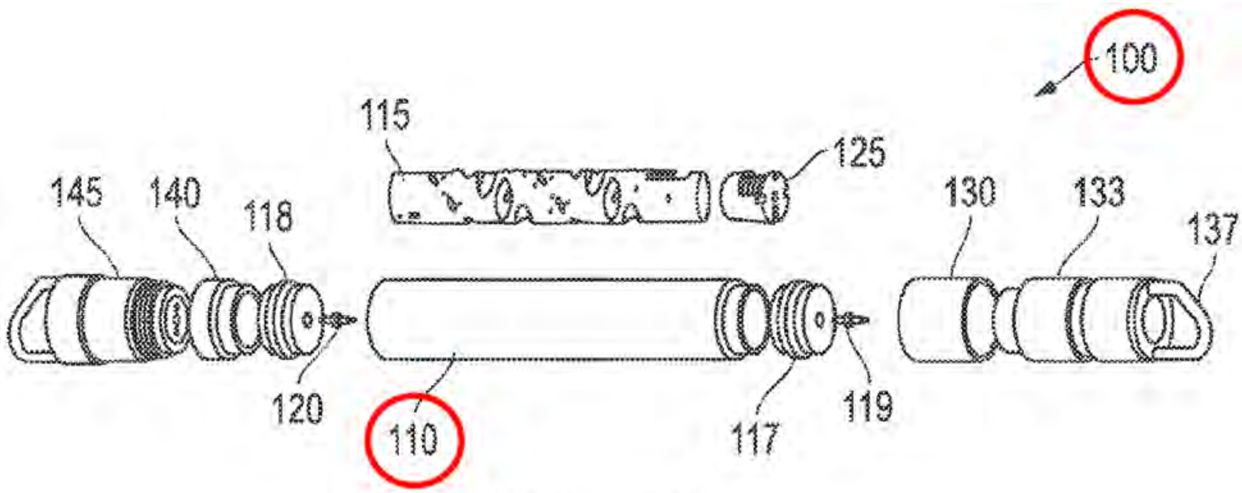


FIG. 1A

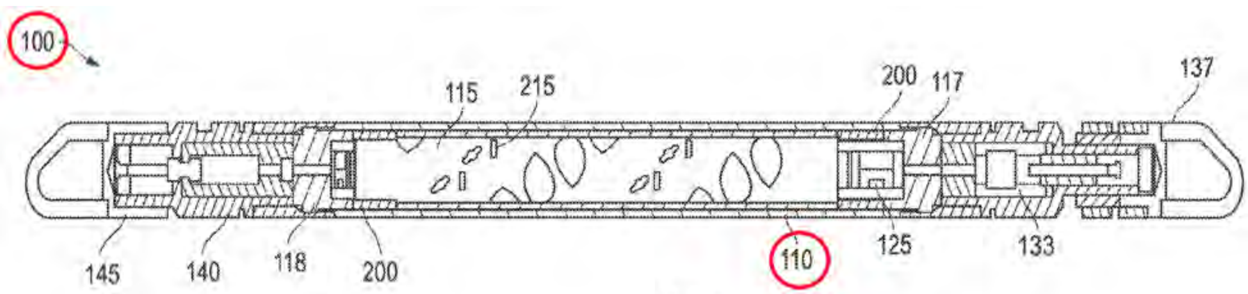
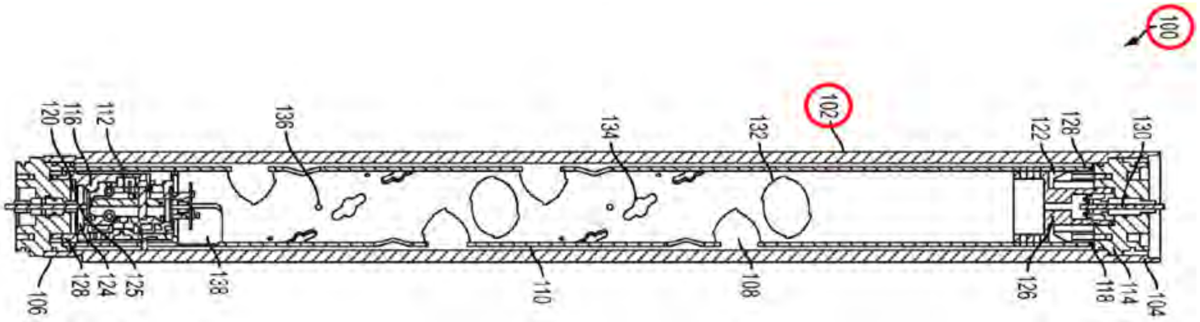


FIG. 2A

C. Rogman teaches an outer gun carrier

64. Rogman teaches a perforating device 100 and 300 with a tubular body or carrier 102 and 302 having a hollow interior as claimed. (Ex. 1014, Rogman, ¶¶ 0015, 0027, FIGS. 1, 3.)

FIG. 1



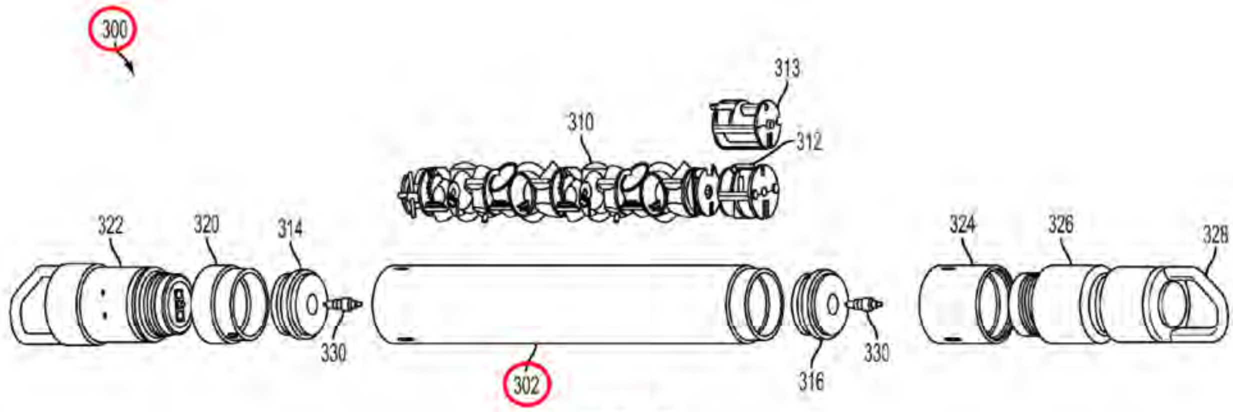
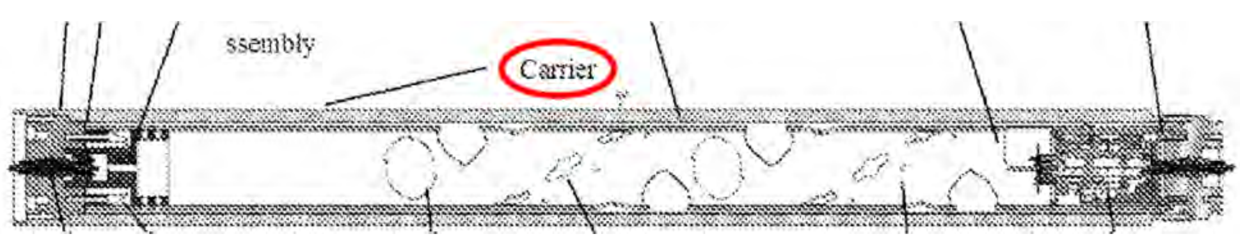


FIG. 3

65. Rogman Prov. also teaches an outer gun carrier with a hollow interior as claimed. (Ex. 1020, Rogman Prov., pp. 1, 2, FIGS. 1, 3, 6, and 7.)



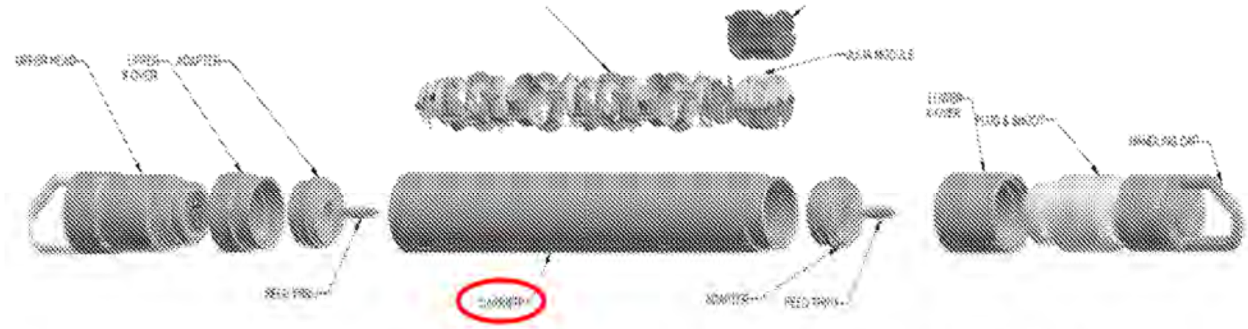


Fig. 3: Overview of the Gun system (shown with previous plastic loading tube design)

D. Lanclos teaches an outer gun carrier

66. Lanclos teaches a perforating system 60 including perforating guns 62_1 and 62_2, with shaped charges 64 in a tubular body or carrier having a hollow interior as claimed. (Ex. 1015, Lanclos, 4:44-5:23 and FIGS. 3-5.) The carrier limitations in the '938 Patent are taught by the tubular housings of perforating guns 62_1 and/or 62_2 and the combination of either of those housings with cartridge sub 68, which is a tubular housing with a hollow interior. *Id*.

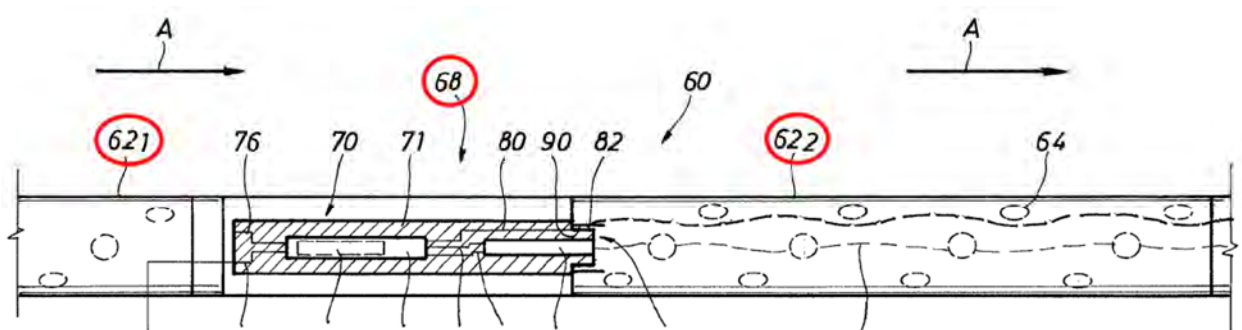


FIG. 3

67. Lanclos also teaches a perforating gun 14 with a tubular body or carrier having a hollow interior as claimed. (Ex. 1015, Lanclos, 1:63-2:13, FIGS. 1-2D.) The carrier limitations in the '938 Patent are taught by the tubular housings of perforating gun

14 and the combination of either of those housings with firing head 40 and/or connecting subs 15, which are tubular housings with a hollow interior.

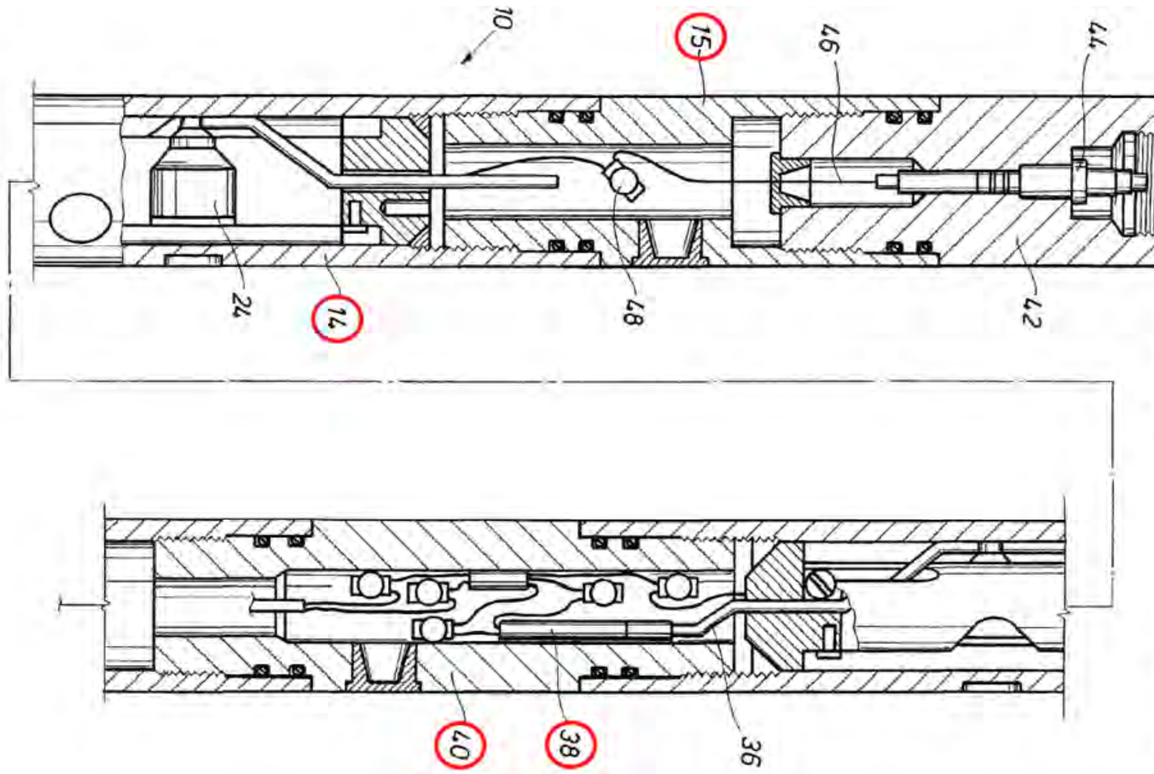


FIG. 2A

FIG. 2B

E. Bonavides teaches an outer gun carrier

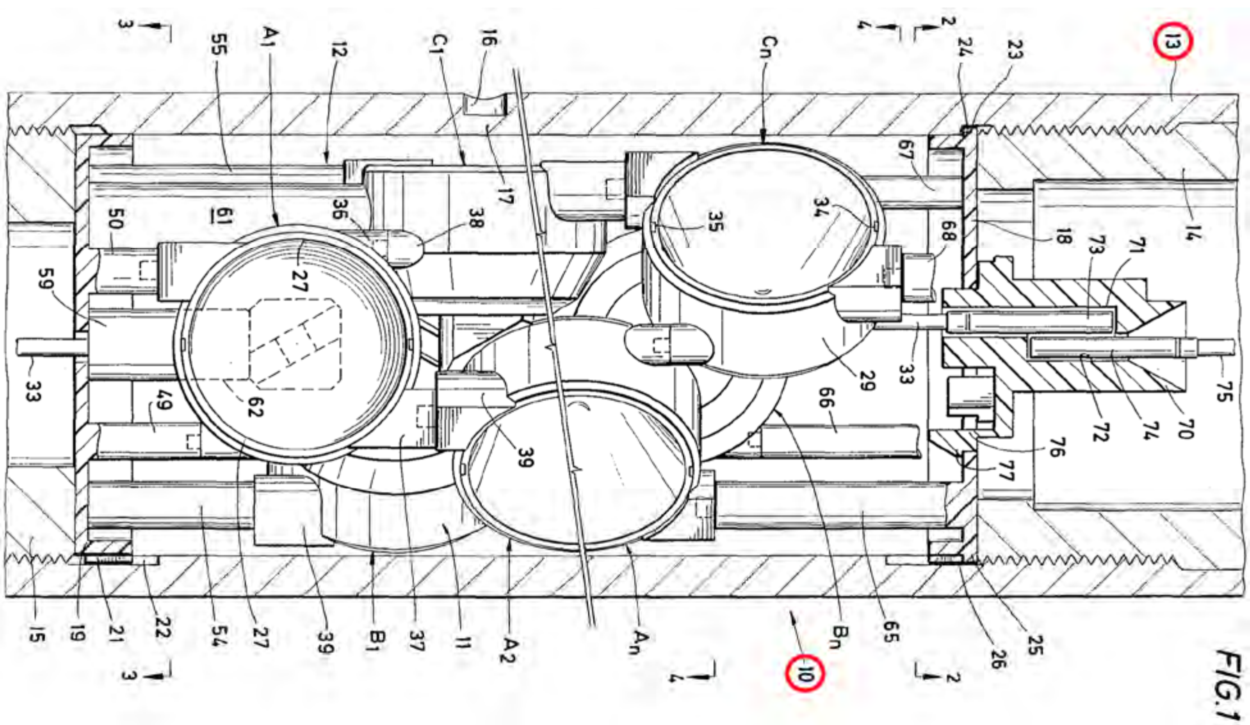
68. Bonavides specifically teaches that a downhole tool 145, including a perforating gun, and controller 105 can be enclosed in a single housing or two or more separate housings. (Ex. 1017, Bonavides, 5:29-35, 7:24-29.) A POSITA would understand that Bonavides teaches an outer gun carrier with a hollow interior as claimed.

69. Even if Bonavides did not explicitly teach a hollow carrier, a POSITA would be motivated to combine Bonavides with their common knowledge of hollow perforating gun carriers as acknowledged by the ‘938 Patent’s background. This

would be the predictable application of known methods to the disclosure of Bonavides without any unexpected results, simple substitution of the known hollow carrier perforating gun for the perforating devices taught, the use of known hollow carrier perforating guns for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of perforating guns that are available with a reasonable expectation of success.

F. Lendermon teaches an outer gun carrier

70. Lendermon teaches a perforating apparatus 10 with a tubular carrier 13 with an upper head 14 and a lower head 15 having a hollow interior as claimed. (Ex. 1003, Lendermon, 4:58-68, 5:5-63 and FIG. 1.)



G. Goodman teaches an outer gun carrier

71. Goodman teaches a perforating string 30 with perforating guns 10, 40, and 51-54 and tubular carriers 31 and 48 having a hollow interior as claimed. (Ex. 1018, Goodman, ¶¶ 0006, 0007, 0018, 0022, 0024-26, FIGS. 2-5.) These teachings of Goodman specifically acknowledge the interchangeability of single piece and multi-piece perforating gun carriers.

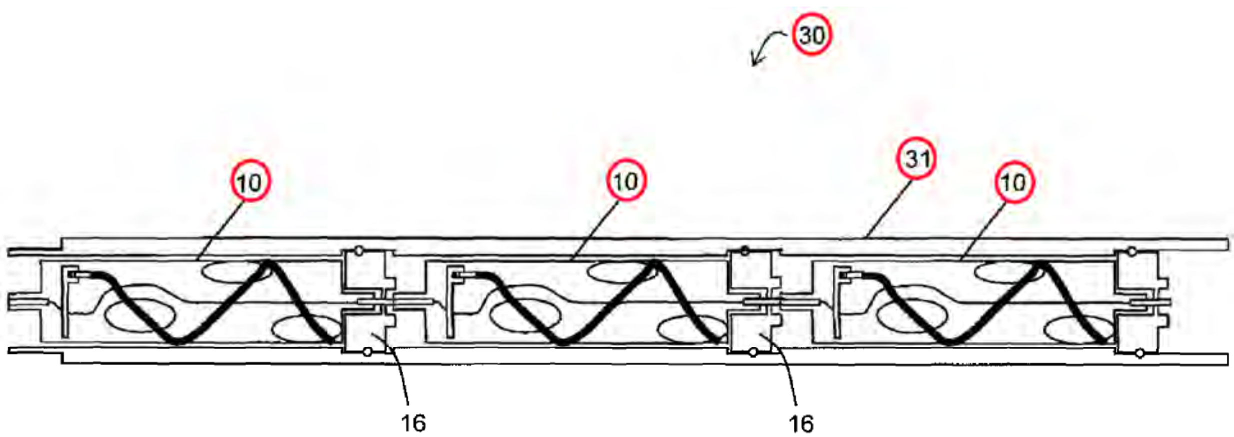


FIG. 3

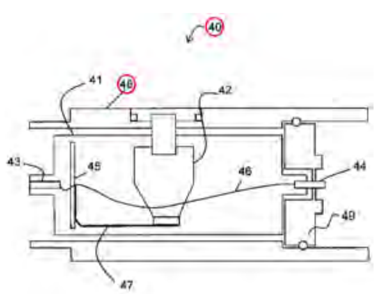


FIG. 4

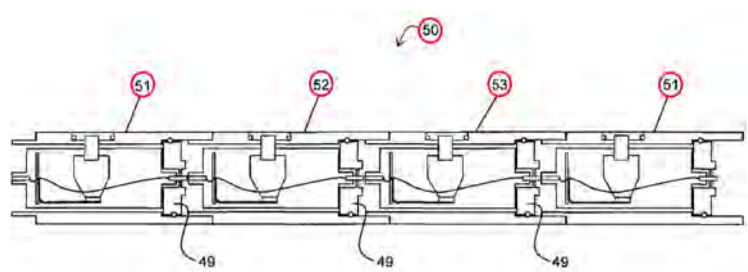
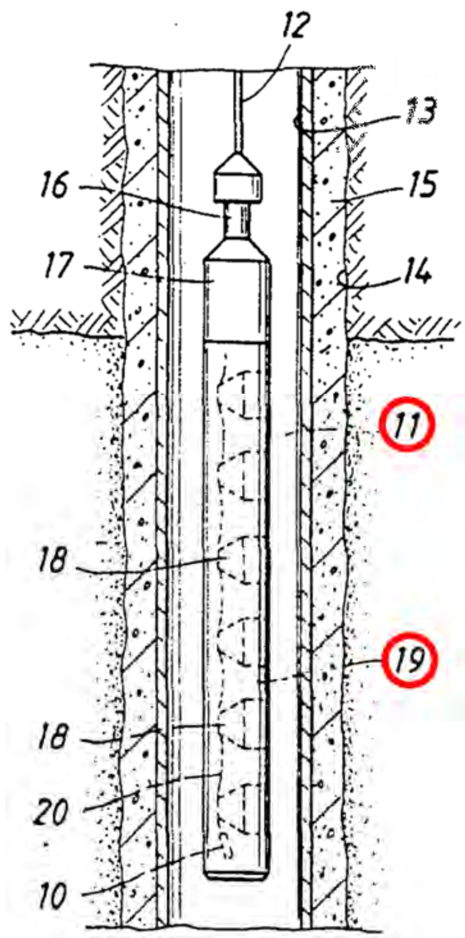


FIG. 5

H. Carisella teaches an outer gun carrier

72. Carisella teaches a perforating gun 11 with a tubular carrier 19 having a hollow interior as claimed. (Ex. 1019, Carisella, 5:52-57, FIG. 1.)

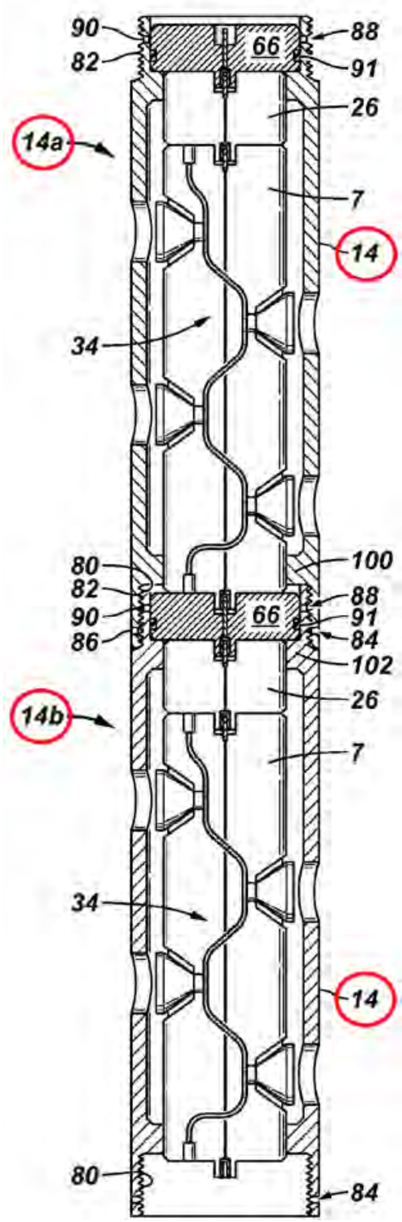
FIG.1



I. Black teaches an outer gun carrier

73. Black teaches a perforating gun 10 with a tubular carrier 14 having a hollow interior as claimed. (Ex. 1002, Black, ¶¶ 0004, 0007, 0020, 0023, 0026, FIGS. 1-2, 4, 6-7, 10.) Black specifically states that a carrier 14 may be made from multiple sections/portions 14*a*, 14*b*. (Ex. 1002, Black, ¶¶ 0020, 0035-39, 0041, FIG. 10.)

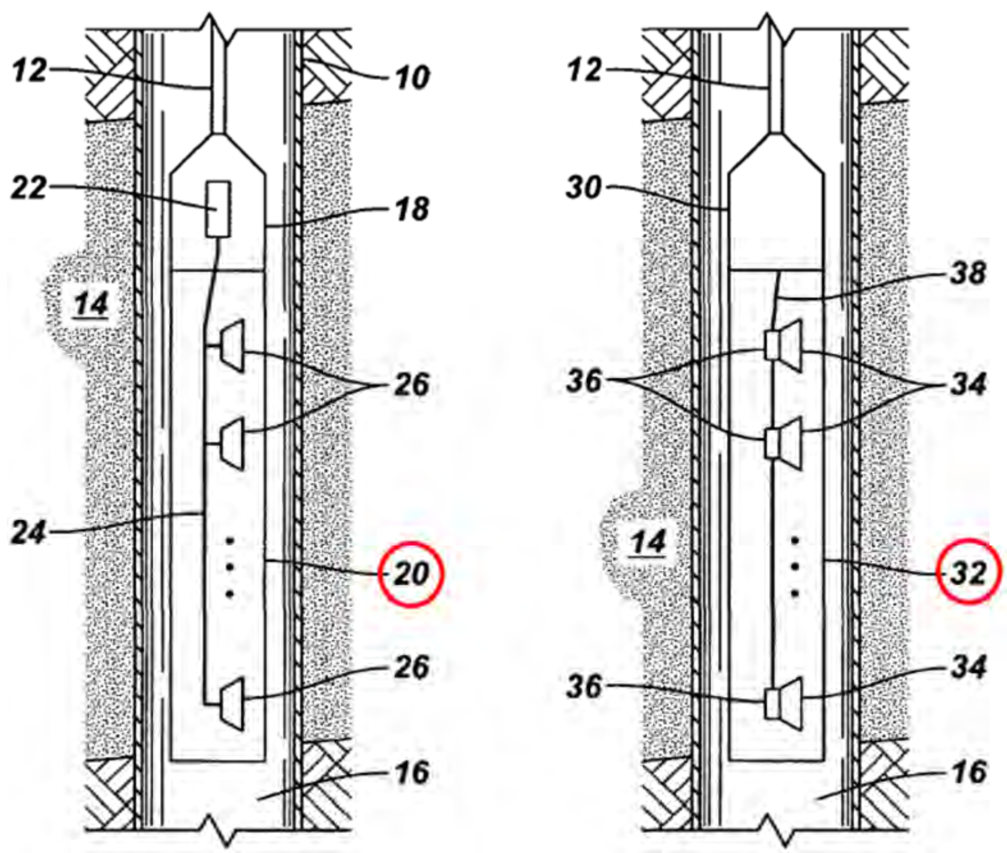
FIG. 10



J. Brooks teaches an outer gun carrier

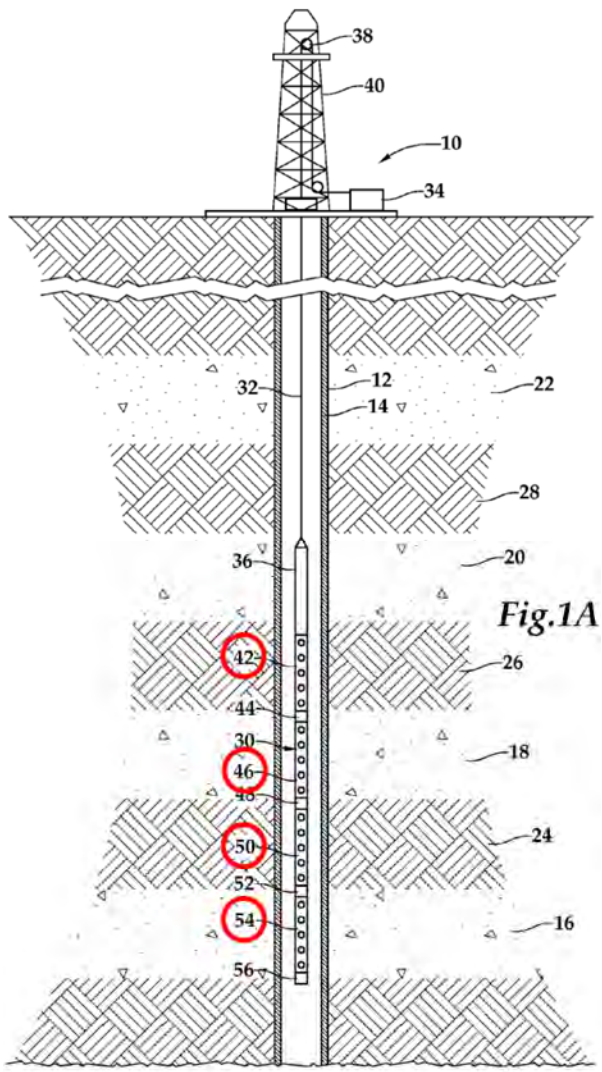
74. A POSITA would understand Brooks teaches perforating guns 20 and 32 with a tubular carrier having a hollow interior as claimed. (Ex. 1021, Brooks, 3:26-32, 3:52-57, 4:7-13, FIGS. 1A, 1B.) Even if Brooks did not explicitly teach a tubular carrier with a hollow interior, it would be inherent to a POSITA reading Brooks and Brooks' discussions of components in the perforating gun.

FIG. 1A FIG. 1B



K. Crawford teaches an outer gun carrier

75. A POSITA would understand Crawford teaches tool string 30 with perforating guns 42, 46, 50, 54 with a tubular carrier having a hollow interior as claimed. (Ex. 1022, Crawford, ¶¶ 0027-28, 0045.) Even if Crawford did not explicitly teach a tubular carrier with a hollow interior, such would be inherent to a POSITA reading Crawford and its discussions of components within the perforating gun. (Ex. 1022, Crawford, ¶ 0045.)



L. EWAPS teaches an outer gun carrier

76. EWAPS teaches a perforating gun with a tubular carrier having a hollow interior as claimed. (Ex. 1013, EWAPS, pp. 4, 6, 8, 9, and 12.)

M. SLB Catalog teaches an outer gun carrier

77. SLB Catalog teaches a perforating gun with a tubular carrier having a hollow interior as claimed and the benefits of such systems. (Ex. 1005, SLB Catalog, pp. 0009, 0043, 0118, 0122, 0127, 0139-144, 0155, 0174-0233.)

N. POSITA Common Knowledge includes an outer gun carrier

78. A POSITA's common knowledge includes the design, operation, and construction of perforating guns and their many common interchangeable variations in design, operation, and construction, including hollow carrier guns and capsule guns. A POSITA's common knowledge includes a variety of devices, assemblies, and systems for well bore perforating, including hollow carrier guns and capsule guns. Therefore, A POSITA's common knowledge teaches a tubular carrier having a hollow interior as claimed.

79. A POSITA would understand that an outer gun carrier is describing the housing of a “carrier” type perforating gun where the internal components are protected from wellbore fluids as opposed to an exposed, or “capsule” type, perforating gun where each individual shaped charge must provide its own protection from wellbore fluids by encapsulating the explosive and liner in a small pressure-tight “capsule.”

80. Such an outer gun carrier would contain shaped charges, shaped charge holders, and detonating cord contained entirely within the outer gun carrier and, as often as not, also a detonator. Other components which add to function or utility may also be included such as charge positioning or aligning devices, electrical switches, circuits, wiring, etc.

81. A POSITA would know that a carrier type perforating gun system provides overall better performance and is much more robust than an exposed or capsule type perforating gun system.

82. The ‘938 Patent does not describe what is different or novel about the outer gun carrier claim(s) versus prior art.

VII. Claim 1 limitation of "a charge holder positioned within the outer gun carrier and including at least one shaped charge....", Claim 13 limitation of "inserting a charge holder within a hollow interior of an outer gun carrier, wherein the charge holder includes a detonating cord connected to the charge holder and at least one shaped charge…."

83. Claim 1 of the '938 Patent includes the limitation of "**a charge holder positioned within the outer gun carrier and including at least one shaped charge....**" (Ex. 1001, the '938 Patent, 11:18-19.) Claim 13 of the '938 Patent includes a similar limitation of "**inserting a charge holder within a hollow interior of an outer gun carrier, wherein the charge holder includes a detonating cord connected to the charge holder and at least one shaped charge….**" (Ex. 1001, the '938 Patent, 12:36-39.)

A. Claim construction of the charge holder

84. A POSITA would understand the term "charge holder" to mean simply a structure that holds a shaped charge in a perforating gun. The claim language above adds that the charge holder is within an outer gun carrier and includes a shaped charge and, in the case of Claim 13, further includes a detonating cord. The plain and ordinary meaning of the charge holder for a POSITA is a device holding a shaped charge inside a gun carrier (and including a detonating cord for Claim 13.)

B. The charge holder as claimed is not supported by the written specification

85. The claim language encompasses charge holders holding more than one shaped charge, but the '938 Patent does not describe such a charge holder. Instead, the '938 Patent describes its charge holders as "a basic component is a single charge holder that centralizes a single shaped charge," and never mentions a charge holder having multiple shaped charges. (Ex. 1001, the '938 Patent, 5:62-63.) The '938 Patent does not contain a written description that would indicate to a POSITA that the applicant had possession of a charge holder with multiple charges, but only the narrower invention including "a single charge holder … [holding] a single shaped charge."

86. Regarding Claim 13, the '938 Patent never discloses a charge holder that "includes a detonating cord." Instead, the '938 Patent describes "a detonation cord connected to the top connector and to each stackable charge holder; at least one bottom connector for terminating the detonation cord in the gun system," and "capturing a detonation cord traversing the charge holder." (Ex. 1001, the '938 Patent, 2:4-7, 2:26-29, 2:46-49, 3:29-34, 5:42-44, 5:66-67, 7:19-21, 9:34-61.) Therefore, the '938 Patent does not contain a written description that would indicate to a POSITA that the applicant had possession of a charge holder that "includes a detonating cord."

C. The charge holder as claimed is within the common knowledge of a POSITA

87. A POSITA's common knowledge includes the design, operation, and construction of perforating guns and their many common interchangeable variations in design, operation, and construction, including hollow carrier guns with charge holders. Therefore, A POSITA's common knowledge teaches a charge holder as in Claims 1 and 13 above. If a particular piece of perforating gun prior art did not explicitly teach a charge holder as claimed, a POSITA would find a charge holder inherent in any disclosure of a hollow carrier perforating gun.

88. It is well known in the art that a perforating gun generally includes a carrying device for holding one or more shaped charges and connecting a detonating cord to those charges. Therefore this limitation is taught by the prior art and to a POSITA would be only an obvious modification as well known in the art.

89. It is well known in the art that a hollow carrier perforating gun generally includes a carrying device for holding one or more shaped charges along with corresponding detonating cord, among other things. Therefore this limitation is taught by the prior art and to a POSITA would be only an obvious modification as well known in the art.

90. Further, a POSITA would be motivated to combine or modify any perforating gun prior art based on their common knowledge of charge holders in hollow carrier and capsule perforating guns. This would be the predictable application of known

methods to the prior art disclosures without any unexpected results, simple substitution of the known charge holder for the perforating devices taught, the use of known charge holders in hollow carrier guns for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of perforating gun structures that are available with a reasonable expectation of success.

D. Schacherer teaches the charge holder

91. Schacherer teaches an eccentric weight 42 holding a shaped charge (explosive component 24) and detonating cord (explosive component 22), teaching this limitation of Claims 1 and 13. (Ex. 1004, Schacherer, 3:9-15, 3:60-4:4, 4:7-10, FIGS. 1, 2.)

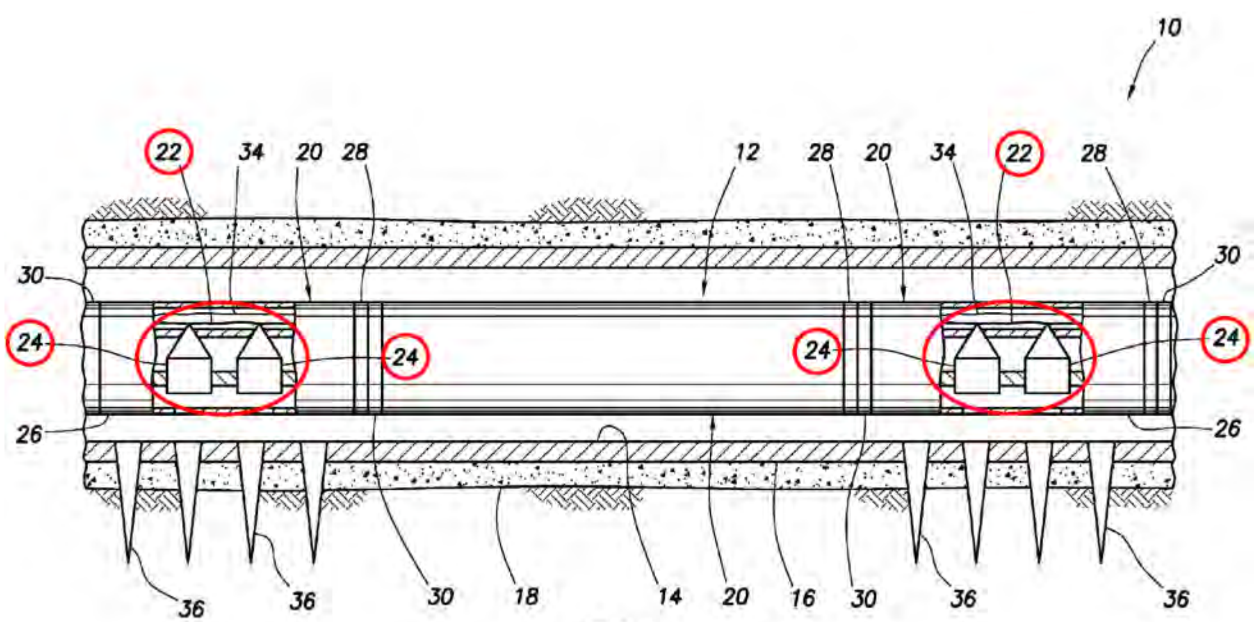


FIG. 1

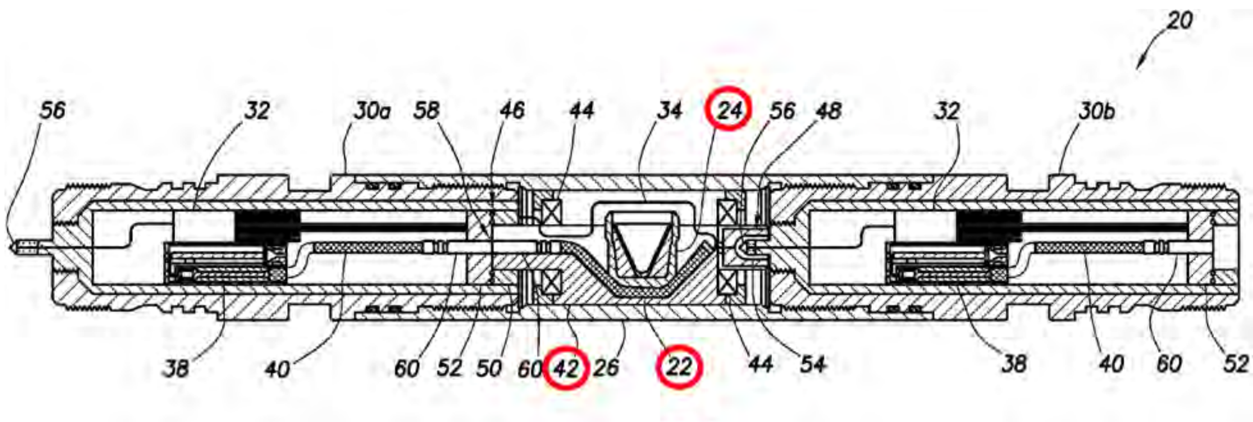


FIG.2

92. Schacherer also references and incorporates two patent publications that teach a suitable way of mounting these components in the outer housing in detail, and describes a similar commercially available system. (Ex. 1004, Schacherer, 3:22-29.)

93. Schacherer also teaches the claimed charge holder in figures 5, which shows typical tubular loading tubes with end fitting and detonating cord 22 inside the housing 26 of explosive assemblies 20. (Ex. 1004, Schacherer, 5:37-51, FIG. 5.) A POSITA reading Schacherer would understand that the sections circled below represent opposing ends of a typical tubular charge holder that would hold shaped charges and detonating cord as shown in figures 1 and 2.

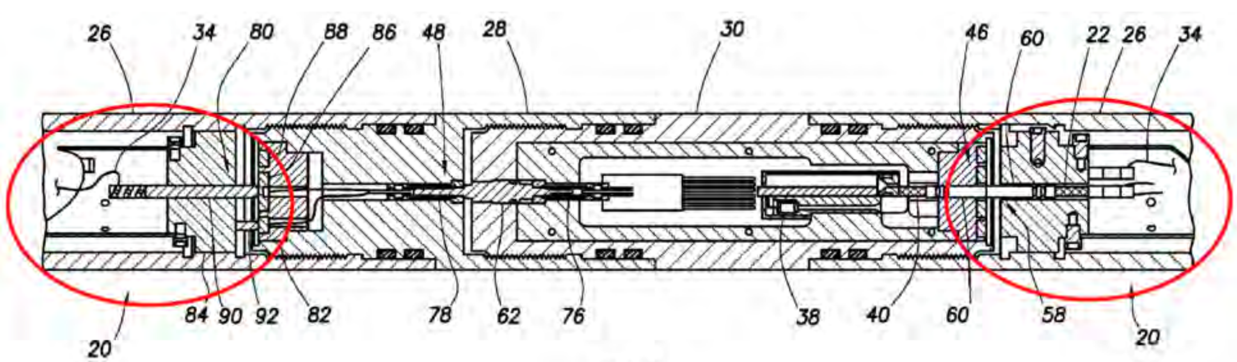


FIG.5

E. Harrigan teaches a charge holder

94. Harrigan teaches a charge holder (loading tube 115) inside an outer gun carrier 110 holding shaped charges at shaped charge locations 410. (Ex. 1012, Harrigan, ¶¶ 0007, 0022, 0024, 0042, FIGS. 1, 2A, 4B; Ex. 1028, Harrigan Prov., pp. 3-5, 7, FIGS. 1, 2, 4.) A POSITA would find detonating cord attached to the shaped charges, loading tube 115, and detonator inherent in Harrigan because that is how shaped charges are almost universally detonated in perforating guns and a POSITA would assume that connection would be completed in the standard way to make the system of Harrigan functional. (Ex. 1012, Harrigan, ¶¶ 0007, 0022, 0024, 0042, FIGS. 1, 2A, 4B; Ex. 1028, Harrigan Prov., FIGS. 1, 2, 4.) Therefore, Harrigan teaches these limitations of Claims 1 and 13.

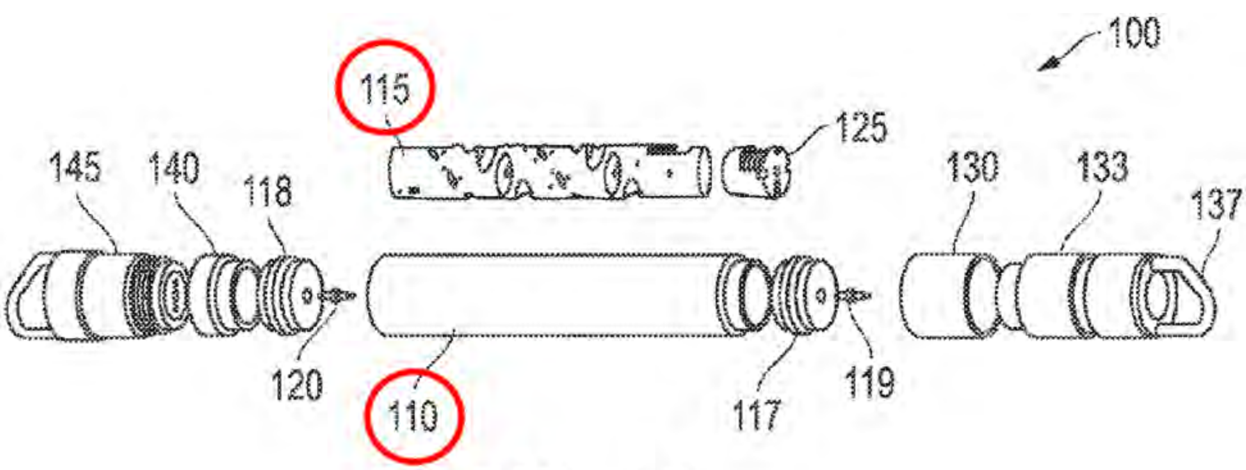


FIG. 1A

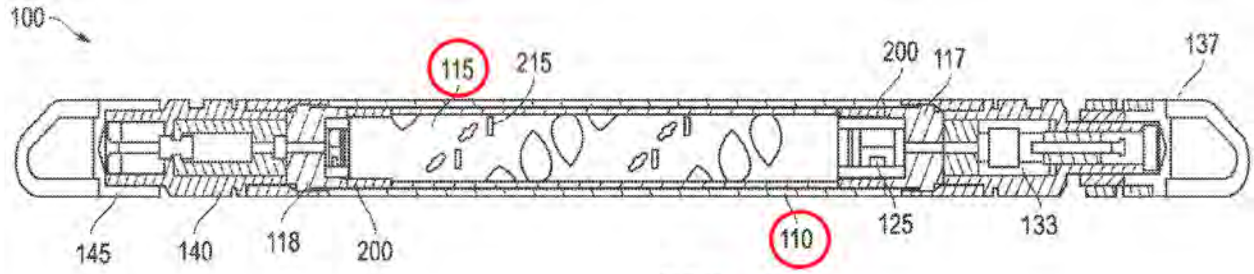


FIG. 2A

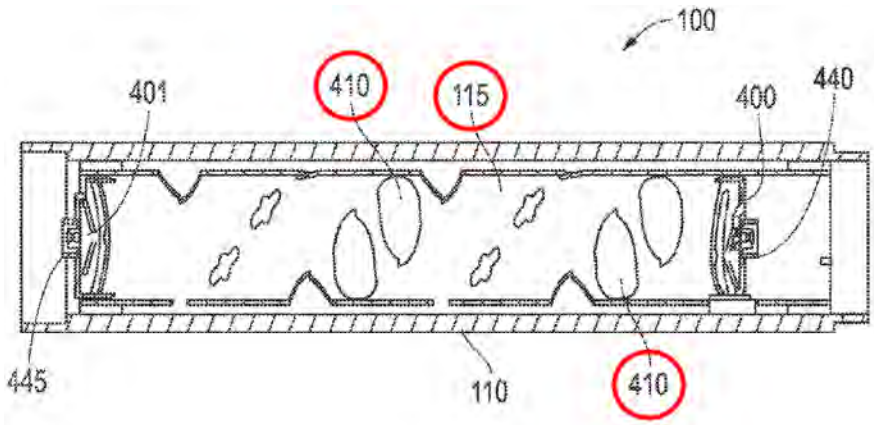


FIG. 4B

F. Rogman teaches a charge holder

95. Rogman and Rogman Prov. teach a charge holder (loading tube 110, 310) inside an outer gun carrier 102 holding shaped charges 202 in charge jacket holders 132, and detonator cords 404 in detonating cord slots 134, teaching this limitation of Claims 1 and 13. (Ex. 1014, Rogman, ¶¶ 0005, 0006, 0020, 0025, 0029, 0036, FIGS. 1-4; Ex. 1020, Rogman Prov., pp. 1-7, FIGS. 1-6.)

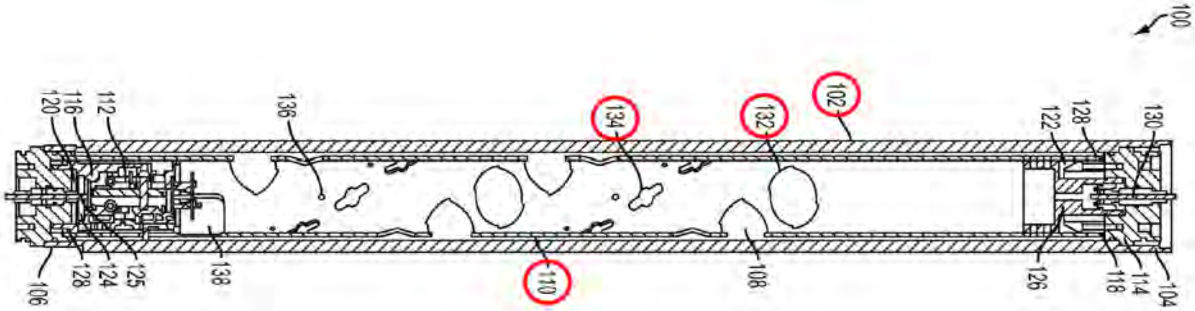


FIG. 1

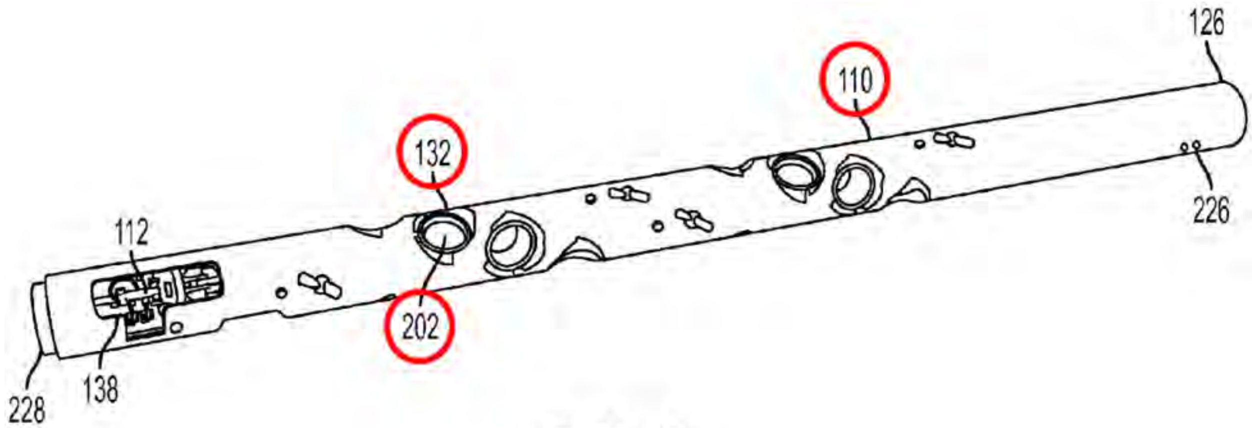


FIG. 2

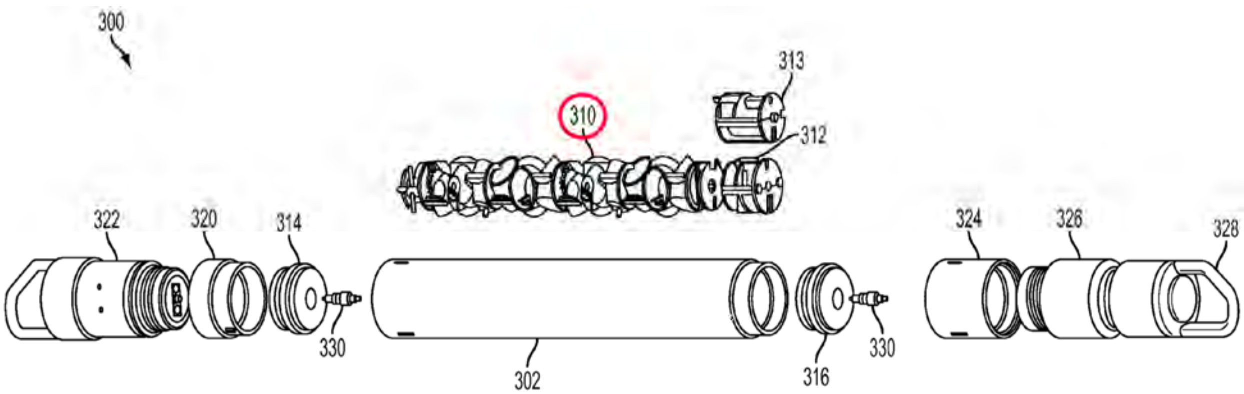
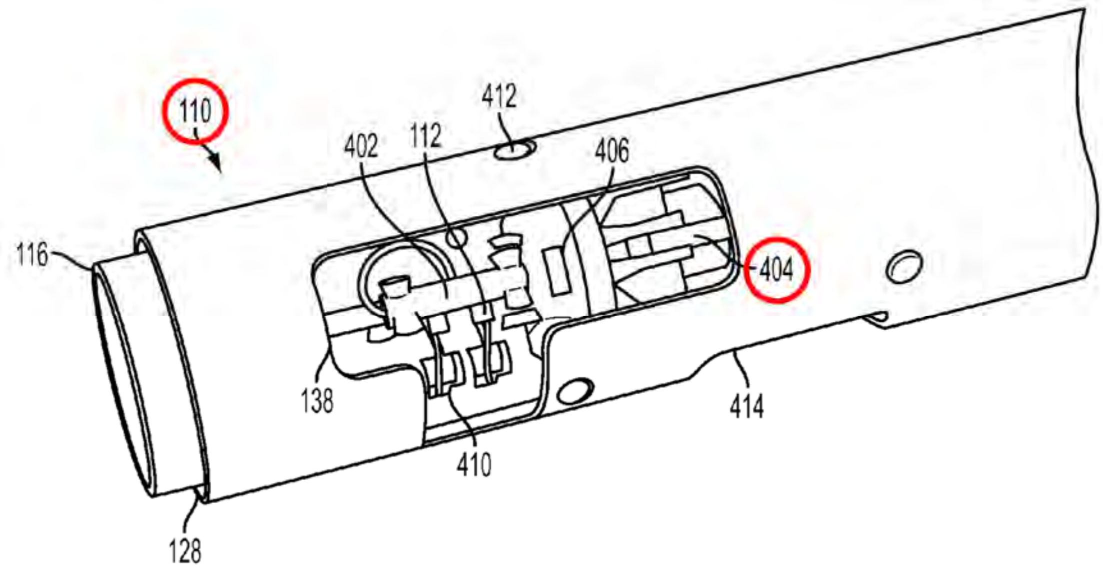
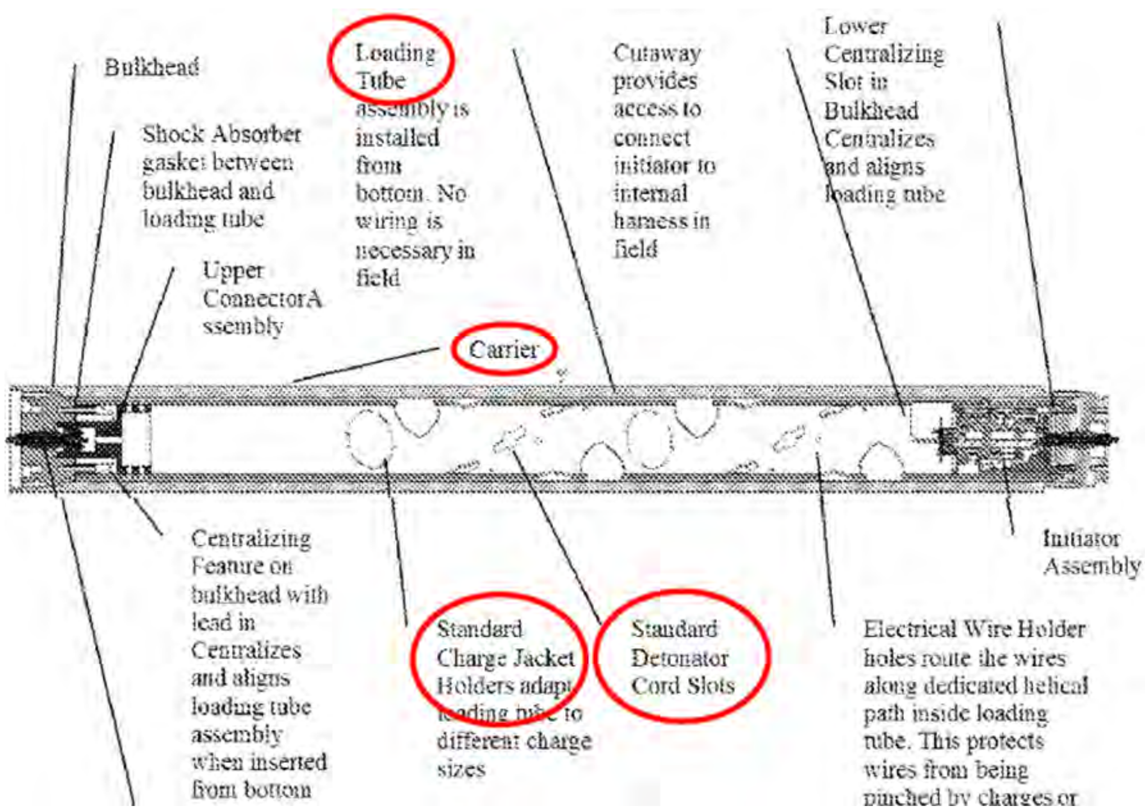


FIG. 3

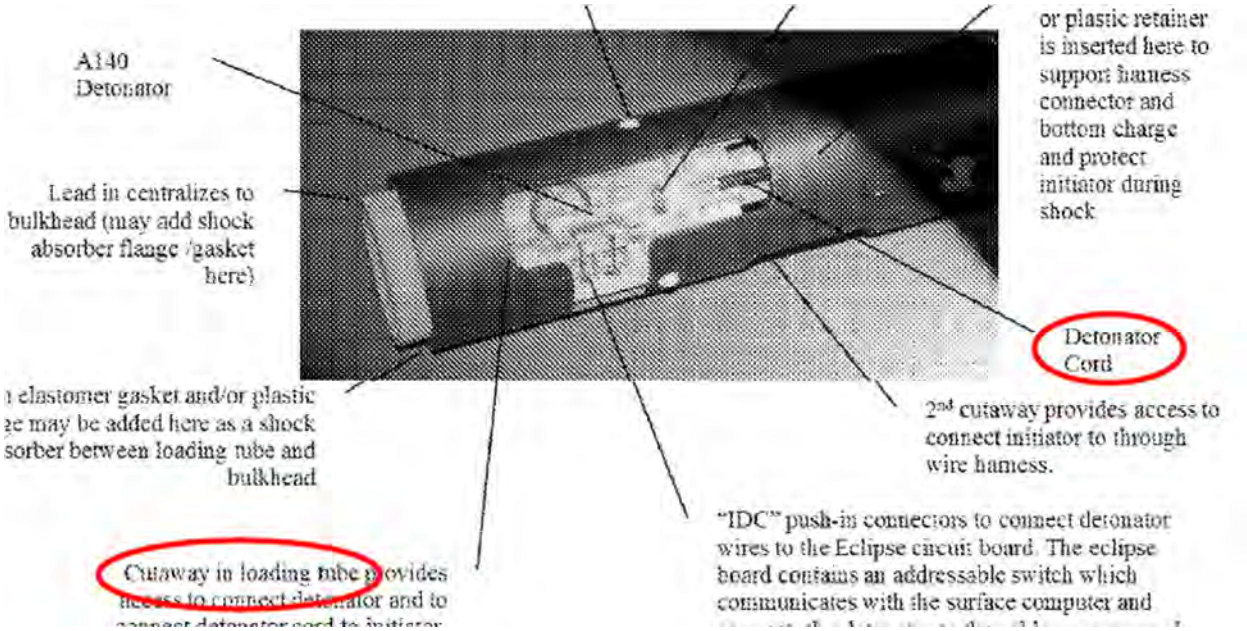


110
412
402
112
406
116
404
138
414
410
128

FIG. 4



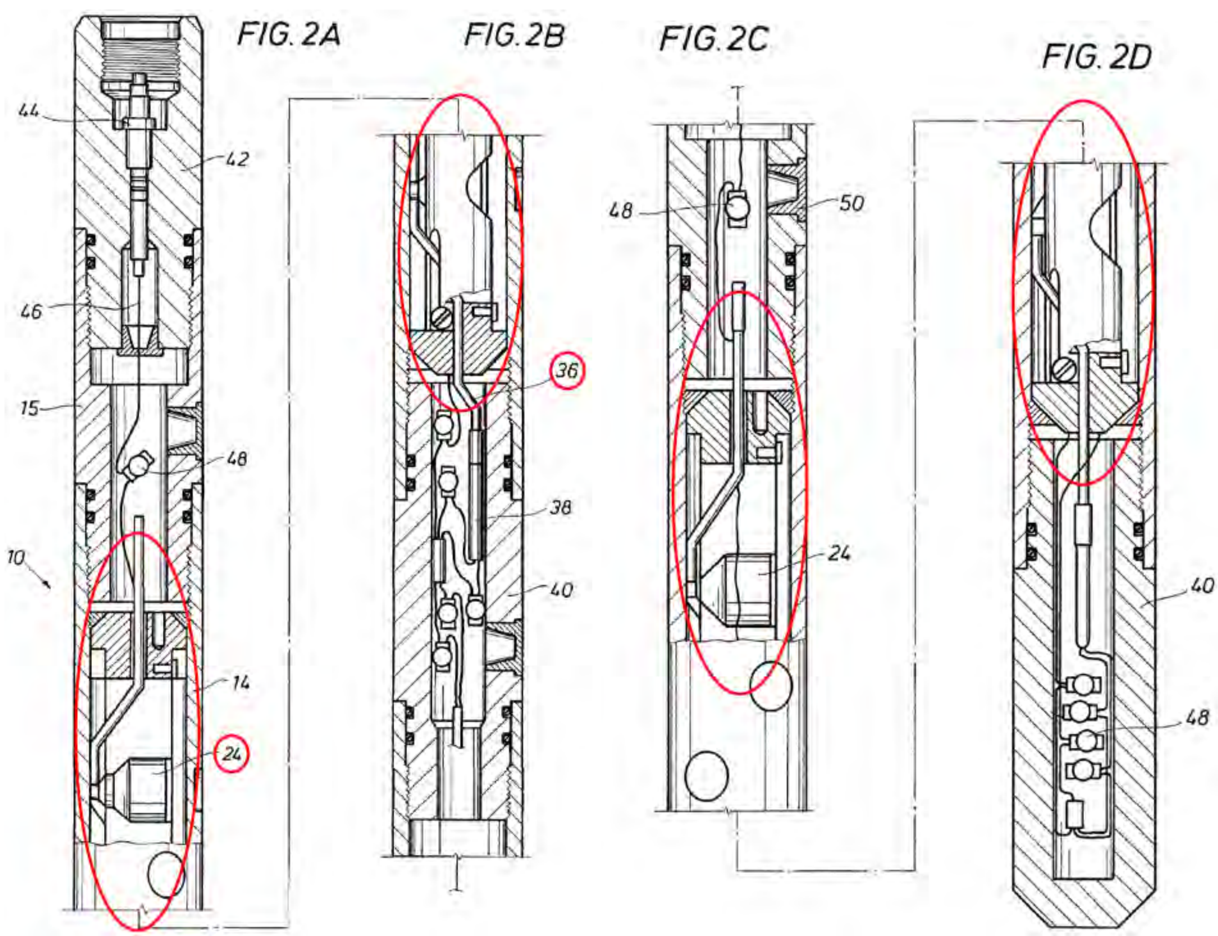
Bulkhead
Loading Tube assembly is installed from bottom. No wiring is necessary in field
Cutaway provides access to connect initiator to internal harness in field
Lower Centralizing Slot in Bulkhead Centralizes and aligns loading tube
Shock Absorber gasket between bulkhead and loading tube
Upper ConnectorA ssembly
Carrier
Centralizing Feature on bulkhead with lead in Centralizes and aligns loading tube assembly when inserted from bottom
Standard Charge Jacket Holders adapt loading tube to different charge sizes
Standard Detonator Cord Slots
Initiator Assembly
Electrical Wire Holder holes route the wires along dedicated helical path inside loading tube. This protects wires from being pinched by charges or



96. A POSITA would find detonating cord attached to the shaped charges, loading tube, and initiator inherent in Rogman and Rogman Prov. because that is how shaped charges are almost universally detonated in perforating guns and a POSITA would assume that connection would be completed in the standard way to make the system of Rogman Prov. functional. Therefore, Rogman and Rogman Prov. teach these limitations of Claims 1 and 13.

G. Lanclos teaches a charge holder

97. Lanclos teaches the claimed charge holder in figures 2A-D, which show typical tubular loading tubes with end fittings holding charges 24 and detonating cord 36 inside a housing of a perforating gun 14. (Ex. 1015, Lanclos, 1:63-2:21, FIG. 2A-D.) A POSITA reading Lanclos would understand that the sections circled below represent opposing ends of a typical tubular charge holder that would hold shaped charges and detonating cord. Therefore, Lanlos teaches these limitations of Claims 1 and 13.



H. Lendermon teaches charge holder

98. Lendermon teaches stackable charge holders (intertwined assembly 12, hollow containers or outer cases 29) inside an outer gun carrier 13 holding shaped charges 11, and detonator cord 33 (in slots 32), teaching these limitations of Claims 1 and 13. (Ex. 1003, Lendermon, 1:18-36, 1:58-2:28, 3:5-7, 5:22-32, 5:64-6:22, 6:32-40, 7:3-18, 7:69-54, 14:23-31, FIGS. 1, 4-7.)

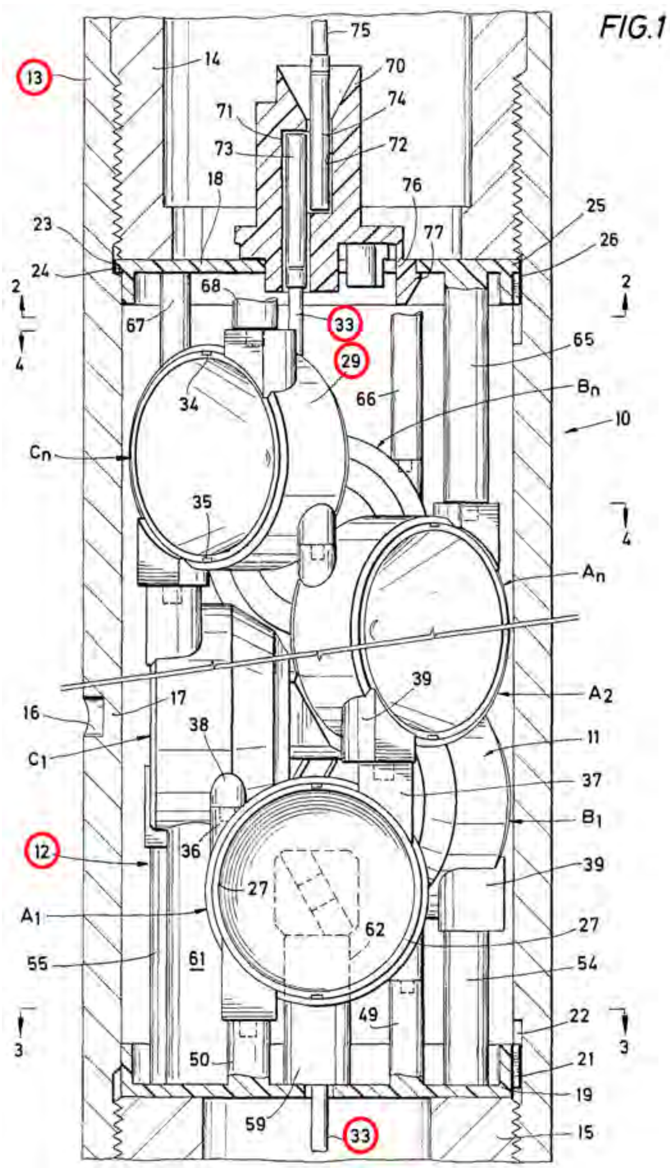
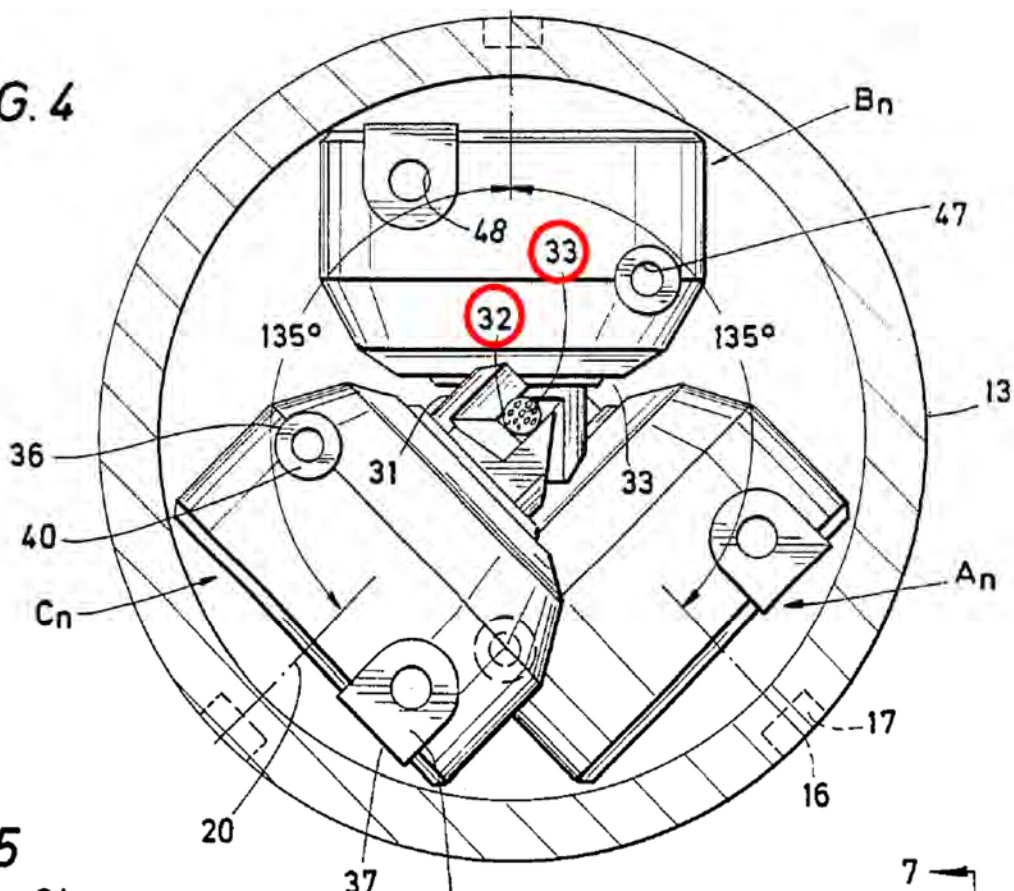


FIG. 4



G.5

34
41
29
46
35

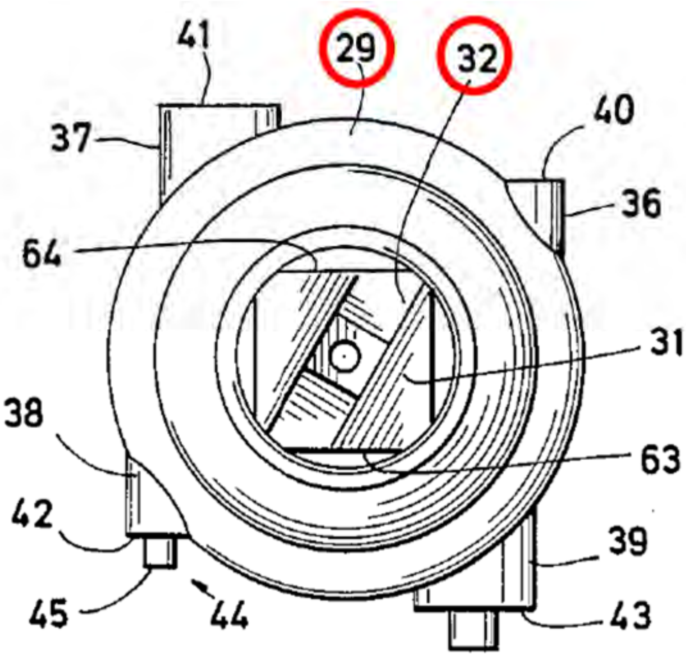


FIG.7

I. Goodman teaches a charge holder

99. Goodman teaches charge holders (loading tube 10) inside an outer gun carrier, 20, 48 holding shaped charges 23, 42 in receptacles 13, and detonator cord 24, 47 in receptacles 14, teaching these limitations of Claims 1 and 13. (Ex. 1018, Goodman, ¶¶ 0005-7, 0018-20, 0022, 0024-26, FIGS. 1-5.)

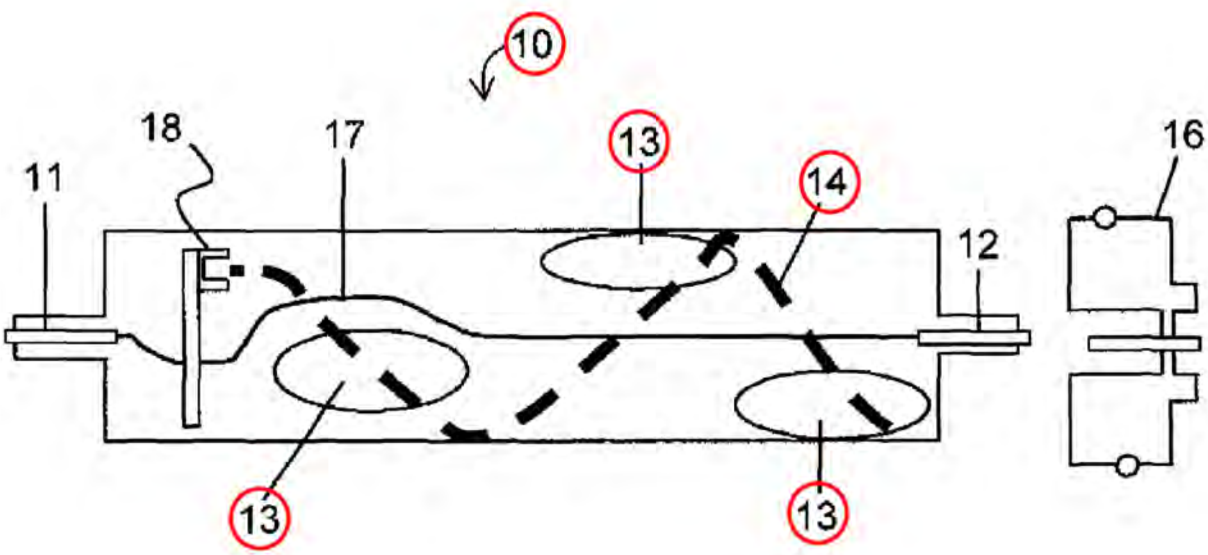


FIG. 1

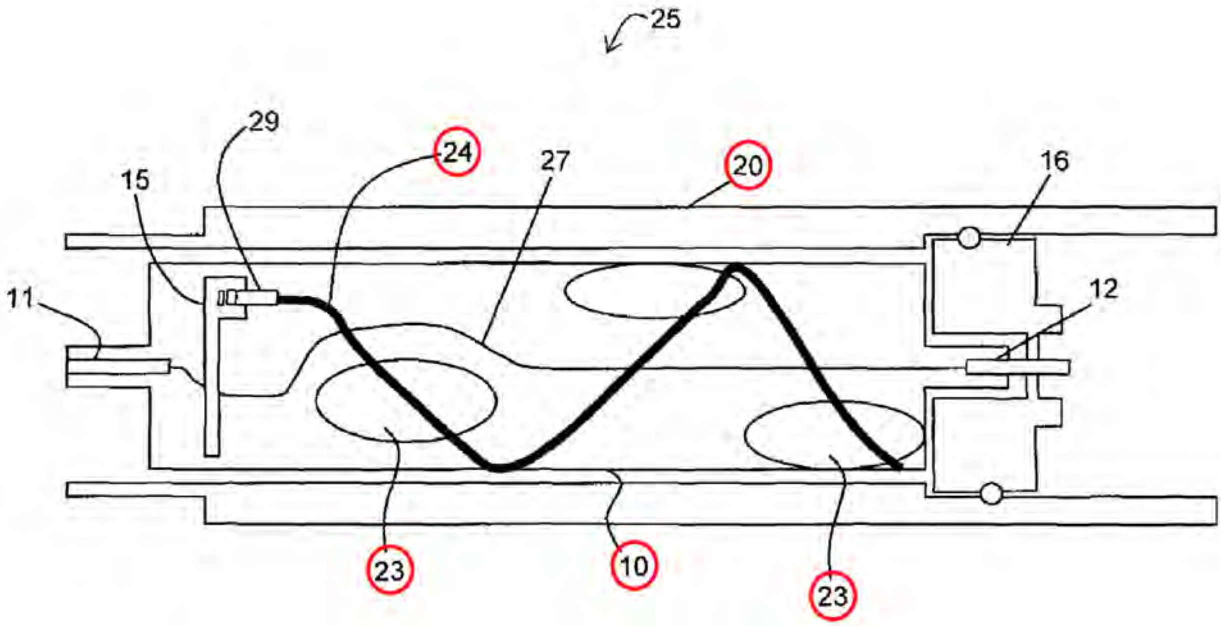


FIG. 2

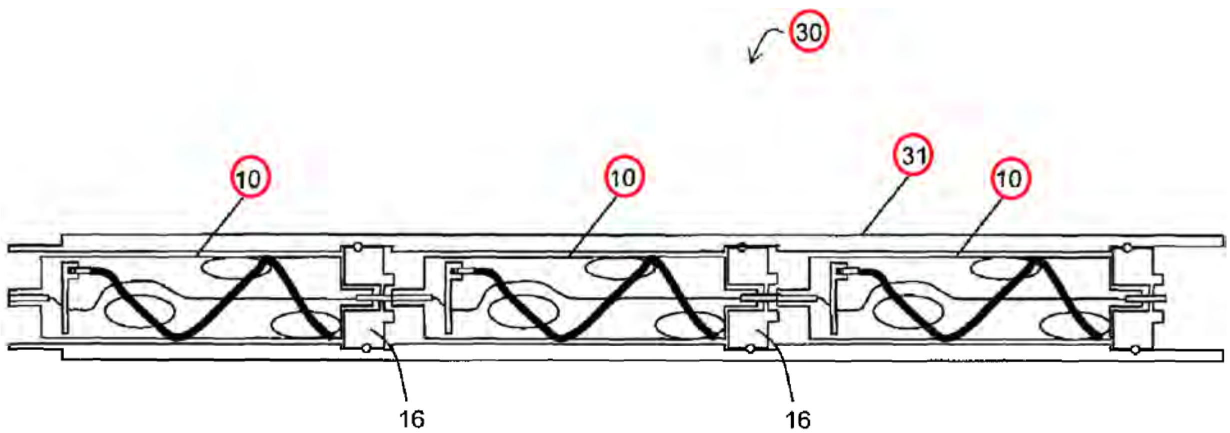


FIG. 3

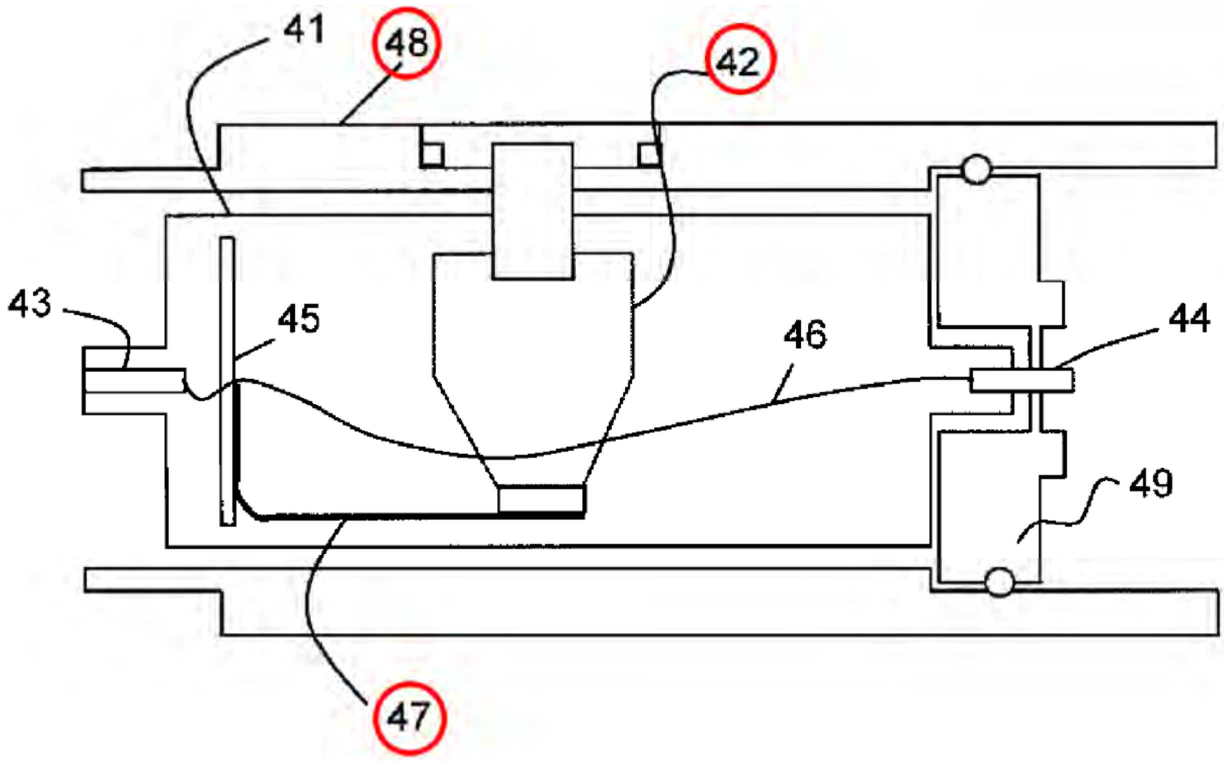
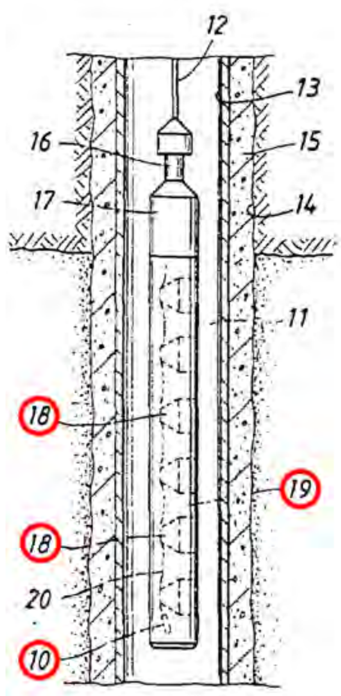


FIG. 4

J. Carisella teaches a charge holder

100. Carisella teaches a charge holder inside an enclosed outer gun carrier 19 holding shaped charges 18, and detonating cord 20, teaching this limitation of Claims 1 and 13. (Ex. 1019, Carisella, 1:25-28, 5:52-65, FIG. 1.)

FIG.1

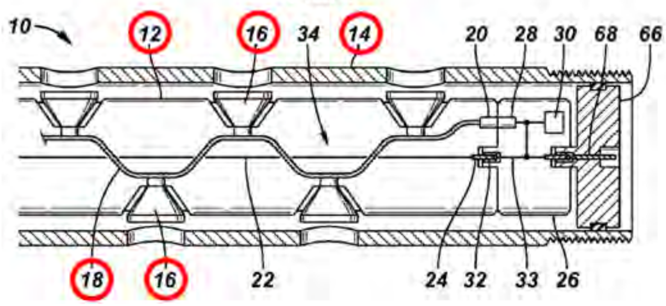


101. A POSITA would find a charge holder holding the shaped charges 18 and detonating cord 20 inside the enclosed carrier 19 inherent in Carisella because something must hold those items and a charge holder has long been the standard method for holding those components in hollow carrier perforating guns and a POSITA would assume that holder would be completed in the standard way to make the system of Carisella functional. Therefore, Carisella teaches these limitations of Claims 1 and 13.

K. Black teaches a charge holder

102. Black teaches a charge holder (loading tube 7, 12) inside an outer gun carrier 14 holding shaped charges 16 in receptacles 13, and detonating cord 18, teaching these limitation of Claims 1 and 13. (Ex. 1002, Black, ¶¶ 0004-8, 0023-27, 0034, 0038, FIGS. 1, 2, 4, 6-7, 10.)

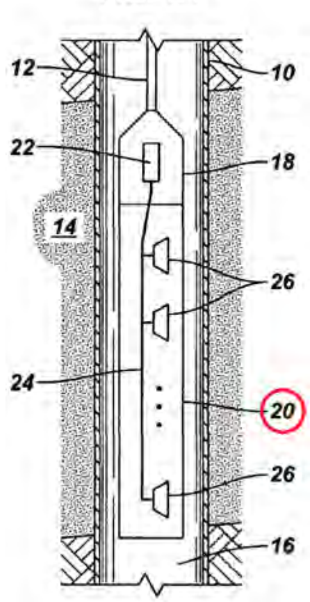
FIG. 7



L. Brooks teaches a charge holder

103. Brooks teaches an outer gun body 20, holding shaped charges 26, and detonating cord 24. (Ex. 1021, Brooks, 3:43-51, 4:3-19, FIG. 1A.)

FIG. 1A

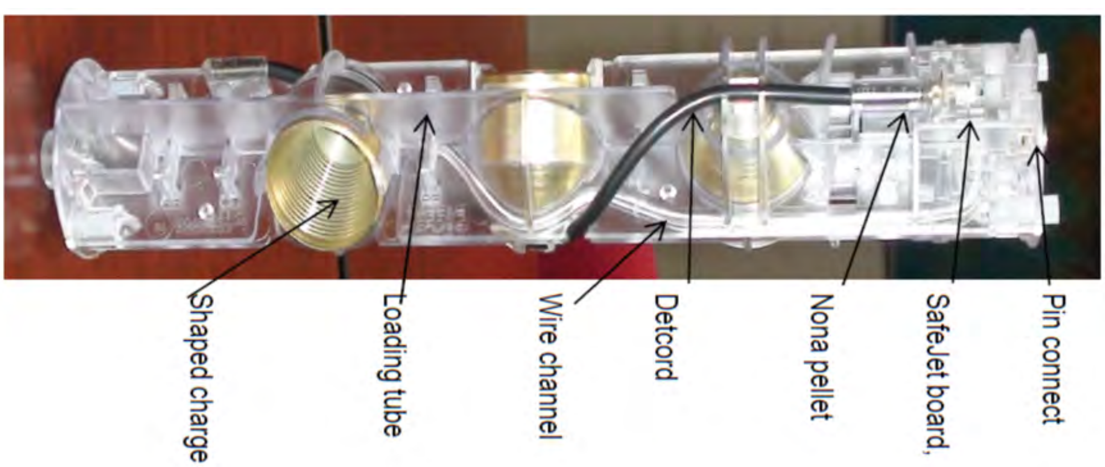


104. A POSITA would find a charge holder holding the shaped charges 26, and detonating cord 24 inside the gun body is inherent in Brooks because something must hold those items and a charge holder has long been the standard method for holding those components in hollow carrier perforating guns and a POSITA would assume that holder would be completed in the standard way to make the system of Brooks functional. Therefore, Brooks teaches these limitations of Claims 1 and 13.

M. EWAPS teaches a charge holder

105. EWAPS teaches a charge holder (loading tube) inside an outer gun carrier holding shaped charges and detonating cord, teaching these limitations of Claims 1 and 13. (Ex. 1013, pp. 4, 9, 10, and 12.)

Pre-assembled with wiring and detonator cord - no booster, no crimping



N. SLB Catalog teaches a charge holder

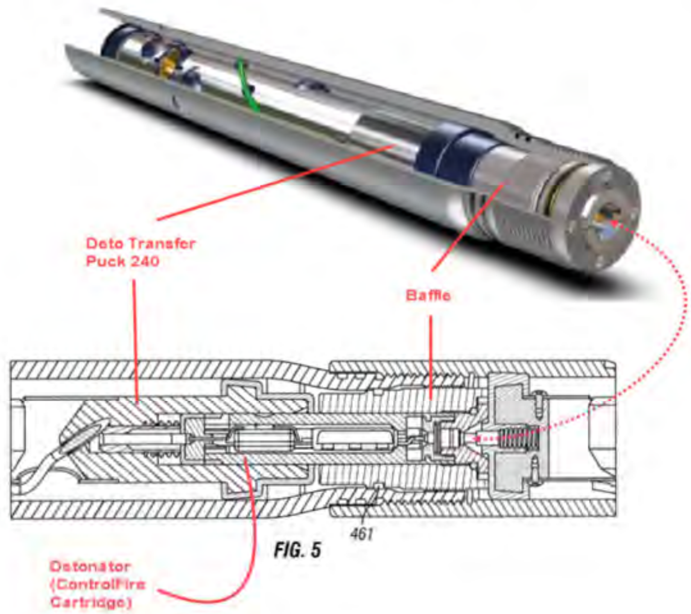
106. SLB Catalog teaches hollow carrier perforating guns that inherently include a charge holder holding shaped charges and detonating cord as claimed in these elements of Claims 1 and 13, and the benefits of such systems. (Ex. 1005, SLB Catalog, pp. 0009, 0043, 0118, 0122, 0127, 0139-144, 0155, 0174-0233.) The SLB Catalog explicitly teaches a loading tube with shaped charge and detonating cord as claimed in these elements of Claims 1 and 13. (Ex. 1005, SLB Catalog, pp. 143, 229, 231, FIGS. 91, 163, 165.)

VIII. <u>Claim 13 limitation of "b) inserting a top connector into the outer gun carrier adjacent to the charge holder, the top connector comprising a hollow channel.... (c) inserting a detonator into the hollow channel of the top connector…" and Claim 5 limitation of "a top connector, wherein the detonator is positioned within the top connector."</u>

107. Claim 13 of the '938 Patent includes the limitation of "**(b) inserting a top connector into the outer gun carrier adjacent to the charge holder, the top connector comprising a hollow channel....**" (Ex. 1001, the '938 Patent, 12:40-42.) It further includes the limitation of "(**c) inserting a detonator into the hollow channel of the top connector….**" (Ex. 1001, the '938 Patent, 12:43-44.) Claim 5 of the '938 Patent includes the limitation of "**a top connector, wherein the detonator is positioned within the top connector.**" (Ex. 1001, the '938 Patent, 11:46-48.)

A. Claim construction of "top connector"

108. The term "top connector" has no standard meaning to a POSITA. In its infringement contentions, Patent Owner alleged that multiple components (deto transfer puck and bulkhead) combined to meet the top connector limitation. (Ex. 1006, Infringement Contentions, p. 14.) Further, those components Patent Owner alleges meet the top connector limitations are simply an end of a charge holder. (Ex. 1006, Infringement Contentions, p. 14.)

US 10,472,938 Claim 5	Defendant's H-1® Perforating Gun System
5. The perforating gun of claim 1, further comprising a top connector, wherein the detonator is positioned within the top connector.	The H-1 gun system has a top connector, i.e., the deto transfer puck and bulkhead, where the portion of the CFC labeled "detonator" in the schematic is positioned within the top connector. 

109. The '938 Patent describes a top connector as follows: "provides energetic coupling between the detonator and detonating cord." (Ex. 1001, the '938 Patent, 3:9-12, 6:19-20, 7:32-36.)

110. The '938 Patent does not describe what is meant by a detonator "positioned within" a top connector, but it does describe a dual spring pin connector including items 124, 126A, 126B, 128A, 128B "positioned within" tandem seal adapter 48. (Ex. 1001, the '938 Patent, 8:31-39.) Those components are not entirely within, but only partially within tandem seal adapter 48. (Ex. 1001, the '938 Patent, 8:31-39, FIG. 32, 33, 35B.)

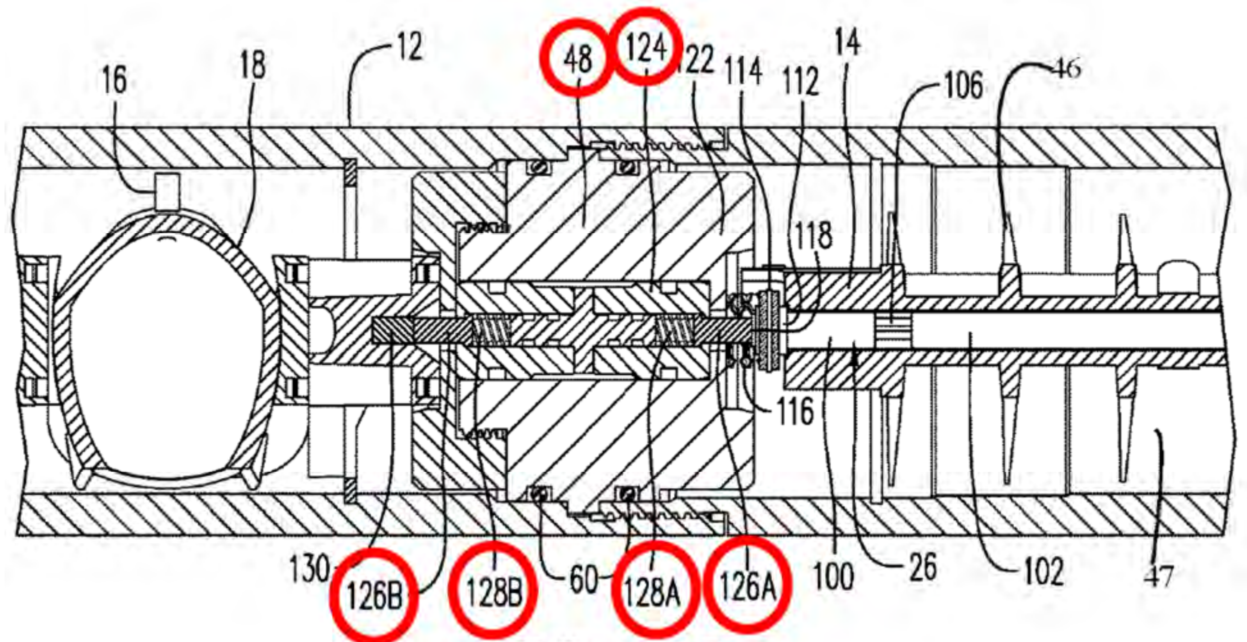


FIG. 32

111. The '938 Patent is unclear as to whether a top connector must be a separate component or whether the limitation can be met by other claimed components, such as a charge holder, a carrier, or a detonator body as Patent Owner has alleged infringement. Therefore, Claims 5 and 13 fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention and is indefinite.

112. Claim 5 also refers to "the top connector," but Claim 1 contains no reference to a top connector. It is unclear what, if any, additional limitation is provided by Claim 5. Therefore, Claim 5 fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention and is indefinite.

113. Although the meaning of the top connector elements of Claim 5 is unclear, a POSITA's most likely understanding or best guess of what the Claim 5 limitation above would mean is "a component with the detonator at least partially within it."

114. The '938 Patent does not describe a channel in the top connector, but does refer to an elongated opening 247 in a top connector. (Ex. 1001, the '938 Patent, 7:36-42.) The '938 Patent does describe "v-shaped channels 221" in a <u>bottom connector</u> that are depicted as recessed in the bottom connector. (Ex. 1001, the '938 Patent, 6:42-44, FIG. 5.)

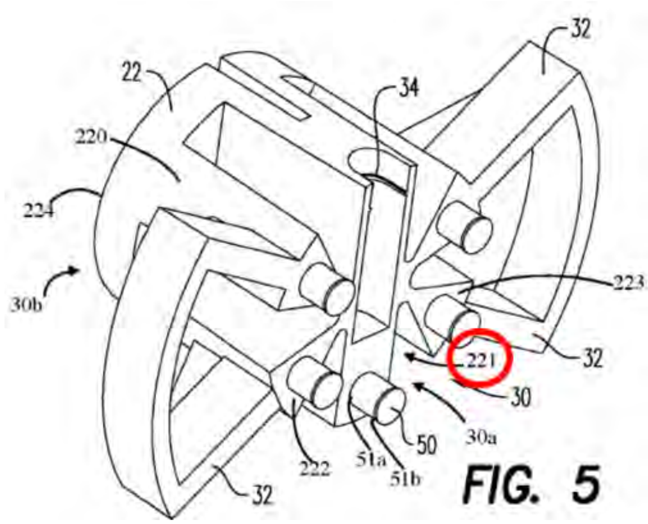


FIG. 5

115. Because the '938 Patent does not use this term to describe any particular structure, it is not clear to a POSITA what is meant by a "hollow channel" in a top connector and Claim 13 fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention and is indefinite.

116. Because Claim 13 goes on to require inserting a detonator into the hollow channel, A POSITA would understand that the hollow channel of Claim 13 must be able to receive a detonator at least partially within it.

117. Although the meaning of the top connector elements of Claim 13 is unclear, a POSITA's most likely understanding or best guess would be that step b) requires inserting a component within a recess or opening that can receive a detonator at least partially within it, at least partially into the outer gun carrier adjacent to the charge holder, and that step c) requires inserting a detonator at least partially into that component.

118. The '938 Patent describes prior art perforating guns as having "a detonating cord leading through the gun carrier that is coupled to a detonator." (Ex. 1001, the '938 Patent, 1:40-42, 1:49-53.) This is the same function the '938 patent ascribes to the top connector. (Ex. 1001, the '938 Patent, 6:19-20 ("the top connector 14 provides energetic coupling between the detonator and detonating cord.")) As described below, a POSITA would understand that some component would be necessary in the prior art to perform this function to render any perforating gun functional.

B. POSITA's common knowledge of a top connector

119. A POSITA's common knowledge would include that a typical perforating gun includes a detonator coupled to a detonating cord. A POSITA's common knowledge would include that a typical perforating gun system can include a component that holds a detonator to couple the detonator to a detonating cord. Therefore, a POSITA's common knowledge teaches the top connector limitation of Claim 5.

120. A POSITA's common knowledge would include that the detonator in a typical perforating gun can be inserted into such a component and that that component would be inserted into a gun carrier. Therefore, a POSITA's common knowledge teaches the top connector limitations b) and c) of Claim 13.

121. A POSITA's common knowledge would include the use of adapters to fit perforating gun components into a variety of sizes of carriers. For example, a POSITA would know that a single sized detonator could be adapted for use in a variety of sizes of perforating gun carriers by providing adapters with an internal geometry to match the detonator and a variety of external geometries to fit different sized perforating guns.

122. A POSITA would know that the detonator is often positioned in the "Top Connector" as this would be a natural, convenient, and safe place to place a detonator in many gun string configurations and operational environments. Placing the detonator in a "Top Connector" is by no means novel nor new but does have the

benefit of convenience if it is actually more convenient than other options which are in fact equally available.

123. In a multi-gun string to be shot selectively in a horizontal well, as is typical now in the horizontal oil and gas shale perforating market, it does not matter exactly where or in which component that the detonator is placed, be that a gun, an adapter, or a component in a gun or an adapter. The gun will function properly as long as the detonator can be electrically connected to the power, ground and control electronics and ballistically or energetically connected to the detonating cord. Further, when placed in a perforating gun that will be detonated in a horizontal well, the detonator does not have to be located in the lower end of the perforating gun if fluid desensitization is desired because a fluid desensitizable detonator will be equally desensitized in any local internal to the gun, when it is also immersed in fluid.

124. The placement of the detonator in a "Top Connector" might appear to be novel or new, however a POSITA knows that in fact it is not. During the past (and even to the present) in traditional wireline conveyed perforating gun system operations in vertical wells, the detonator was positioned at the bottom of each gun so that the detonator could be fluid desensitized in the event of fluid entry which resulted from a seal failure, and thereby would be preventing a potentially catastrophic failure due to the gun being blown up instead of detonating normally. This location for the placement of the detonator was virtually a safety mandate because many of the

carrier type perforating guns of the past often leaked fluid through damaged port plug seals in the case of multiple use port plug style carrier guns, or from poor seal preparation in the case of the smaller thru-tubing style carrier guns. In the case of the port plug style guns the fluid seal on many port plugs often became compromised after becoming damaged from various causes following multiple jobs. Ten jobs was often the limit that such a port plug gun could be reliably used before being discarded. The thru-tubing style guns were often cut to length at the wellsite by field personnel, a tapered seal bore was prepared with a reamer, and holes were drilled in the ends so that cap screws could be used to retain the adapters. This process was prone to many causes for error, including a damaged or worn reamer which was not able to produce an effective sealing surface, and leaving burrs around the drilled holes which could cut or otherwise damage o-rings during assembly. Fluid entry was a common occurrence. A carrier style perforating gun which is detonated with fluid inside will often rupture, causing a catastrophic failure that sometimes results in damage to the wellbore casing or tubing surrounding the perforating gun.

125. As tubing conveyed in addition to wireline conveyed perforating operations entered the market, it soon became obvious that the old rules needed changing. Placing the detonator at the bottom of a long perforating gun string posed obvious and serious safety problems. Imagine pulling a long "failed-to-fire" perforating gun string out of the well with unfired perforating guns all up to the rig floor, through the surface

equipment and down several hundred feet, with a live unfired detonator at the bottom. The "rules" needed changing. Since tubing conveyed carrier style perforating guns did not have port plugs and the sealing surfaces were prepared in much more controlled circumstances in a machine shop, failures from unwanted fluid entry almost disappeared. Firing heads and detonators were placed at the top of the gun string, and the detonator for each individual perforating gun was placed in a "Top Connector" in each perforating gun. Fluid desensitization of detonators was largely abandoned as being unnecessary.

126. At the same time that these tubing conveyed style carrier guns entered the market for tubing conveyed perforating operations, they were also configured for wireline conveyed operations due to their superior performance versus the previous perforating gun systems available until then. Whereas in the earlier wireline conveyed perforating operations the detonator was traditionally placed by necessity at the bottom of each individual gun, including in multi-gun configurations detonated selectively, it soon became obvious that if a detonator could be placed at the top of these same guns for tubing conveyed operations without issue, they could also be placed at the top of these same guns for wireline operations, without issue, and they were. This was an especially attractive option when long uninterrupted intervals were to be perforated and selective perforating was not needed. Wireline operations were subsequently and often shot top down, successfully and safely, with

the perforating gun string assembled in the same manner as they would have been assembled for a tubing conveyed perforating operation.

127. A POSITA knows that the benefit of placing the detonator in a “Top Connector” if he/she wants to do so for any practical or convenient reason confers a benefit to him/her simply because he/she is freely able to place the detonator entirely within a gun, entirely within an adapter between guns, for example in a tandem seal adapter or similar component, or partially in a gun, or partially in an adapter, none of the options of which are novel nor new, and there are no practical restrictions to his/her choice and practice in doing the same.

C. Schacherer teaches a top connector as claimed

128. Schacherer teaches a detonator inserted within connector 30, 30a, (Ex. 1004, Schacherer, 6:37-41, FIGS. 2, 4, 5, and 7.) Schacherer teaches connecters, 30 and 30a inserted within the gun carrier 26. (Ex. 1004, Schacherer, FIGS. 2, 4, 5, and 7.) Schacherer teaches this connector coupling a detonator 30 to detonating cord 22. (Ex. 1004, Schacherer, 1:23-27, 3:33-36, 4:40-48, 5:47-51, 6:37-41 6:57-59, 7:27-33, 9:49-50, 9:64-67, 10:19-21, 10:46-49, FIGS. 2, 4, 5, and 7.) Schacherer teaches

connecters, 30 and 30a inserted within the gun carrier 26.

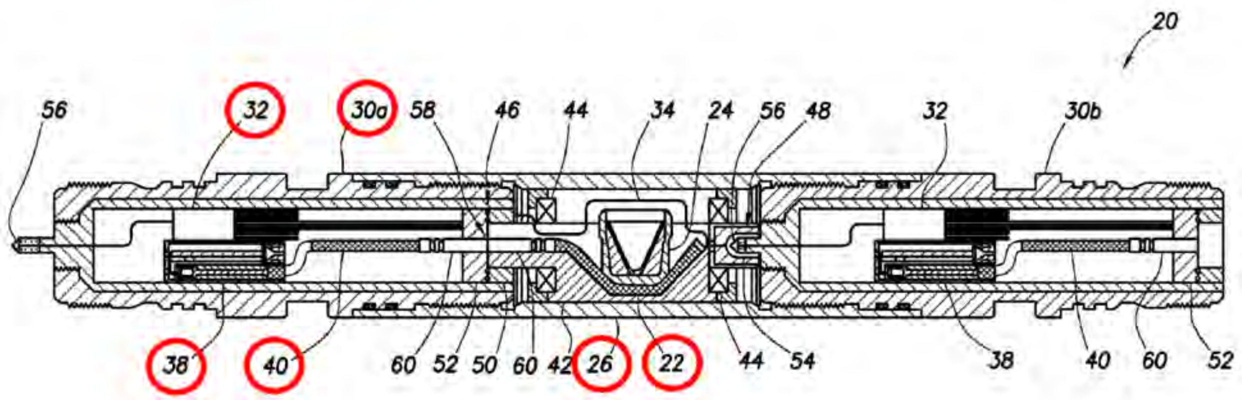


FIG.2

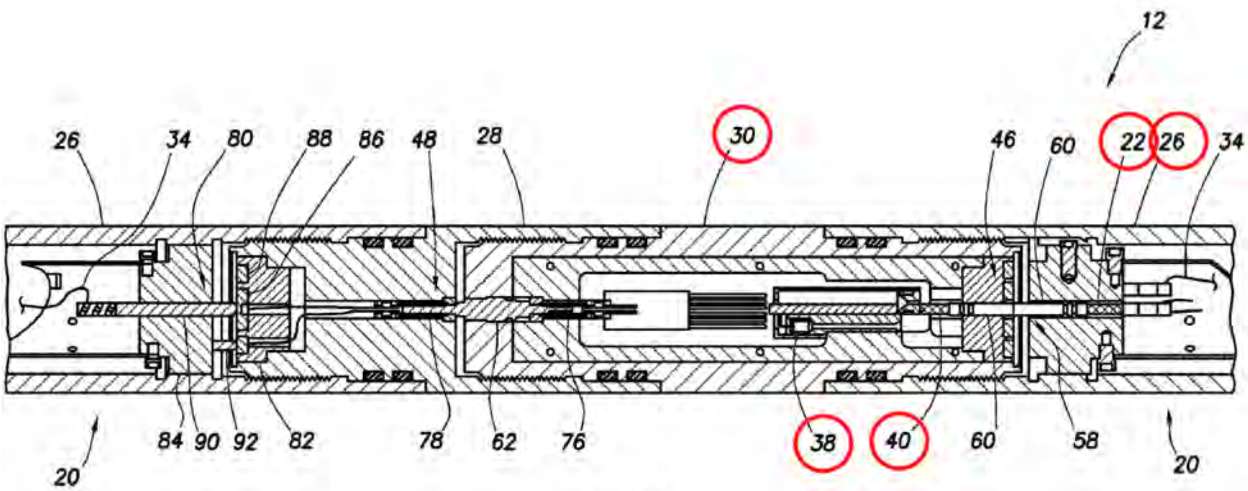


FIG.5

129. In Ex. 1004, Schacherer, a POSITA would see the disclosure, both in the description and in the highlighted blue regions in FIGS. 4, 5 and/or 7 below, as teaching a housing, a body, or a detonator body containing a detonator.

130. Schacherer teaches "[i]n the assembling step 104, preferably each of the explosive assemblies 20 is completely assembled, including coupling the electrical detonator 38 to the explosive component 40 and installing these in the connector 30 with the

selective firing module 32." (Ex. 1004, Schacherer, 6:37-41.) A POSITA would recognize that connector 30 and the housing inside connector 30 are each a component containing detonator 38, and that, where connector 30 is positioned at the upper end of outer housing 26 (the perforating gun carrier), it could also be viewed as the top connector of the '938 Patent.

131. Schacherer also teaches a top connector in the bodies of 46 and 58 in FIGS. 2, 5, and 7 and that body is inserted within the carrier 26 and couples the inserted detonator to the detonating cord 22. (Ex. 1004, Schacherer, FIGS. 2, 5, and 7.) A POSITA would recognize and conclude that Schacherer teaches, "[t]he perforating gun of claim 1, further comprising a top connector, wherein the detonator is positioned within the top connector," as claimed.

132. Ex. 1004, Schacherer teaches a connector 30 with a selective firing module 32, a detonator 38, and rotary electrical contacts 48 and 46 replacing a wired electrical connection. (Ex. 1004, Schacherer, 3:37-41, 5:64-67, 6:9-12, 8:19-28.) Detonator 38 is installed into connector 30. A POSITA would understand that, both by the description and in viewing FIG. 2, the detonator 38 resides within a hollow channel within the connector 30, the connector 30 is installed into the end of the outer gun carrier (outer housing 26) and serves as a top connector adjacent to the charge holder (eccentric weight 42 and as described above.) Schacherer also teaches the claimed charge holder in figure 5, which shows typical tubular loading tubes with end fitting

and detonating cord 22 inside the housing 26 of explosive assemblies 20. (Ex. 1004, Schacherer, 5:37-51, FIG. 5.) A POSITA reading Schacherer would understand that connector 30 is adjacent to the charge holder section circled below.

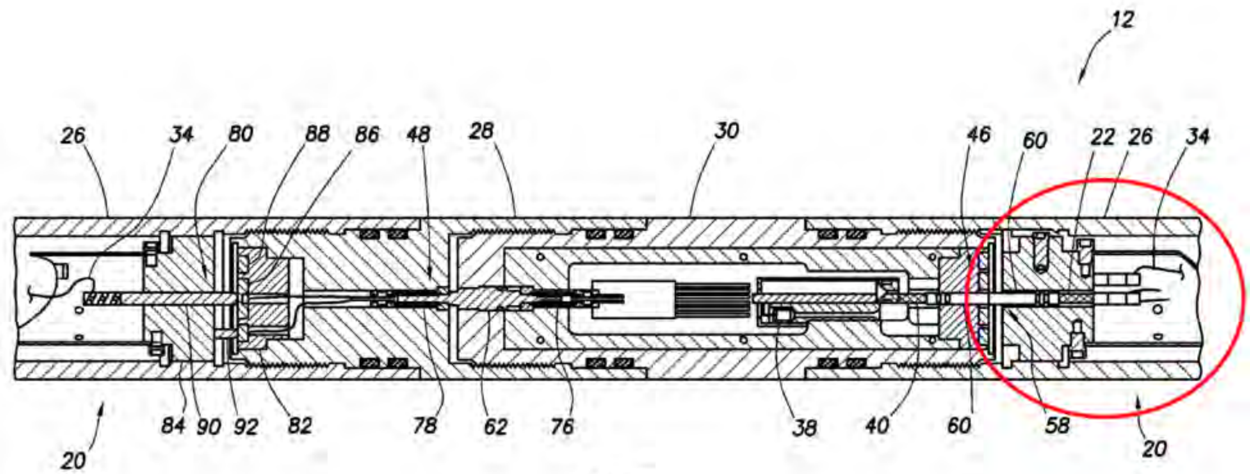


FIG.5

133. Schacherer teaches the Claim 13 limitations, “(b) inserting a top connector into the outer gun carrier adjacent to the charge holder, the top connector comprising a hollow channel,” and “(c) inserting a detonator into the hollow channel of the top connector.”

134. It would be obvious for a POSITA to modify the teachings of Schacherer to include a top connector adapting a detonator to fit the inner surface of varying sized perforating guns, as Harrigan teaches for centralizer rings 200 and as is well known in the common knowledge in the art. This would be the predictable application of known methods to Schacherer without any unexpected results, simple substitution of the known adapters, the use of known adapters for their understood benefits, and obvious to try as selecting from the finite number of identifiable and options for

assembling perforating guns that are available with a reasonable expectation of success.

D. Harrigan teaches a top connector as claimed

135. Harrigan teaches an initiator assembly module 125 plugged into loading tube 115 and both held in place within the carrier 110 by centralizing rings 200. (Ex. 1012, Harrigan, ¶¶ 0033-34, 38, 45; FIGS. 2A, 3A, and 2B; Ex. 1028, Harrigan Prov., pp. 4-5, FIG. 3, 4.)

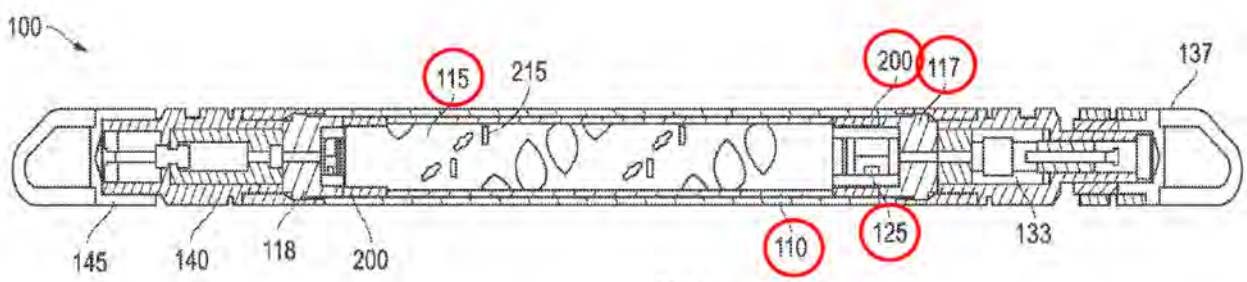


FIG. 2A

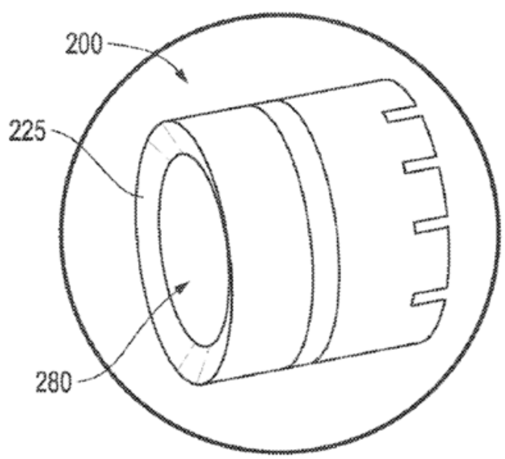


FIG. 2B

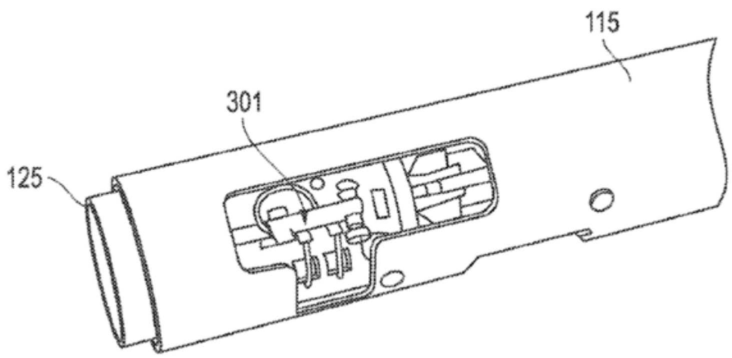


FIG. 3A

136. Harrigan also teaches a shock absorbing mount or connector 400 and a coupling 440 that receive the initiator assembly 125 in charge holder 125. (Ex. 1012, Harrigan, ¶¶ 0039-41; Ex. 1028, Harrigan Prov., p. 4, FIGS. 2, 3.)

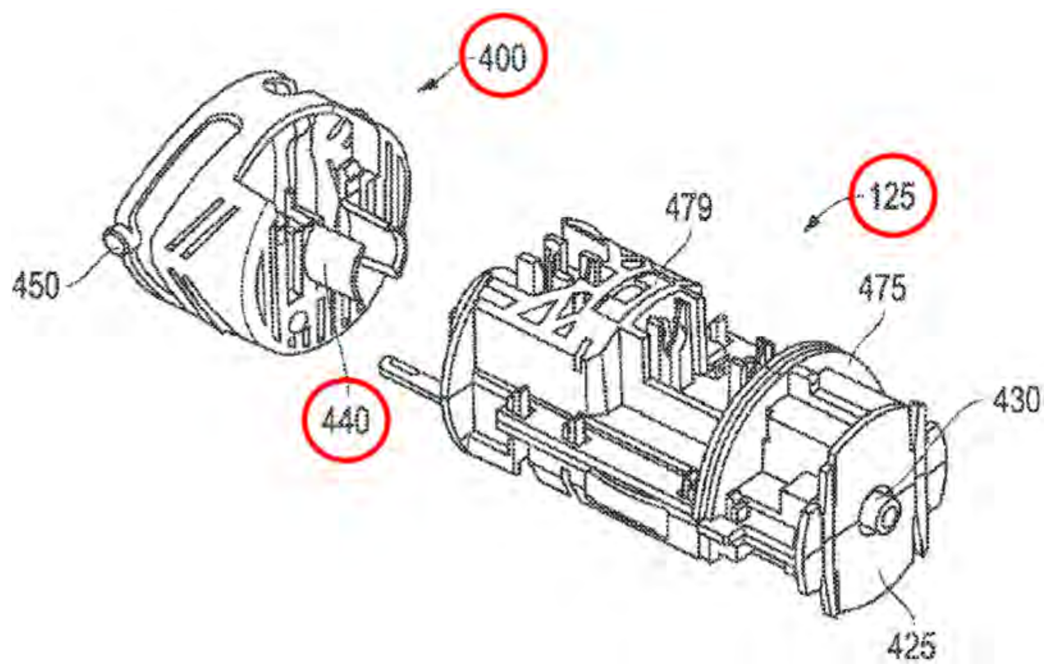


FIG. 4A

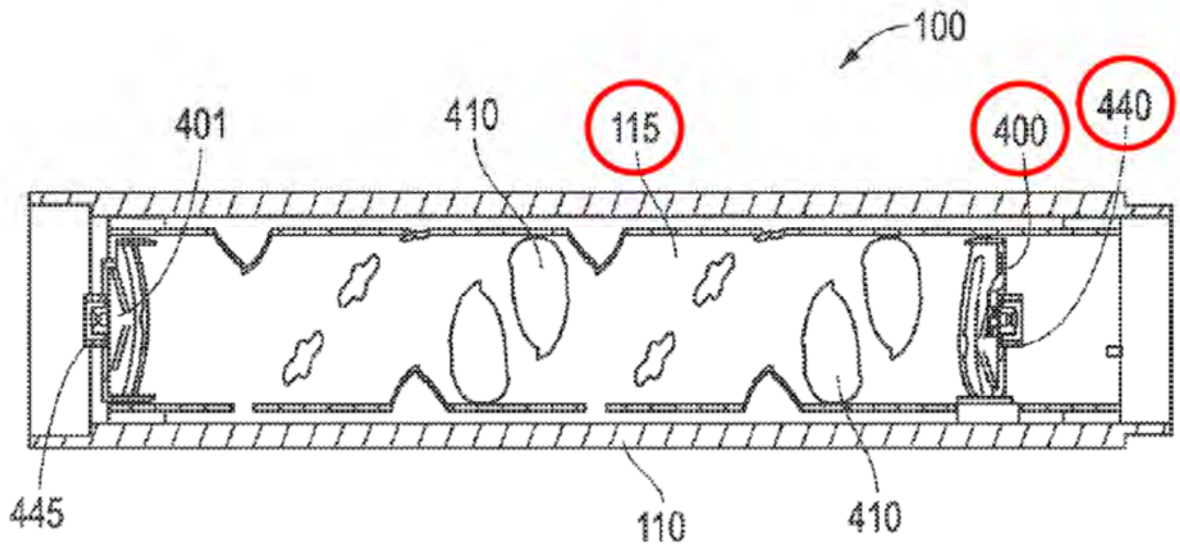


FIG. 4B

137. Each of the end of loading tube 115 the initiator assembly 125 is plugged in to, centralizing rings 200, mount/connector 400, coupling 440, is taught by Harrigan as including an opening for receiving at least a portion of the initiator assembly 125. (Ex. 1012, Harrigan, FIGS. 2A, 2B, 3A, 4A, 4B; Ex. 1028, Harrigan Prov., p. 5, FIG. 4.)

138. The top connector limitations of Claims 5 and 13 are met by the end of loading tube 115 the initiator assembly 125 is plugged in to, centralizing rings 200, mount/connector 400, and coupling 440.

E. Rogman teaches a top connector as claimed

139. Rogman and Rogman Prov. teach an initiator assembly 112, 312, 313 plugged into the loading tube 110, 310, inserted into the carrier 102, 302, and coupled to detonator cord 404. (Ex. 1014, Rogman, ¶¶ 0015, 0021, 0026-27, 0029, FIGS. 1-3; Ex. 1020, Rogman Prov., pp. 1-4, FIGS. 1-5.) Rogman teaches a lower connector assembly 125 with features that retain it in carrier 102. (Ex. 1014, Rogman, ¶ 0015; Ex. 1020, Rogman Prov., pp. 1-4, 6-8, FIGS. 1-5.) Rogman teaches insertion and removal of initiator assembly 112 through a cutaway section 138. (Ex. 1014, Rogman, ¶ 0021.)

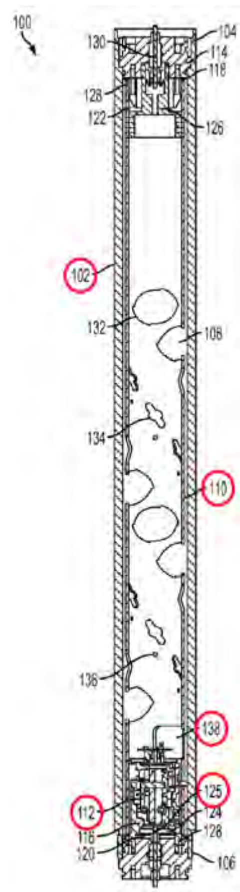


FIG. 1

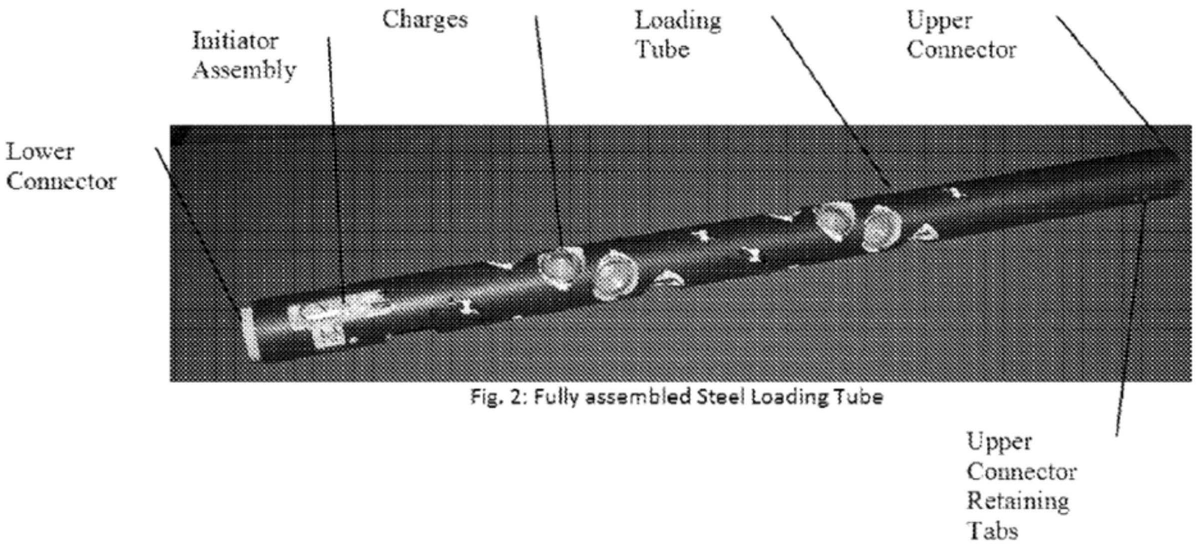


Fig. 2: Fully assembled Steel Loading Tube

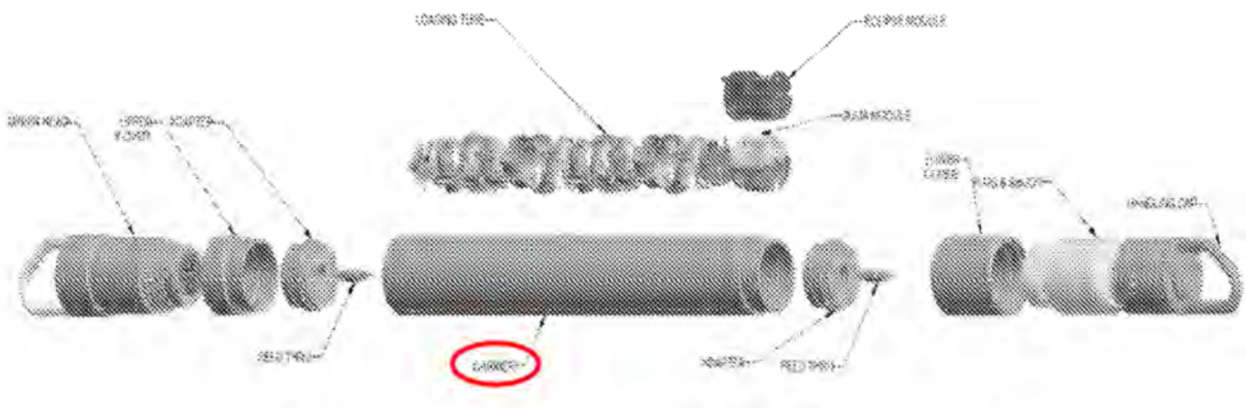


Fig. 3: Overview of the Gun system (shown with previous plastic loading tube design)

140. Each of the end of loading tube 110 and the lower connector assembly 125 is taught by Rogman as including an opening for receiving at least a portion of the initiator assembly 112 and are each necessarily and inherently inserted into the carrier. (Ex. 1014, Rogman, ¶¶ 0015, 0021, 0026-27, 0029, FIGS. 1-3; Ex. 1020, Rogman Prov., pp. 1-4, 6-8, FIGS. 1-5.)

141. The top connector limitations of Claims 5 and 13 are met by the end of loading tube 110 the initiator assembly 112 is plugged in to, and the lower connector assembly 125 as taught by Rogman and Rogman Prov.

142. It would be obvious for a POSITA to modify the teachings of Rogman and Rogman Prov. to include a top connector adapting a detonator to fit the inner surface of varying sized perforating guns, as Harrigan teaches for centralizer rings 200 and as is well known in the common knowledge in the art. This would be the predictable application of known methods to Rogman without any unexpected results, simple substitution of the known adapters, the use of known adapters for their understood benefits, and obvious to try as selecting from the finite number of identifiable and options for assembling perforating guns that are available with a reasonable expectation of success.

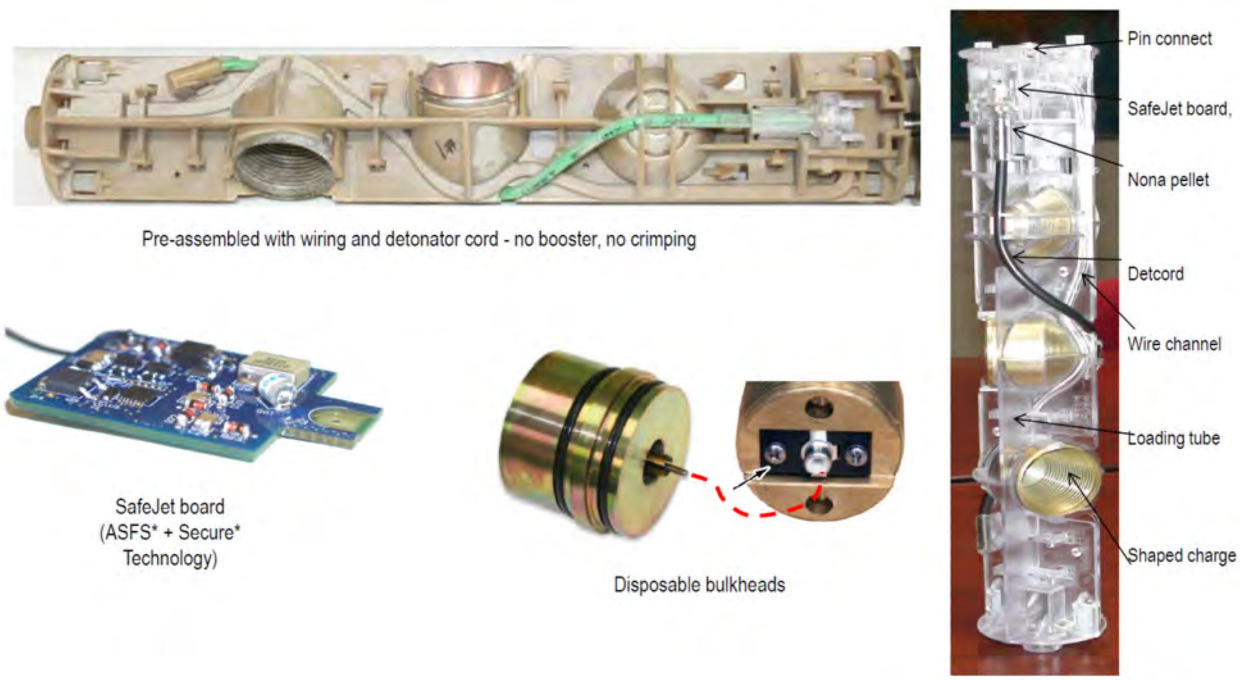
143. Ex. 1020, Rogman Prov. teaches an initiator assembly, positioned at one end of the shaped charge assembly and inside a gun carrier. (Ex. 1020, Rogman, pp. 1-3, FIGS. 1-4.) Rogman Prov. also states specifically, "[t]his may be replaced in future design by a connector similar to the top connector design which aligns with the initiator and allows a hands-free insertion of the initiator module." (Ex. 1020, Rogman Prov., p. 4, FIG. 5.) A POSITA would know that, for a detonator to fit into an initiator module, there must be a space in the module for that purpose, and that this space can be referred to as a hollow channel. A POSITA would recognize that the initiator module of Rogman Prov. which holds an initiator (detonator) would meet the top connector limitation of Claim 5 and 13. A POSITA would conclude that Rogman Prov. teaches

the Claim 13 limitation, "(b) inserting a top connector into the outer gun carrier adjacent to the charge holder, the top connector comprising a hollow channel."

144. A POSITA would know to install a detonator into the initiator module of Rogman Prov., and that therefore Rogman Prov. teaches the claim limitation of, "(c) inserting a detonator into the hollow channel of the top connector."

F. EWAPS teaches a top connector as claimed

145. EWAPS teaches a POSITA a detonator (SafeJet board) in a housing adjacent to one end of a charge holder (loading tube.) (Ex. 1013, EWAPS, p. 0010.)



146. EWAPS shows that those components are inserted into a carrier. (Ex. 1013, EWAPS, pp. 009-11.)

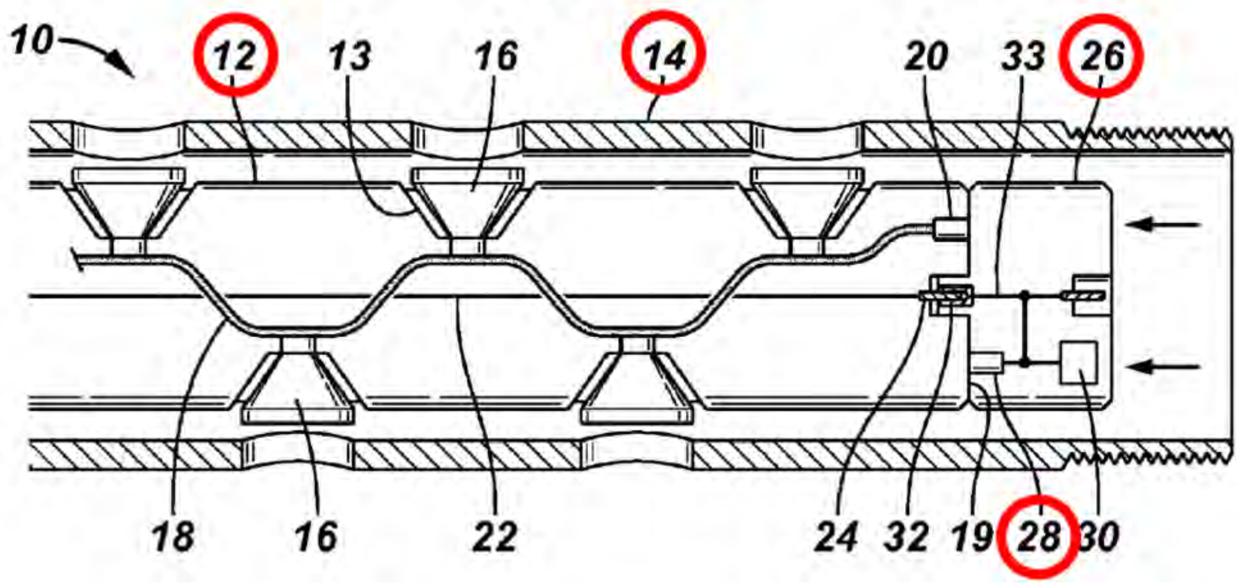
147. A POSITA would understand that the detonator and loading tube of EWAPS must be inserted into the carrier for the system of EWAPS to function. Therefore, EWAPS teaches the top connector limitations of Claims 5 and 13.

148. It would be obvious for a POSITA to modify the teachings of EWAPS to include a top connector adapting a detonator to fit the inner surface of varying sized perforating guns, as Harrigan teaches for centralizer rings 200 and as is well known in the common knowledge in the art. This would be the predictable application of known methods to EWAPS without any unexpected results, simple substitution of the known adapters, the use of known adapters for their understood benefits, and obvious to try as selecting from the finite number of identifiable and options for assembling perforating guns that are available with a reasonable expectation of success.

G. Black teaches a top connector as claimed

149. Black teaches an arming device 26 that includes a detonator 28 plugged into a charge holder (loading tube) 12, 7, inserted inside a carrier 14. (Ex. 1002, Black, ¶¶ 0023-24, 0026, 0036, FIGS. 1, 2, 4, and 6.)

FIG. 2



150. Black teaches that arming device 26 is received in the end of loading tube 12 and fixed in place using protrusions 38 and groove 40 to align detonator 28 with detonating cord 18. (Ex. 1002, Black, ¶¶ 0031-32, FIGS. 8-9.) Black teaches that end of loading tube 12 includes openings 40, 54, etc. for receiving at least a portion of arming device 26. (Ex. 1002, Black, FIGS. 1, 2, 4, 6-10.) The top connector limitations of Claims 5 and 13 are met by the end of loading tube 12 that the arming device 26 is coupled to.

FIG. 8

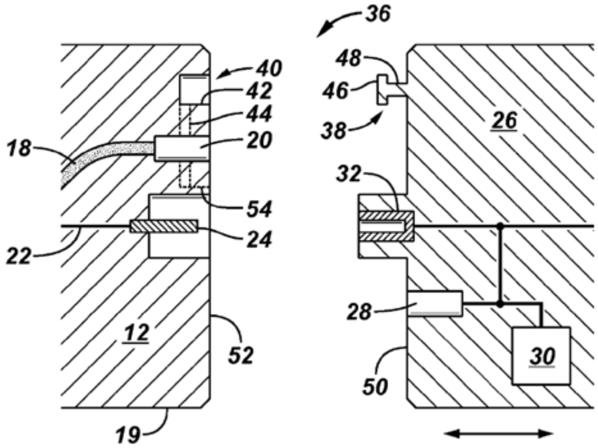
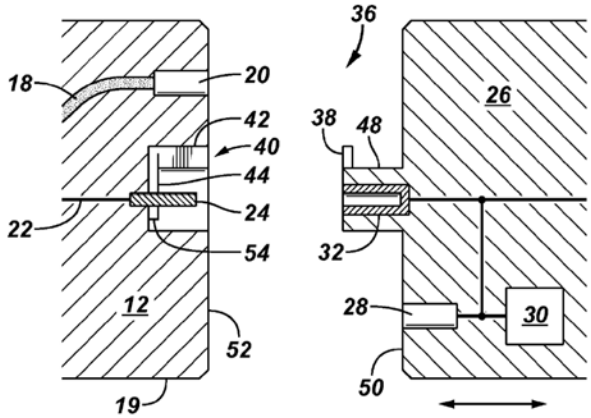


FIG. 9



151. Alternatively, the body of arming device 26 meets the limitations of Claims 5 and 13 because the detonator 28 is inserted in the body of 26 which is inserted within the gun carrier 14 adjacent to the charge holder 12. (Ex. 1002, Black, ¶¶ 0023-24, 0026, 0036, FIGS. 1, 2, 4, and 6.)

152. Black teaches shoulders 102 in the carrier 14 that centralize and hold arming device 26. (Ex. 1002, Black, FIG 10.) This teaching also meets the limitations of Claim 5 because the detonator is positioned within the shoulder 102.

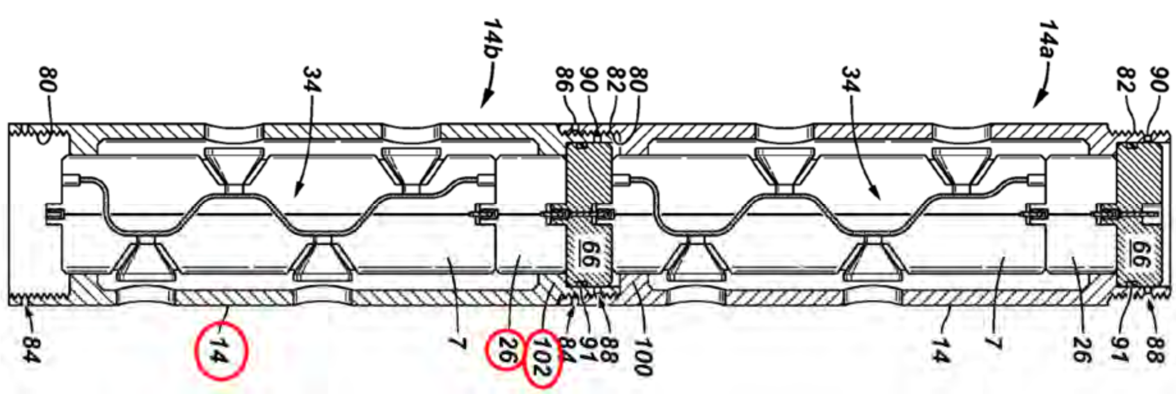
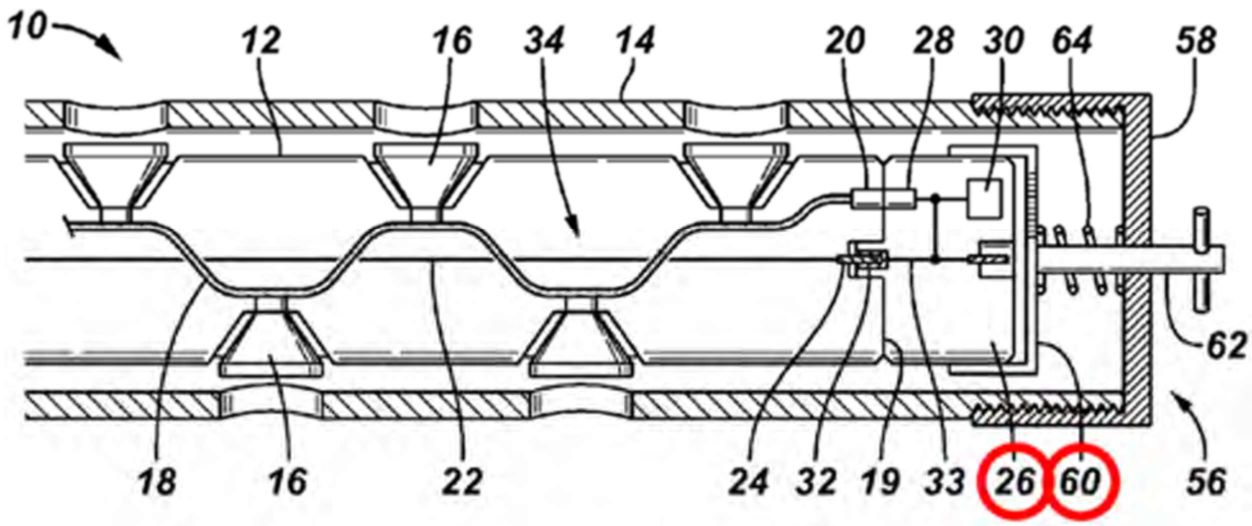


FIG. 10

153. Black also teaches a top connector in support device 60 that the arming device 26 is within, adjacent to the loading tube, meeting the top connector limitations of Claims 5 and 13. (Ex. 1002, Black, ¶ 0033, FIG. 6.)

FIG. 6



154. It would be obvious for a POSITA to modify the teachings of Black to include a top connector adapting a detonator to fit the inner surface of varying sized perforating guns, as Harrigan teaches for centralizer rings 200 and as is well known in the common knowledge in the art. This would be the predictable application of known methods to Black without any unexpected results, simple substitution of the known adapters, the use of known adapters for their understood benefits, and obvious to try as selecting from the finite number of identifiable and options for assembling perforating guns that are available with a reasonable expectation of success.

H. Lanclos teaches a top connector as claimed

155. Lanclos teaches a cartridge assembly 70 inside a cartridge sub 68. (Ex. 1015, Lanclos, 4:61-5:1, FIG. 3.) Lanclos' cartridge assembly includes a detonator 88 and electrical connections, including connector 90. (Ex. 1015, Lanclos, 5:1-23, 5:34-51, 5:68-6:65, 7:12-30, FIG. 3.)

156. Lanclos teaches that the cartridge sub 68 is coupled to and is inserted into a perforating gun 62_2. (Ex. 1015, Lanclos, 4:61-63, 7:12-16, FIG. 3.) A POSITA would recognize the perforating guns of Lanclos as hollow carrier perforating guns. A POSITA would understand that the cartridge sub 68 and carrier or body of perforating guns 62_1, 62_2 act as a gun carrier as claimed.

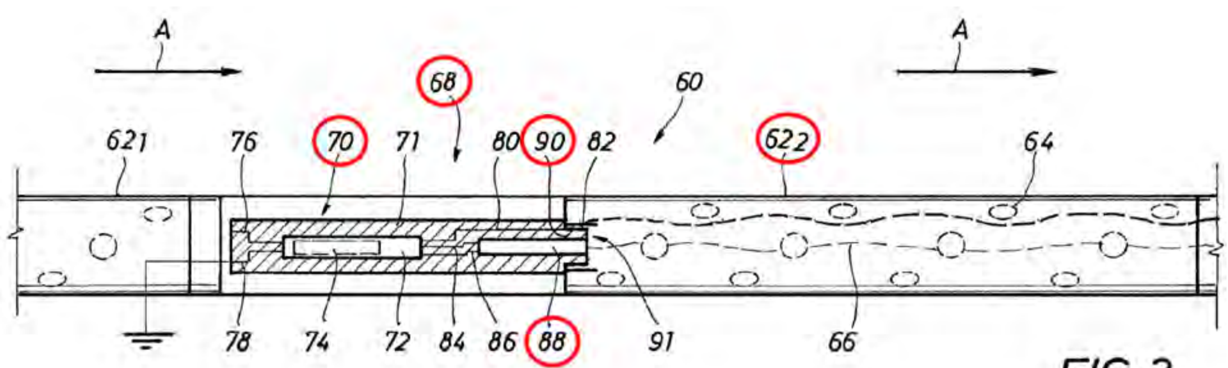


FIG. 3

157. A POSITA would understand that the cartridge assembly of Lanclos is inserted into the gun carrier.

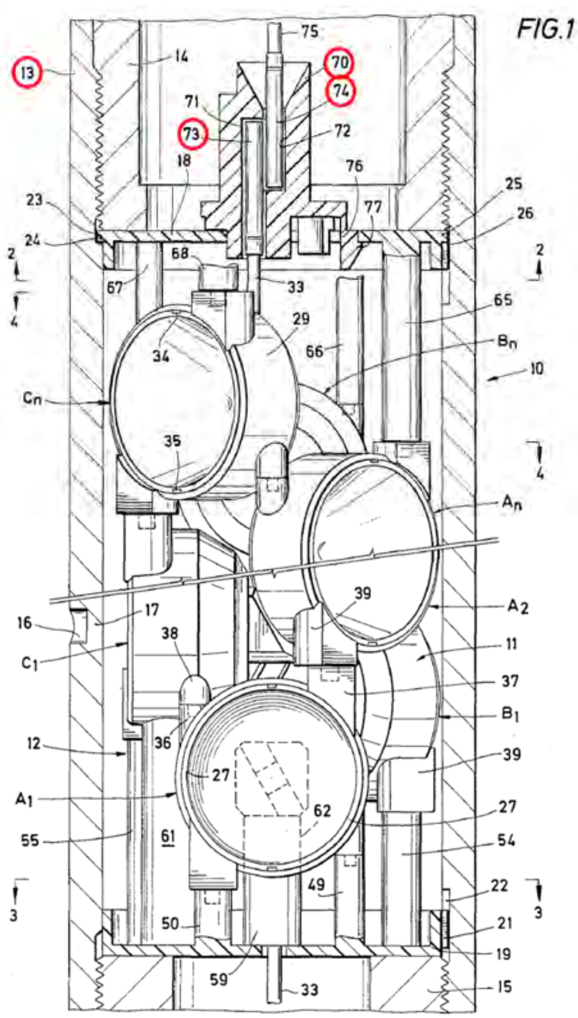
158. A POSITA would understand that Lanclos' cartridge assembly 70 would be adjacent to a typical charge holder as shown figures 2A-D, and discussed above, in carrier 62_2. (Ex. 1015, Lanclos, 1:63-2:21, FIGS. 2A-D, 3.)

159. A POSITA would understand that either Lanclos' cartridge sub 68 and/or the body of cartridge assembly 70 meet the top connector limitations of Claims 5 and 13.

160. It would be obvious for a POSITA to modify the teachings of Lanclos to include a top connector adapting a detonator to fit the inner surface of varying sized perforating guns, as Harrigan teaches for centralizer rings 200 and as is well known in the common knowledge in the art. This would be the predictable application of known methods to Lanclos without any unexpected results, simple substitution of the known adapters, the use of known adapters for their understood benefits, and obvious to try as selecting from the finite number of identifiable and options for assembling perforating guns that are available with a reasonable expectation of success.

I. Lendermon teaches a top connector as claimed

161. Lendermon teaches detonators 73 and 74 inserted in upright member 70 inserted in carrier 13 adjacent to stackable charge holders (intertwined assembly 12, hollow containers or outer cases 29.) (Ex. 1003, Lendermon, 1:18-36, 1:58-2:28, 3:5-7, 4:58-68, 5:22-32, 5:64-6:22, 6:32-40, 7:3-18, 7:69-54, 10:36-59, 14:23-31, FIG. 1, 4-7.) A POSITA would understand that Lendermon's detonators would necessarily be inserted into the upright member 70, which would in turn be inserted into carrier 13. Lendermon teaches the top connector elements of Claims 5 and 13.



J. Goodman teaches a top connector as claimed

162. Goodman teaches a detonator/initiator 15, 45, and 47 having electrical connectors for engaging with receptacle 18 and an electrical receptacle 17 for connecting connectors 11, 12, 43, and 44 entirely within a gun carrier 20, 48. (Ex. 1018, Goodman, ¶¶ 0005-7, 0018-20, 0023-24, FIGS. 1-5.)

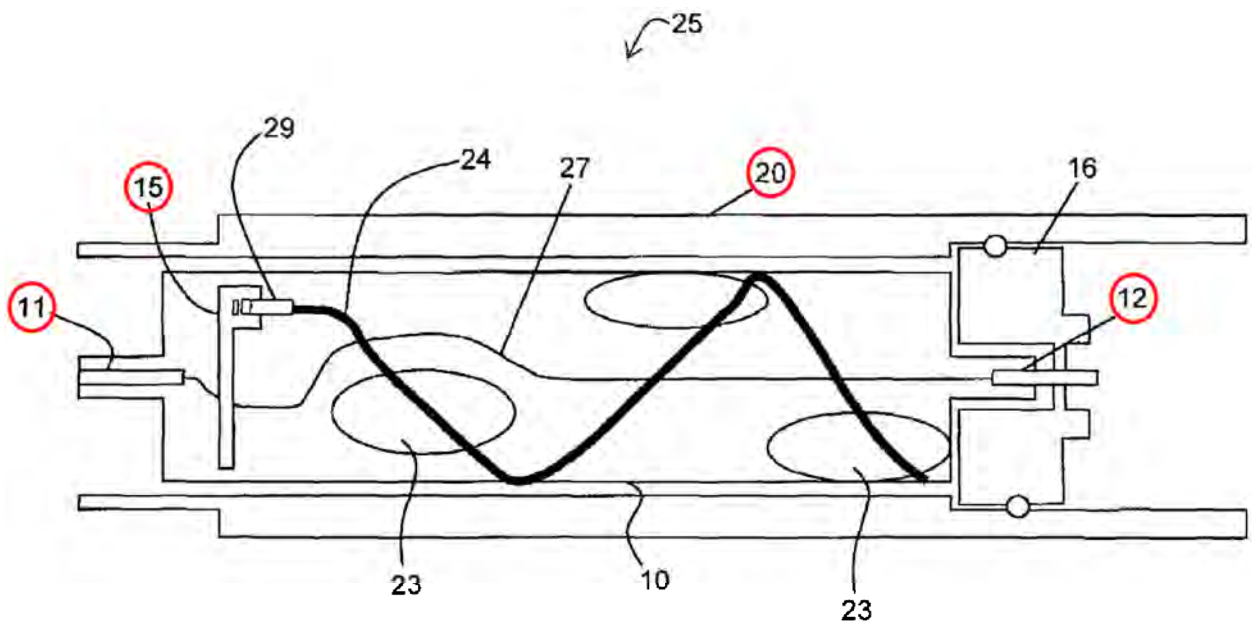


FIG. 2

163. A POSITA would understand that the devices taught by Goodman must inherently have a component with the detonator at least partially within it to make the device of Goodman functional, it could not function floating in space as shown in the drawings. Such a component would be necessary to hold the detonator in place relative to the detonating cord and to prevent damage during transport and use. Per

the drawings of Goodman, such a component would necessarily be inserted into the carrier 20 and the detonator necessarily inserted into that component adjacent to a charge holder.

164. Goodman inherently teaches a POSITA the top connector limitations of Claims 5 and 13.

K. Bonavides teaches a top connector

165. Bonavides teaches "the perforating tool includes an explosive detonator that may be enclosed within a common housing with the tool controller 105." Ex. 1017, 7:24-30. Per the drawings of Bonavides, the tool controller 105 would necessarily be inserted into the carrier and the detonator necessarily inserted into the tool controller adjacent to a charge holder. Bonavides teaches a POSITA the top connector limitations of Claims 5 and 13.

L. Brooks teaches a top connector as claimed

166. A POSITA would understand that the devices taught by Brooks must inherently have a component with the detonator 22 at least partially within it to make the device of Brooks functional, it could not function floating in space as shown in the drawings. (Ex. 1021, Brooks, FIGS. 1A, 1B.) Such a component would be necessary to hold the detonator in place relative to the detonating cord and to prevent damage during transport and use. Per the drawings of Brooks, such a component would necessarily be inserted into the carrier 20 or 32 and the detonator 22 or 36 necessarily inserted

into that component adjacent to a charge holder. Brooks inherently teaches a POSITA the top connector limitations of Claims 5 and 13.

167. A POSITA would be motivated to combine the carrier and detonator of Brooks with the top connector of Schacherer, Harrigan, Rogman, Lendermon, Goodman, Black and/or common knowledge to teach using top connector because it will not function as intended without a top connector in order to help align and hold components in place, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of Brooks without any unexpected results, simple substitution of the known connectors for the perforating components taught, the use of known connectors for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of top connectors that are available with a reasonable expectation of success.

IX. **<u>Claim 1 limitation of "a detonator contained entirely within the outer gun carrier...." and Claim 14 limitation of "wherein inserting the detonator into the outer gun carrier includes pushing the detonator into the outer gun carrier…."</u>**

168. Claim 1 of the '938 Patent includes the limitation of "**a detonator contained entirely within the outer gun carrier....**" (Ex. 1001, the '938 Patent, 11:20.) Claim 14 includes the limitation of "**wherein inserting the detonator into the outer gun carrier includes pushing the detonator into the outer gun carrier….**" (Ex. 1001, the '938 Patent, 12:59-61.)

A. Common knowledge of a POSITA includes locating a detonator entirely within the outer gun carrier.

169. A POSITA would recognize that a detonator is often contained within a perforating gun. The plain and ordinary meaning of "A detonator contained entirely within the outer gun carrier" to a POSITA is "a detonator contained entirely within the hollow interior of the outer gun carrier."

170. A POSITA would recognize that inserting a detonator into an outer gun carrier necessarily requires pushing the detonator into the gun carrier. It is unclear what the language of Claim 14 covers since it appears to add nothing to the limitations of Claim 13. Therefore, it fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention and is indefinite. Further, Claim 14 says "wherein inserting the detonator into the outer gun carrier includes …" but Claim 13 does not include inserting a detonator into the outer gun carrier. It is unclear what

the language of Claim 14 covers since it could be interpreted as further limiting the "inserting a detonator into the top connector" limitation of Claim 13, requiring that step (b) of Claim 13 must happen before step (c), or adding a new step of "inserting a detonator into the outer gun carrier". Because each of these three claim interpretation options is equally valid in view of the specification, Claim 14 fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention and is indefinite. Although the meaning of Claim 14 is unclear, a POSITA's most likely understanding or best guess would be as an additional step of "pushing the detonator at least partly into the hollow interior of the outer gun carrier."

171. A POSITA would know that there are not many options for where to place a detonator in a perforating gun assembly. It can be placed entirely within a gun, entirely within an adapter between guns, for example in a tandem seal adapter or similar component, or partially in a gun, or partially in an adapter. There are no other practical options. Where a designer decides to place the detonator has more to do with historical precedent at his company, or what he/she wants to focus on enhancing. For example is it more beneficial to make the guns as short as possible, or the adapters as short as possible. When there is a desire to keep a gun string of numerous selectively fired guns as short as possible for wellsite operational concerns, or to be able to run as many guns in one trip in the well as can fit into

surface pressure control equipment, there are tradeoffs between the length of the guns versus the length of the adapters. There are also other factors such as that perforating guns are thrown away after each job whereas adapters are often able to be used many times before being thrown away. Placing a detonator entirely within the perforating gun carrier, or anywhere else in the overall gun assembly, is not novel by any means. The ‘938 Patent does not describe what is different or novel about the “detonator entirely within the gun” claim(s) versus prior art.

172. A POSITA would understand that an outer gun carrier as claimed in the ‘938 Patent could be either a single piece or multi-piece housing.

173. The background section of the ‘938 patent states “In order to initiate the perforators, there is a detonating cord leading through the gun carrier that is coupled to a detonator.” (Ex. 1001, the ‘938 Patent, 1:40-42.) This appears to state that the prior art taught detonators within gun carriers.

174. The ‘938 Patent does not discuss the detonator being “entirely within” the gun carrier or any benefits provided by the detonator being within the gun carrier.

175. Similarly, the ‘938 Patent does not discuss or associate any benefits with pushing a detonator into the gun carrier.

176. The lack of meaningful discussion of these limitations in the ‘938 Patent supports that they were prior art techniques well known to POSITAs.

177. A POSITA's common knowledge includes the design, operation, and construction of perforating guns and their many common interchangeable variations in design, operation, and construction, including hollow carrier guns with detonators entirely within the hollow interior of the carrier and pushing those detonators into the interior of the carrier.

178. It is well known in the art that a hollow carrier perforating gun often includes a detonator entirely within the outer carrier for detonating that perforating gun. Therefore this limitation is common in the prior art and would be only an obvious modification as well known in the art.

179. It is well known in the art that a hollow carrier perforating gun generally includes a detonator entirely within the outer carrier, among other things. Therefore this limitation is taught by the prior art and to a POSITA would be only an obvious modification as well known in the art.

180. Further, a POSITA would be motivated to combine or modify any perforating gun prior art based on their common knowledge of detonators in hollow carrier perforating guns. This would be the predictable application of known methods to the prior art disclosures without any unexpected results, simple substitution of the known detonator holder for the perforating devices taught, the use of known detonator holders in hollow carrier guns for their understood benefits, and obvious

to try as selecting from the finite number of identifiable and predictable types of perforating gun structures that are available with a reasonable expectation of success.

B. Schacherer teaches locating a detonator entirely within the outer gun carrier

181. Schacherer teaches a well tool system 12 with explosive assemblies 20 (perforating guns) with outer housings 26 and connectors 30 and, optionally, 28. (Ex. 1004, Schacherer, 2:25-40, 3:30-43, 3:66-4:4, 5:37-42, 6:9-12, 8:4-14, FIGS. 1, 2, 4, 5.)

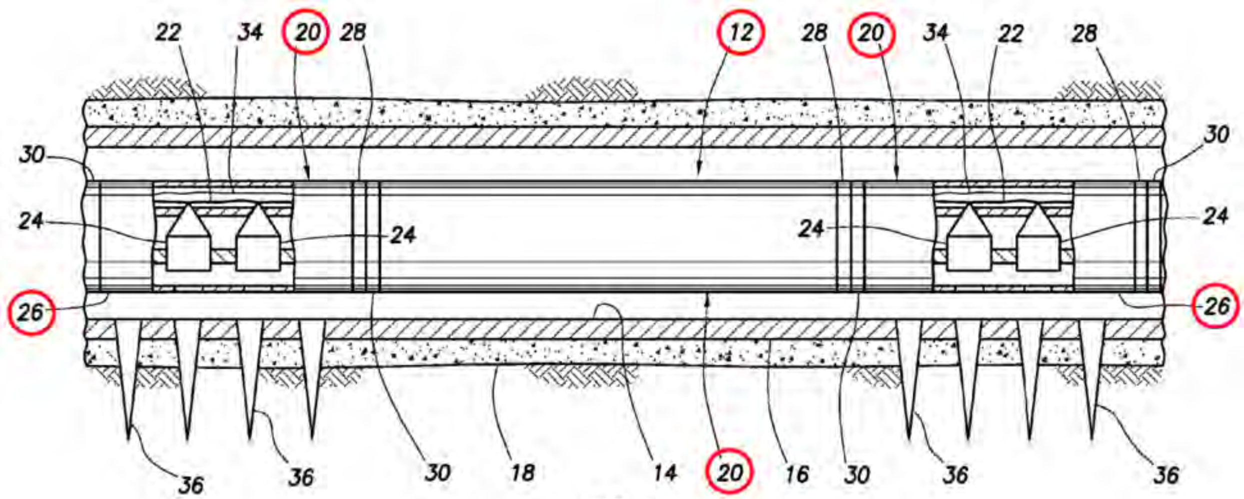


FIG. 1

182. Schacherer teaches that, when assembled, the outer housing 26 and connector 30 together serve as a perforating gun housing for encapsulating not only perforating charges 24, but also a detonator assembly including a selective firing module 32, an electrical detonator 38, detonating cord 40, and electrical connections 76, 46, and 48. (Ex. 1004, Schacherer, 2:49-56, 3:30-37, 4:5-33, 4:42-48, 5:12-16, 5:32-51, 6:3-12, FIGS. 2, 4, 5.)

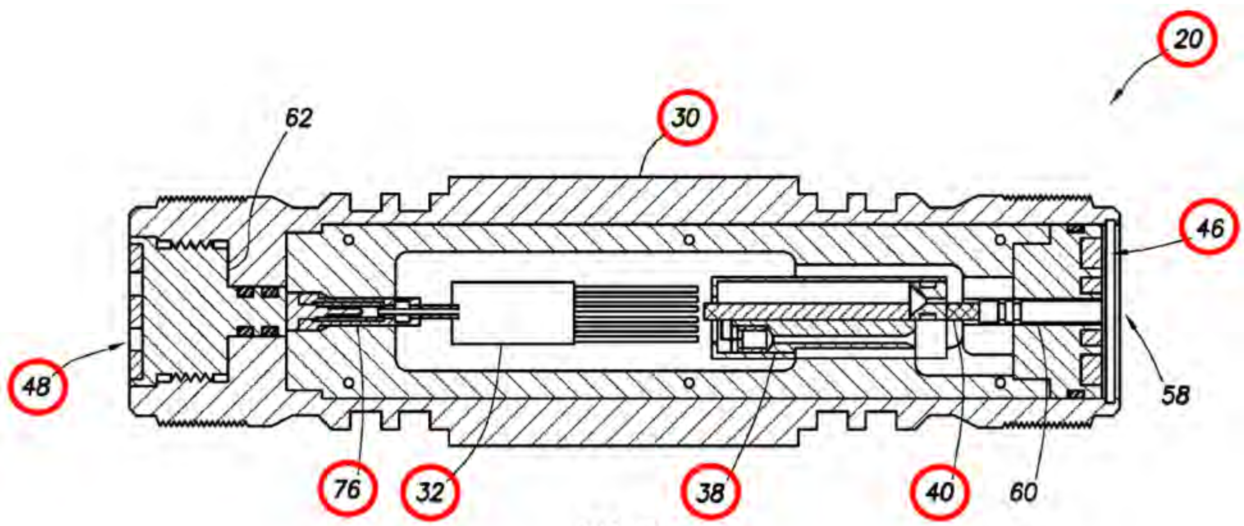


FIG.4

183. Schacherer refers to the combination of housing 26 and connector 30 as "explosive assemblies 20" (*Id*. at 8:10–13), states that "explosive assemblies 20 are perforating guns" (*Id*. at 2:35–36), and explains that "explosive assemblies 20 can be transported to a well location with each explosive assembly being already assembled…." (*Id*. at 3:30–43.) Those disclosures support that outer housing 26 and connector 30 act as a single housing for "transporting the explosive assemblies 20 from the remote location 110 to the well location 112." (*Id*. at 8:4–14, FIG. 8.)

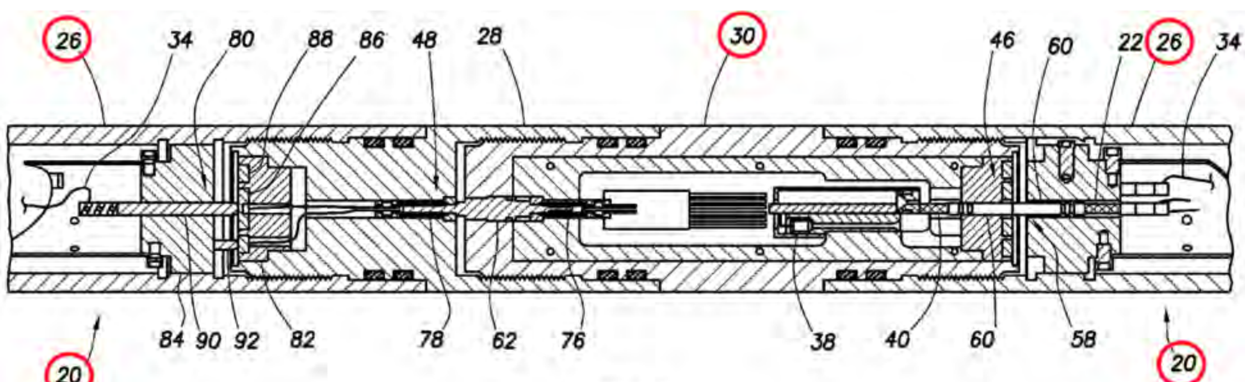
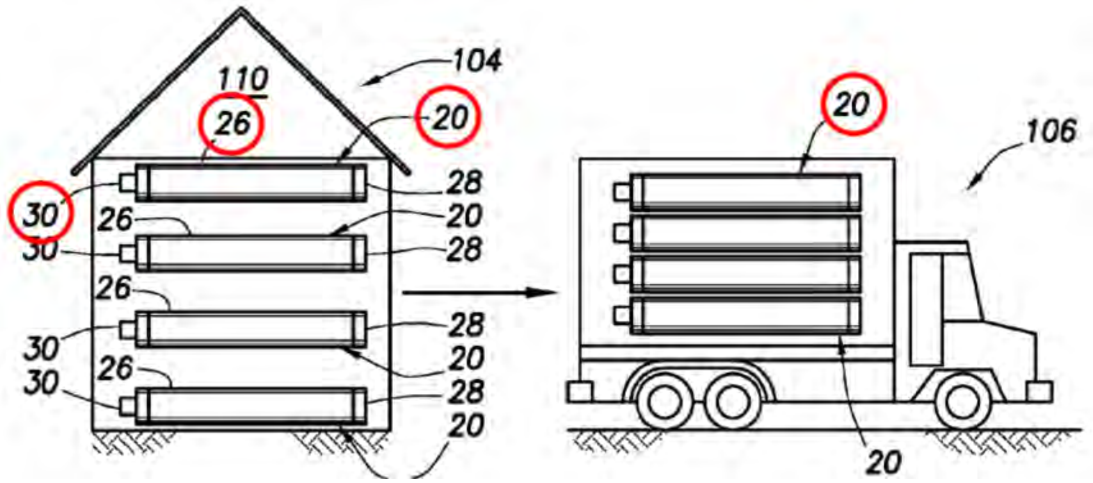


FIG.5



184. The PTAB has already found that Schacherer teaches the nearly identical claim limitation "a detonator assembly contained entirely within the perforating gun housing."

185. Schacherer illustrates in FIGS. 4 and 7 two versions of an assembly with detonator 38. A POSITA would recognize in FIG. 4 that the detonator 38 assembly, shaded in blue, is installed into connector 30 by pushing. A POSITA would recognize from FIG. 7 that the disclosure of an assembly of detonator 38. Schacherer illustrates in FIG. 5, the detonator 38 assembly is installed into the outer gun carrier 26.

186. Schacherer teaches a POSITA a detonator contained entirely within the hollow interior of the outer gun carrier and pushing the detonator into the gun carrier as claimed.

C. Harrigan teaches locating a detonator entirely within the outer gun carrier

187. A POSITA would be motivated to combine the teachings of Harrigan (forcibly pushing the initiator assembly module, or detonator, into place) with Schacherer (installing the detonator assembly into the outer gun carrier) to teach "wherein inserting the detonator into the outer gun carrier includes pushing the detonator into the outer gun carrier," as claimed, because the combination would be obvious to try and would yield predictable results.

188. Harrigan teaches an initiator assembly module 125 plugged into the loading tube 125 and inserted into the carrier 110. (Ex. 1012, Harrigan, ¶¶ 0033, FIGS. 1, 2A, 4B; Ex. 1028, Harrigan Prov., pp. 4, 5, FIGS. 2-4.) Harrigan's initiator assembly 125 is entirely within the carrier 110. (Ex. 1012, Harrigan, ¶¶ 0033, FIGS. 1A; Ex. 1028, Harrigan Prov., pp. 3-5, FIG. 1-4.)

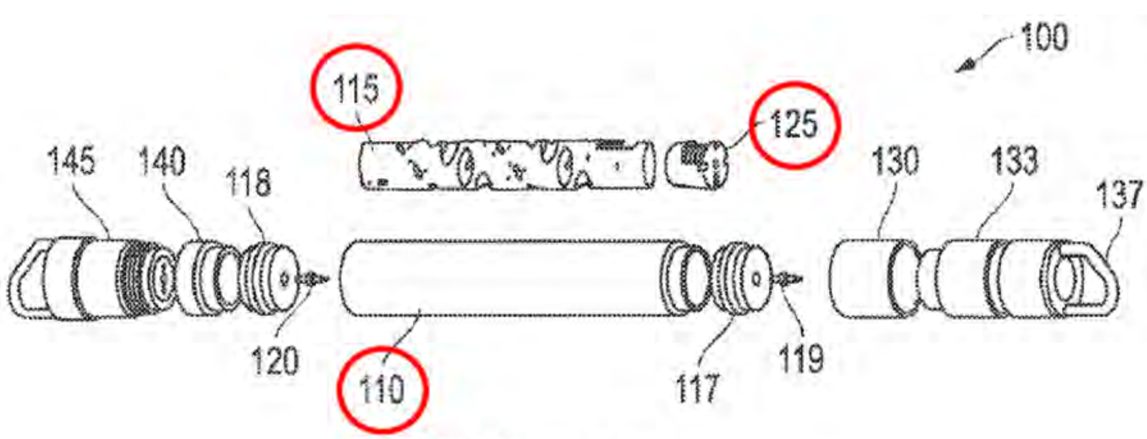


FIG. 1A

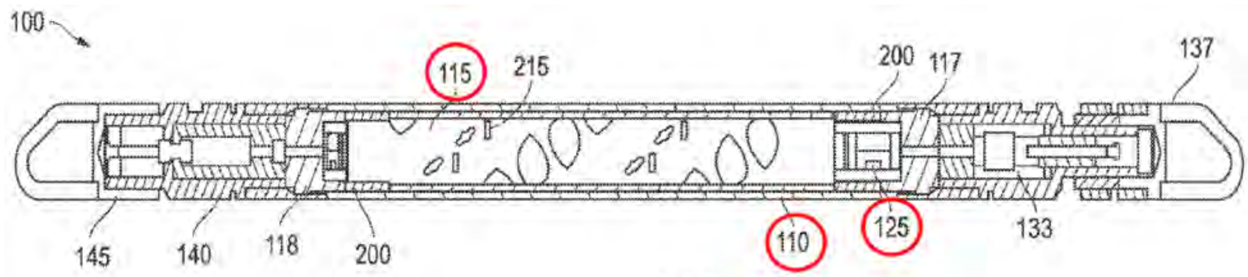


FIG. 2A

189. Harrigan's initiator assembly includes a detonator 301 and electrical connection 430. (Ex. 1012, Harrigan, ¶¶ 0010, 0022-23, 0037-38, 0044, FIGS. 3A, 4A; Ex. 1028, Harrigan Prov., p. 5, FIG. 4.) Harrigan teaches that the initiator assembly module 125 "is plugged into the loading tube 115." (Ex. 1012, Harrigan, ¶ 0033; Ex. 1028, Harrigan Prov., p. 4, 5, FIG. 2, 4.) Harrigan also teaches that the initiator assembly module 125 "is forcibly pushed into place." (Ex. 1012, Harrigan, ¶¶ 0033 and 0040; Ex. 1028, Harrigan Prov., p. 5, FIG. 4.)

190. Harrigan teaches a POSITA a detonator contained entirely within the hollow interior of the outer gun carrier and pushing the detonator into the gun carrier as claimed.

D. Lerche '278 teaches locating a detonator entirely within the outer gun carrier

191. Ex. 1011, Lerche '278 makes no distinction between perforating gun and detonator where it teaches, "[e]ach of the tool subs 10B, 10C, 10D can be a perforating gun" and further teaches that "sub 10 depicted in FIG. 2 includes a detonating device 26." (Ex. 1011, Lerche '278, 2:64-65, 4:46-47.) A POSITA would understand from the

Lerche '278 disclosure that a detonator would be contained entirely within a perforating gun housing.

E. Rogman teaches locating a detonator entirely within the outer gun carrier

192. Rogman and Rogman Prov. teach an initiator assembly 112, 312 plugged into the loading tube 110, 310 and inserted into the carrier 102, 302. (Ex. 1014, Rogman, ¶¶ 0015, 0021, 0026-27, FIGS. 1-3; Ex. 1020, Rogman Prov., pp. 1-4, FIGS. 1-4.) Rogman's initiator assembly 125 is entirely within the carrier 102.

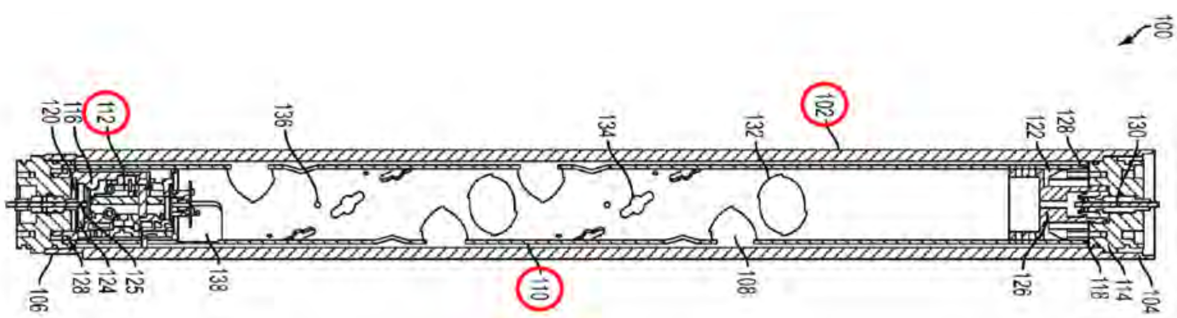


FIG. 1

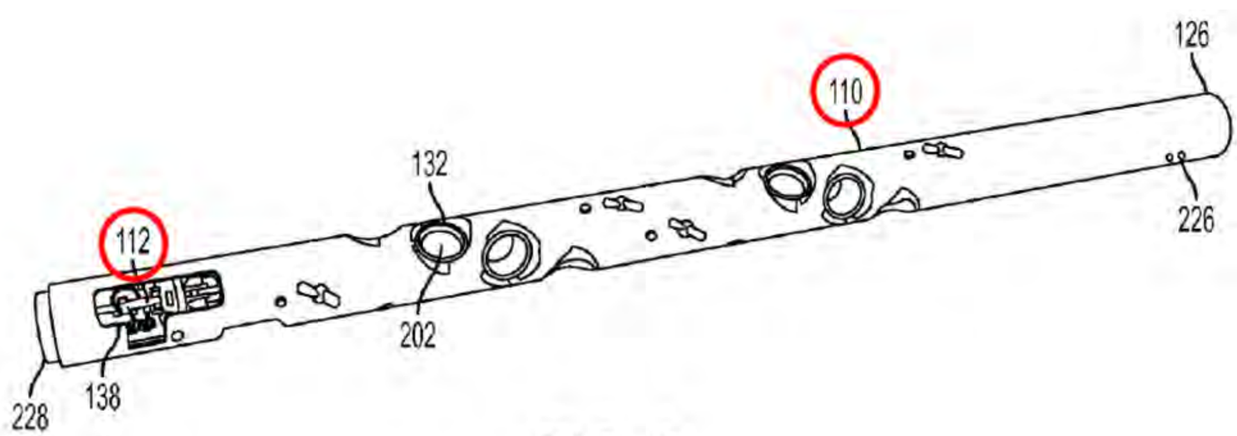


FIG. 2

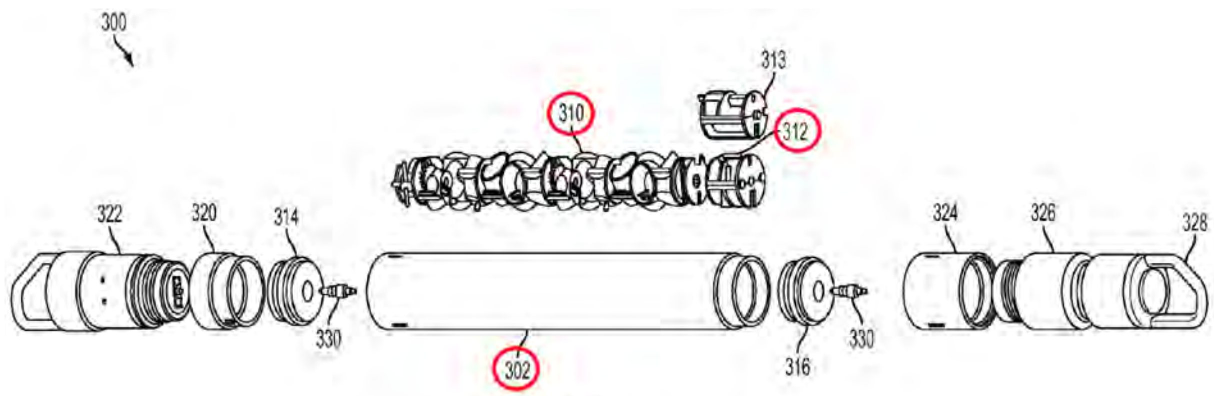
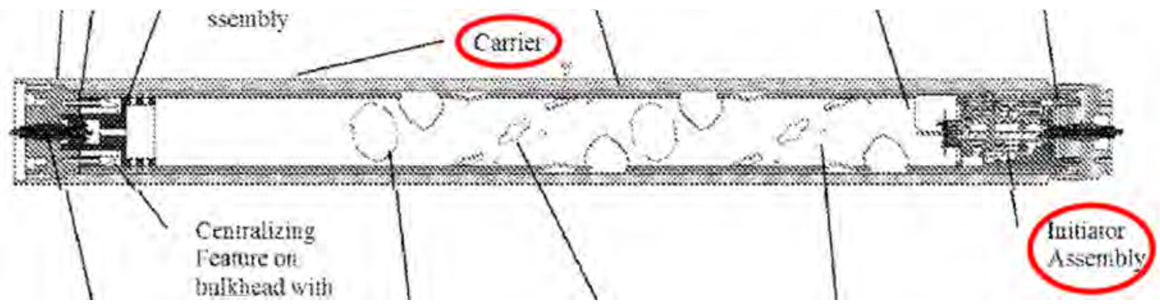


FIG. 3



193. Rogman and Rogman Prov. teach an initiator assembly having a detonator 402 and electrical connections, including an RCA jack coaxial connector. (Ex. 1014, Rogman, ¶¶ 0029, 0031, Claim 17, FIG. 4; Ex. 1020, Rogman Prov., pp. 3-4, 6-7, FIGS. 4, 5.)

194. A POSITA would understand that the initiator assembly of Rogman and Rogman Prov. is pushed into the gun carrier.

195. Rogman and Rogman Prov. teach a POSITA a detonator contained entirely within the hollow interior of the outer gun carrier and pushing the detonator into the gun carrier as claimed.

F. Lanclos teaches locating a detonator entirely within the outer gun carrier

196. Lanclos teaches a cartridge assembly 70 inside a cartridge sub 68. (Ex. 1015, Lanclos, 4:61-5:1, FIG. 3.) Lanclos' cartridge assembly includes a detonator 88 and electrical connections, including connector 90. (Ex. 1015, Lanclos, 5:1-23, 5:34-51, 5:68-6:65, 7:12-30, FIG. 3.)

197. Lanclos teaches that the cartridge sub 68 is coupled to perforating guns 62_1, 62_2. (Ex. 1015, Lanclos, 4:61-63, 7:12-16, FIG. 3.) A POSITA would recognize the perforating guns of Lanclos as hollow carrier perforating guns. A POSITA would understand that the cartridge sub 68 and carrier or body of perforating guns 62_1, 62_2 act as a gun carrier as claimed.

198. A POSITA would understand that the cartridge assembly of Lanclos is pushed into the gun carrier.

199. Lanclos teaches a POSITA a detonator contained entirely within the hollow interior of the outer gun carrier and pushing the detonator into the gun carrier as claimed.

G. Bonavides teaches locating a detonator entirely within the outer gun carrier

200. Bonavides teaches that a downhole tool 145, including a perforating gun, and controller 105 can be enclosed in a single housing or two or more separate housings. (Ex. 1017, Bonavides, 5:29-35, 7:24-29.) Bonavides also teaches a detonator in a common housing with the tool controller 105. (Ex. 1017, Bonavides, 7:24-29.) A

POSITA would understand that Bonavides detonator would necessarily be pushed into the outer housing or gun carrier.

201. Bonavides teaches a POSITA a detonator contained entirely within the hollow interior of the outer gun carrier and pushing the detonator into the gun carrier as claimed.

H. Lendermon teaches locating a detonator entirely within the outer gun carrier

202. Lendermon teaches detonators 73 and 74 contained entirely within carrier 13. (Ex. 1003, Lendermon, 4:58-68, 10:39-59, FIG. 1.) A POSITA would understand that Lendermon's detonators would necessarily be pushed into the outer housing or gun carrier. Lendermon teaches a POSITA a detonator contained entirely within the hollow interior of the outer gun carrier and pushing the detonator into the gun carrier as claimed.

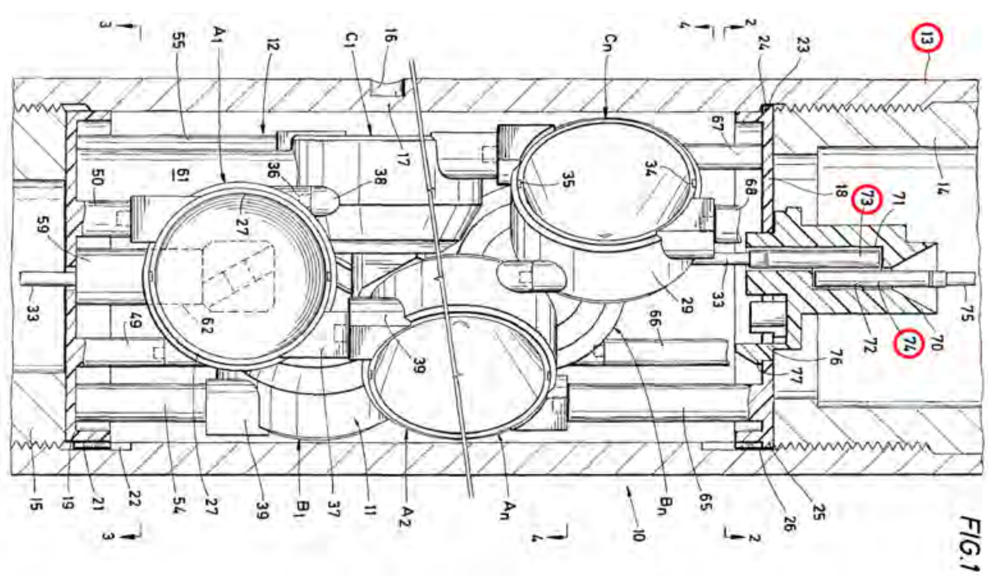


FIG.1

I. Goodman teaches locating a detonator entirely within the outer gun carrier

203. Goodman teaches a detonator/initiator 15, 45, and 47 having electrical connectors for engaging with receptacle 18 and an electrical receptacle 17 for connecting connectors 11, 12, 43, and 44 entirely within a gun carrier 20, 48. (Ex. 1018, Goodman, ¶¶ 0005-7, 0018-20, 0023-24, FIGS. 1-5.) A POSITA would find it inherent in Goodman to have electrical connectors on the initiator to engage with receptacle 18 to make the device of Goodman functional.

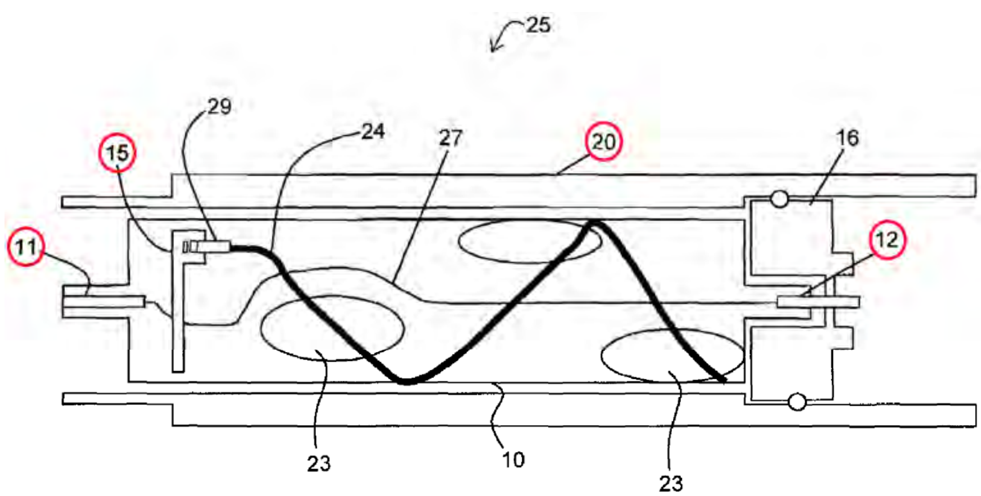


FIG. 2

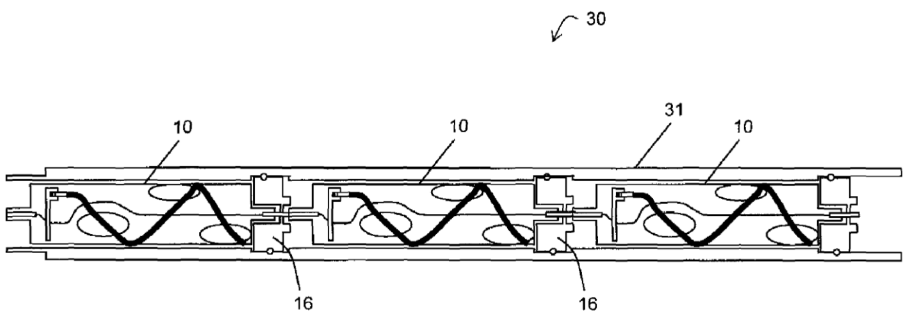


FIG. 3

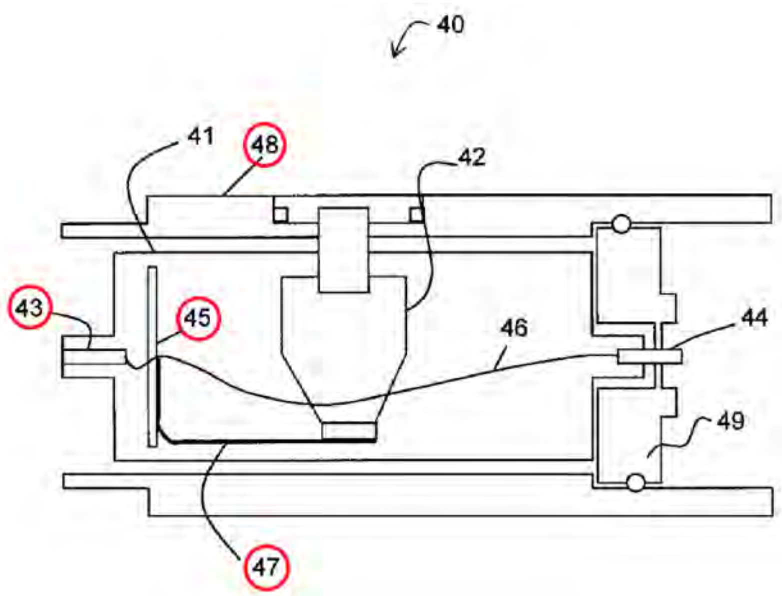


FIG. 4

204. A POSITA would understand that Goodman's detonators/initiators would necessarily be pushed into the outer housing or gun carrier. Goodman teaches a POSITA a detonator contained entirely within the hollow interior of the outer gun carrier and pushing the detonator into the gun carrier as claimed.

J. Carisella teaches locating a detonator entirely within the outer gun carrier

205. Carisella teaches detonator 26 entirely within a perforating gun carrier 19. (Ex. 1019, Carisella, 5:66-6:10, FIGS. 2, 3.) A POSITA would understand that Carisella's detonator 26 would necessarily be pushed into the gun carrier. Carisella teaches a POSITA a detonator contained entirely within the hollow interior of the outer gun carrier and pushing the detonator into the gun carrier as claimed.

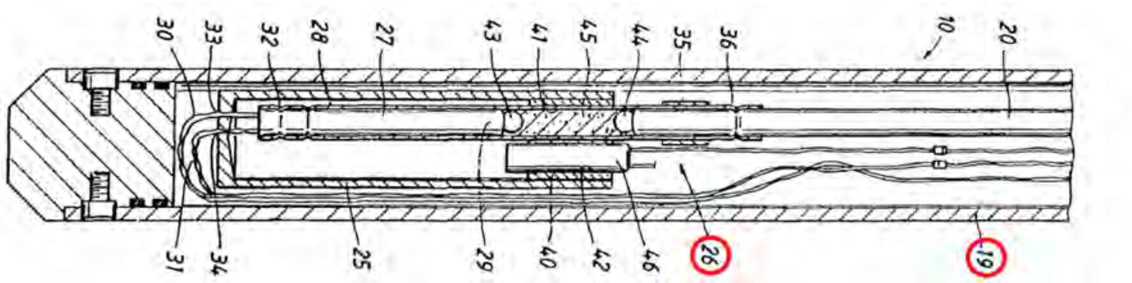
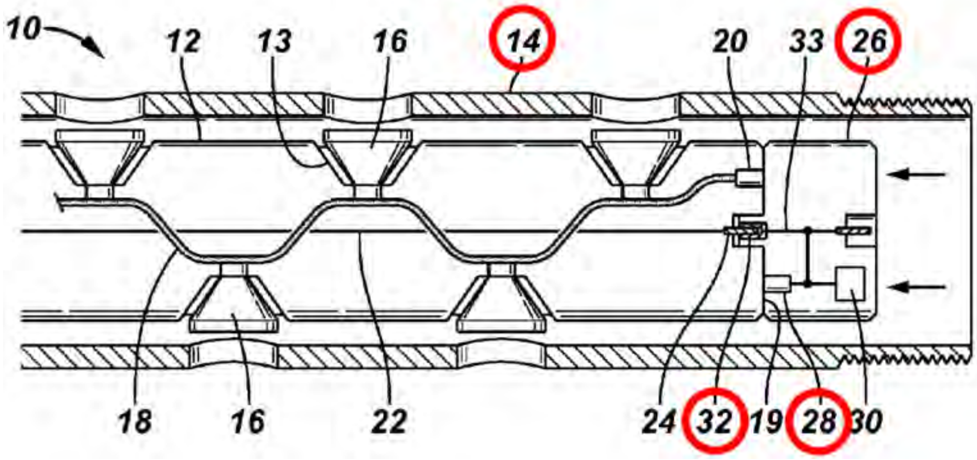


FIG.2

K. Black teaches locating a detonator entirely within the outer gun carrier

206. Black teaches an arming device 26 including a detonator 28 and an electrical connector 32 entirely within a gun carrier 14 (Ex. 1002, Black, ¶¶ 0007-8, 0023-24, FIGS. 1, 2, 4, 6, 7, 10.) A POSITA would understand that Black's arming device 26 and detonator 28 would necessarily be pushed into the gun carrier as shown in FIG. 2. (Ex. 1002, Black, ¶¶ 0023-24, FIG. 2.) Black teaches a POSITA a detonator contained entirely within the hollow interior of the outer gun carrier and pushing the detonator into the gun carrier as claimed.

FIG. 2



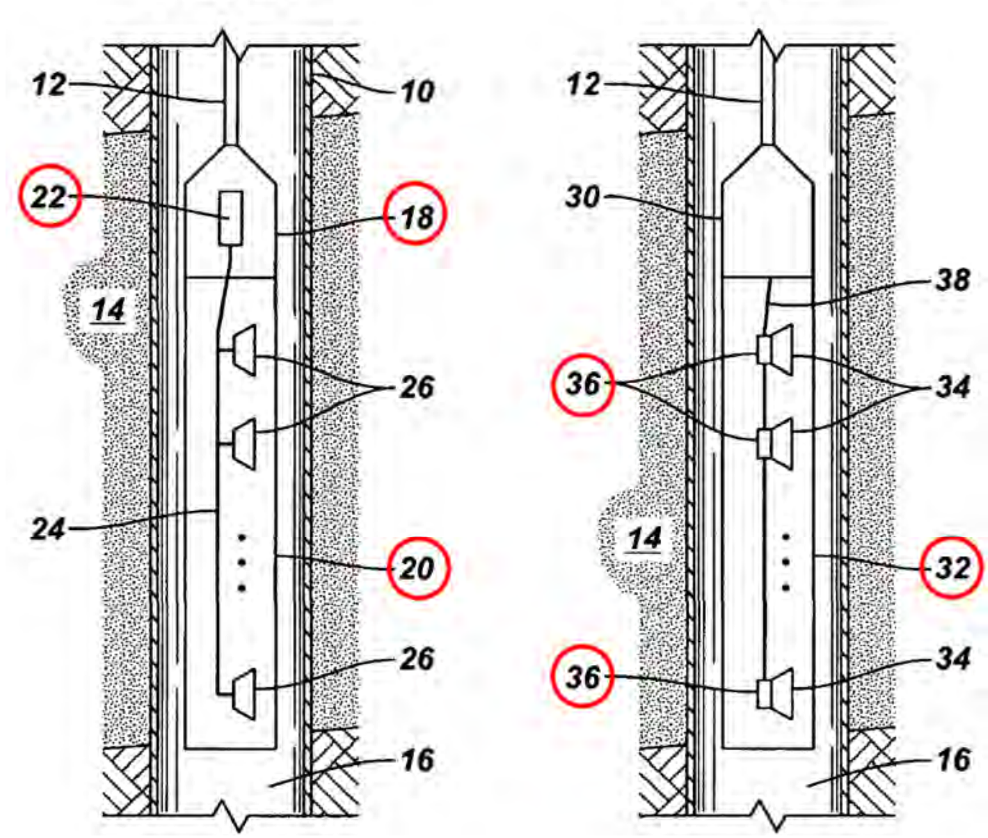
L. Brooks teaches locating a detonator entirely within the outer gun carrier

207. Brooks teaches detonators 36 entirely within a perforating gun carrier. (Ex. 1021, Brooks, 4:7-19, FIG. 1B.) Brooks also teaches a detonator 22 in a firing head 18 attached to a perforating gun 20. (Ex. 1021, Brooks, 3:26-37, FIG. 1A.) A POSITA would understand that Brooks' gun carrier and firing head 18 act as a single housing for containing the components of the perforating tool. A POSITA would also find it a trivial and obvious modification of the embodiment of Brooks' FIG. 1A to move the detonator 22 inside the gun carrier 20. This would be the predictable application methods from common knowledge of a POSITA and other embodiments of Brooks, to that embodiment of Brooks without any unexpected results, simple substitution of the known options taught, the use of known techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and

predictable arrangements of components that are available with a reasonable expectation of success.

FIG. 1A

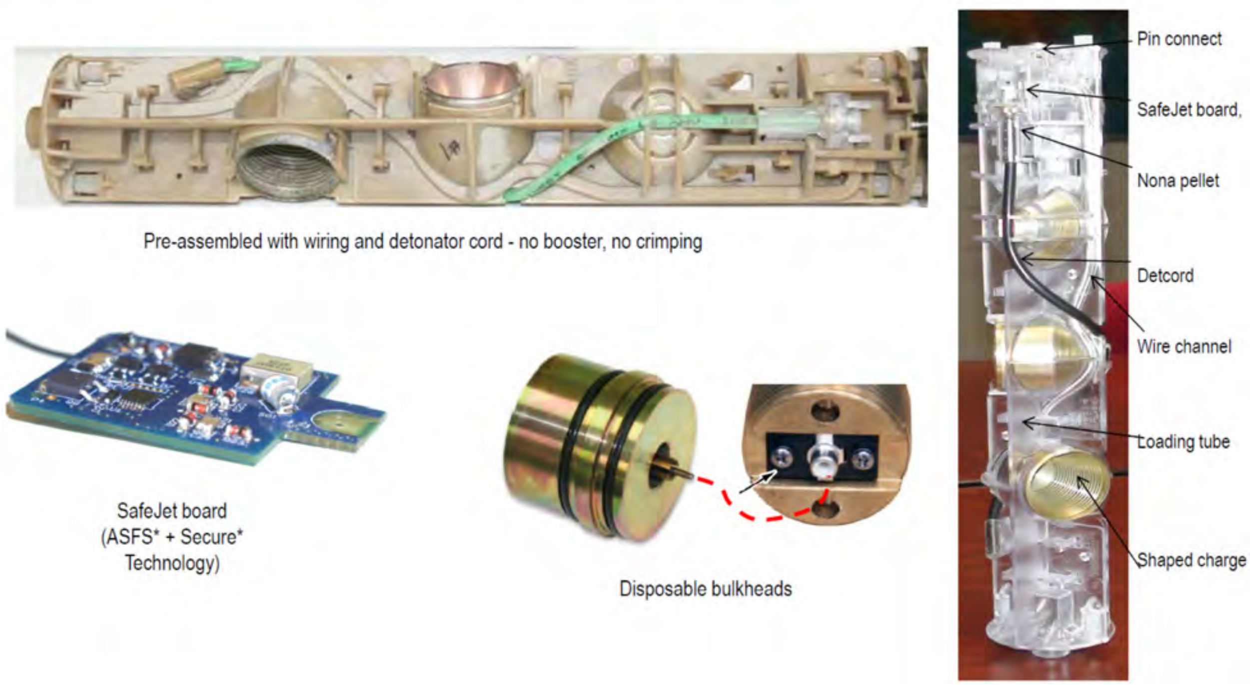
FIG. 1B



208. A POSITA would understand that Brooks' detonators 22 and 36 would necessarily be pushed into the gun carrier. Brooks teaches a POSITA a detonator contained entirely within the hollow interior of the outer gun carrier and pushing the detonator into the gun carrier as claimed.

M. EWAPS teaches locating a detonator entirely within the outer gun carrier

209. EWAPS teaches a detonator with electrical contacts inside a perforating gun carrier. (Ex. 1013, EWAPS, pp. 5, 9, 10.)



210. A POSITA would understand that a detonator must be present between the SafeJet Board and Nona pellet of EWAPS to function as intended. A POSITA would understand that the detonator of EWAPS necessarily be pushed into the gun carrier. EWAPS teaches a POSITA a detonator contained entirely within the hollow interior of the outer gun carrier and pushing the detonator into the gun carrier as claimed.

N. SLB Catalog teaches locating a detonator entirely within the outer gun carrier

211. SLB Catalog teaches a detonator within a perforating gun carrier. (Ex. 1005, SLB Catalog, pp. 0031, 0220, 0242-44, 0255, FIGS. 12, 154, 170, 171-173, 183.) A POSITA would understand that the detonator of SLB Catalog necessarily be pushed into the gun carrier. SLB Catalog teaches a POSITA a detonator contained entirely within the hollow interior of the outer gun carrier and pushing the detonator into the gun carrier as claimed.

X. <u>Claim 1 limitation of "the detonator including a detonator body containing detonator components...", Claim 9 limitation of "a modular detonator, comprising: a detonator body containing detonator components…", Claim 13 limitation of "the detonator including a detonator body containing detonator components…"</u>

212. Claim 1 of the '938 Patent includes the limitation of "**the detonator including a detonator body containing detonator components....**" (Ex. 1001, the '938 Patent, 11:21-22.) Claim 9 includes the limitation of "**a modular detonator, comprising: a detonator body containing detonator components….**" (Ex. 1001, the '938 Patent, 11:63-64.) Claim 13 includes the limitation of "**the detonator including a detonator body containing detonator components….**" (Ex. 1001, the '938 Patent, 12:44-45.)

A. The '938 Patent includes no written description supporting a detonator body containing detonator components

213. '938 patent describes a detonator body 102, but provides no description whatsoever of what may be inside it so we have no guidance as to what the detonator components may be.

214. The '938 Patent describes a detonator body 102 as being included in the detonator assembly 26. (Ex. 1001, the '938 Patent, 8:7-10.) FIGS. 27-32 depict a cylindrical housing as the detonator body 102.

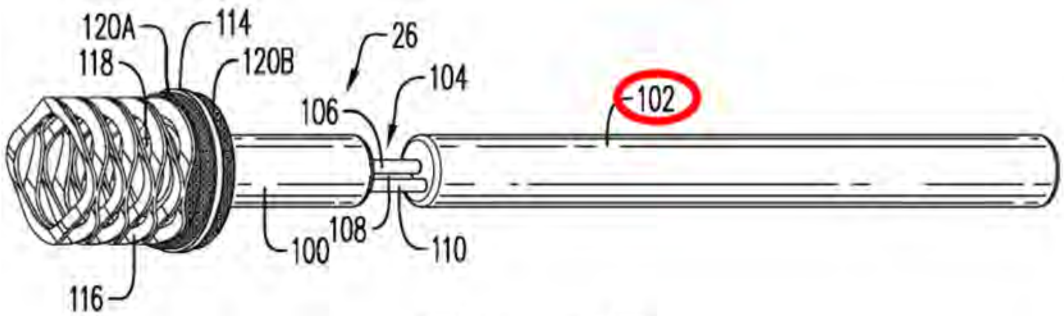


FIG. 27

215. The '938 Patent never describes the body 102 as containing any "detonator components," and never discloses what a "detonator component" may be. In fact, none of the components of a detonator described or mentioned in the claims of the '938 Patent is ever described as inside detonator body 102.

216. Because the '938 Patent never describes any detonator components inside body 102, or any detonator components at all, it does not reasonably convey to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date of the patent.

217. A POSITA reading the '938 Patent would understand that the claims refer to a subset of "detonator components" in the detonator body," but because the '938 patent never describes any such components, a POSITA would not understand what those components were or could be. Because the '938 Patent never describes any detonator components in a detonator body, or any detonator components at all, it fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention.

B. Claim construction of a detonator body containing detonator components

218. A POSITA's best guess for the meaning of "a detonator body containing detonator components" is a housing, body, or container containing some or all parts of a detonator, or a detonator assembly.

219. Regarding Claim 9, there are no references within the specification of the '938 Patent teaching a "modular detonator." A POSITA would not have a general understanding of what the term "modular detonator" means. Reviewing the '938 claims and specification, a POSITA would be unclear as to what, if anything, the term "modular" adds to the detonator. Therefore, Claim 9 does not inform a POSITA about the scope of the invention with reasonable certainty.

220. For purposes of determining invalidity under anticipation or obviousness, a POSITA's best guess would be that a modular detonator is simply a detonator.

221. A POSITA's common knowledge would include that detonators typically have their parts contained in a housing or body.

C. Schacherer teaches a detonator body containing detonator components

222. Ex. 1004, Schacherer teaches "[a]n electrical detonator 38 (not visible in FIG. 1, see FIGS. 2, 4-7 & 9) can be coupled to an explosive component 40 in each of the connectors 30..." (Ex. 1004, Schacherer, 3:33-35.) The "explosive assemblies 20 is completely assembled, including coupling the electrical detonator 38 to the

explosive component 40 and installing these in the connector 30 with the selective firing module 32." (Ex. 1004, Schacherer, 6:37-41.) The specification further describes that the "electrical detonators 38 are preferably coupled to the respective explosive components 40 in the respective connectors 30." (Ex. 1004, Schacherer, 6:57-59, see also 6:67-7:2, 7:18-20.) Schacherer teaches in FIG. 4 that the coupler 62, the connector 30, and rotary detonation coupling act as a body containing detonator components. (Ex. 1004, Schacherer, 5:25-31.)

223. A POSITA would recognize the highlighted blue regions from Schacherer FIGS. 4, 5, and 7 as teaching a detonator body containing detonator parts:

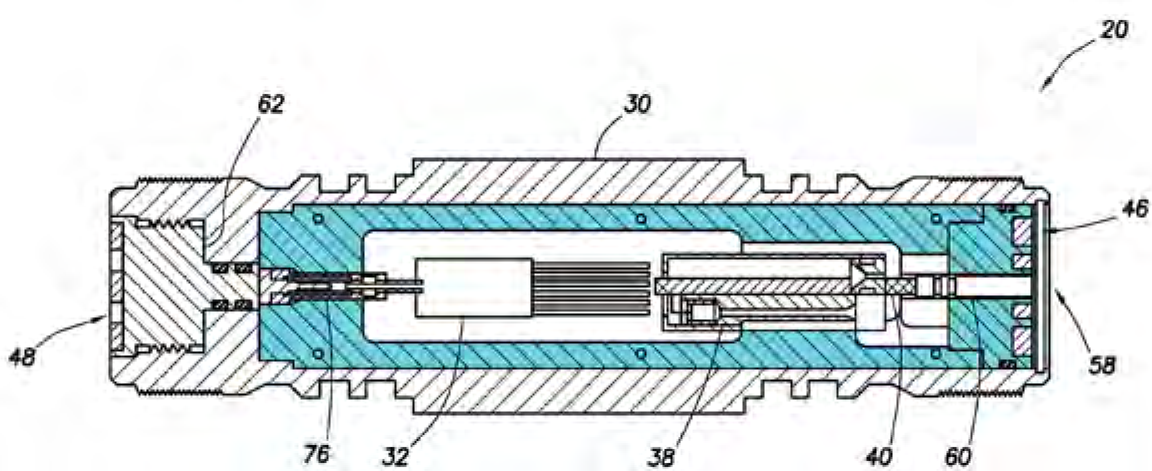


FIG.4

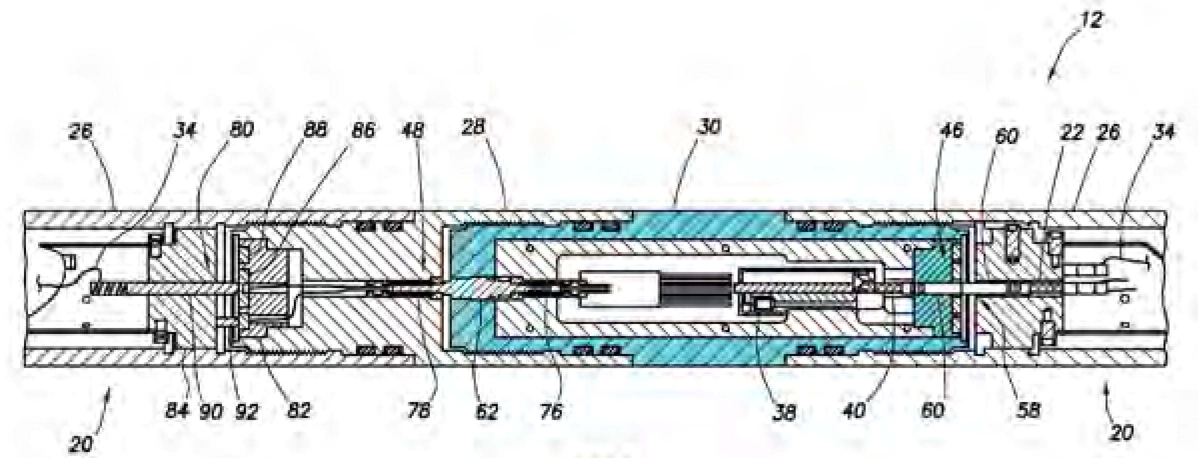


FIG.5

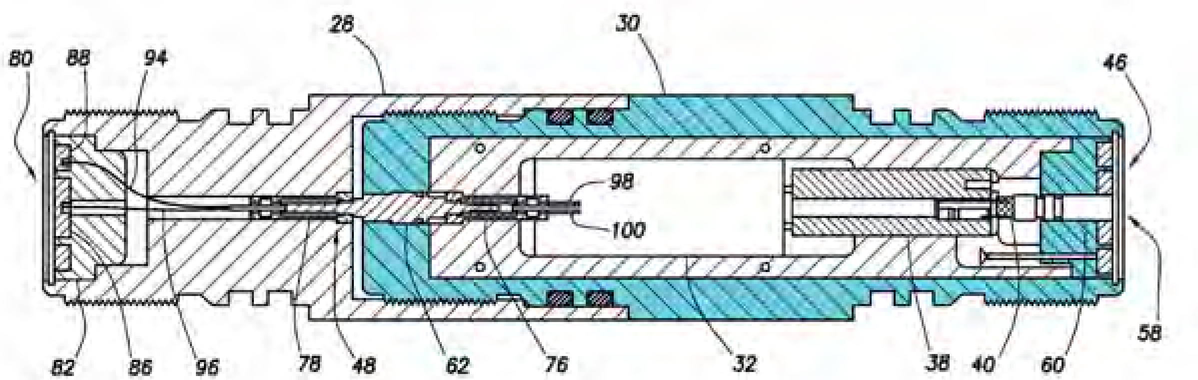


FIG.7

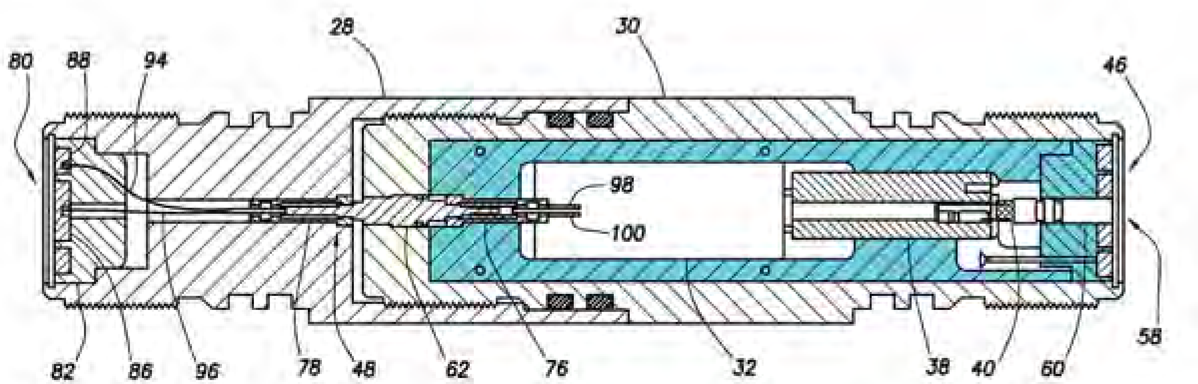


FIG.7

224. A POSITA would understand that Schacherer's detonator 38 teaches an independent housing containing detonator components.

225. A POSITA would see the disclosure of Schacherer, both in the description and in FIGS. 4, 5, and/or 7, as teaching a body or "a detonator body containing detonator components" as claimed in the limitation language of Claims 1, 9, and 13.

D. Harrigan teaches a detonator body containing detonator components

226. Ex. 1012, Harrigan teaches "[h]owever, in the embodiment shown, the loading tube 115 is also configured to accommodate an initiator assembly module 125. That is, rather than utilizing externally wired initiator and detonator components, manually wired to the gun 100 at the oilfield, a single pre-wired subassembly package 125 of such functionality may be plugged into the loading tube 115." (Ex. 1012, Harrigan, ¶ 0022, FIGS. 1A, 2A, 3A, 3B & 4A; Ex. 1028, Harrigan Prov., pp. 3-5, FIGS. 2-4, (top of p. 2 states "Spring-loaded connectors to prevent shock-related disconnections.").) "Specifically, with added reference to FIGS. 3A, 3B, and 4A even though the module 125 is outfitted with a detonator 301..." (Ex. 1012, Harrigan, ¶ 0023.) "Thus, the gun 100, and in particular, the initiator assembly module 125 may be delivered in a pre-wired manner with a detonator 301 in place (see FIG. 3A.)" (Ex. 1012, Harrigan, ¶ 0027; Ex. 1028, Harrigan Prov., p. 3, FIG. 1.) A POSITA would understand that the initiator assembly module 125 disclosure of

Harrigan teaches a detonator body and detonator assembly, thereby teaching the limitation of Claims 1, 9, and 13, "a detonator body containing detonator components."

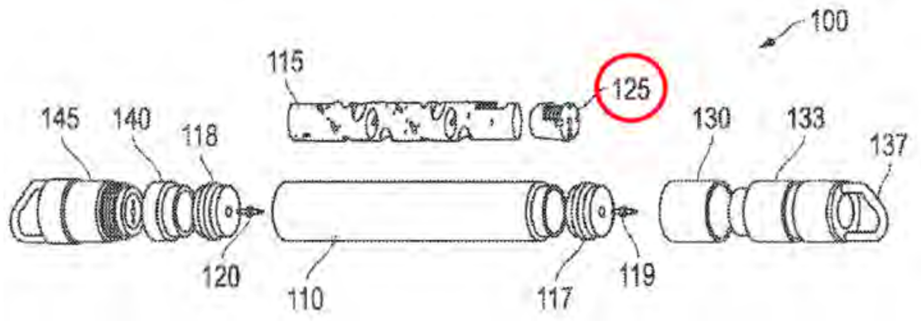


FIG. 1A

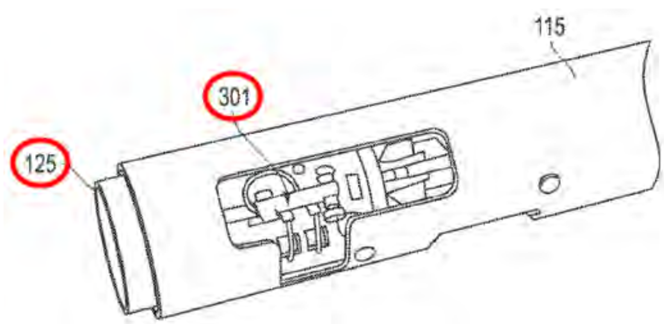


FIG. 3A

227. A POSITA would recognize that the detonator 301 teaches an independent housing containing detonator components. A POSITA would understand that the detonator 301 disclosure of Harrigan teaches a detonator body, thereby teaching the limitation of Claims 1, 9, and 13, "a detonator body containing detonator components." The initiator assembly module 125 and detonator 301 each teach the claimed detonator body.

E. Rogman teaches a detonator body containing detonator components

228. Ex. 1014, Rogman teaches several versions of an initiator assembly 112, 312, 313 which are configured for housing components of the detonator assembly (detonator, circuit board for selectively addressing and controlling a detonator, and booster.) (Ex. 1014, Rogman, ¶¶ 0021, 0027, 0029, FIGS. 1-4.)

229. Rogman teaches:

> The initiator assembly 112 can include one or more detonators 402, one or more detonator cords 404, one or more ballistic interrupt shutters 406, one or more insulation-displacement connectors ("IDCs”) 410, and one or more retaining tabs 412. The detonator 402 and the detonator cord 404 can form a ballistic train of the initiator 112. The detonator 402 can be or include a primary ignition source that initiates the ignition of the detonator cord 404. The detonator cord 404 can include a fuse and can be operably coupled to the detonator 402. The detonator 402 can initiate a detonation wave on the detonator cord 404, and the detonation wave can propagate on one or more Subsequent detonating cord(s) 404 to the perforating charges 202 to cause the charges 202 to fire. Unintentional or premature firing or activation of the detonator cord 404 can be prevented by the ballistic interrupt shutter 406. For example, unintentional firing of the detonator cord 404 can be prevented until a particular command is sent to release the shutter 406.

(Ex. 1014, ¶ 0029, FIG. 4.)

230. Rogman teaches “[t]he initiator assembly 112 can include a circuit board (not shown.) The circuit board can communicate with a surface computer (not shown). The circuit board can also connect the detonator 402 to a power cable on command.”

(Ex. 1014, ¶ 0031.) Rogman teaches "[t]he perforating device 300 can include … initiator assembly 312, a supplemental initiator assembly 313 … as disclosed in reference to FIGS. 1 and 2, above." (Ex. 1014, Rogman, ¶ 0027, FIGS. 1, 2 & 3.)

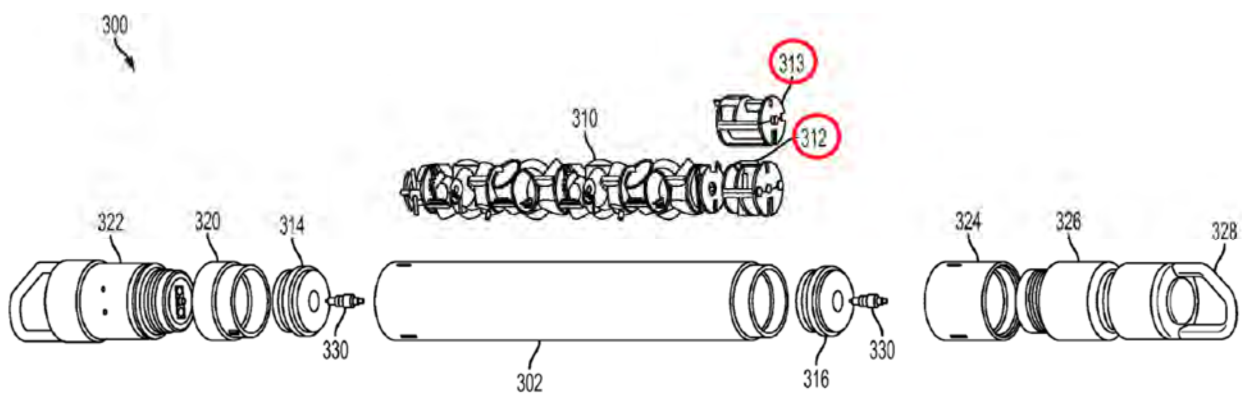


FIG. 3

231. Rogman Prov. also teaches a detonator body containing detonator parts in its initiator assembly or firing module "containing addressable switch, detonator, and connectors." (Ex. 1020, Rogman Prov., pp. 1-4, 7.)

232. A POSITA would recognize that the detonator 402 of Rogman teaches an independent housing containing detonator components.

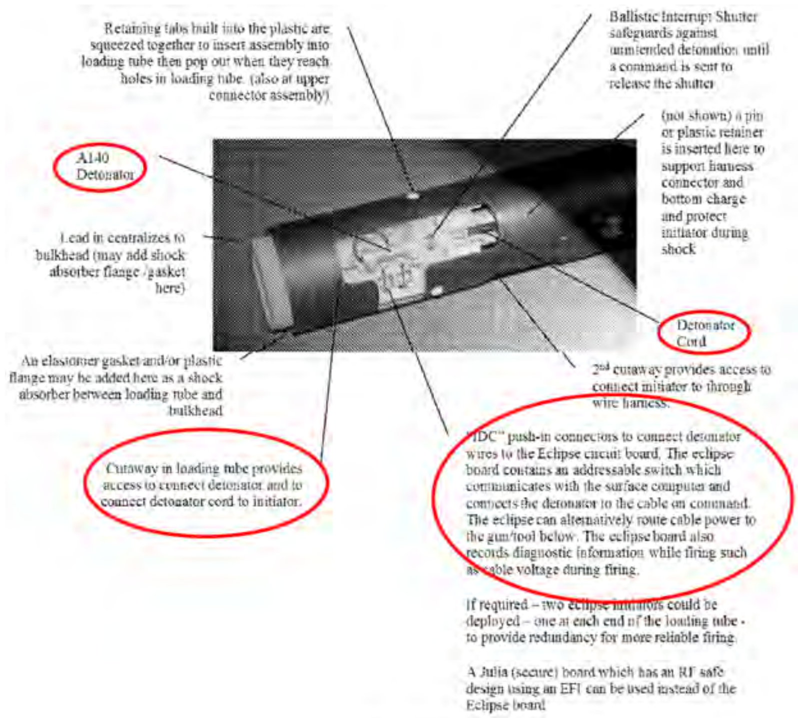


Fig. 4: Eclipse initiator

233. A POSITA would recognize Rogman and Rogman Prov. teach "a detonator body containing detonator components..." as claimed.

F. EWAPS teaches a detonator body containing detonator components

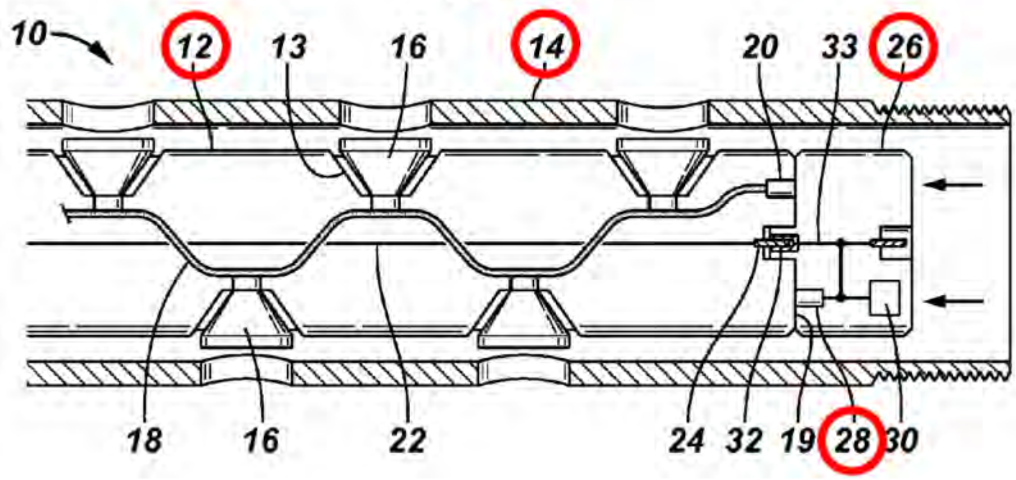
234. Ex. 1013, EWAPS illustrates and teaches, in the photographic images on page 0010, two versions of a plastic molded holder, container, or body which is configured for housing components of the detonator assembly (detonator, circuit board for selectively addressing and controlling a detonator, and booster), as well as other internal components of a perforating gun including detonating cord, shaped charges, wiring, coaxial style non-manual electrical connections, etc. (Ex. 1013, EWAPS, p.

0010.) A POSITA would recognize EWAPS as teaching "a detonator body containing detonator components…" as claimed.

G. Black teaches a detonator body containing detonator components

235. Black teaches an arming device 26 that includes a detonator 28 plugged in to a charge holder (loading tube) 12, 7, inserted inside a carrier 14. (Ex. 1002, Black, ¶¶ 0023-24, 0026, 0036 FIGS. 1, 2, 4, 6.)

FIG. 2



236. Black teaches "arming device 26 includes a detonator 28 (for example an RF-safe initiator), firing electronics 30 (for example, an addressable switch), and an electrical connector 32 and electrical conductor 33." (Ex. 1002, Black, ¶ 24.) A POSITA would understand that Black's detonator 28 includes a body or housing as depicted in the figures.

237. Both arming device 26 and detonator 28 of Black teach a detonator body containing detonator parts.

H. Lanclos teaches a detonator body containing detonator components

238. Ex. 1015, Lanclos discloses "a cartridge sub 68 having a cartridge assembly 70 set within the housing of the cartridge sub 68." (Ex. 1015, Lanclos, 4:61-63.) The cartridge assembly 70 is shown in FIG. 3 and described as having "an elongated body 71, and within the body 71 are a switch assembly 72 and an optional circuit board 74 for selectively performing switching operations within the switch assembly 72." (Ex. 1015, Lanclos, 4:64-5:1.) A detonator 88 is described and shown within the cartridge assembly 70. (Ex. 1015, Lanclos, 5:18-19.) A POSITA would understand that Lanclos' detonator 88 includes a body or housing as depicted in the figures. A POSITA would recognize that the Lanclos teaches a cartridge sub 68 containing a cartridge assembly 70, as shown in FIG. 3, having a body 71 that contains a switch assembly 72, a circuit board 74, and a detonator 88. A POSITA would therefore recognize the shaded blue regions from FIG. 3 as showing a body or "a detonator body containing detonator components" as claimed in the limitation language of Claims 1, 9, and 13. A POSITA would recognize that detonator 88 and elongated body 71 of Lanclos each teach a detonator body containing detonator components as claimed in the limitation language of Claims 1, 9, and 13.

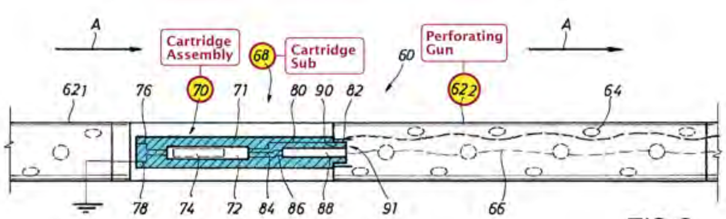


FIG. 3

I. Lendermon teaches a detonator body containing detonator components

239. Lendermon teaches detonators 73 and 74 with detonator bodies containing detonator components for crimping onto detonating cord: "To complete the assembly of the perforating apparatus 10, a generally-cylindrical upright member 70 is cooperatively arranged to be mounted on top of the upper base member 18. Side-by-side paralleled longitudinal bores 71 and 72 are arranged in the upright member 70 and cooperatively sized for respectively receiving typical detonators 73 and 74 and securing them in a side-by-side relation. The parallel bores 71 and 72 are either separated by a thin wall or there is a opening communicating the bores to be certain that the detonation of the detonator 74 will efficiently detonate the detonator 73. Thus, by crimping the detonator 73 on the upper end of the detonating cord 33, the detonation of the side-by-side detonators 73 and 74 will actuate the perforating apparatus 10." (Ex. 1003, Lendermon, 10:38-50, FIG. 1.) A POSITA would recognize that detonators 73 and 74 of Lendermon teach a detonator body containing detonator components as claimed in the limitation language of Claims 1, 9, and 13.

J. Goodman teaches a detonator body containing detonator components

240. Goodman teaches a detonator/initiator 15, 45, and 47 having electrical connectors for engaging with receptacle 18 and an electrical receptacle 17 for connecting connectors 11, 12, 43, and 44. (Ex. 1018, Goodman, ¶¶ 0005-7, 0018-20, 0023-24, FIGS. 1-5.) A POSITA would recognize that detonator/initiator 15, 45, and 47 of Goodman teach a detonator body containing detonator components as claimed in the limitation language of Claims 1, 9, and 13.

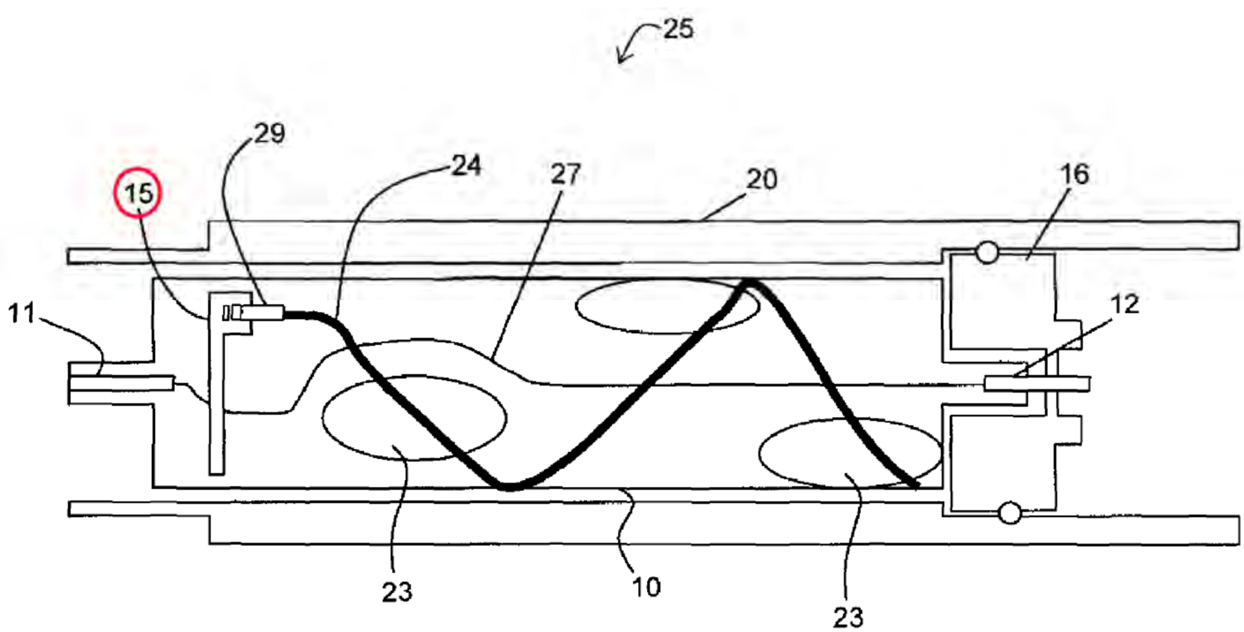


FIG. 2

K. Bonavides teaches a detonator body containing detonator components

241. Bonavides teaches "the perforating tool includes an explosive detonator that may be enclosed within a common housing with the tool controller 105." (Ex. 1017, Bonavides, 7:24-30.) A POSITA would recognize that the housing of tool controller 105 of Goodman and the detonator itself each teach a detonator body containing detonator components as claimed in the limitation language of Claims 1, 9, and 13.

L. Carisella teaches a detonator body containing detonator components

242. Carisella teaches "a tubular housing 25 carrying a typical electrically-initiated detonator indicated generally at 26," and details about the components of the detonator within the housing. (Ex. 1019, Carisella, 6:3-29, FIGS. 2-3.)

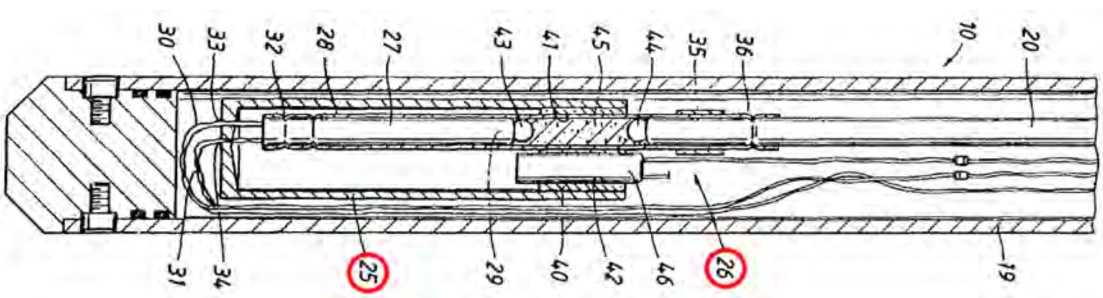


FIG. 2

243. A POSITA would recognize that the Carisella's housing 25 teaches a detonator body containing detonator components as claimed in Claims 1, 9, and 13.

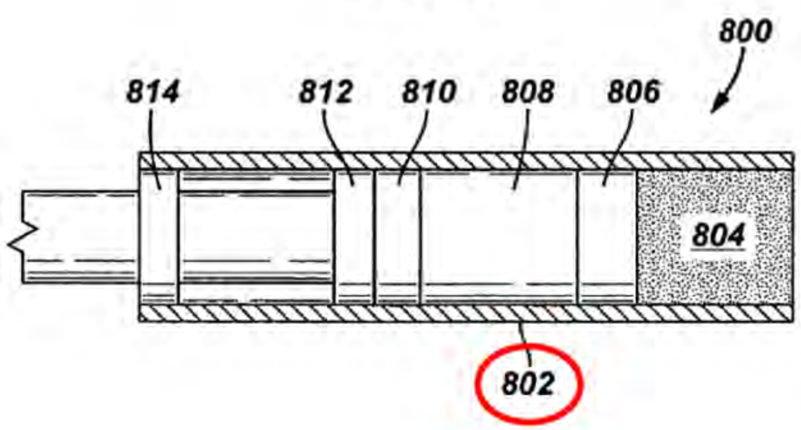
M. Lerche '929 teaches a detonator body containing detonator components

244. Lerche '929 teaches a detonator body in main housing 12. A POSITA would recognize that the Lerche '929's firing head 22 and second housing 12 teach a detonator body containing detonator components, such as booster 16a and secondary explosive pellet 22e, as claimed in Claims 1, 9, and 13. (Ex. 1016, Lerche '929, 3:59-4:19, 5:43-55, FIGS. 1-2.)

N. Brooks teaches a detonator body containing detonator components

245. Brooks teaches a detonator housing 802 containing detonator parts. (Ex. 1021, Brooks, 7:24-39, FIGS. 8A, 8B.)

FIG. 8A



246. A POSITA would recognize that Brooks' housing 802 teaches a detonator body containing detonator components as claimed in Claims 1, 9, and 13.

O. The detonator body and detonator components are within the common knowledge of a POSITA

247. A POSITA would know that all detonators used in oilfield perforating applications have a body and typical detonator components, including an initiation explosive or device, an output explosive, electronic circuitry for some detonators, and a housing. Most have wires attached and some have no wires attached but complete their electrical power and/or signal and/or ground communications by contact to various components or surfaces of the detonator. Some may call a complete detonator a "modular detonator," but that would seem redundant as all detonators could be considered to be modular.

248. The '938 Patent does not describe what is different or novel about the detonator body, components or modular detonator claims versus prior art, nor does it disclose any information about what the detonator components are.

P. SLB Catalog teaches a detonator body containing detonator components

249. SLB Catalog teaches detonators with detonator bodies containing detonator parts as have been common knowledge and in common use in the art and energetic coupling of those detonators to detonating cords. (Ex. 1005, SLB Catalog, pp. 028-030, 032, FIGS. 9, 10, 13.)

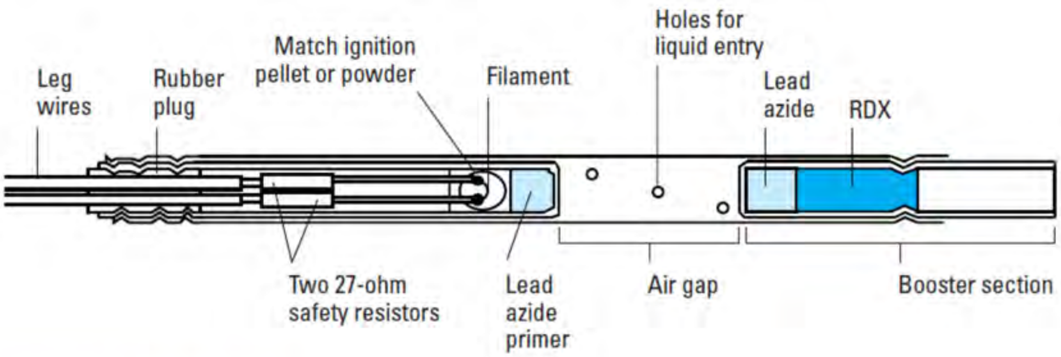


Figure 9. Fluid-desensitized electrical detonator.

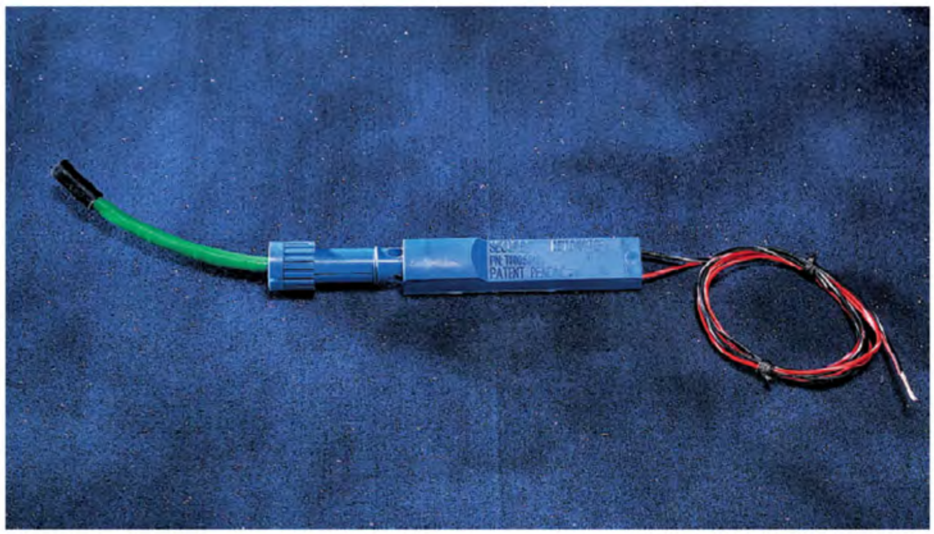


Figure 13. Secure detonator.

250. A POSITA would recognize that SLB Catalog teaches a detonator body containing detonator components as claimed in Claims 1, 9, and 13.

251. A POSITA would recognize that the prior art of each of the examples of Black, Lendermon, Brooks, Bonavides, Carisella, EWAPS, SLB Catalog, Rogman, Rogman Prov., Goodman, Harrigan, Harrigan Prov., Schacherer and Lanclos teach the Claims 1, 9, and 13 limitation of "a detonator body containing detonator components."

XI. <u>Claim 1 limitation of “a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, and…”, Claim 9 limitation “a wireless signal-in connector; a wireless through wire connector; a wireless ground contact connector…”, and Claim 13 limitation “a wireless signal in connector, a wireless through wire connector, and a wireless ground contact connector….” And dependent Claims 8 and 12.</u>

252. Claim 1 in the ‘938 Patent includes the limitation “**a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, and…**.” (Ex. 1001, the ‘938 Patent, 11:23-24.) Claim 9 includes the limitation “**a wireless signal-in connector; a wireless through wire connector; a wireless ground contact connector….**” (Ex. 1001, the ‘938 Patent, 11:65-67.) Claim 13 includes the limitation “**a wireless signal in connector, a wireless through wire connector, and a wireless ground contact connector….**” (Ex. 1001, the ‘938 Patent, 12:46-47.) Dependent Claim 8 includes the limitation of “**wherein the detonator is configured for being electrically contactably received within the perforating gun without using a wired electrical connection, and the wireless signal-in connector, the wireless through-wire connector, and the wireless ground contact connector together are configured to replace the wired electrical connection and to complete an electrical connection merely by contact.**” (Ex. 1001, the ‘938 Patent, 11:55-62.) Dependent Claim 12 includes the limitation of “**wherein the modular detonator is configured for being electrically contactably received within the gun assembly of the perforating gun system**

without using a wired electrical connection, and the wireless signal-in connector, the wireless through-wire connector, and the wireless ground contact connector together are configured to replace the wired electrical connection and to complete an electrical connection merely by contact.” (Ex. 1001, the ‘938 Patent, 12:26-33.)

A. There is no written support for the term “wireless” in the specification.

253. The ‘938 Patent neither defines nor describes the term “wireless.” The ‘938 Patent never uses the word “wireless” outside of the claims. The ‘938 Patent does say “Another basic component includes a push-in detonator that does not use wires to make necessary connections,” and “[i]n an embodiment, all connections are made by ***connectors***, such as spring-loaded connectors, ***instead of wires***, ***with the exception of the through wire*** that goes from the top connector 14 to the bottom connector 22, ***whose ends are connectors***.” (Ex. 1001, the ‘938 Patent, 6:8-9, 6:24-28.)

254. The ‘938 Patent neither defines nor describes the terms “wireless signal-in connector,” “wireless through wire connector,” or “wireless ground contact connector.” The ‘938 Patent neither defines nor describes the terms “through wire connector,” “signal-in connector,” or “ground contact connector.”

255. During prosecution, Patent Owner amended these terms from the original “wireless bulkhead connect[or/ing] portion,” “wireless through wire connecting portion,” and “wireless ground portion,” in response to a rejection that these terms did not find support in the specification. (Ex. 1008, File History, pp. 68-69, 80.)

256. A POSITA would typically interpret the word “wireless” in the context of a perforating gun to refer to radio communications, such as WiFi or Bluetooth, or perhaps inductive power transfer, such as is used for “wireless” charging of mobile phones.

257. The ‘938 Patent uses the term “signal-in” only to refer to “a signal-in wire 108” within detonator 26. (Ex. 1001, the ‘938 Patent, 8:6-19.)

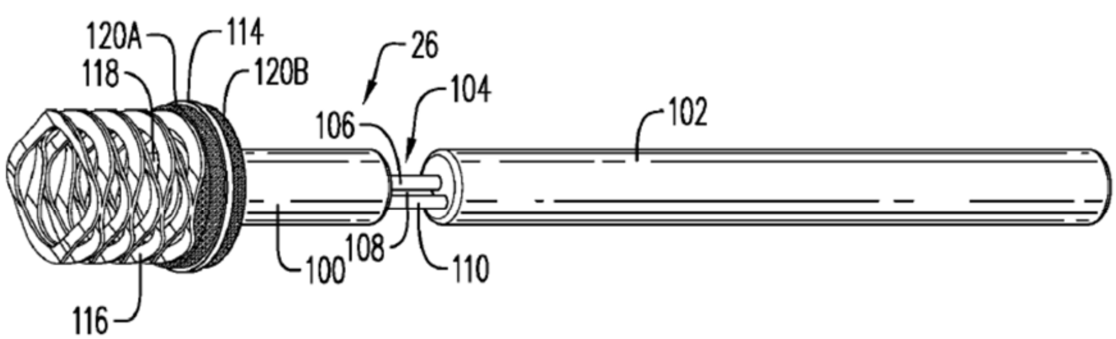


FIG. 27

258. The file history indicates that a POSITA should look to the bulkhead connector teachings to understand the signal-in connector term. (Ex. 1008, File History, pp. 68-69, 80.) The ‘938 Patent says: “a bulkhead connector element 118 for connecting the signal-in wire 108 to the bulkhead assembly 58 (also not shown).” (Ex. 1001, the ‘938 Patent, 8:17-19.) Note that this is not a connector as that term is understood by

a POSITA, but a contact element, or contactor. The bulkhead connector element is described as "connecting the signal-in wire 108 to the bulkhead assembly 58," making it difficult for a POSITA to understand how it could be "wireless." (Ex. 1001, the '938 Patent, 8:17-19.)

259. The term "through wire connector element 112" is disclosed, but it is also mischaracterized as a "connector" when it is actually a contact surface (a contact element or contactor) as shown for example in FIG. 28. (Ex. 1001, the '938 Patent, 8:13-14, FIGS. 28-29, 32-33, 35A-35B.) The through wire connector element 112 is also described as "connected to the through wire 106," making it difficult for a POSITA to understand how it could be "wireless." (Ex. 1001, the '938 Patent, 8:13-14.) The '938 Patent variously describes a "through wire" as either part of the detonator, or a conductor traversing the length of the charge holder outside of the detonator. (Ex. 1001, the '938 Patent, 2:65-67, 6:24-28, 8:6-19, 8:37-39, 953-55, FIG. 35B.)

260. The term "ground contact element 114" is depicted, for example, in FIG. 28, but it is still an electrical surface contact (a contact element or contactor), not a connector. (Ex. 1001, the '938 Patent, 8:14-17, FIGS. 28-29, 32-33, 35A-35B.) The ground contact element 114 is described as "connecting the ground wire 110 to the tandem seal adapter (also not shown), through ground springs 116," making it difficult for a POSITA to understand how it could be "wireless."

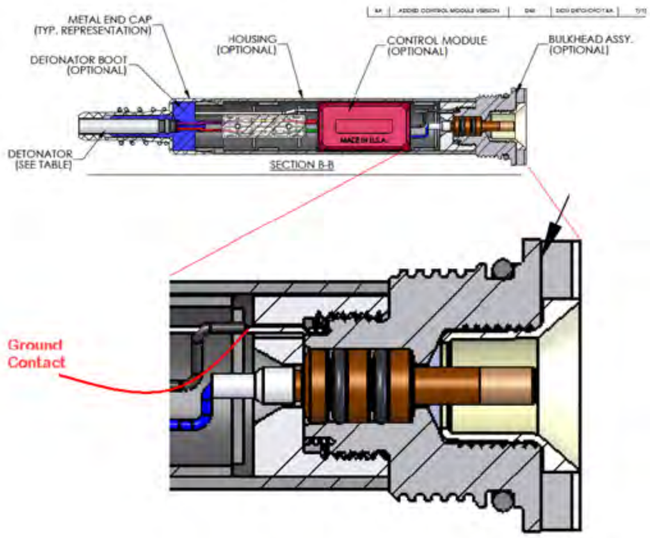
261. This ambiguity is made clear by Patent Owner's arguments in another IPR that a detonator that included any wires could not be wireless, even when the term "wireless" had been defined in that patent:

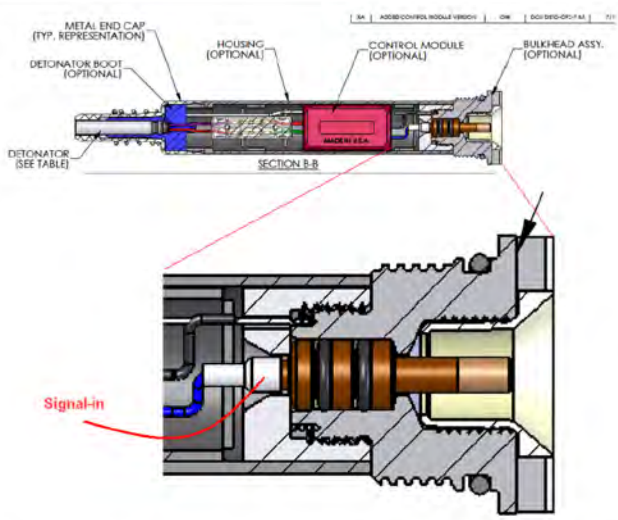
> DynaEnergetics, in turn, argues that Schacherer's detonator assembly is not "wireless" because "Schacherer provides for the electric and ballistic transfer by incorporating an electrically wired detonator (38)." PO Resp. 25–26; see also PO Sur-Reply 13–15 ("the detonator assembly of Schacherer (38) was wired"). But, in arguing that Schacherer's detonator assembly is "wired," DynaEnergetics oversimplifies what constitutes Schacherer's detonator assembly and ignores the express language of the claim. … DynaEnergetics faults Schacherer for using a wired connection between *subcomponents* of the detonator assembly.

262. (Ex.1010, Final Written Decision, pp. 6-7, 13-14.)

263. Claims 8 and 12 effectively incorporate the definition of "wireless" from Patent Owner's US Patent 9,581,422 ('422 Patent) at issue in IPR2018-00600, in which all original claims have been held unpatentable. (Ex.1010, Final Written Decision, pp. 6-7, 13-14, 30.) Therefore, if the term "wireless" is given the meaning Patent Owner gave it in '422 Patent, then the scope of Claims 1 and 8 is identical as are Claims 9 and 12, defying the doctrine of claim differentiation.

264. Patent Owner has now alleged infringement of these "*wireless*" connector limitations *by wires*:

US 10,472,938 Claim 1	Defendant's H-1® Perforating Gun System
1[g] and a wireless ground contact connector, and	 *See, e.g.*, US Department of Transportation, Classification of Explosives, Tracking No. 2016100087, dated Jan. 13, 2017, ControlFire Cartridge Assembly Detonator Family, Product Number 1356, at 2.

US 10,472,938 Claim 1	Defendant's H-1® Perforating Gun System
1[e] a wireless signal-in connector,	 *See, e.g.*, US Department of Transportation, Classification of Explosives, Tracking No. 2016100087, dated Jan. 13, 2017, ControlFire Cartridge Assembly Detonator Family, Product Number 1356, at 2.

265. (Ex. 1006, Infringement Contentions, pp. 020-021.)

266. The '938 Patent does not define what "wireless" means and does not use that term outside of the claims. Further, Patent Owner has made contradictory assertions about

what might be covered by the term "wireless." Because the '938 patent does not provide a definition or explanation of the word "wireless" it could mean anything from WiFi through a ring terminal on the end of a wire. The word "wireless" in the claims introduces ambiguity about the scope of the claims and causes them to fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Therefore, all claims of the '938 Patent are invalid as indefinite.

267. Because the patent never describes a "wireless signal-in connector," "wireless through wire connector," "wireless ground contact connector," "through wire connector," "signal-in connector," or "ground contact connector," it does not reasonably convey to those skilled in the art that the inventor had possession of the claimed subject matter. Therefore, all claims of the '938 Patent are invalid for lack of written description.

268. The '938 Patent also does not provide meaningful description of what the terms "signal-in," "through wire," and "ground" mean when applied to connectors. The only description of those terms applied to connectors is that the connectors are "connected to" or are "for connecting" similarly labeled wires. (Ex. 1001, the '938 Patent, 8:6-19.) This issue is further confused by Claims 7, 9, and 20 adding to the detonator the "signal in wire" and "ground wire" connected to the similarly labeled connectors. Similarly Claims 2, 13, and 15 add the "through wire" connected to the

"through wire connector," and Claims 7 and 11 add the ground wire connected to the "wireless ground wire connector."

269. If the connectors are not defined by the wires they are connected to, which seems likely since they are "wireless", then the labels "signal-in," "through wire," and "ground" have no meaning. (Ex. 1001, the '938 Patent, 11:51-54.) If the terms "signal-in," "through wire," and "ground" are given meaning in the wireless connector elements, then Claims 1, 2, and 7 would have the same scope, as would Claims 9 and 11 and 13, 15, and 20. Such overlapping claiming violates the principles of claim differentiation.

270. Because of the difficulty presented to a POSITA in deciphering the terms, "wireless signal-in connector," "wireless through wire connector," and "wireless ground contact connector," the claims fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Therefore, all claims of the '938 Patent are invalid as indefinite.

B. Claim Construction of the term "wireless."

271. A POSITA's best guess as to the meaning of the claim element "a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector," and the similar language in Claim 9, as informed by the specification, is three electrical contacts.

272. With regard to Claims 8 and 12, it is unclear what is meant by the terms "without using a wired electrical connection," "configured to replace the wired electrical connection," and "gun assembly of the perforating gun system…."

273. Outside of the '938 Patent, a POSITA would not have an understanding of what "without using a wired connection" or "configured to replace the wired electrical connection" means. The word "wired" does not appear in the '938 Patent outside of the claims. The '938 Patent does not describe what a "wired electrical connection" is, or what would constitute "without using a wired electrical connection" or "configured to replace the wired electrical connection." The '938 Patent also provides no information on what "wired electrical connection" the detonator is "configured to replace." The claims never introduce a "wired connection" for the detonator to replace. Viewed in light of the specification, the language of the '938 Patent provides no guidance as to what "without a wired connection" and "configured to replace the wired electrical connection" mean.

274. The closest the '938 Patent comes to discussing these issues is "a push-in detonator that does not use wires to make necessary connections. The push-in detonator may uses spring-loaded connectors, thus replacing any required wires and crimping." (Ex. 1001, the '938 Patent, 6:8-11.) This introduces the possibility that there are some required wires that would otherwise have been crimped, so the limitations of Claims 8 and 12 may just mean that wires no longer have to be crimped in some

fashion, but in what fashion they might have been, or may not be, crimped is unexplained.

275. Based on the complete lack of description and inherent ambiguity of these terms, a POSITA could not determine the scope of Claims 8 and 12 with reasonable certainty.

276. The ‘938 Patent mentions discusses what a “gun assembly” is when it twice says: “assembling a plurality of the stackable charge holders in a predetermined phase to form a first gun assembly.” (Ex. 1001, the ‘938 Patent, 2:59-60, 9:47-48.) So according to the specification, a gun assembly is a plurality of stackable charge holders assembled in a predetermined phase. But then the specification says “the top connector 14 and bulkhead 58 accommodate electrical and ballistic transfer to the charges of the next gun assembly for as many gun assembly units as required, ***each gun assembly unit having all the components of a gun assembly***.” (Ex. 1001, the ‘938 Patent, 7:63-67.) But the ‘938 Patent does not say what “all the components of a gun assembly” are. The ‘938 Patent mentions the possibility of a top connector “of a second or subsequent gun assembly, but is unclear whether the top connector is a required component of a gun assembly. (Ex. 1001, the ‘938 Patent, 6:60-64.)

277. Because of this, a POSITA is left guessing as to what the scope of Claims 9-12 is, whether it requires a plurality of stackable charge holders, a top connector, or something different, but undefined.

278. The ‘938 Patent discloses: “The bottom connector 22 from a first gun assembly can accommodate or house an electrical connection through a bulkhead assembly 58 to the top connector 14 of a second or subsequent gun assembly, as seen for instance in FIG. 19.” (Ex. 1001, the ‘938 Patent, 6:60-64, FIG. 19.)

279. The ‘938 Patent discloses: “pushing in a tandem seal adapter with o-rings onto the first gun assembly.” (Ex. 1001, the ‘938 Patent, 10:6-7.)

280. The ‘938 Patent discloses: “threading a subsequent gun assembly onto the first gun assembly or threading a top sub (element 72 in FIGS. 1, 23 and 24) onto a topmost assembled gun assembly,” (Ex. 1001, the ‘938 Patent, 10:11-13.)

281. A POSITA’s best guess as to the meaning of the limitations of Claims 8 and 12 is that the detonator can be electrically connected to within a perforating gun without the need to connect or attach wires directly to each other.

282. The ‘938 Patent describes only one embodiment of a detonator with electrical contacts. (Ex. 1001, the ‘938 Patent, FIGS. 27-31, 35A.) If the claims of the ‘938 Patent are interpreted to cover not only the type of electrical contacts disclosed, but also radio and inductive connectors, then the scope of the claims has overreached the scope of the inventor's contribution to the field of art as described in the patent specification because the specification does not show a POSITA that the inventor actually invented the invention as broadly claimed. If that is so, then at least Claims 1, 8, 9, 12, and 13 are invalid for lack of written description. Additionally, because

the ‘938 Patent only discloses a single embodiment of a detonator with electrical contacts arranged in a single way, to the extent the claim scope exceeds that embodiment, then the scope of the claims has overreached the scope of the inventor's contribution to the field of art as described in the patent specification because the specification does not show a POSITA that the inventor actually invented the invention as broadly claimed.

283. A POSITA’s common knowledge includes the use of electrical contacts generally, including to replace “wired connections.” The purpose of electrical contacts, in all of their forms is to reduce manipulation of wire when making electrical connections. This is true for every electrical connector including: a wall outlet, HDMI connectors, USB connectors, a coaxial cable jack, RCA jacks, banana plugs, ring terminals, spade terminals, etc., each of which would be within the common knowledge of a POSITA. A POSITA’s common knowledge would include the use of addressable switches with detonators and their requirement for three conductors providing an input path, a ground or return path, and a communications path to the next detonator, as also taught by Lerche ‘278, Lerche ‘868, and Lerche ‘090. (Ex. 1023, Lerche ‘868, FIGS. 13, 15, 19A; Ex. 1024, Lerche '090, FIGS. 13, 15, 19A.) Accordingly, the use of a detonator assembly having three electrical contacts was within the common knowledge of a POSITA when the ‘938 Patent was filed.

284. “The electrical conductors 34 (e.g., wires, **<u>conductive ribbons or traces, etc.</u>**) electrically connect the selective firing modules 32 to a source (e.g., a wireline, a telemetry transceiver, etc.) of an electrical signal.” (Ex. 1004, Schacherer, 2:57-60.)

C. Schacherer teaches the wireless limitations

285. Ex. 1004, Schacherer teaches an “electrical conductor 34 is electrically coupled to the electrical contact 54, and the selective firing module 32 is electrically coupled to the electrical contact 56.” (Ex. 1004, Schacherer, 4:34-36, FIG. 2.) This is further illustrated in FIGS. 4, 5, and 7 with the electrical contacts at each end highlighted below:

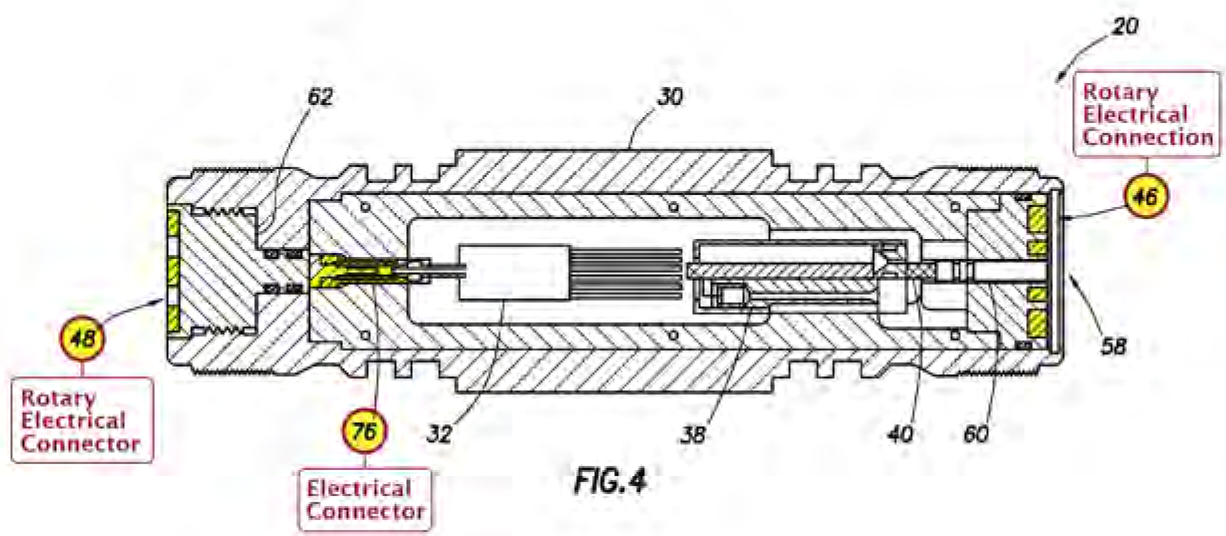


FIG. 4

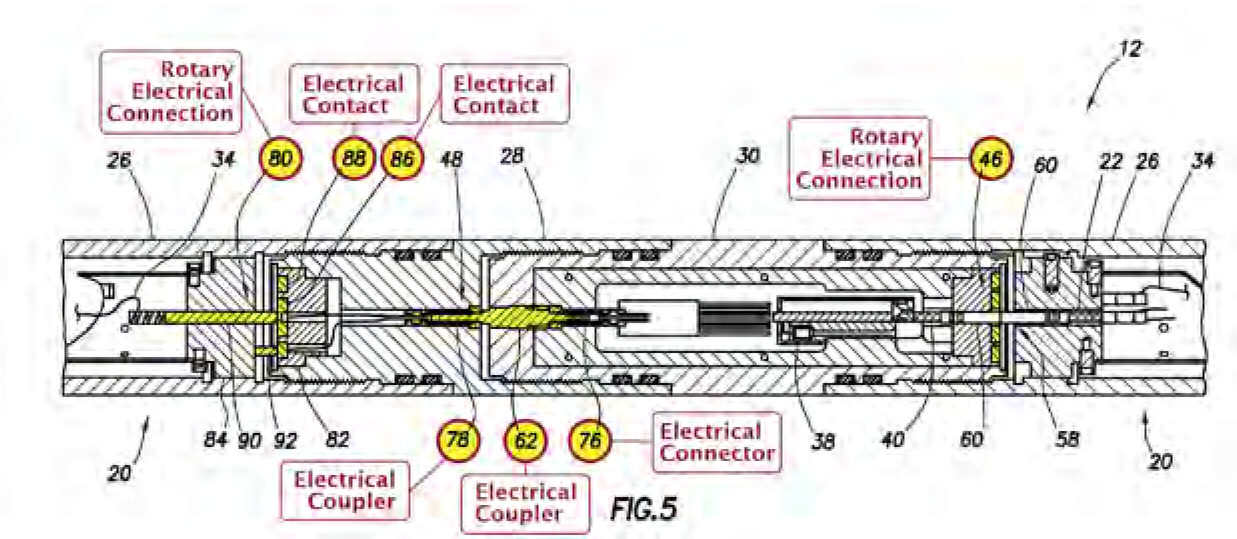


FIG.5

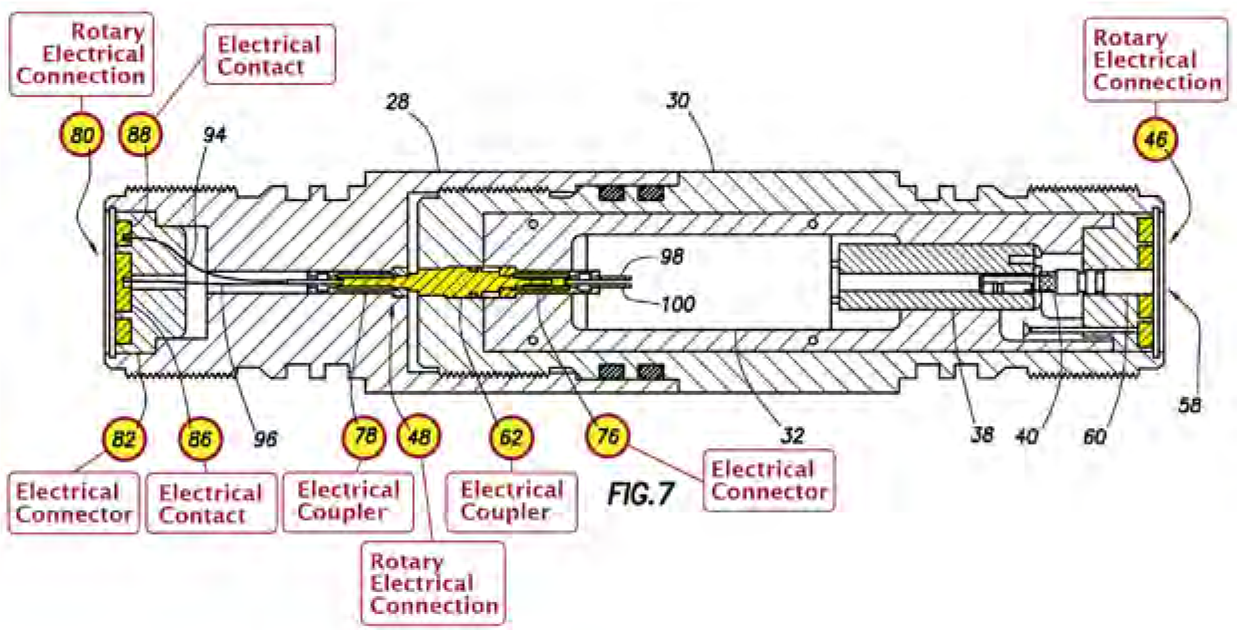


FIG.7

286. Schacherer teaches "[t]he electrical coupler 62 depicted in FIG. [3] includes electrical contacts 64, 66 at one end, and electrical contacts 68, 70 at another end. Contacts 64, 68 are electrically connected to each other, and contacts 66, 70 are electrically connected to each other." (Ex. 1004, Schacherer, 5:17-21, FIG. [3].) "Referring additionally now to FIG. 4, the electrical coupler 62 is representatively

illustrated as being installed in another configuration of the connector 30. Note that the coupler 62 is sealingly received in an end of the connector 30, so that if the explosive component 40 is detonated, pressure will not transfer to another explosive assembly 20 past the coupler 62." (Ex. 1004, Schacherer, 5:25-31.) "[T]he selective firing module 32 is electrically connected to the rotary electrical connection 48 via the mating couplers 62, 76." (Ex. 1004, Schacherer, 5:33-36.) The coupler 62 has electrical contacts 64, 66, 68, and 70 as shown below:

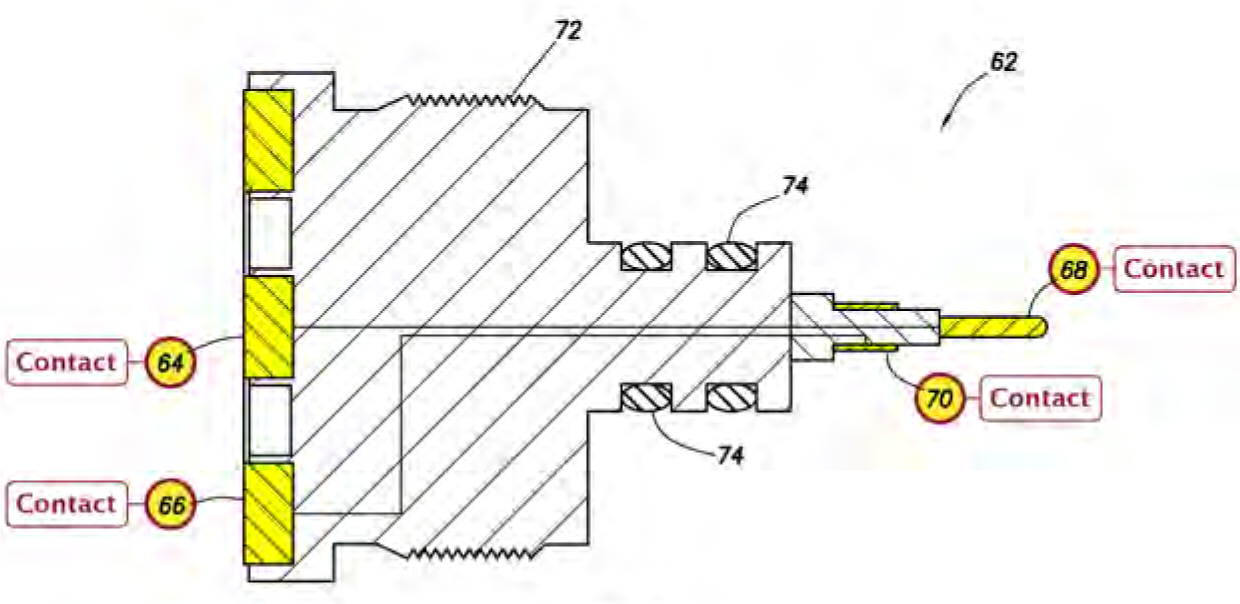


FIG.3

287. Thus, a POSITA would understand that the explosive assembly 20 has a connector 30 with rotary electrical connections 46 and 48 and electrical coupler 62.

288. "When the connectors 28, 30 are connected to each other, at least two electrical conductors 94, 96 in the connector 28 are electrically connected to at least two

respective conductors 98, 100 in the connector 30. The signal may be modulated on one set of the conductors 94, 98 or 96, 100, with the other set of conductors being a ground. Alternatively, a single set of conductors could be used for transmitting the signal, with the outer housings 26 and connectors 28, 30 being used for grounding purposes (if they are made of electrically conductive materials, such as steel, etc.)." (Ex. 1004, Schacherer, 6:13-22.) A POSITA would recognize that Schacherer teaches electrical contacts as construed and claimed in Claims 1 and 9.

289. Schacherer does teach "outer housing 26 in electrical contact with the wireless ground portion 46." Schacherer teaches that "a single set of conductors could be used for transmitting the signal, with the outer housings 26 and connectors 28, 30 being used for grounding purposes (if they are made of electrically conductive materials, such as steel, etc.)." (Ex. 1004, Schacherer, 6:18-22.) A POSITA would understand that electrical contact 70 and its associated conductors could be replaced by the connection directly to and between the outer housings, 26, 30, 28, and so on of Schacherer to convey the ground path of the communications circuit. A POSITA would be familiar with the methods, techniques, and devices used to transmit the ground path of a circuit through metallic outer housings of downhole tools as that is the standard ground path for downhole tools, including perforating guns. Furthermore, electrical connectors 82 and 84 are in direct ground contact with outer housings 26 in Schacherer. A POSITA would understand that, to implement that

teaching, the ground contact of electrical connections 46 and 80 would be electrically connected to the outer housings, 26, 30, 28, and so on to convey the ground path of the communications circuit. A POSITA would recognize that Schacherer teaches wireless electrical contacts so that the detonator can be electrically connected to a perforating gun without the need to connect or attach wires directly to each other as construed and claimed in Claims 1, 8, 9, 12, and 13.

D. Harrigan teaches wireless connectors

290. Ex. 1012, Harrigan teaches "[a]mong modular components, the gun may also include an initiator assembly module that is electrically coupled to a modular feedthrough with a connector." (Ex. 1012, Harrigan, Abstract; Ex. 1028, Harrigan Prov., pp. 5-7, FIGS. 4-6.) Harrigan further discloses, "[f]urther, each bulkhead 117, 118 may have a modular feedthru 119, 120 to ultimately provide electrically connectivity between internal components such as the initiator assembly module 125 and communications from surface. Thus, signature commands from surface may reach the initiator assembly module 125 to trigger perforating as noted above." (Ex. 1012, Harrigan, ¶ 0024; Ex. 1028, Harrigan Prov., pp. 5, 6, FIGS. 5, 5 (*sic*).) Harrigan also teaches, "rather than utilizing externally wired initiator and detonator components, manually wired to the gun 100 at the oilfield, a single pre-wired subassembly package 125 of such functionality may be plugged into the loading tube 115." (Ex. 1012, Harrigan, ¶ 0022; Ex. 1028, Harrigan Prov., pp. 3-5, FIGS. 2-4.) Harrigan teaches an "initiator

assembly module configured for plugging into the loading tube." (Ex. 1012, Harrigan, ¶¶ 0015-16, 0033, FIGS. 2A, 3A, 3B; Ex. 1028, Harrigan Prov., p. 5, FIG 4.) Harrigan teaches "a modular feedthru assembly [119, 120] is also provided that securably receives an electrical connector of the initiator assembly at an interface therebetween," "to ultimately provide electrically connectivity between internal components such as the initiator assembly module 125 and communications from surface." (Ex. 1012, Harrigan, ¶¶ 0010, 0024; Ex. 1028, Harrigan Prov., pp. 5-6, FIGS. 5, 5 (*sic*).) Harrigan teaches details of the feedthrough electrical contacts and a POSITA would understand that the initiator 125 would have complementary electrical contacts. (Ex. 1012, Harrigan, ¶ 0025; Ex. 1028, Harrigan Prov., p. 6, FIG. 5.) Harrigan infers the desirability of a system designed to reduce the number of electrical connections made at the oilfield. (Ex. 1012, Harrigan, ¶¶ 0008-9; Ex. 1028, Harrigan Prov., p. 3, FIG. 1.) The Harrigan Prov. teaches, "[s]pring-loaded connectors to prevent shock-related disconnections." (Ex. 1028, Harrigan Prov., p. 2.)

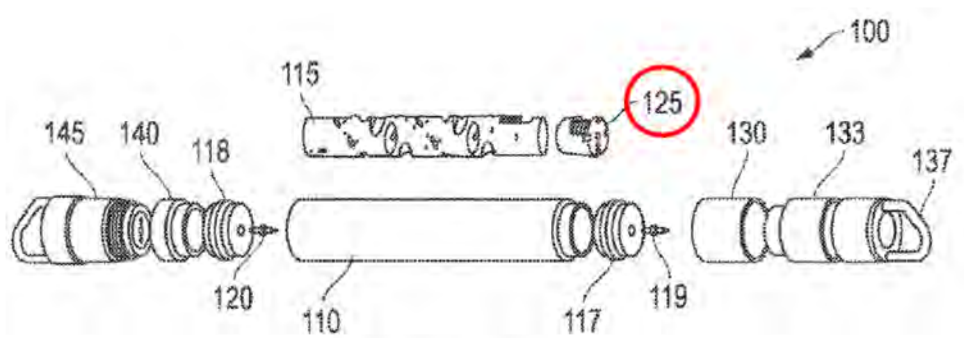


FIG. 1A

291. Harrigan explicitly teaches, "[i]n the view of FIG. 4A, an electrical connection 430 is shown that emerges from the face 425 of the module 125 for connection to a feedthru 119 as detailed further below." (Ex. 1012, Harrigan, ¶ 0042; Ex. 1028, Harrigan Prov., p. 4, FIGS. 2-3.) Harrigan also teaches, "[a] coupling 440 may be provided for securely receiving the module 125 as it is inserted within the tube ll5 and mated thereto. (Ex. 1012, Harrigan, ¶ 0039, FIGS 4A, 4B; Ex. 1028, Harrigan Prov., p. 7, FIG. 6.)

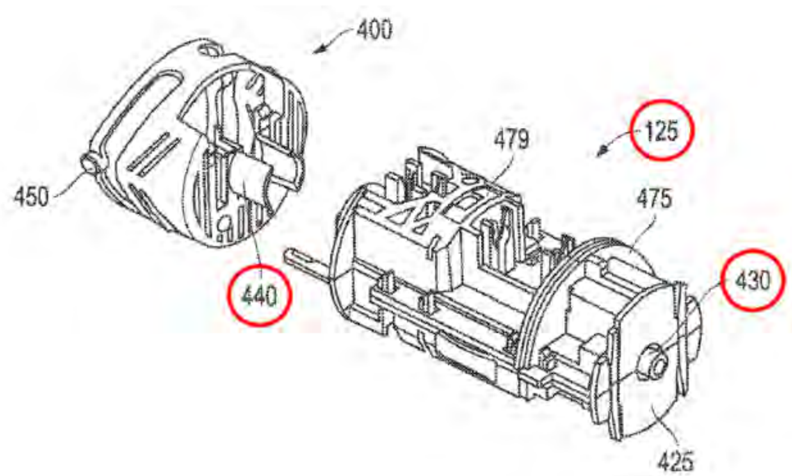


FIG. 4A

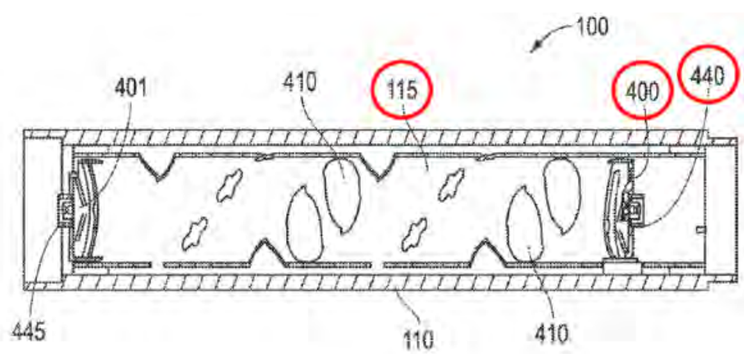


FIG. 4B

292. Harrigan provides detailed teaching about the possible construction of electrical connectors, including a pin in the center of the contact. (Ex. 1012, Harrigan, ¶¶ 0043-45, FIGS. 4A, 4B, 5A, 5B; Ex. 1028, Harrigan Prov., p. 6, FIG. 5.)

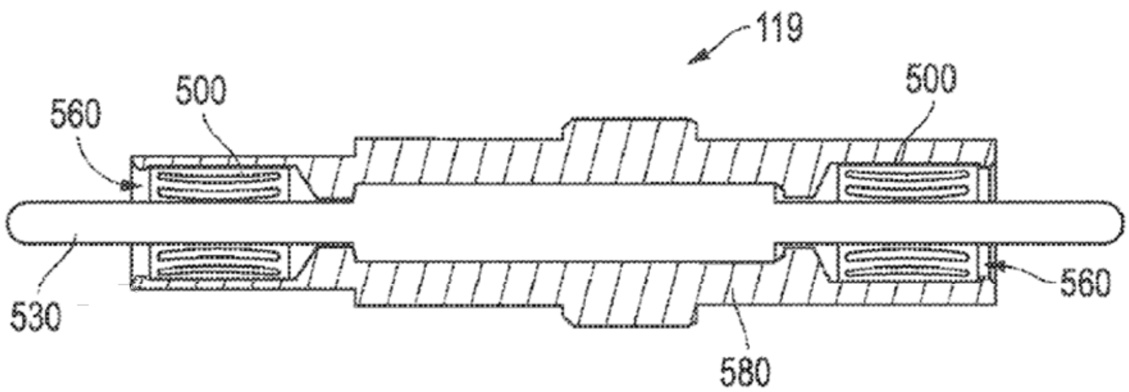


FIG. 5A

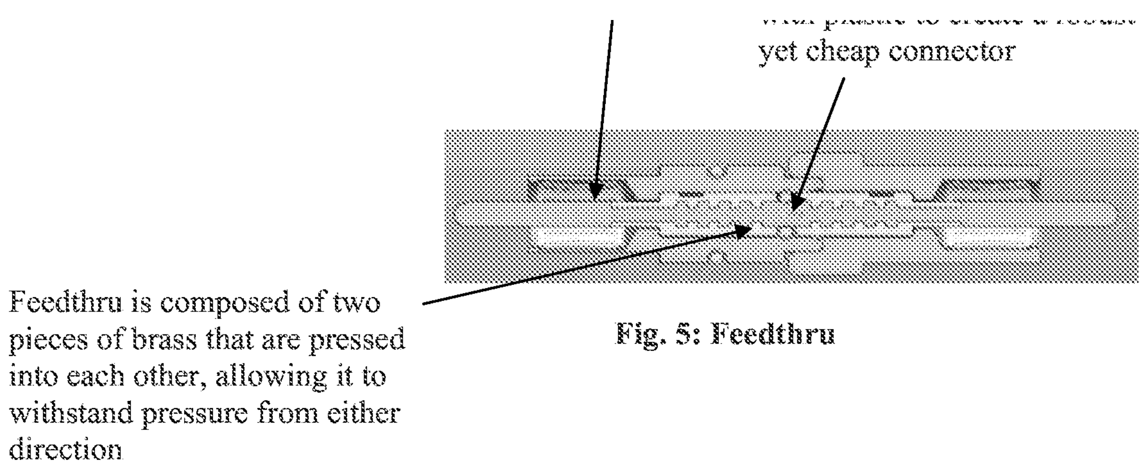


Fig. 5: Feedthru

293. Harrigan specifically teaches that, “secure ground contact is maintained.” (Ex. 1012, Harrigan, ¶ 0043.) A POSITA would recognize FIG. 5A and 5B of Harrigan as teaching a two conductor coaxial connector, similar to an RCA connector. (Ex. 1012, Harrigan, ¶¶ 0043-45, FIGS. 4A, 4B, 5A, 5B; Ex. 1028, Harrigan Prov., pp. 4-7, FIGS. 2, 5, 5 (*sic*), 6.)

294. Harrigan teaches a pre-wired initiator assembly 125, meaning an initiator assembly with electrical contacts as described. (Ex. 1012, Harrigan, ¶¶ 0022, 0027, Claims 12, 15; Ex. 1028, Harrigan Prov., p. 3.) Harrigan teaches pre-wiring the loading tube with a feed through wire (communicative line). (Ex. 1012, Harrigan, ¶ 0032; Ex. 1028, Harrigan Prov., p. 3.)

295. A POSITA would recognize that Harrigan teaches an initiator module 125 that would require at least 3 electrical contacts to function as described. A POSITA would understand that the electrical contacts on initiator module 125 would provide for a signal in to the initiator, a signal through the initiator to a next initiator, and a ground connection.

296. A POSITA would recognize that Harrigan teaches wireless electrical contacts so that the detonator can be electrically connected to a perforating gun without the need to connect or attach wires directly to each other as claimed in Claims 1, 8, 9, 12, and 13.

E. Rogman teaches wireless connectors

297. Ex. 1014, Rogman teaches, "[t]he first and second bulkheads 114, 116 can also include one or more coaxial conduits adapted to allow a coaxial cable, such as a power cable or any other wiring, to pass through the first and second bulkheads 114, 116 while maintaining fluid isolation of the loading tube 110 and space between the carrier 102 and the loading tube 110." (Ex. 1014, Rogman, ¶ 0019.) Rogman teaches, "[t]he initiator assembly 112 can include a circuit board... the circuit board can communicate with a surface computer... the circuit board can also connect the detonator 402 to a power cable on command." (Ex. 1014, Rogman, ¶ 0031.) Upon viewing FIGS. 1, 3 and 5, a POSITA would recognize that all electrical communication, contacts and connections required for the gun system to function properly, including signal-in, through wire and ground, are completed upon connecting or screwing multiple gun assemblies together, without the need to manually attach wires. (Ex. 1014, Rogman, FIGS. 1, 3, and 5.)

298. Rogman and Rogman Prov. teach a loading tube pre-wired with a feed through wire (power cable 502) (Ex. 1014, Rogman, ¶¶ 33-36; Ex. 1020, Rogman Prov., pp. 1, 2, 4, 5, 7.) Rogman teaches, "multi-use connectors such as an RCA jack" for connecting the circuit board to the power cable. (Ex. 1014, Rogman, ¶ 31.) Rogman Prov. teaches, "pre-assembled coaxial or twisted pair cables with integrated connectors," and a coaxial connector a POSITA would recognize as an RCA jack

and teaches using such a connector on both sides of the initiator. (Ex. 1020, Rogman Prov., pp. 1, 4, 7, 8.) Rogman teaches pass-through communications from a first initiator to a second initiator. (Ex. 1020, Rogman Prov., pp. 3, 7, 8.) A POSITA would recognize the power cable 502 of Rogman as a multi-conductor coaxial cable, as would be appropriate for use with the RCA jack disclosed in Rogman. (Ex. 1014, Rogman, ¶¶ 33-36, FIG. 6; Ex. 1020, Rogman Prov., pp. 1, 5, FIGS. 1, 6.) A POSITA would understand that the two conductors of such a cable are typically known as a “signal line” and a “ground line”. A POSITA would understand that the power cable and RCA jacks of Rogman and Rogman Prov. would provide for a signal in to the initiator 112, a signal through the initiator 112 to a next initiator 112, and a ground connection.

299. Rogman teaches insulation displacement connectors IDCs for connecting the detonator to the circuit board and the circuit board to the power cable, which also meet the wireless electrical contact limitations. (Ex. 1014, Rogman, ¶ 31, Claims 5, 17, 18; Ex. 1020, Rogman Prov., p. 3, FIG. 4.)

300. A POSITA would understand and conclude that Rogman teaches wireless electrical contacts so that the detonator can be electrically connected to a perforating gun without the need to connect or attach wires directly to each other as construed and claimed in Claims 1, 8, 9, 12, and 13.

F. EWAPS teaches wireless connectors

301. Ex. 1013, EWAPS teaches a signal-in (hot), ground, and feed-thru wires associated with an addressable switch and detonator. (Ex. 1013, EWAPS, p. 6.) EWAPS on page 0010 teaches mating coaxial connectors (pins and barrels) in the bulkheads and corresponding ends of the plastic loading tube, as well as a wire channel along the plastic loading tube to enjoin the coaxial electrical connections, corresponding to signal-in and through wire contacts. (Ex. 1013, EWAPS, p. 0010.) A POSITA would recognize the connectors in EWAPS as RCA connectors. A POSITA would recognize that the ground contact is completed merely by connecting the several gun assemblies together as the bulkheads and gun carriers are conducting metal as illustrated on page 0009. The connections are completed by attaching or screwing one gun assembly to the next with no manual attachment of wires required. (Ex. 1013, EWAPS, p. 0009) A POSITA would understand that the electrical contacts on the initiator, bulkheads, and loading tube of EWAPS would provide for a signal in to the initiator, a signal through the initiator to a next initiator, and a ground connection.

302. A POSITA would recognize that EWAPS teaches electrical contacts so that the detonator can be electrically connected to a perforating gun without the need to connect or attach wires directly to each other as construed and claimed in Claims 1, 8, 9, 12, and 13.

G. Black teaches wireless connectors

303. Ex. 1002, Black teaches an arming device 26, including a detonator 28, firing electronics 30 (such as an addressable switch), electrical connector 32 and an electrical connector opposite connector 32. (Ex. 1002, Black, ¶¶ 0024-26, FIGS. 8, 9.) Black teaches that electrical connectors of arming device 26 can be RCA connectors. (Ex. 1002, Black, ¶ 29.) A POSITA would understand that an RCA connector has two conductive electrical contacts, an inner pin and outer ring.

304. A POSITA would understand that a ground or return contact would be required for the firing electronics 30 of Black to function properly. An electrical circuit requires at least two conductors to each component, one towards and one away, or inductive, radio, or other "wireless" transmission replacing one or more of those legs.

305. A POSITA would understand the detonator 28 and firing electronics 30 to each require at least two conductors connecting them to the firing and communications circuit. Accordingly, a POSITA would read Black's electrical connectors 32, 24 and conductors 33, 22 as containing paired conductors, such as coaxial or twisted pair conductors and contacts as would be used with the disclosed RCA connectors. A POSITA would understand Black to teach a signal-in electrical contact and electrical path to the addressable switch, a signal out, or through electrical contact and electrical path from the addressable switch to a next perforating gun, and a ground or return electrical contact and electrical path from the addressable switch to

complete the necessary communications circuit for addressable perforating and function as described.

306. The detonator connections of Black are completed by attaching or screwing one gun assembly to the next with no manual attachment of wires required. (Ex. 1002, Black, ¶¶ 37-41, FIGS. 1-10.) A POSITA would understand that the electrical contacts on the arming device 26, bulkheads 66, and loading tube 7 of Black would provide for a signal in to the arming device 26, detonator 28, and firing electronics 30, a signal through the arming device, to a next arming device, and a ground connection.

307. A POSITA would recognize that Black teaches electrical contacts so that the detonator can be electrically connected to a perforating gun without the need to connect or attach wires directly to each other as construed and claimed in Claims 1, 8, 9, 12, and 13.

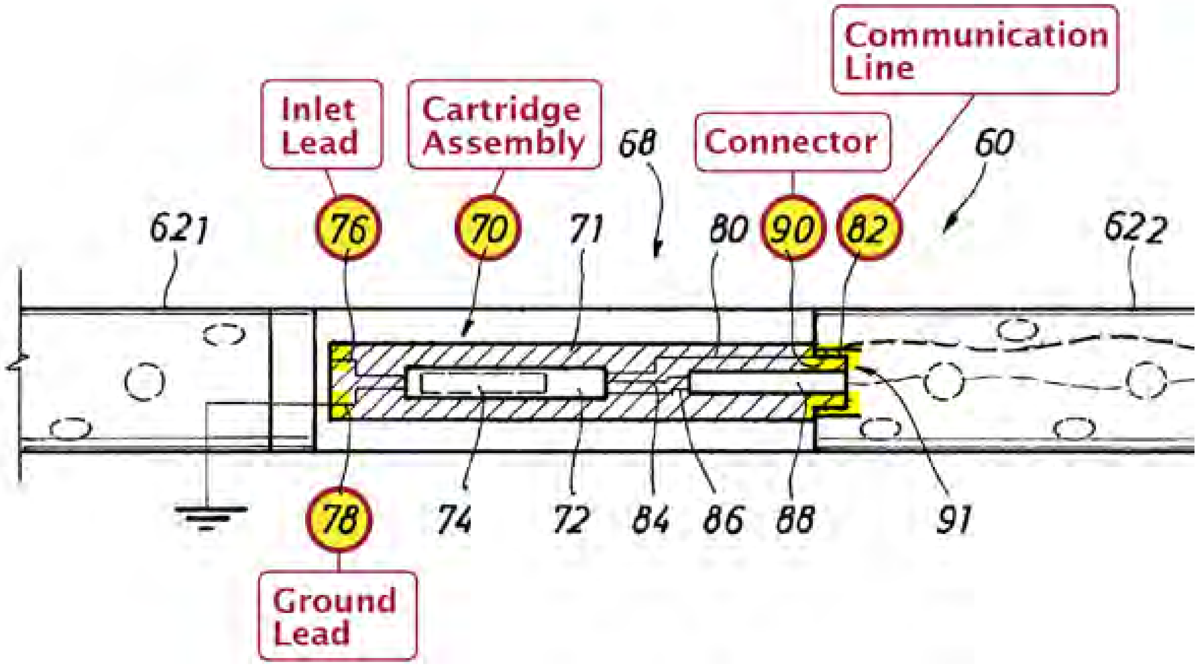
H. Lanclos teaches the wireless limitations

308. Ex. 1015, Lanclos discloses "the switch assembly 72 regulates transmission therethrough of electrical signals through the switch assembly 72." (Ex. 1015, Lanclos, 5:1-4.) The switch assembly 72 is shown in FIG. 3 and described as having an inlet lead 76, a ground lead 78 and a supply lead 80. (Ex. 1015, Lanclos, 5:5-11.)

309. The cartridge sub 68 is described as having a "connector 90 axially inserts within an annular electrical receptacle 92... the electrical receptacle is electrically conductive, so that the combination of the electrical receptacle 92 and connector 90 provides an

electrical coupling between the exit lead 80 and the communication line 82." (Ex. 1015, Lanclos 5:41-47.) The connection assembly is described as being "made up of a disc-like flange member set into close contact with the spring connector." (Ex. 1015, Lanclos 6:54-56.)

310. One example embodiment for connecting the cartridge sub 68 to a perforating gun may include a "rod and pin connector, where the pin connector is mounted on a free end of the rod." (Ex. 1015, Lanclos, 5:41-47.) It goes on to further explain that "[c]oaxially projecting from the end of the cartridge sub 68 and adjacent the detonator 88 is a spring connector; the spring connector communicates with the downstream connector by connection through the end wall at the downstream end of the sub 68." (Ex. 1015, Lanclos, 6:33-37.) "The spring connectors can provide connectivity on the upstream and downstream sides of the cartridge sub 68." (Ex. 1015, Lanclos, 6:38-39.) In operation "a signal traveling through the signal wire is transmitted through the terminals to the pin connector for delivery to the switch assembly." (Ex. 1015, Lanclos, 6:48-50.) The location of the electrical contacts are shown highlighted in FIG. 3 below:



311. Lanclos describes multiple ways to make electrical contact without manually or physically making a connection through soldering, twisting wires together and taping, attaching a terminal connector, or other such similar manual action. Specific examples of electrical contacts taught in Lanclos are rod and pin connectors, coaxial connectors, flange connectors. (Ex. 1015, Lanclos, 5:35-36, 5:46-47, 6:19-37, 6:38-65.) Lanclos also teaches the use of "wireless" spring connectors on upstream and downstream ends of cartridge sub 68.

312. A POSITA would recognize that Lanclos teaches electrical contacts so that the detonator can be electrically connected to a perforating gun without the need to connect or attach wires directly to each other as construed and claimed in Claims 1, 8, 9, 12, and 13.

I. Goodman teaches wireless connectors

313. Goodman teaches that its detonator may include an addressable switch, a fireset and an initiator. (Ex. 1018, Goodman, ¶¶ 0005-6, 0016, 0018, 0020.) Goodman teaches a detonator/initiator 15, 45, and 47 having electrical connectors for engaging with receptacle 18 and an electrical receptacle 17 for connecting connectors 11, 12, 43, and 44. (Ex. 1018, Goodman, ¶¶ 0005-7, 0018-20, 0023-24, FIGS. 1-5.) A POSITA would find it inherent in Goodman to have electrical connectors on the initiator to engage with receptacle 18 to make the device of Goodman functional.

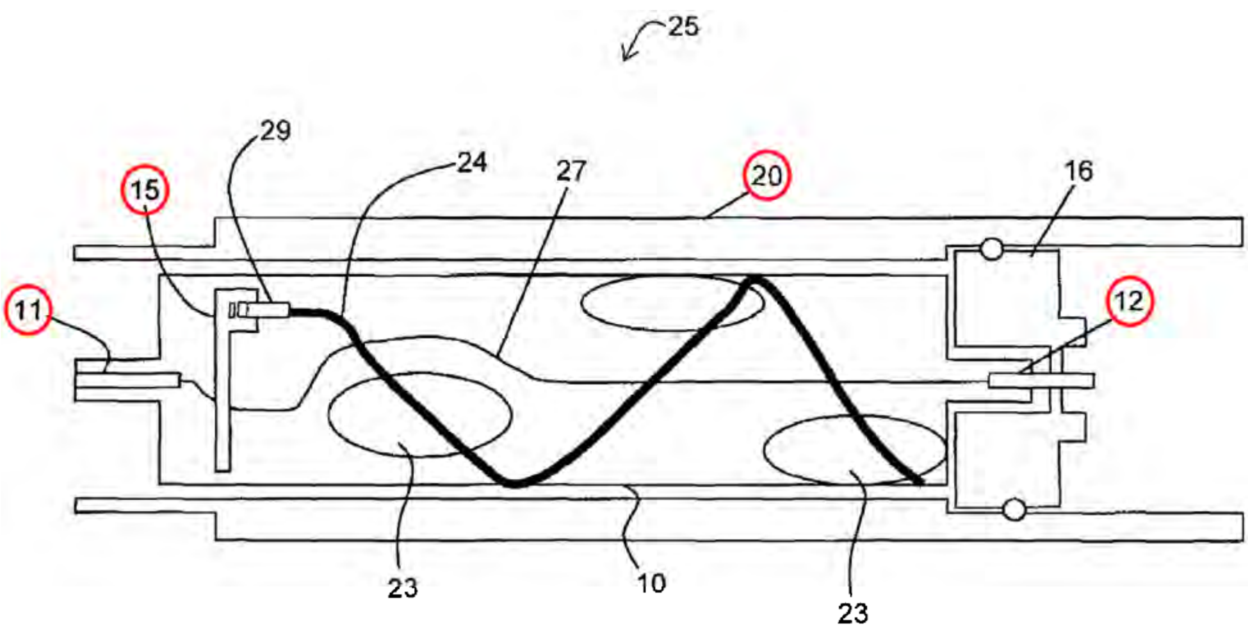


FIG. 2

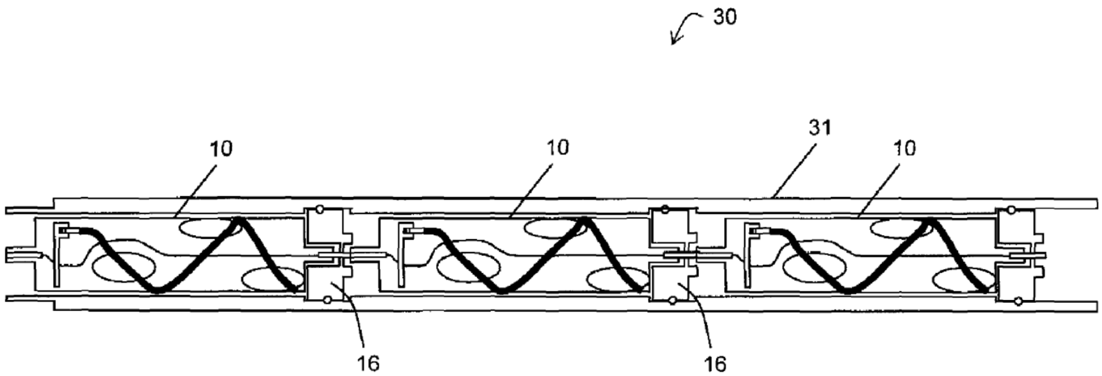


FIG. 3

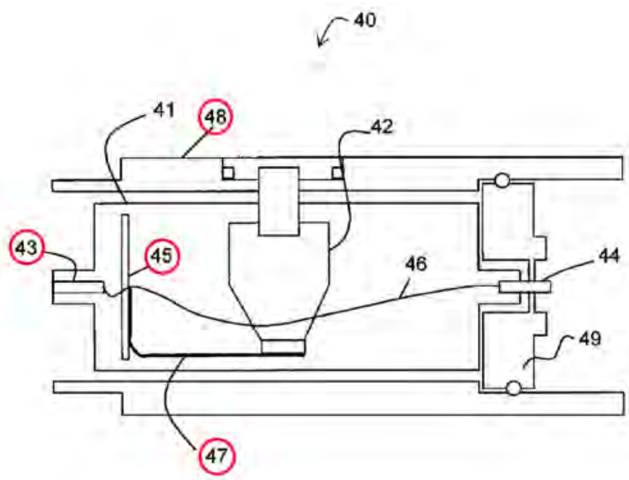


FIG. 4

314. A POSITA would recognize that Goodman's addressable detonator would require at least 3 electrical contacts to function as described. A POSITA would understand that the electrical contacts on Goodman's addressable detonator would provide for a signal in to the initiator, a signal through the initiator to a next initiator, and a ground connection. Goodman discusses that one issue with previous systems was "the

connection of a number of wires in a very small space." A POSITA would understand that a ground or return contact would be required for the addressable detonator of Goodman to function properly. An electrical circuit requires at least two conductors to each component, one towards and one away, or inductive, radio, or other "wireless" transmission replacing one or more of those legs. A POSITA would understand the detonator and addressable switch to each require at least two conductors connecting them to the firing and communications circuit. Accordingly a POSITA would read Goodman's electrical connectors 11, 12, 43, and 44 and wiring 27 and 46 as each containing paired conductors, such as coaxial or twisted pair conductors and contacts as would be used with RCA connectors. A POSITA would understand Goodman to teach a signal-in electrical contact and electrical path to the addressable switch, a signal out, or through electrical contact and electrical path from the addressable switch to a next perforating gun, and a ground or return electrical contact and electrical path from the addressable switch to complete the necessary communications circuit for addressable perforating and function as described.

315. A POSITA would recognize that Goodman teaches wireless electrical contacts so that the detonator can be electrically connected to a perforating gun without the need to connect or attach wires directly to each other as claimed in Claims 1, 8, 9, 12, and 13.

J. Bonavides teaches the wireless limitations

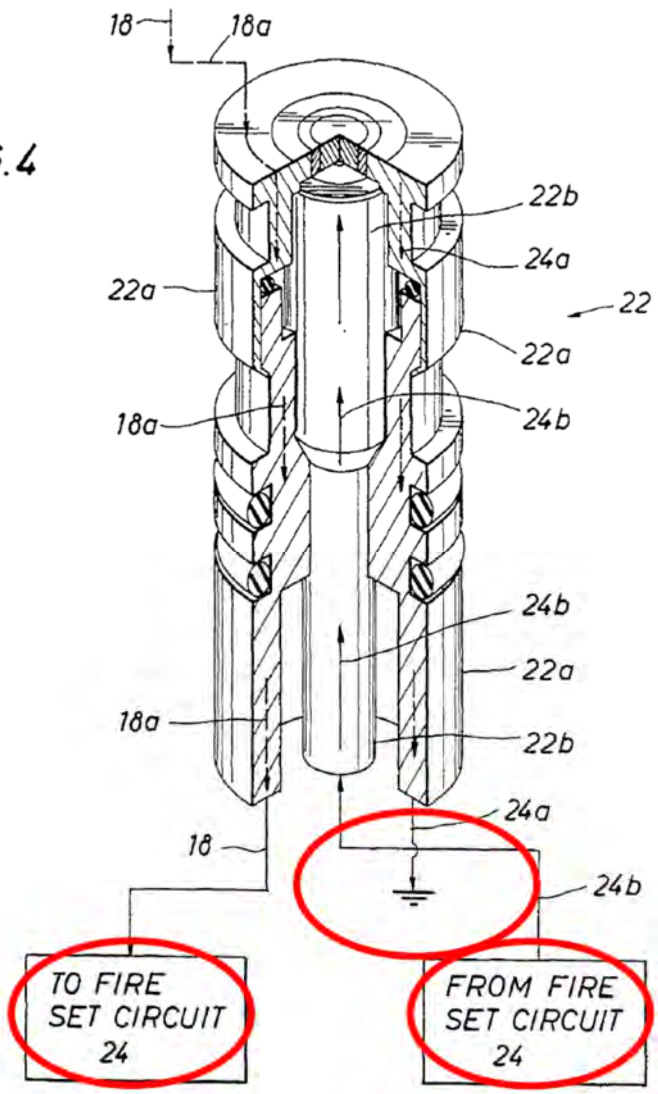
316. Ex. 1017, Bonavides teaches that it is well known in the art to use the tubular bodies of perforating guns, subs, and related tools to transmit the ground path of a circuit in a tool string. (Ex. 1017, Bonavides, 2:42-45, 14:51-53.) Therefore, Bonavides teaches electrical ground contact(s) throughout a tool or perforating gun string.

317. A POSITA would recognize that the prior art of each of the examples of EWAPS, Rogman, Harrigan, Schacherer and Lanclos teach the Claims 1, 9, and 13 limitation of, "a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector…." If a POSITA had any doubt about the efficacy of electrical ground contact or continuity, he/she would look to Bonavides to provide assurance of an electrical ground presence throughout.

K. Lerche '278 and '929 teach wireless connectors

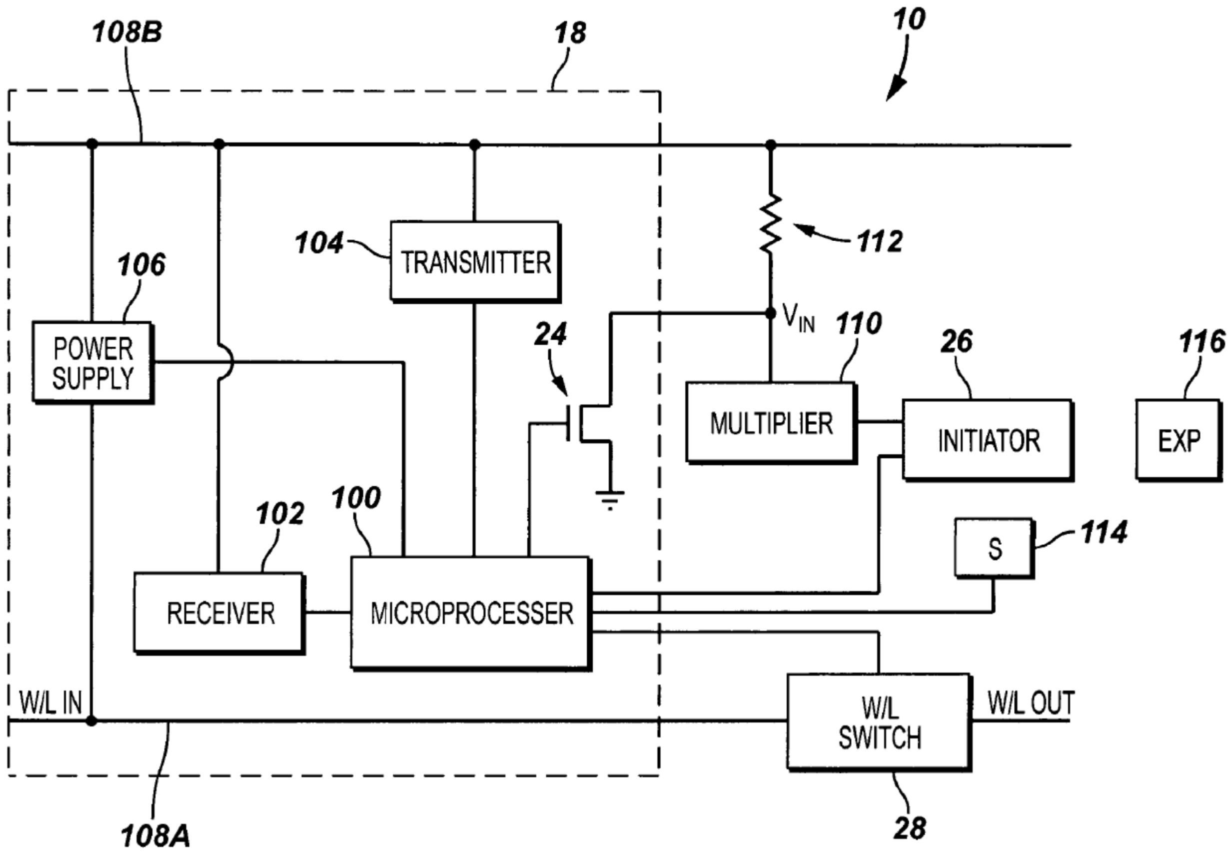
318. Lerche '929 teaches a detonator having electrical contacts and no wires. (Ex. 1016, Lerche '929, 4:47-5:14, FIGS. 4, 8A, 10-12.)

FIG. 4



319. Lerche '278 teaches that addressable detonators require at least three electrical connections: a wireline in (signal-in), a wireline out (through wire), and a ground/return 108B. (Ex. 1011, Lerche '278, 4:52-58, FIGS. 1-2.)

FIG. 2



320. It would be obvious to a POSITA to modify Lerche ‘278 to include electrical contacts taught by Lerche ‘929. Such a substitution would be the predictable application of known methods to the disclosure of Lerche ‘278 without any unexpected results, simple substitution of the known electrical contacts for the wires taught, the use of known hollow carrier perforating guns for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of electrical connections and connectors that are available with a reasonable expectation of success.

L. Brooks teaches wireless connectors

321. Brooks teaches an addressable detonator that connects with "a standard plug 814." (Ex. 1021, Brooks, 7:24-39, 8:33-9:9, FIGS. 8A, 8B.) A POSITA would understand that the electrical contacts of the standard plug 814 of Brooks would provide for a signal in to the initiator, a signal through the initiator to a next initiator, and a ground connection.

322. A POSITA would recognize that Brooks teaches electrical contacts so that the detonator can be electrically connected to a perforating gun without the need to connect or attach wires directly to each other as construed and claimed in Claims 1, 8, 9, 12, and 13.

M. The wireless limitation is within the common knowledge of a POSITA.

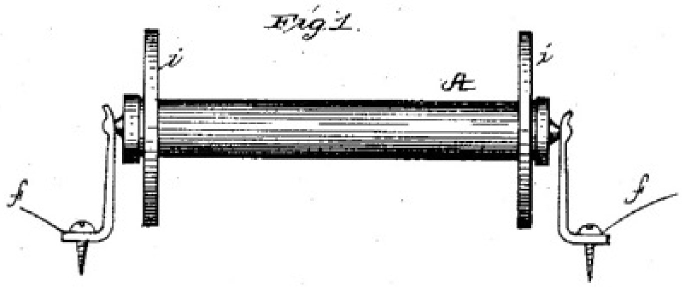
323. A POSITA would understand that completing electrical power connections or signal communications by contacting the elements that are to be enjoined together rather than manually joining the elements together by twisting wires or screwing or threading connectors would be easier, less time consuming, and less prone to error. For example, standard commercially available AA and other similar style batteries complete their connections simply by contact. The same is true for electrical extension cords plugging into power receptacles and other electrical extension cords. The concept and practice has been known for well over 100 years, at least since

Thomas A. Edison's US Patent 438,305 "Fuse Block", filed October 14, 1885, published / granted October 14, 1890.

324. The '938 Patent does not describe what is different or novel about the wireless claim(s) versus prior art, nor does it define what is meant by "wireless."

325. An example which illustrates the "wireless connectors" concept can be found with every AAA, AA, B, C and D type storage battery, and countless other battery types and devices in common use worldwide for many decades. All of their final electrical connections are made "wirelessly" merely by contact, i.e., without manually making the last wired connection and thus having "wireless connectors". The wires and circuitry are still in all of their mating devices but the component of comparison interest (e.g., battery) is installed without making the last physical wiring connection "manually", but by merely inserting the device into a battery holder and touching its ends to the electrical contacts. In common everyday use; billions of batteries.

326. Another example illustrating the commonality of the "wireless" concept can also be found with every automotive fuse in use over the past several decades, and of several different models of fuses. Again, billions of fuses in everyday use worldwide for decades. The fuse connections to the circuit are by contact, not wireless, but by "wireless" and wires are present and necessary within their respective fuse boxes to complete the circuit.



327. Figure 1 above discloses one of the earliest, if not the earliest, examples of electrical fuses using “wireless” connections to their respective component circuitry and fuse holding mechanism. (Ex. 1025, Thomas A. Edison, FIG. 1)

328. Modern automotive fuses with “wireless” connections complete their connections to a circuit by contact or insertion, and wires or conductors are present and necessary within their respective fuse boxes to complete the circuit. (Ex. 1026, Seibang Oh.)

329. A POSITA could believe that many others have used such “wireless connectors” within their products without making that feature a claim of innovation to pursue and obtain a US patent for an otherwise unpatentable product.

330. A POSITA would find it obvious, either individually or where needed in combination, to look to the prior art “wireless connectors” of Schacherer, Lanclos, Lerche ‘929, Wikipedia’s disclosure of common commercial AAA, AA, B, C or D batteries, Thomas A. Edison, and Seibang Oh, to teach “wherein the detonator assembly is configured to be electrically contactingly received within a detonator positioning assembly within the perforating gun assembly without using the wired electrical connection, . . .” as claimed in the ‘938 Patent.

XII. Insulator limitations – Claim 1 limitation of "an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector…", Claim 9 limitation of "an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector…", and Claim 13 limitation of "an insulator electrically isolating the wireless signal in connector from the wireless through wire connector;"

331. Claim 1 in the '938 Patent includes the limitation "**an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector…**." (Ex. 1001, the '938 Patent, 11:26-27.) Claim 9 includes the limitation "**an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector….**" (Ex. 1001, the '938 Patent, 12:4-5.) Claim 13 includes the limitation "**an insulator electrically isolating the wireless signal in connector from the wireless through wire connector….**" (Ex. 1001, the '938 Patent, 12:49-50.)

A. The insulator limitation is not supported in the written description

332. The '938 Patent never describes "an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector." The '938 Patent's only discussion of any insulator in a detonator describes insulating elements 120A and 120B "for the purpose of insulating the detonator head 100 and the detonator wires 104 from surrounding components." (Ex. 1001, the '938 Patent, 8:19-22.) FIG. 28 of the '938 Patent shows insulating element 120A between a bulkhead connector element 118 and a ground contact element 114 and insulating element 120B between

ground contact element 114 and through wire connector element 112. (Ex. 1001, the '938 Patent, 8:6-22.) This does not appear to show an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector.

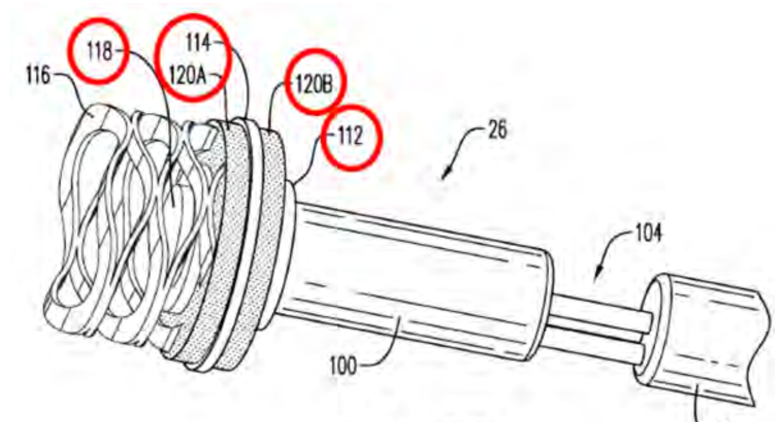


FIG. 28

333. Further, Figure 35A of the '938 Patent, an "electrical schematic view of a detonator," shows all three of the wires 104 continuing past insulating elements 120A and 120B to the bulkhead connector element 118. (Ex. 1001, the '938 Patent, 4:60-62, 8:6-22, FIG. 35A.) If an insulator is supposed to separate item 118 from item 112, then figure 35A, the only drawing in the '938 Patent that alleges to show the inside of the detonator, is misleading at best.

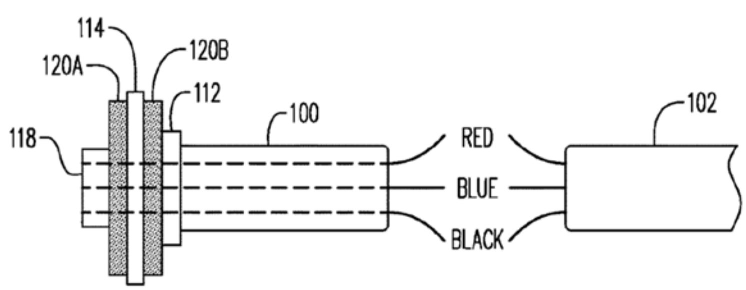


FIG. 35A

334. Because the ‘938 Patent never describes an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector, and instead describes different arrangements and functions, it does not reasonably convey to those skilled in the art that the inventor had possession of the claimed subject matter.

335. For the reasons discussed above, the terms “wireless signal-in connector” and the “wireless through wire connector,” introduce uncertainty into the claims, meaning any claim terms and claims that incorporate them fail to inform those skilled in the art about the scope of the invention with reasonable certainty.

B. Claim construction of the term “insulator”

336. A POSITA’s best guess interpretation of this limitation would be an insulator positioned between two electrical contacts of a detonator.

C. Common knowledge of a POSITA regarding the insulator limitations

337. A POSITA’s common knowledge includes the use of electrical contacts generally, including to replace “wired connections.” The purpose of electrical contacts, in all of their forms, is to reduce manipulation of wire when making electrical connections. A POSITA’s common knowledge would include the separation of all electrical contacts by insulators. If electrical contacts are not separated by insulators, then they cannot function independently to provide different functions or paths in the circuit. This is true for every electrical connector including: a wall outlet, HDMI connectors,

USB connectors, a coaxial cable jack, RCA jacks, banana plugs, ring terminals, spade terminals, etc., each of which would be within the common knowledge of a POSITA. A POSITA's common knowledge would include the use of addressable switches with detonators and their requirement for three conductors providing an input path, a ground or return path, and a communications path to the next switch and/or detonator, as also taught by Lerche '278, Lerche '868, and Lerche '090. (Ex. 1023, Lerche '868, FIGS. 13, 15, 19A; Ex. 1024, Lerche '090, FIGS. 13, 15, 19A.) A POSITA's common knowledge would include the necessity of separating these conductors with insulators for the devices to function properly. A POSITA would understand that insulators used to electrically isolate electrical contacts would have the benefits of preventing wires and electrical connections within a perforating gun string, or any other functioning electrical device, from shorting to each other. A POSITA knows that electrical contacts must be separated by an insulator to act as separate contacts and that an insulator can support conductors in connectors. You simply cannot have two or more independent electrical circuits without an electrical insulator between them. A POSITA would understand that there are a limited number of identifiable and predictable means of separating electrical conductors, all of which require an insulator between the conductors, either air or an insulating material. A POSITA would understand that there are a limited number of identifiable and predictable types of electrical connections, all of which require an insulator between the conductors. A POSITA would have a reasonable expectation of success adapting an electrical connection or insulator from one perforating gun to another.

338. The ‘938 Patent does not describe what is different or novel about the insulator claims versus prior art.

339. Accordingly, the use of a detonator assembly having three electrical contacts with insulators between them so that the detonator can be electrically connected to a perforating gun without the need to connect or attach wires directly to each other was within the common knowledge of a POSITA when the ‘938 Patent was filed.

D. Schacherer teaches the insulator limitations

340. Ex. 1004, Schacherer teaches using an insulator. Schacherer teaches “[t]he electrical coupler 62 depicted in FIG. [3] includes electrical contacts 64, 66 at one end, and electrical contacts 68, 70 at another end. Contacts 64, 68 are electrically connected to each other, and contacts 66, 70 are electrically connected to each other.” (Ex. 1004, Schacherer, 5:17-21, FIG. 3.) A POSITA would know and/or recognize that 64 and 68 are electrically insulated from 66 and 70.

341. Schacherer teaches “[w]hen the connectors 28, 30 are connected to each other, at least two electrical conductors 94, 96 in the connector 28 are electrically connected to at least two respective conductors 98, 100 in the connector 30. The signal may be modulated on one set of the conductors 94, 98 or 96, 100, with the other set of conductors being a ground.” (Ex. 1004, Schacherer, 6:13-18.) A POSITA would

know and/or recognize that 94 and 98 must be electrically insulated from 96 and 100. A POSITA would understand that the line-in contacts on one end of the connector 30 taught by Schacherer would be insulated from the other line or circuit contact on the other and of connector 30, and further insulated through the body of rotary electrical connection 46 and electrical coupler 62. It is also inherent that a POSITA would recognize in FIG. 3 of Schacherer that the structure located between the contact 70 and contact 68 is an insulator.

342. A POSITA would recognize that the bodies of these items must have electrical insulators in order for electrical contacts in those items to function as described in the Schacherer disclosure. A POSITA would recognize that Schacherer teaches, "an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector…." as claimed in the limitation language of Claims 1 and 9. A POSITA would recognize that insulators between the various electrical components, contacts and devices are inherently necessary for the system described in Schacherer to function as described. Therefore, either explicitly or inherently, Schacherer discloses the insulator claim element of Claims 1, 9, and 13.

343. Ex. 1010, Final Written Decision declares that Schacherer met the insulator limitation of representative claim 1 of US Patent 9,581,422. The insulator limitations of US Patent 9,581,422 are similar to those of the '938 Patent. The Final Written Decision states, "[i]n the end, when accounting for the undisputed level of skill in

the art—an advanced degree in electrical engineering and five years of experience working with perforating guns—we find that a skilled artisan clearly would have understood that any and all electrical contacts within Schacherer's detonator assembly are necessarily electrically insulated from each other in order that the detonator assembly may function properly and safely… We find it difficult to imagine any circumstance in which a skilled artisan would overlook the inherent necessity of insulating electrical contacts within a detonator assembly where, as DynaEnergetics' own expert admits, "[s]afety is paramount in the design and operation of these highly energetic systems and extensive precautions are taken to protect personnel handling guns prior to installing them in the wellbore." Ex. 2004 ¶ 25. That testimony, along with the evidence discussed above, persuades us that Schacherer inherently meets the "insulator" limitation of representative claim 1. See Pet. 41–44." (Ex. 1010, Final Written Decision, p. 24.) During prosecution the Examiner found the prior art disclosure of U.S. 9,677,363 (also issued to Schacherer) teaches "an insulator (see Fig. 3, annotated below, wherein the insulator is the material positioned between electrical contacts 64, 66 and connectors 68, 70 to facilitate conductive signal paths from 66 to 70 and from 64 to 68 respectively) electrically isolating the wireless bulkhead connector portion 64 from the wireless through wire connecting portion 66." (Ex. 1008, File History, pp. 83-84).

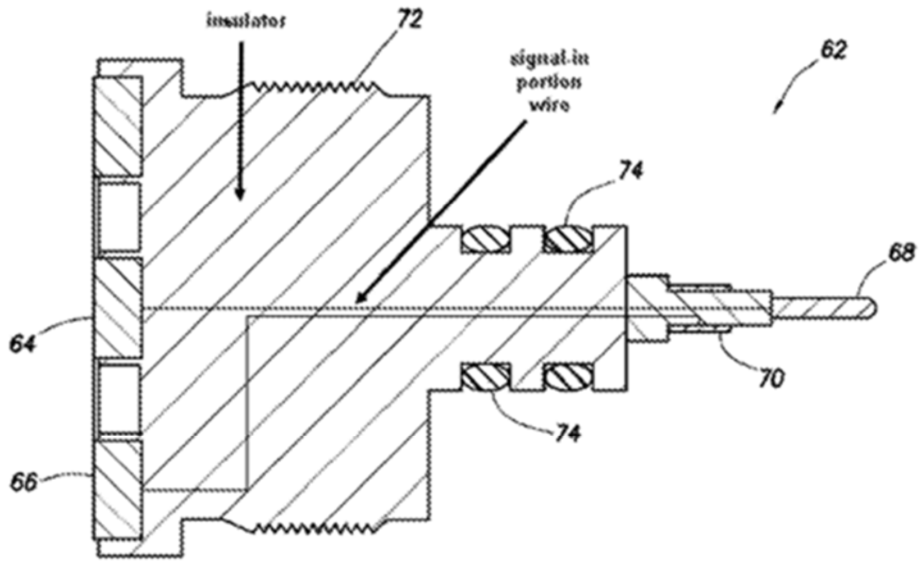


FIG.3

E. Harrigan teaches the insulator limitations

344. Ex. 1012, Harrigan teaches an insulator. Harrigan teaches "[w]ith added reference to FIG. 4B, the connector 530 may be secured to the electrical connection 430 of the initiator assembly module 125 and to a crossover 130 at another end thereof (see FIG. 1A.) Thus, a body portion 580 of the feedthru 119 provides structural support for the electrical path that runs from the module 125 and through the feedthru 119. In one embodiment, the connector 530 is largely plastic that is molded over a central electrical pin." (Ex. 1012, Harrigan, ¶ 0044; Ex. 1028, Harrigan Prov., p. 6, FIG. 5.) A POSITA would know and recognize that the plastic that is molded over the central electrical pin also functions as the necessary insulator because plastic is electrically non-conductive (absent fillers designed specifically to make it conductive).

345. Harrigan explicitly teaches "In the view of FIG. 4A, an electrical connection 430 is shown that emerges from the face 425 of the module 125 for connection to a feedthru 119 as detailed further below." (Ex. 1012, Harrigan, ¶ 0042; Ex. 1028, Harrigan Prov., p. 4, FIG. 3.) Harrigan also teaches "A coupling 440 may be provided for securely receiving the module 125 as it is inserted within the tube ll5 and mated thereto. (Ex. 1012, Harrigan, ¶ 0039, FIGS 4A, 4B; Ex. 1028, Harrigan Prov., p. 7, FIG. 6.)

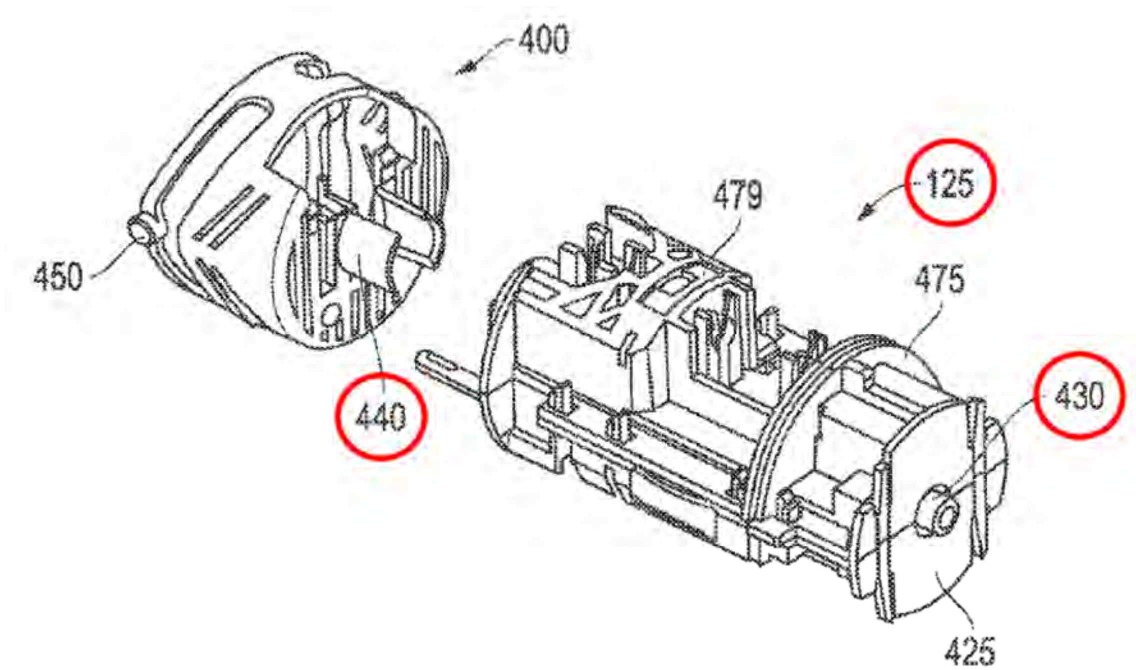


FIG. 4A

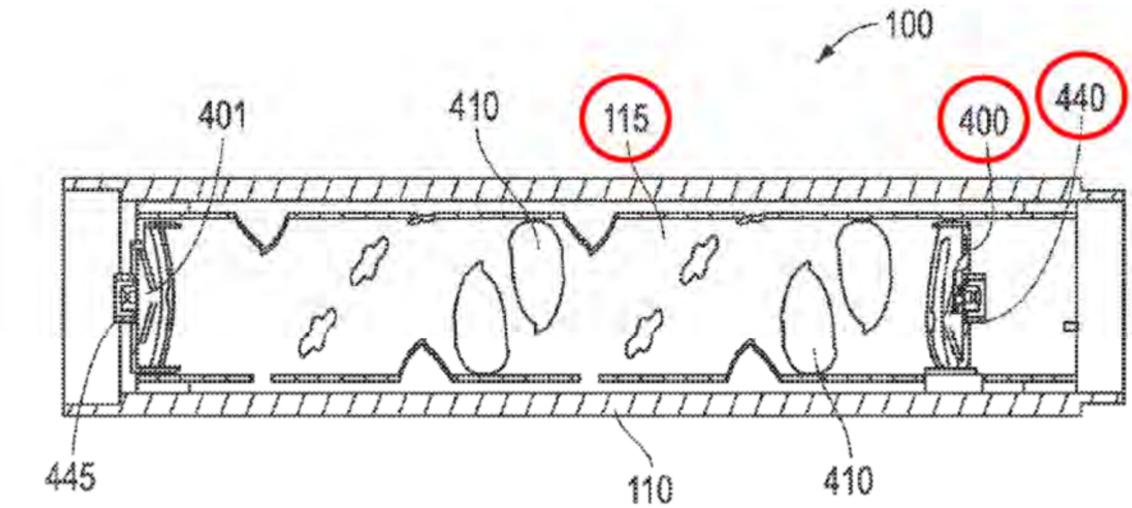


FIG. 4B

346. Harrigan provides detailed teaching about the possible construction of electrical connectors, including a pin in the center of the contact. (Ex. 1012, Harrigan, ¶ 0043-45, FIGS 4A, 4B, 5A, 5B; Ex. 1028, Harrigan Prov., p. 6, FIG. 5.)

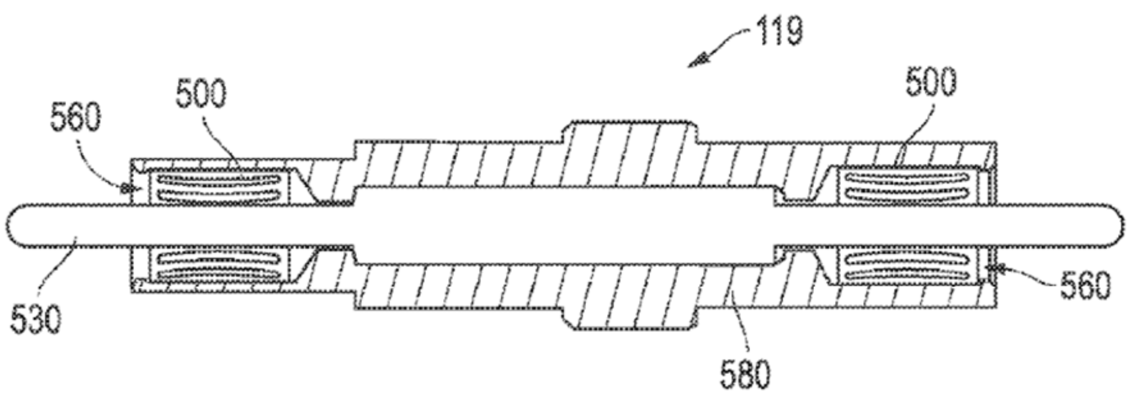


FIG. 5A

347. Harrigan specifically teaches that "secure ground contact is maintained." A POSITA would recognize FIG. 5A and 5B of Harrigan as teaching a two conductor coaxial

connector, similar to an RCA connector. (Ex. 1012, Harrigan, ¶¶ 0043-45, FIGS. 4A, 4B, 5A, 5B; Ex. 1028, Harrigan Prov., pp. 4-7, FIGS. 2, 5, 5 (*sic*), 6.) A POSITA would recognize that the pin 530 and springs 500 of Harrigan would be separated by an insulator.

348. A POSITA would recognize that Harrigan teaches an initiator module 125 that would require at least 3 electrical contacts to function as described. A POSITA would understand that the electrical contacts on initiator module 125 would provide for a signal into the initiator, a signal through the initiator to a next initiator, and a ground connection.

349. A POSITA would find separation of the electrical contacts on opposite ends of initiator 125, including the contact for a signal in and a signal through to the next initiator inherent in Harrigan. A POSITA would find that an insulator must necessarily separate these electrical contacts for the devices taught in Harrigan to function.

350. Therefore, a POSITA would conclude that Harrigan also teaches "an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector…." either explicitly or inherently, as claimed in Claims 1, 9, and 13.

F. Rogman teaches the insulator limitations

351. Ex. 1014, Rogman teaches "multi-use connectors such as an RCA jack" for connecting the circuit board to the power cable. (Ex. 1014, Rogman, ¶ 31.) Rogman Prov. teaches "pre-assembled coaxial or twisted pair cables with integrated connectors," and a coaxial connector a POSITA would recognize as an RCA jack and teaches using such a connector on both sides of the initiator. (Ex. 1020, Rogman Prov., pp. 1, 4, 7, 8.) A POSITA would understand that an RCA jack would include two electrical contacts separated by an insulator. Rogman teaches pass-through communications from a first initiator to a second initiator. (Ex. 1020, Rogman Prov., pp. 3, 7, 8.) A POSITA would recognize the power cable 502 of Rogman as a multi-conductor coaxial cable, as would be appropriate for use with the RCA jack disclosed in Rogman. (Ex. 1014, Rogman, ¶¶ 33-36, FIG. 6; Ex. 1020, Rogman Prov., pp. 1, 5, FIGS. 1, 6.) A POSITA would understand that the two conductors of such a cable are typically known as a "signal line" and a "ground line". A POSITA would understand that Rogman and Rogman Prov. teach a two contact RCA jack on each end of the initiators 112, 312, 313. A POSITA would understand that the power cable and RCA jacks of Rogman and Rogman Prov. would provide for a signal into the initiator 112, a signal through the initiator 112 to a next initiator 112, and a ground connection. A POSITA would understand that the contacts of the RCA jacks

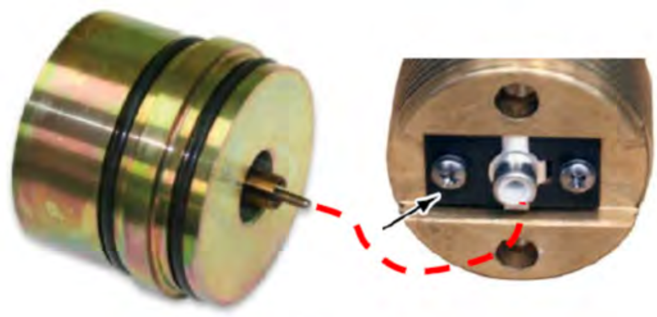
of Rogman and Rogman Prov. must necessarily be separated by an insulator to function as intended.

352. Rogman teaches that insulators exist in a modular gun system "[t]he circuit board can be connected to the detonator 402 via the insulation-displacement connectors ("IDCs") 410. (Ex. 1014, Rogman, ¶ 0031.) The circuit board can also be connected to the power cable via the IDCs 410." (Ex. 1014, Rogman, ¶ 0031.) A POSITA would recognize that in order to need "insulation-displacement connectors", you must have insulation that needs to be displaced. Indeed, all electrical circuitry must use insulators in order to separate two or more electrical signal and/or power paths.

353. Therefore, a POSITA would conclude that Rogman teaches "an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector…." either explicitly or inherently, as claimed in Claims 1, 9, and 13.

G. EWAPS teaches the insulator limitations

354. Ex. 1013, EWAPS on page 0010 teaches mating coaxial connectors (pins and sockets) in the bulkheads and corresponding ends of the plastic loading tube, as well as a wire channel along the plastic loading tube to enjoin the coaxial electrical connections, corresponding to signal-in and through wire contacts. (Ex. 1013, EWAPS, p. 0010.) A POSITA would recognize the connectors in EWAPS 212 as RCA connectors. *Id*. A POSITA would understand that the RCA connectors of EWAPS include insulators as seen in white. *Id*.


Disposable bulkheads

355. A POSITA would recognize that the ground contact is completed merely by connecting the several gun assemblies together as the bulkheads and gun carriers are conducting metal as illustrated on page 0009, requiring RCA connectors or similar electrical contacts on the ends of the loading tube and bulkheads. (Ex. 1013, EWAPS, p. 0009.) The connections are completed by attaching or screwing one gun assembly to the next with no manual attachment of wires required. (Ex. 1013, EWAPS, p. 0009.) A POSITA would understand that the electrical contacts on the initiator, bulkheads, and loading tube of EWAPS would provide for a signal into the initiator, a signal through the initiator to a next initiator, and a ground connection. A POSITA would understand that the contacts of the RCA jacks of Rogman and Rogman Prov. must necessarily be separated by an insulator to function as intended.

356. A POSITA would recognize that EWAPS teaches "an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector…." either explicitly or inherently, as claimed in Claims 1, 9, and 13.

H. Black teaches the insulator limitations

357. Black teaches an arming device 26, including a detonator 28, firing electronics 30 (such as an addressable switch), electrical connector 32 and an electrical connector opposite connector 32. (Ex. 1002, Black, ¶¶ 0024-26, FIGS. 8, 9.) Black teaches that electrical connectors of arming device 26 can be RCA connectors. (Ex. 1002, Black, ¶ 29.) A POSITA would understand that an RCA connector has two conductive electrical contacts, an inner pin and outer ring, separated by an insulator.

358. A POSITA would understand that a ground or return contact would be required for the firing electronics 30 of Black to function properly. An electrical circuit requires at least two conductors to each component, one towards and one away, or inductive, radio, or other "wireless" transmission replacing one or more of those legs. A POSITA would understand the detonator 28 and firing electronics 30 to each require at least two conductors connecting them to the firing and communications circuit. Accordingly, a POSITA would read Black's electrical connectors 32, 24 and conductors 33, 22 as containing paired conductors, such as coaxial or twisted pair conductors and contacts as would be used with the disclosed RCA connectors. A POSITA would understand Black to teach a signal-in electrical contact and electrical path to the addressable switch, a signal out, or through electrical contact and electrical path from the addressable switch to a next perforating gun, and a ground or return electrical contact and electrical path from the addressable switch to

complete the necessary communications circuit for addressable perforating and function as described.

359. The detonator connections of Black are completed by attaching or screwing one gun assembly to the next with no manual attachment of wires required. (Ex. 1002, Black, FIGS. 1-10.) A POSITA would understand that the electrical contacts on the arming device 26, bulkheads 66, and loading tube 7 of Black would provide for a signal in to the arming device 26, detonator 28, and firing electronics 30, a signal through the arming device, to a next arming device, and a ground connection. A POSITA would understand that the contacts of the RCA jacks of Black provisional must necessarily be separated by an insulator to function as intended.

360. A POSITA would recognize that Black teaches "an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector …." either explicitly or inherently, as claimed in Claims 1, 9, and 13.

I. Lanclos teaches the insulator limitations

361. Ex. 1015, Lanclos teaches that an insulator must exist between the inlet lead 76 and ground lead in order to have "the switch assembly 72 regulates transmission therethrough of electrical signals through the switch assembly 72…." (Ex. 1015, Lanclos, 5:1-3.) Furthermore, an insulator must exist in order to have the "exiting the switch assembly 72, on a side opposite the inlet lead 76, is a supply lead 80…." (Ex. 1015, Lanclos, 5:9-10.)

362. Lanclos teaches that the cartridge sub 68 "provides a generally seamless way of forming an electrical connection" … "through connectors 90 and receptacles 92" … substantially simultaneously with coupling of the cartridge sub 68 and perforating gun 62, so that manually forming electrical connections is unnecessary." (Ex. 1015, Lanclos, 7:19-30.)

363. It is inherent in Lanclos to a POSITA that the electrical wires, specifically inlet lead 76, ground lead 78, and supply lead 80 must be electrically insulated/isolated from each other in order to be separate. Otherwise all lines short to each other and become in effect the same single conductor. Therefore, a POSITA would understand that an insulator must be positioned between the line-in portion and the line-out portion in order to prevent the lines from short-circuiting and failing to operate as intended.

364. A POSITA would understand that Lanclos inherently teaches, "an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector…." as claimed in the limitation language of Claims 1, 9, and 13.

365. It would be obvious to a POSITA, even without an explicit teaching in the prior art, to use insulators to prevent wires and electrical connections within a gun string from shorting to each other. A POSITA knows that different electrical contacts and circuits must be separated by an insulator to act as separate contacts or circuits and that an insulator can support conductors in connectors.

J. Goodman teaches the insulator limitations

366. Goodman teaches that its detonator may include an addressable switch, a fireset and an initiator. (Ex. 1018, Goodman, ¶¶ 0005-6, 0016, 0018, 0020.) Goodman teaches a detonator/initiator 15, 45, and 47 having electrical connectors for engaging with receptacle 18 and an electrical receptacle 17 for connecting connectors 11, 12, 43, and 44. (Ex. 1018, Goodman, ¶¶ 0005-7, 0018-20, 0023-24, FIGS. 1-5.) A POSITA would find it inherent in Goodman to have electrical connectors on the initiator to engage with receptacle 18 to make the device of Goodman functional.

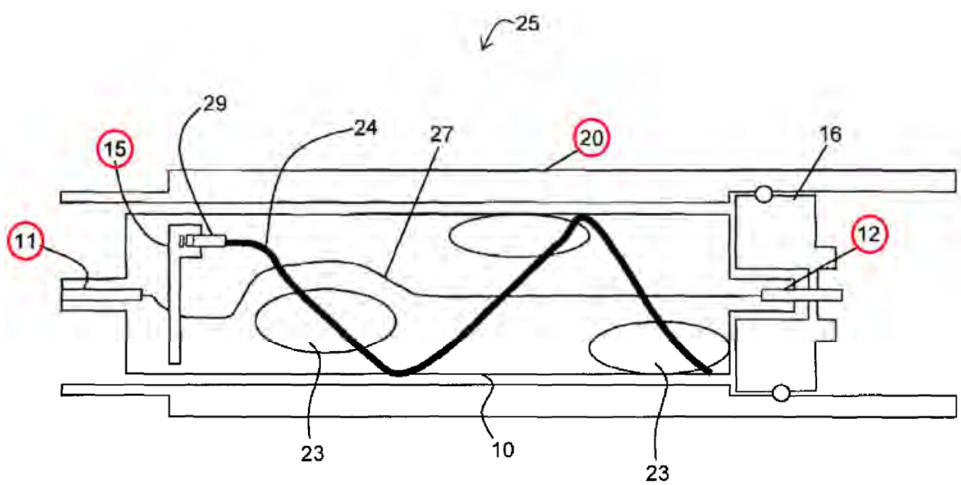


FIG. 2

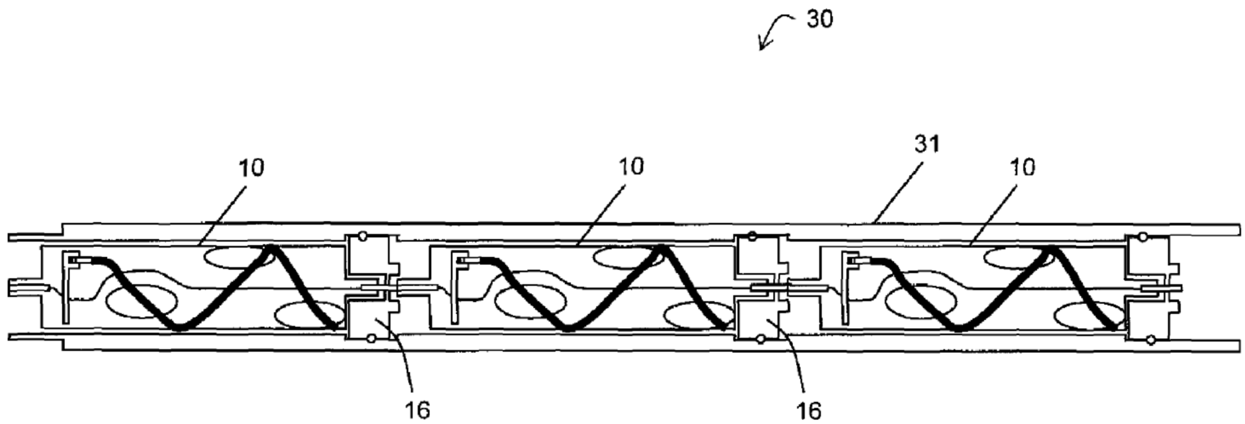


FIG. 3

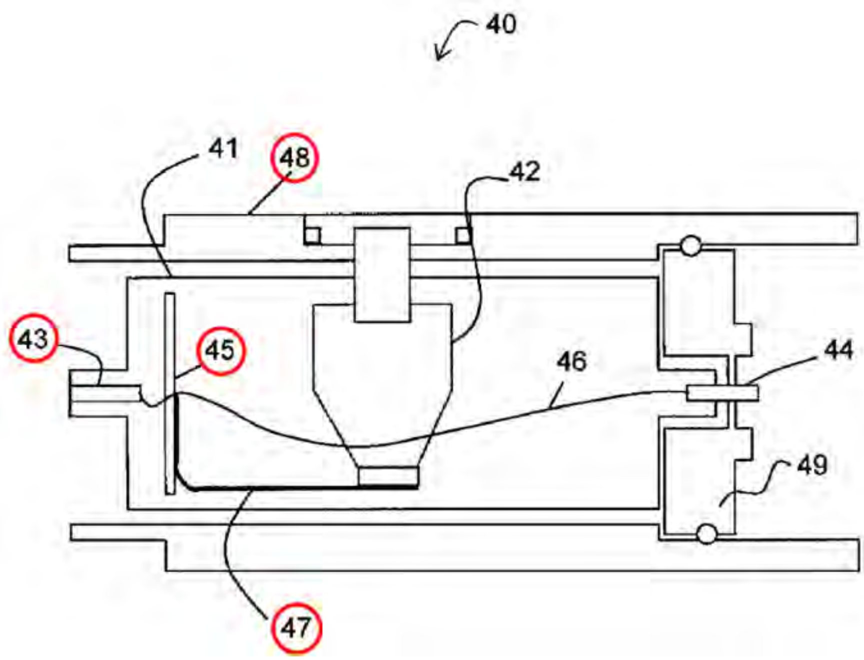


FIG. 4

367. A POSITA would recognize that Goodman's addressable detonator would require at least 3 electrical contacts to function as described. A POSITA would understand that the electrical contacts on Goodman's addressable detonator would provide for a signal into the initiator, a signal through the initiator to a next initiator, and a ground connection. Accordingly, a POSITA would read Goodman's electrical connectors 11, 12, 43, and 44 and wiring 27 and 46 as each containing paired conductors, such as coaxial or twisted pair conductors and contacts as would be used with RCA connectors. A POSITA would understand that Goodman's conductors would be separated by insulators for Goodman's system to function as designed.

368. A POSITA would understand Goodman to teach a signal-in electrical contact and electrical path to the addressable switch, a signal out, or through electrical contact and electrical path from the addressable detonator to a next perforating gun, and a ground or return electrical contact and electrical path from the addressable switch to complete the necessary communications circuit for addressable perforating and function as described. A POSITA would understand that Goodman's contacts would be separated by insulators for Goodman's system to function as designed.

369. A POSITA would recognize that Goodman teaches "an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector …." either explicitly or inherently, as claimed in Claims 1, 9, and 13.

K. Lerche ‘929 teaches the insulator limitations

370. Lerche ‘929 teaches an insulator 22b3 on the surface of a pin 22b to insulate it from other electrical conductors. (Ex. 1016, Lerche ‘929, 5:17-36, 5:64-6:11, 6:21-25, 7:60-68.)

L. Obviousness

371. It would be obvious to a POSITA, even without an explicit teaching in the prior art, to use insulators to prevent wires and electrical connections within a gun string from shorting to each other. A POSITA would know that different electrical contacts and circuits must be separated by an insulator to act as separate contacts or circuits and that an insulator can support conductors in connectors.

372. A POSITA would be motivated to combine Schacherer’s electrical connectors and couplers with the electrical connectors and insulator teachings of Lerche ‘929, Harrigan, Rogman, Goodman, Black, EWAPS, and/or common knowledge to teach using an insulator between electrical contacts because the combination is required for Schacherer to function correctly, it is safer to electrically insulate wires such as using coaxial wires, twisted pairs, electrical wires in general in conjunction with insulated electrical connections or coaxial connectors, and it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of Schacherer without any unexpected results, simple substitution of the known connectors and insulators for the perforating

devices taught, the use of known connectors and insulators for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of electrical connectors that are available with a reasonable expectation of success.

373. A POSITA would be motivated to combine the switch assemblies of Lanclos with the electrical connectors and insulator teachings of Lerche ‘929, Harrigan, Rogman, Goodman, Black, EWAPS, and/or common knowledge to teach using an insulator between electrical contacts because the combination is required for Schacherer to function correctly, it is safer to electrically insulate wires such as using coaxial wires, twisted pairs, electrical wires in general in conjunction with insulated electrical connections or coaxial connectors, and it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of Lanclos without any unexpected results, simple substitution of the known connectors and insulators for the perforating devices taught, the use of known connectors and insulators for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of electrical connectors that are available with a reasonable expectation of success.

XIII. **The Claim 1 limitation of "a bulkhead, wherein the bulkhead includes a contact pin in wireless electrical contact with the wireless signal-in connector…," Claim 9 limitation of "the wireless signal-in connector is configured for making wireless electrical contact with an electrical contact of a bulkhead assembly…," and Claim 16 limitation of "connecting a bulkhead into the outer gun carrier, wherein the bulkhead includes a contact pin and connecting the bulkhead into the outer gun carrier includes placing the contact pin in wireless electrical contact with the wireless signal in bulkhead connector."**

374. Claim 1 in the '938 Patent includes the limitation "**a bulkhead, wherein the bulkhead includes a contact pin in wireless electrical contact with the wireless signal-in connector….**" (Ex. 1001, the '938 Patent, 11:29-31.) Claim 9 includes the limitation "**the wireless signal-in connector is configured for making wireless electrical contact with an electrical contact of a bulkhead assembly….**" (Ex. 1001, the '938 Patent, 12:7-9.) Claim 16 includes the limitation "**connecting a bulkhead into the outer gun carrier, wherein the bulkhead includes a contact pin and connecting the bulkhead into the outer gun carrier includes placing the contact pin in wireless electrical contact with the wireless signal in bulkhead connector.**" (Ex. 1001, the '938 Patent, 12:65-13:3.)

A. The bulkhead limitations are not supported in the written description

375. As discussed above, the word "wireless" in the claims introduces ambiguity about the scope of the claims and causes them to fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Those same problems apply

to the ambiguity introduced by the term “wireless electrical contact” which is never used, defined, or explained, in the ‘938 Patent. This ambiguity about the scope of the claims causes them to fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Therefore, Claims 1, 9, and 16 of the ‘938 Patent, and all claims that depend from them, are invalid as indefinite.

376. The ‘938 Patent discloses a bulkhead assembly 58. (Ex. 1001, the ‘938 Patent, 7:57.) The ‘938 Patent states that the bulkhead assembly 58 can “accommodate electrical and ballistic transfer to the charges….” (Ex. 1001, the ‘938 Patent, 7:63-67.) However, a POSITA would know that the bulkhead 58 depicted in FIGS. 19, 32-34 and the bulkhead 124 depicted in FIG. 35B do not show any ballistic transfer capability. For instance, referring to FIG. 19, the bulkhead 58 would need ballistic components, such as a ballistic input, ballistic throughput, and a ballistic output in order to provide or facilitate a ballistic transfer. Furthermore, a POSITA would recognize that, in the perforating gun system disclosed in the ‘938 Patent, a ballistic transfer to the shaped charge(s) would come from the detonating cord, and also that an electrical power or signal is not transferred to the (explosive) charges.

377. The ‘938 Patent discusses a bulkhead assembly 58, and a pressure bulkhead 124, sometimes shortened to bulkhead 124. (Ex. 1001, the ‘938 Patent, 7:55-8:5, 8:28-39.) But the ‘938 Patent says that pin of bulkhead 124 “is connected to the through wire 106” not the signal-in wire or “wireless signal-in connector.” (Ex. 1001, the

‘938 Patent, 8:28-39.) The figures of the ‘938 patent appear to point to a conductive core as bulkhead assembly 58, while referring to surrounding structure as pressure bulkhead 124. (Ex. 1001, the ‘938 Patent, FIGS. 19, 32, 33.)

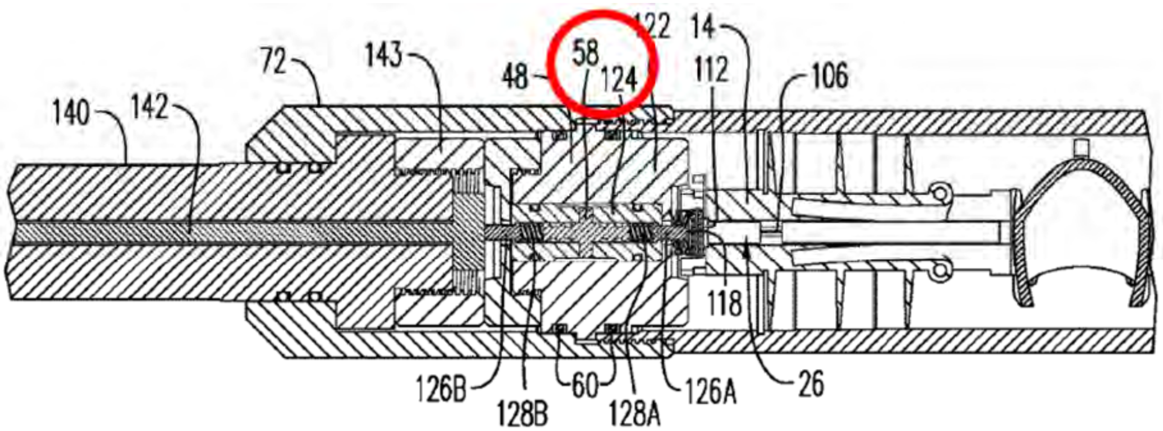


FIG. 33

378. Given the description of a bulkhead referring to different components for different purposes, it is difficult for a POSITA to understand what is meant by these limitations of Claims 1, 9, and 16. It is also difficult for a POSITA to understand what is meant by “wherein the bulkhead includes a contact pin” when at least some of the description indicates that the bulkhead ***is*** a contact pin. Because a POSITA cannot tell, what, if anything, is meant by this limitation, it fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Therefore, Claims 1, 9, and 16 of the ‘938 Patent, and all claims that depend from them, are invalid as indefinite.

379. It is unclear what is meant in Claim 16 by “connecting a bulkhead into the outer gun carrier.” The ‘938 Patent does not discuss “connecting” a bulkhead, or anything else,

"into the outer gun carrier." The figures do not show anything called a bulkhead physically connected to an outer gun carrier. Therefore, if this limitation requires a bulkhead be physically connected to an outer gun carrier, the written description does not convey to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date of the patent and this claim is invalid. The alternative, consistent with the specification, is that "connecting a bulkhead into the outer gun carrier" is meaningless.

380. Claim 9 presents additional clarity problems. It is not clear what limitation, if any, is provided by the phrase "is configured for making wireless electrical contact with an electrical contact of a bulkhead assembly." It is unclear to a POSITA whether this language requires the presence of "a bulkhead assembly," a specific bulkhead assembly, or arrangement of a bulkhead assembly, or merely the ability to theoretically connect to any "bulkhead assembly". It is unclear what, if anything, makes a connector "configured for" making electrical contact with a bulkhead assembly. Without a specific type of electrical connection defined, then any electrical contact could be "configured for making electrical contact with an electrical contact of a bulkhead assembly" and this claim language is meaningless. Because a POSITA cannot tell, what, if anything, is meant by this limitation, Claim 9 fails to inform, with reasonable certainty, those skilled in the art about the scope

of the invention. Therefore, Claim 9 of the ‘938 Patent, and all claims that depend from it, are invalid as indefinite.

381. The limitation “when the modular detonator is received within the gun assembly of the perforating gun system” introduces additional uncertainty into Claim 9. A POSITA cannot tell what a gun assembly is or whether Claim 9 requires that the detonator actually be inserted into a gun assembly to make electrical contact or only have the theoretical capability to make electrical contact. A POSITA also cannot be sure of the temporal aspect of the claim limitation. The claim language appears to require that electrical contact is made ***when*** the detonator is received, but as discussed below, the ‘938 Patent never describes such a system. The ambiguity inserted by the term “gun assembly” is detailed above with regard to the bulkhead limitation. Because a POSITA cannot tell, what, if anything, is meant by this limitation, Claim 9 fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Therefore, Claim 9 of the ‘938 Patent, and all claims that depend from it, are invalid as indefinite.

382. Further, the ‘938 Patent never describes a detonator that makes electrical contact with a bulkhead or tandem seal adapter “***when*** it is received within a gun assembly.” In every example of the ‘938 Patent, a detonator is first inserted into a gun carrier, then a bulkhead and tandem are added. If there is no bulkhead or tandem in the system when the detonator is inserted, then electrical contact cannot be made at the

time the detonator is received in the gun assembly. Therefore, the ‘938 patent’s written description fails to reasonably convey to those skilled in the art that the inventor had possession of the claimed subject matter.

383. The ‘938 Patent discloses the bulkhead 124 as having “spring connector end interfaces comprising contact pins 126A, 126B… the dual spring pin connector assembly is connected to the through wire 106 of the detonator assembly 26.” (Ex. 1001, the ‘938 Patent, 8:31-39.) The ‘938 Patent does not disclose “wireless electrical contact” or “wireless signal-in connector.”

B. Claim construction of the bulkhead limitations.

384. A POSITA’s best guess as to the meaning of this limitation of Claim 1 is that there is a contact pin in electrical contact with the “wireless signal in connector” without the need to connect or attach wires directly to each other.

385. A POSITA’s best guess as to the meaning of this limitation of Claim 16 is putting a contact pin in electrical contact with the “wireless signal in connector” without the need to connect or attach wires directly to each other.

386. A POSITA’s best guess as to the meaning of this limitation of Claim 9 is that it requires a bulkhead or contact pin in electrical contact with the “wireless signal-in connector” without the need to connect or attach wires directly to each other.

C. A POSITA's common knowledge includes the bulkhead limitation

387. A POSITA's common knowledge includes the use of bulkheads, tandem adapters, and related components to seal the inner components within the carrier from the outside environment and seal the gun assemblies from each other." (Ex. 1001, the '938 Patent, 7:57-63.) A POSITA's common knowledge includes putting those bulkheads etc. inside a perforating gun carrier and attaching them to a gun carrier by threading them either directly to the gun carrier or to other perforating gun components. A POSITA's common knowledge includes the use of bulkheads that include conductive pins for transferring an electrical signal from a previous wellbore tool to a next wellbore tool, including from one perforating gun to another, and placing those placing those bulkheads within and connected to gun carriers. Therefore, a POSITA's common knowledge teaches these limitations of Claims 1, 9, and 16.

388. A POSITA would know that, for multiple separately detonated or selectively detonated perforating guns in a perforating gun string, a bulkhead is required between each gun or group of guns to prevent all subsequently detonated guns from being damaged or flooded as each perforating gun or group of guns is detonated. This bulkhead must necessarily provide pressure isolation between adjacent guns or groups of guns while at the same time be able to pass electrical power and/or signal through to the gun(s) below or downstream, for example via an electrical

feedthrough, until such guns have been detonated. This has been a feature and a requirement since the first time two or more perforating guns have been separately detonated during the same decent into an oil or gas wellbore, many decades ago, and prior to my entry to the oil and gas business in 1977.

389. The ‘938 Patent does not describe what is different or novel about the bulkhead claims versus prior art.

D. Schacherer teaches the bulkhead limitation

390. Schacherer teaches a number of variations on electrical coupler 62, including electrical contact pin 68 passing electrical signals through it. (Ex. 1004, Schacherer, 5:10-21, FIGS. 3, 4.)

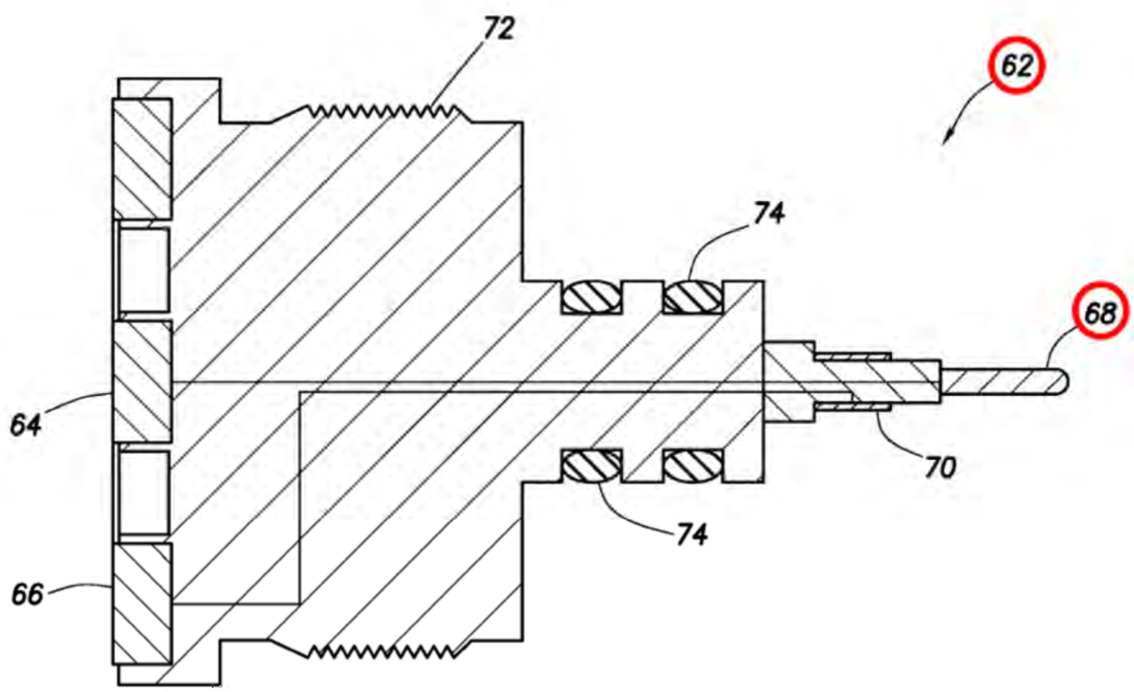


FIG.3

391. Schacherer teaches the contact pin 68 in electrical contact with electrical connector 76 that is electrically coupled to a selective firing module 32. (Ex. 1004, Schacherer, 5:32-36 6:4-8, FIGS. 3, 4, 5, 6.)

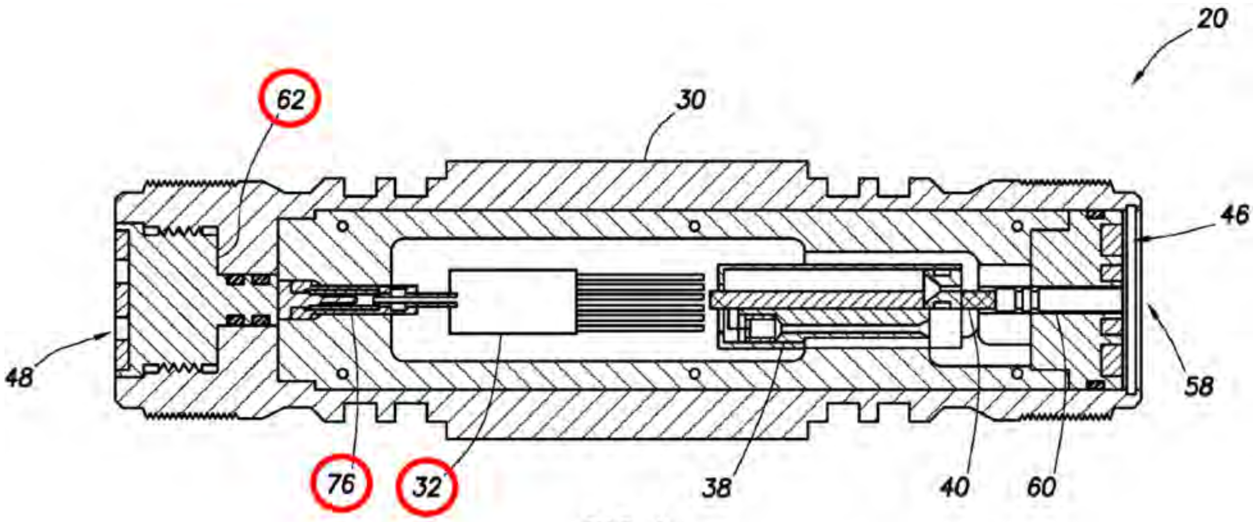


FIG.4

392. Schacherer teaches that electrical contacts 68 and 70 are electrically connected to conductors 98 and 100, which can each function as either a signal-in or a ground to selective firing module 32. (Ex. 1004, Schacherer, 6:13-22, FIGS. 3, 4, 5, 6.)

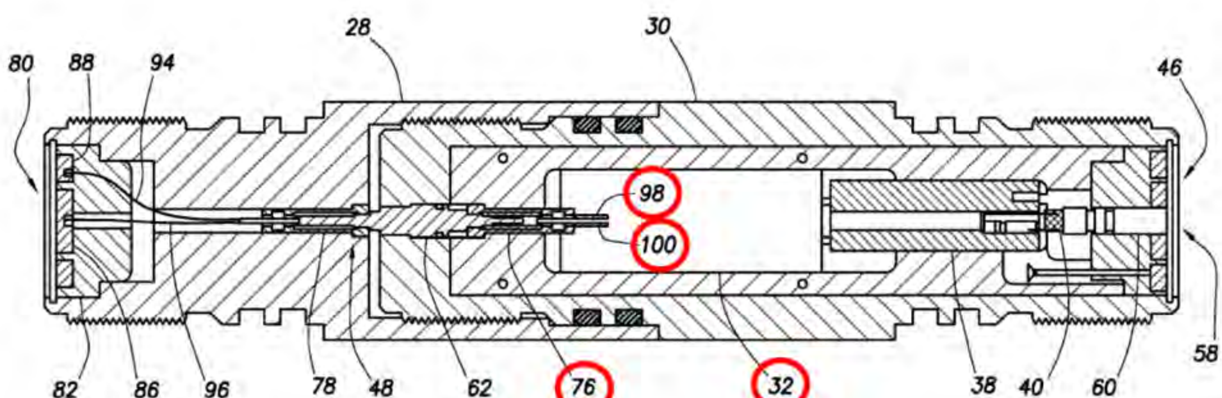


FIG.7

393. A POSITA would understand Schacherer's contact 68 to be a contact pin in electrical contact with a signal-in connector of a detonator without the need to connect or attach wires to each other. (Ex. 1004, Schacherer, 5:37-42.) As discussed elsewhere, a POSITA would understand connector 30 to be a part of the gun carrier and Schacherer's contact 68 is within connector 30.

394. Schacherer teaches both large and small versions of electrical connector 62 fitted in a variety of configurations, housings, and adapters. (Ex. 1004, Schacherer, 5:32-36 6:4-8, FIGS. 3, 4, 5, 6.) Each of the options for electrical connector 62 taught by Schacherer include an electrical contact pin such as item 68.

395. Schacherer also teaches variations of coupler 62 that are longer, but still "mates with the connector 76, which is sealingly received in the connector 30. This provides additional assurance that pressure and fluid will not be transmitted through the connector 30 between explosive assemblies 20." (Ex. 1004, Schacherer, 5:10-21, 6:4-8, FIGS. 3, 6.)

396. Schacherer also teaches that "a single set of conductors could be used for transmitting the signal, with the outer housings 26 and connectors 28, 30 being used for grounding purposes (if they are made of electrically conductive materials, such as steel, etc.)." (Ex. 1004, Schacherer, 6:18-22.) A POSITA would understand that to teach that electrical contact 70 and its associated conductors could be replaced at any point by connection directly to and between the outer housings, 26, 30, 28, and

so on of Schacherer to convey the ground path of the communications circuit. For example, a POSITA would know from these teachings of Schacherer that (with reference to FIG 5) the ground path could go from connecter 76 to connecter 62, then to the outer bodies of connector 30, or connector 28, then to outer carriers 26. A POSITA would also know from, the teachings of Schacherer that the ground path could alternatively go from connector 76 directly to the body of connector 30, or the body within connector 30 and from there to the outer housings 26, 28, and 30. A POSITA would be familiar with the methods, techniques, and devices used to transmit the ground path of a circuit through metallic outer housings of downhole tools as that is the standard ground path for downhole tools, including perforating guns.

397. A POSITA would understand Schacherer's teachings regarding electrical connector 62 and associated electrical contacts teach a POSITA the use of bulkheads that include conductive pins for transferring an electrical signal from a previous wellbore tool to a next wellbore tool, including from one perforating gun to another, and placing those placing those bulkheads within and connected to gun carriers. Therefore, Schacherer teaches these limitations of Claims 1, 9, and 16.

398. Schacherer teaches another bulkhead with electrical contact pin in electrical coupler 78 in Figures 5 and 7. (Ex. 1004, Schacherer, 4:5-10, 5:37-42, 6:9-12, FIGS. 5, 7.) A POSITA would understand Schacherer's coupler 78 to include contact pin in

electrical contact with a signal-in connector of a detonator without the need to connect or attach wires to each other. (Ex. 1004, Schacherer, 5:37-56.) Schacherer also teaches rotary electrical couplers 62 and 78 "being sealed and thereby preventing fluid flow through the respective connector 30." (Ex. 1004, Schacherer, 8:41-45.)

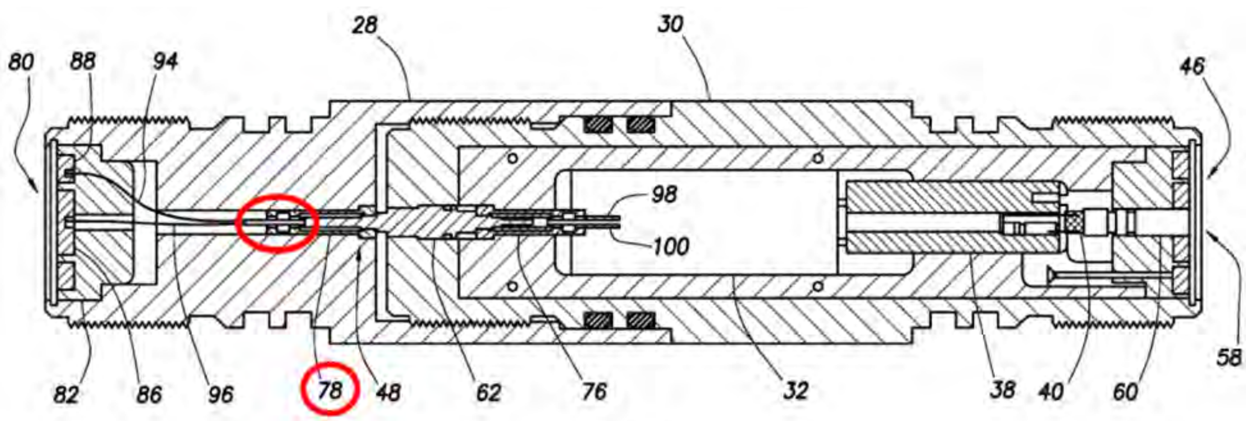


FIG. 7

399. A POSITA would understand Schacherer's coupler 78 to include a contact pin in electrical contact with a signal-in connector of a detonator without the need to connect or attach wires to each other. (Ex. 1004, Schacherer, 5:37-56.) Schacherer also teaches rotary electrical couplers 62 and 78 "being sealed and thereby preventing fluid flow through the respective connector 30." (Ex. 1004, Schacherer, 8:41-45.)

400. A POSITA would understand Schacherer's teachings regarding electrical coupler 78 and associated electrical contacts teach a POSITA the use of bulkheads that include conductive pins for transferring an electrical signal from a previous wellbore tool to

a next wellbore tool, including from one perforating gun to another, and placing those placing those bulkheads within and connected to gun carriers. Therefore, Schacherer teaches these limitations of Claims 1, 9, and 16.

401. Schacherer teaches multiple bulkheads with electrical contact pins in electrical Figure 6 as circled below. (Ex. 1004, Schacherer, 4:5-10, 5:37-42, 6:9-12, FIGS. 5, 7.)

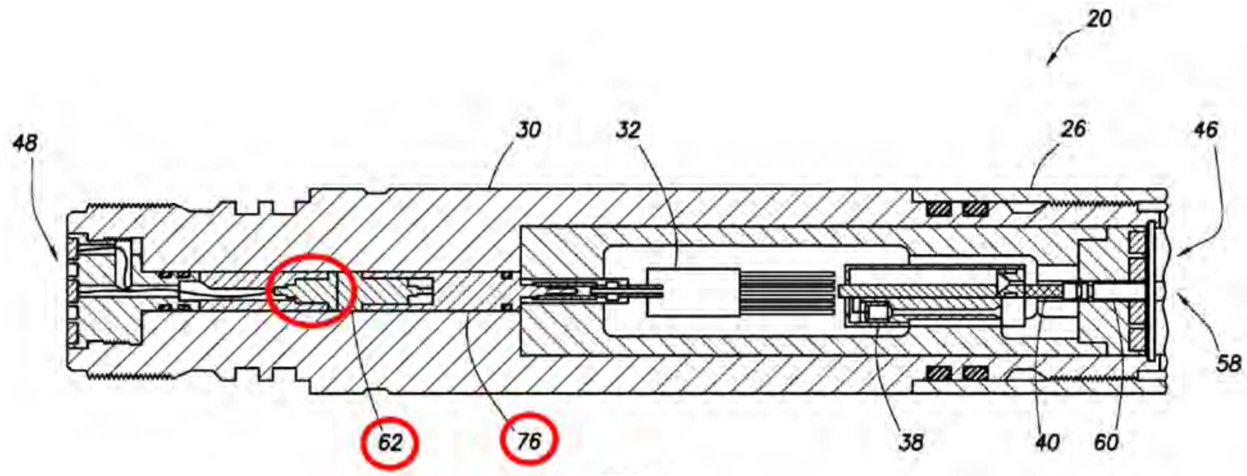


FIG.6

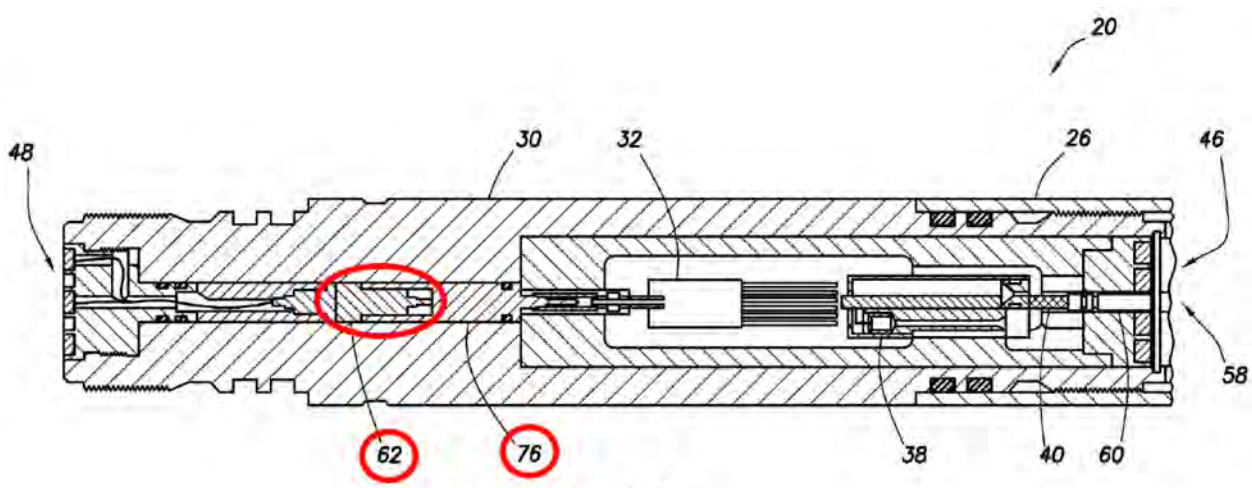


FIG.6

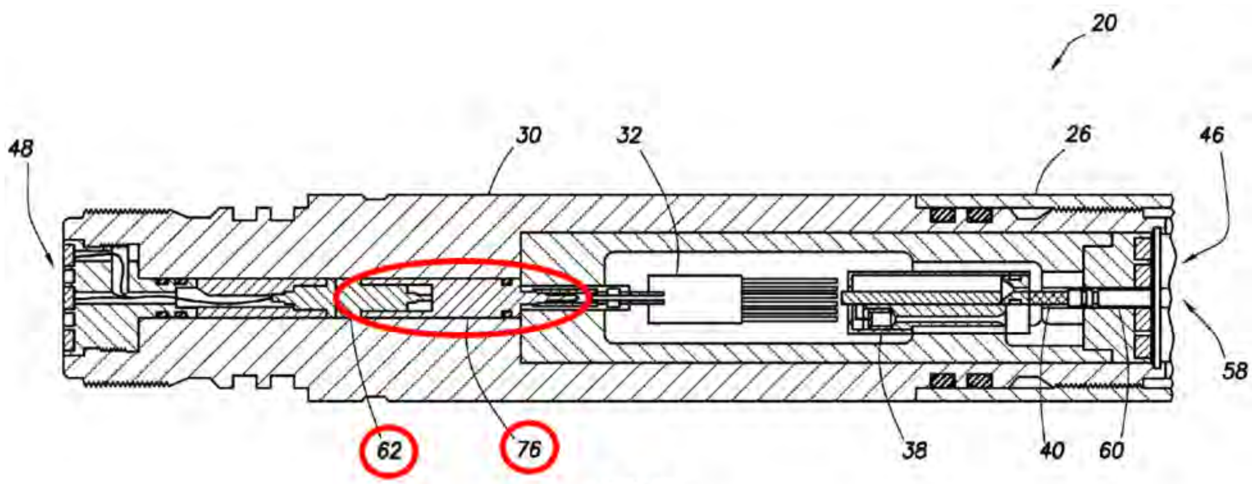


FIG.6

402. A POSITA would understand the circled items above to include a contact pin in electrical contact with a signal-in connector of a detonator without the need to connect or attach wires to each other. (Ex. 1004, Schacherer, 5:37-56.) Schacherer also teaches rotary electrical couplers 62 and 78 "being sealed and thereby preventing fluid flow through the respective connector 30." (Ex. 1004, Schacherer, 8:41-45.)

403. A POSITA would understand Schacherer's teachings regarding the circled couplers and associated electrical contacts teach a POSITA the use of bulkheads that include conductive pins for transferring an electrical signal from a previous wellbore tool to a next wellbore tool, including from one perforating gun to another, and placing those placing those bulkheads within and connected to gun carriers. Therefore, Schacherer teaches these limitations of Claims 1, 9, and 16.

404. Ex. 1004, Schacherer teaches a bulkhead 62 with electrical connections and contacts: "Referring additionally now to FIG. 4, the electrical coupler 62 is representatively illustrated as being installed in another configuration of the connector 30. Note that the coupler 62 is sealingly received in an end of the connector 30, so that if the explosive component 40 is detonated, pressure will not transfer to another explosive assembly 20 past the coupler 62." (Ex. 1004, Schacherer, 5:25-31, FIG. 4.)

405. Schacherer teaches transferring electrical signal(s) from one perforating gun assembly to the next, "[t]he electrical connector 82 includes electrical contacts 86, 88. The electrical connector 84 includes electrical contacts 90, 92 in the form of spring-loaded pins which make sliding electrical contact with the respective contacts 86, 88." (Ex. 1004, Schacherer, 5:60-63, FIG. 5.)

406. Ex. 1004, Schacherer discloses in FIG. 5 a bulkhead in electrical coupler 62. (Ex. 1004, Schacherer, 5:52-56, FIG. 5.) Furthermore, Schacherer teaches "[t]he electrical coupler 62 depicted in FIG. [3] includes electrical contacts 64, 66 at one end, and electrical contacts 68, 70 at another end. Contacts 64, 68 are electrically connected to each other, and contacts 66, 70 are electrically connected to each other." (Ex. 1004, Schacherer, 5:17-21, FIG. [3].) FIG. 7 in Schacherer shows electrical coupler 62 extending from the left end of connector 30. (Ex. 1004, Schacherer, FIG. 7.) This bulkhead electrical coupler 62 includes its electrical contacts in the form of pins and barrels which engage and electrically couple by

contact/insertion. In FIG. 7 above, the electrical coupling is accomplished when adapters or connectors 28 and 30 are connected or screwed together. No manual connection of wires is needed to complete the electrical coupling of all communication, power and ground contact circuits.

E. Harrigan teaches the bulkhead limitations

407. Ex. 1012, Harrigan teaches, "[a]mong modular components, the gun may also include an initiator assembly module that is electrically coupled to a modular feedthrough with a connector." (Ex. 1012, Harrigan, Abstract; Ex. 1028, Harrigan Prov., pp. 4, 5, FIGS, 3, 5.)

408. Harrigan discloses: "Further, each bulkhead 117, 118 may have a modular feedthru 119, 120 to ultimately provide electrically connectivity between internal components such as the initiator assembly module 125 and communications from surface. Thus, signature commands from surface may reach the initiator assembly module 125 to trigger perforating as noted above." (Ex. 1012, Harrigan, ¶ 0024; Ex. 1028, Harrigan Prov., pp. 5, 6, FIGS. 5, 5 (*sic*).) Harrigan teaches that "communications from bulkhead 117 to bulkhead 118 and beyond are wired through the tube 115." (Ex. 1012, Harrigan, ¶ 0032; Ex. 1028, Harrigan Prov., p. 3, FIG. 1.) Harrigan teaches that bulkheads 117, 118, and feedthru's 119, 120, are within and connected to carrier 110. (Ex. 1012, Harrigan, ¶¶ 0024, 0031, 0035-36, FIGS. 1A, 2A, 5A; Ex. 1028, Harrigan Prov., pp. 3, 5, FIGS. 1, 5.)

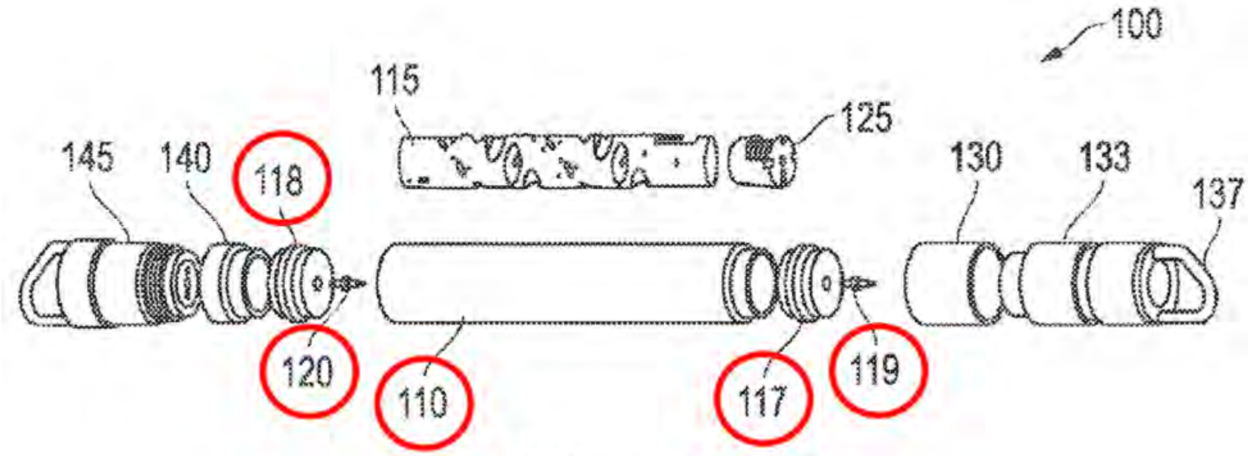


FIG. 1A

409. Harrigan teaches that bulkheads 117 and 118 seal the ends of carrier 110 and loading tube 115. (Ex. 1012, Harrigan, ¶ 0024; Ex. 1028, Harrigan Prov., pp. 3, 5, FIGS. 1, 5.) Harrigan also teaches "rather than utilizing externally wired initiator and detonator components, manually wired to the gun 100 at the oilfield, a single pre-wired subassembly package 125 of such functionality may be plugged into the loading tube 115." (Ex. 1012, Harrigan, ¶¶ 0022, 0033; Ex. 1028, Harrigan Prov., pp. 3-5, FIGS. 2-4.) A POSITA would know that the coaxial connectors of Harrigan's modular feedthrough use pins and barrels to affect their connections. Harrigan teaches that feedthrough 119 includes an electrical connector pin 530 through it. (Ex. 1012, Harrigan, ¶¶ 0043-44, FIG. 5A; Ex. 1028, Harrigan Prov., pp. 5, 6, FIGS. 5, 5 (*sic*).)

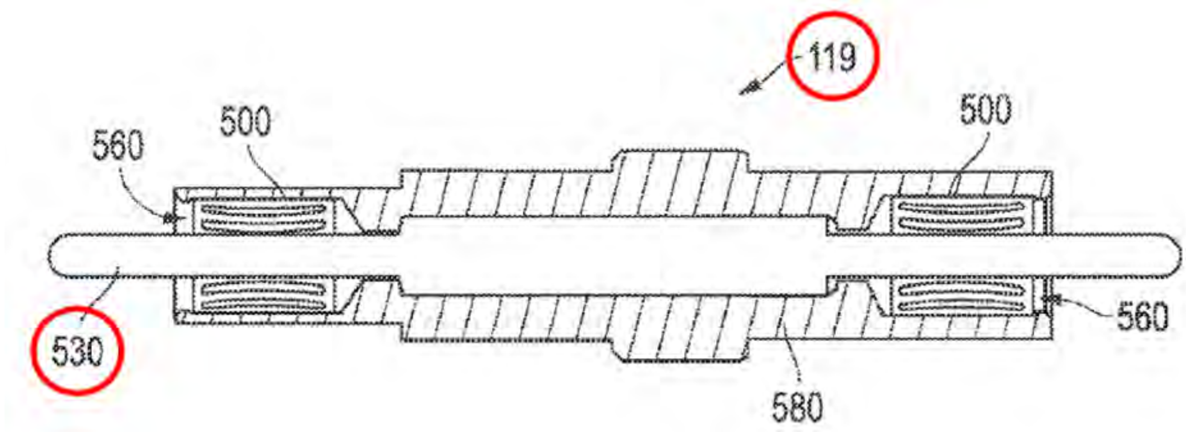


FIG. 5A

410. A POSITA would recognize that Harrigan teaches a pressure barrier and an electrical connection with its bulkhead with feedthrough.

411. A POSITA would recognize that Harrigan teaches a contact pin in electrical contact with the "wireless signal in connector" without the need to connect or attach wires directly to each other. Therefore, Harrigan teaches these limitations of Claims 1, 9, and 16.

F. Rogman teaches the bulkhead limitation

412. Rogman teaches bulkheads 114, 116, 314, 316 isolating the interior of the perforating gun from wellbore fluids and including conduits for electrical communication through them. (Ex. 1014, Rogman, ¶¶ 0017-19, 0035, FIG. 3; Ex. 1020, Rogman Prov., FIG. 5.)

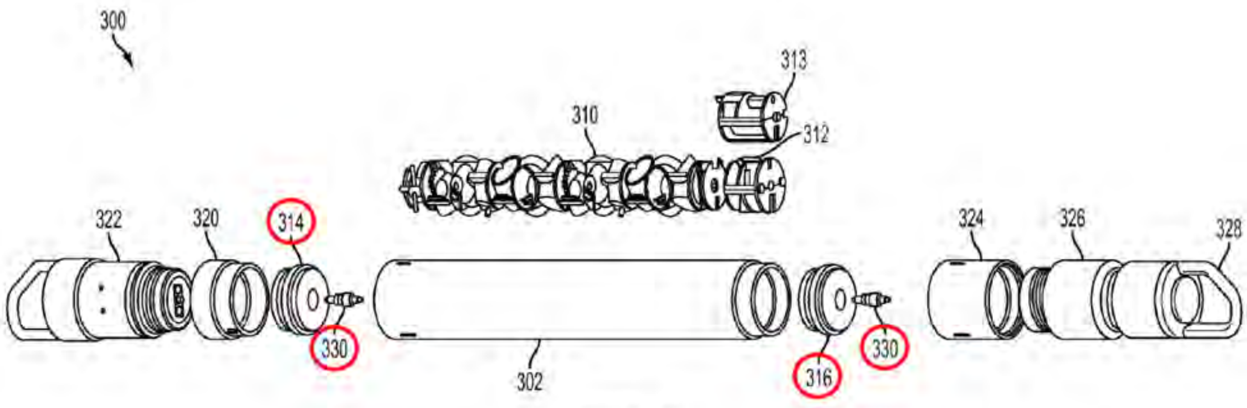


FIG. 3

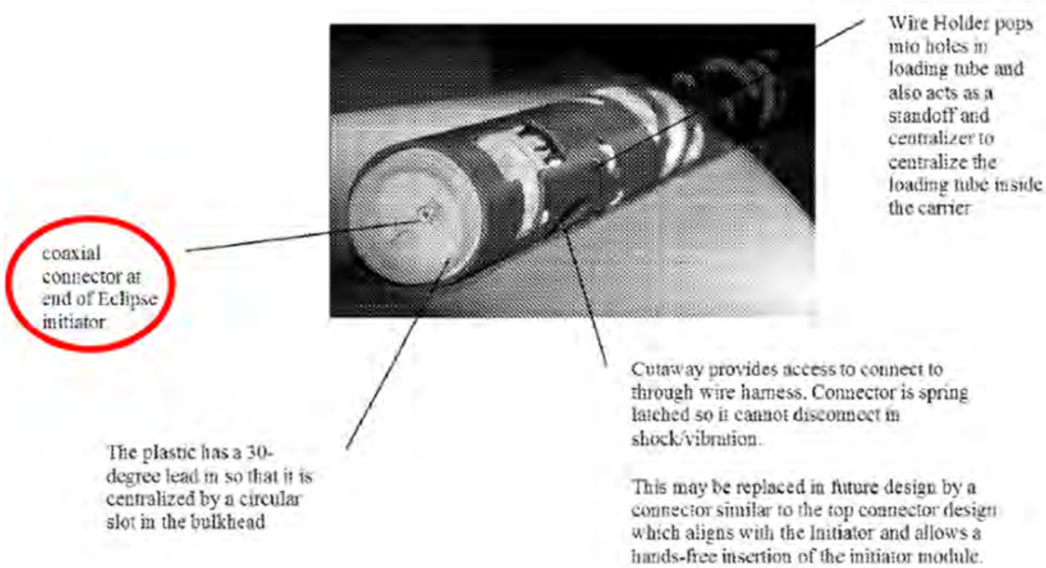


Fig. 5: End of loading tube

413. Rogman teaches that "the power cables 502 of each wellbore perforating device in series can be connected to form a string of power cables." (Ex. 1014, Rogman, ¶¶ 0017-19, 0035.) Rogman teaches seals 130, 330, "to maintain fluid isolation of the loading tube 110." (Ex. 1014, Rogman, ¶¶ 0019, 0035, FIGS 1, 3.) Rogman Prov. teaches "pre-assembled coaxial or twisted pair cables with integrated connectors," and a coaxial connector a POSITA would recognize as an RCA jack and teaches using such a connector through a bulkhead. (Ex. 1020, Rogman Prov., pp. 1, 4, 7, 8.)

414. A POSITA reviewing Rogman would understand seals 130 and 330 to be pressure sealed coaxial connectors designed to mate with the coaxial connectors and RCA jacks taught by Rogman and Rogman Prov. for connecting to the initiator as discussed above. (Ex. 1014, Rogman, ¶¶ 0019, 31, 0035, FIGS. 1, 3; Ex. 1020, Rogman Prov., pp. 1, 4, 7, 8.) A POSITA would understand that the two conductors of coaxial cables and connectors are typically known as a "signal line" and a "ground line". A POSITA would know that coaxial connectors like RCA jacks use pins and barrels to affect their connections. A POSITA would understand that FIGS. 1 and 3 of Rogman show an electrical contact pin through the center of seals 130, 330, passing through bulkheads 114, 116, 314, and 316, consistent with the coaxial connectors taught by Rogman. (Ex. 1014, Rogman, FIGS. 1, 3.)

415. Rogman Prov. teaches a coaxial feedthrough to engage a coaxial connector on an initiator that also hold pressure in both directions. (Ex. 1020, Rogman Prov., pp. 1, 4, 7, 8.)

416. A POSITA would recognize that Rogman and Rogman Prov. teach effecting a pressure barrier (via the presence of a bulkhead) and an electrical connection with coaxial connections, using pins and barrels to effect their connections, through the step of connecting one perforating gun assembly to another.

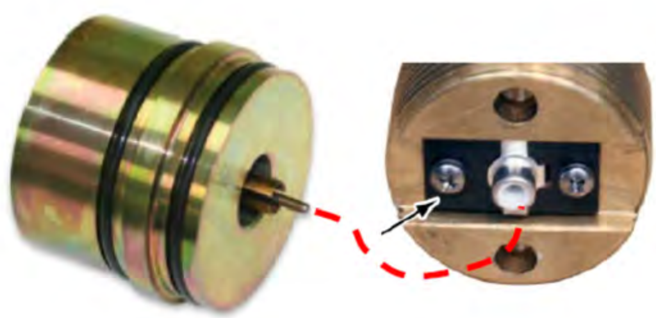
417. A POSITA would recognize Rogman's seals 130, 330 as including a contact pin in electrical contact with the "wireless signal in connector" without the need to connect or attach wires directly to each other. Therefore, Rogman teaches these limitations of Claims 1, 9, and 16.

418. A POSITA would recognize Rogman Prov.'s coaxial feedthrus as including a contact pin in electrical contact with the "wireless signal in connector" without the need to connect or attach wires directly to each other. Therefore, Rogman Prov. teaches these limitations of Claims 1, 9, and 16.

G. EWAPS teaches the bulkhead limitations

419. EWAPS teaches disposable bulkheads with a coaxial RCA type connector for making electrical contact with a corresponding connector on the initiator. (Ex. 1013, EWAPS, pp. 9, 10, 12.) A POSITA would understand the signal-in to the initiator to be carried by the pin in the disposable bulkhead. (Ex. 1013, EWAPS, p. 10.) EWAPS

teaches that the disposable bulkheads have o-rings to provide a seal between perforating guns and to seal the perforating guns from the outside environment when received in and connected to the perforating gun carrier. (Ex. 1013, EWAPS, pp. 9, 10, 12.)



Disposable bulkheads

420. A POSITA would understand that the pin of EWAPS's bulkhead is a contact pin in electrical contact with the "wireless signal in connector" without the need to connect or attach wires directly to each other. Therefore, EWAPS teaches these limitations of Claims 1, 9, and 16.

H. Black teaches the bulkhead limitations

421. Black teaches a pressure bulkhead 66 containing an electrical feed-through conductor 68 in electrical contact with an electrical connector of arming device 26. (Ex. 1002, Black, ¶ 34, FIGS. 7, 10.) Black teaches feedthrough conductor 68 electrically connecting two perforating guns, including to the signal-in contact of one arming device 26. (Ex. 1002, Black, ¶ 34, FIGS. 7, 10.)

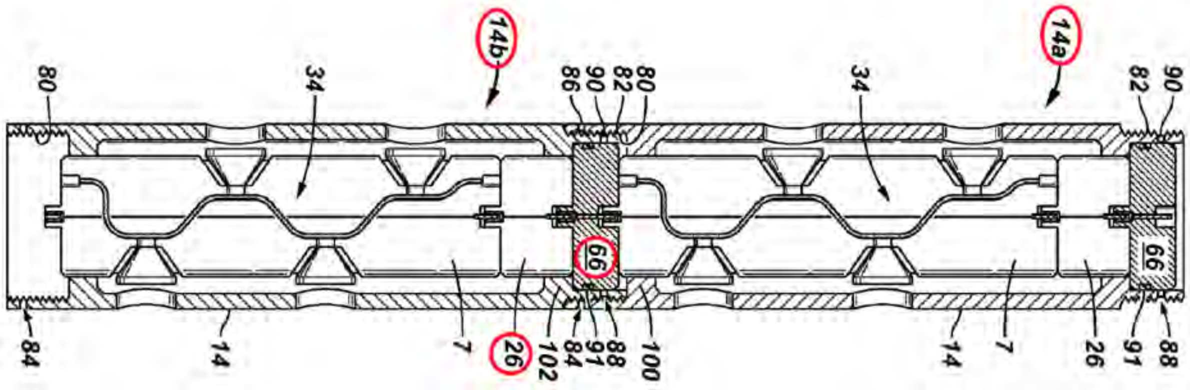


FIG. 10

422. Black teaches that the contact pin is electrically connected with another wellbore tool and a signal-in connector of the detonator. Therefore, Black teaches the limitations of Claim 4.

I. Lanclos teaches the bulkhead limitations

423. Lanclos teaches connector subs 116 “for coupling upstream ends of the cartridge subs 68 with an upstream perforating gun” and “electrical communication extends substantially the length of the string 115 via contact between successive connectors 90 and receptacles 92.” (Ex. 1015, Lanclos, 7:17-30, FIGS. 3-5.) Lanclos teaches a perforating gun string with perforating guns 62_1 through 62_n connected electrically and mechanically by connectors 116 and cartridge subs 68. (Ex. 1015, Lanclos, 7:1-30, FIGS. 3-5.)

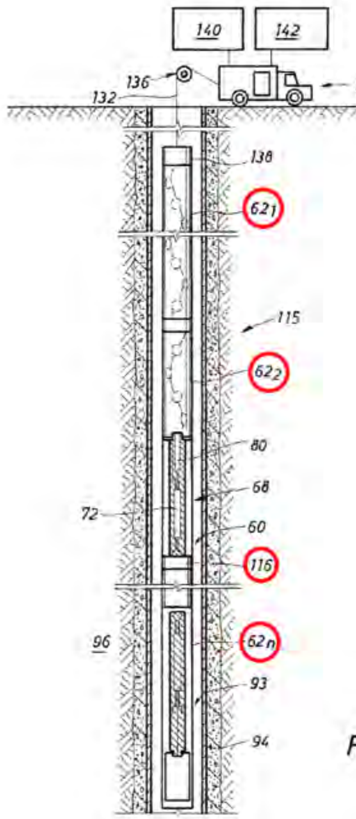


FIG. 5

424. A POSITA would understand that Lanclos teaches connector subs 116 with connectors 90 and receptacles 92. A POSITA would understand that Lanclos teaches connector subs with o-ring seals, and o-ring seals on perforating gun components generally, for sealing the interior of perforating guns from the outside environment. (Ex. 1015, Lanclos, 2:11-13, FIGS. 2A-D.)

425. A POSITA would understand Lanclos to teach a contact pin as a part of electrical connectors and receptacles in connector subs 116. (Ex. 1015, Lanclos, 5:41-47, 6:33-39, 6:48-50, FIGS. 3-5.) Lanclos teaches that the contact pin is in electrical contact with the signal-in contact of the detonator. (Ex. 1015, Lanclos, 6:48-50.)

426. A POSITA would understand that the contact pin in connector sub 116 is a contact pin in electrical contact with the "wireless signal in connector" without the need to connect or attach wires directly to each other. Therefore, Lanclos teaches these limitations of Claims 1, 9, and 16.

J. Goodman teaches the bulkhead limitations

427. Goodman teaches a pressure bulkhead 16, 49 engaging connectors 11 and 12 so that it "provides a path for electrical continuity between the earth's surface and the guns in the string." (Ex. 1018, Goodman, ¶¶ 21-22, 26, FIGS. 2-5.)

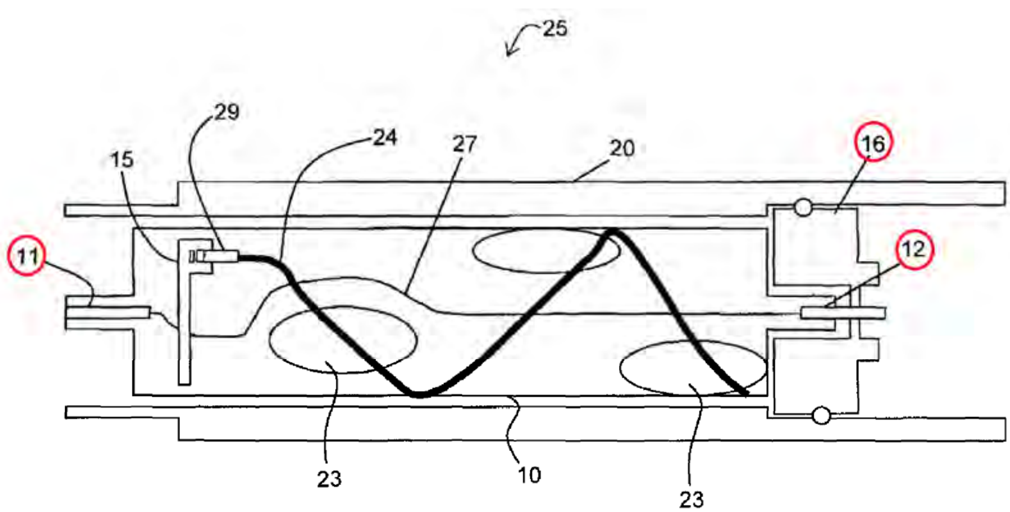


FIG. 2

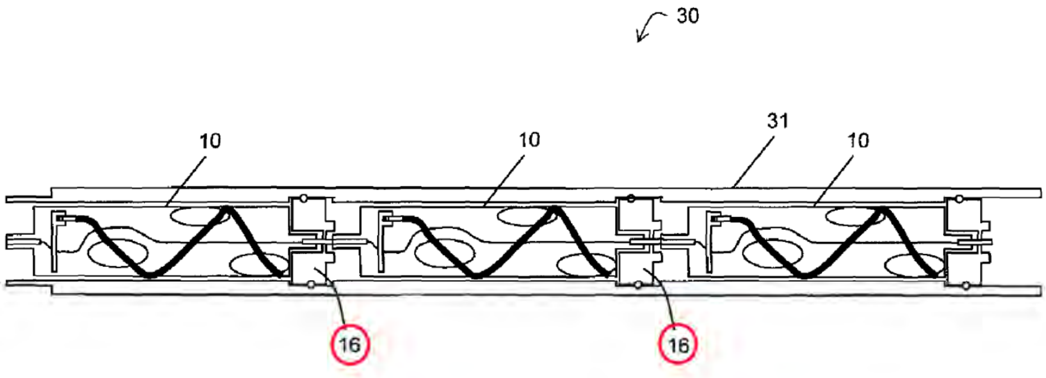


FIG. 3

428. Goodman teaches that pressure bulkhead 16, 49 is within and connected to carrier 20. (Ex. 1018, Goodman, ¶¶ 21-22, 26, FIGS. 2-5.) Goodman teaches that pressure bulkhead 16 "isolates each loading tube assembly from fluids (e.g., wellbore fluids) transported by adjacent loading tube assemblies." (Ex. 1018, Goodman, ¶¶ 21-22, 26, FIGS. 2-5.)

429. A POSITA would understand Goodman's connector 12 to include a signal contact and a ground contact and bulkhead 16 to include corresponding signal and ground contacts to render Goodman's perforating guns functional. A POSITA would understand Goodman's connector 12 to include a contact pin in electrical contact with the "wireless signal in connector" of the detonator without the need to connect or attach wires directly to each other to render Goodman's perforating guns functional. Therefore, Goodman teaches these limitations of Claims 1, 9, and 16.

K. SLB Catalog teaches the bulkhead limitations

430. SLB Catalog teaches "Bulkheads between guns are simple one-wire feed-throughs." (Ex. 1005, SLB Catalog, p. 243.) SLB Catalog teaches "Sealed ballistic bulkheads and swivels are available for long gun strings to prevent flooding of the entire gun string before firing." (Ex. 1005, SLB Catalog, pp. 287, 424.) These teachings are indicative of a POSITA's common knowledge of bulkheads sealing between guns, electrical connections through bulkheads, and the use of tool bodies as a ground path.

L. The bulkhead limitations are obvious

431. A POSITA implementing Lanclos or Goodman would be motivated to combine it with the bulkhead and tandem adapter teachings of Schacherer, Black, Rogman, Harrigan, and/or EWAPS because the electrical contacts through a tandem adapter/bulkhead would be less expensive to manufacture, easier to assemble, would prevent shock related disconnections, and would be obvious to try and would yield predictable results. This would be the predictable application of known methods without any unexpected results, for the perforating components taught, the use of known electrical connectors for their understood benefits, and obvious to try with a reasonable expectation of success.

XIV. Claim 1 limitation of "at least a portion of the bulkhead is contained within a tandem seal adapter, and the wireless ground contact connector is in wireless electrical contact with the tandem seal adaptor." Claim 9 limitation of "[a bulkhead assembly] contained at least in part within a tandem seal adaptor when the modular detonator is received within a gun assembly of a perforating gun system, and the wireless ground contact connector is configured for making wireless electrical contact with the tandem seal adapter when the modular detonator is received within the gun assembly of the perforating gun system."

432. Claim 1 in the '938 Patent includes the limitation "**at least a portion of the bulkhead is contained within a tandem seal adapter, and the wireless ground contact connector is in wireless electrical contact with the tandem seal adaptor.**" (Ex. 1001, the '938 Patent, 11:32-35.) Claim 9 includes the limitation "[a bulkhead assembly] **contained at least in part within a tandem seal adaptor when the modular detonator is received within a gun assembly of a perforating gun system, and the wireless ground contact connector is configured for making wireless electrical contact with the tandem seal adapter when the modular detonator is received within the gun assembly of the perforating gun system."** (Ex. 1001, the '938 Patent, 12:9-17.)

A. The tandem seal adapter limitations are not supported in the written description and there are indefinite

433. As discussed above, the word "wireless" in the claims introduces ambiguity about the scope of the claims and causes them to fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Those same problems apply

to the ambiguity introduced by the term “wireless electrical contact” which is never used, defined, or explained, in the ‘938 Patent. This ambiguity about the scope of the claims causes them to fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Therefore, Claims 1 and 9 of the ‘938 Patent, and all claims that depend from them, are invalid as indefinite.

434. The ‘938 Patent describes a tandem seal adapter 48 as being configured to “seal the inner components within the carrier 12 from the outside environment,… seals the gun assemblies from each other along with the bulkhead 58, and transmits a ground wire to the carrier 12.” (Ex. 1001, the ‘938 Patent, 7:57-63.) The phrase “transmits a ground wire” does not make sense; a wire, as that term is understood by a POSITA, is not transmitted. The ‘938 Patent also teaches that the tandem seal adapter can be one piece or two pieces. (Ex. 1001, the ‘938 Patent, 8:1-5.)

435. A POSITA’s best guess for the meaning of “a tandem seal adapter” would be an adapter or connector providing at least part of a fluid seal between two components or from the outside environment and at least partially containing the bulkhead.

436. A POSITA’s best guess for the meaning of this limitation of Claim 1 would be an adapter or connector, providing at least part of a fluid seal between two components or from the outside environment and at least partially containing the bulkhead, in electrical contact with the “wireless ground contact connector” without the need to connect or attach wires directly to each other.

437. Claim 9 presents additional clarity problems. It is not clear what limitation, if any, is provided by the phrase “the wireless ground contact connector is configured for making wireless electrical contact with the tandem seal adapter.” It is unclear to a POSITA whether this language requires the presence of “a tandem seal adapter,” a specific bulkhead assembly, or arrangement of a tandem seal adapter, or merely the ability to theoretically connect to any “tandem seal adapter”. It is unclear what, if anything, makes a connector “configured for” making electrical contact with a tandem seal adapter. Without a specific type of electrical connection defined, any electrical contact could be “configured for making electrical contact with the tandem seal adapter” and this claim language is meaningless. Because a POSITA cannot tell, what, if anything, is meant by this limitation, Claim 9 fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Therefore, Claim 9 of the ‘938 Patent, and all claims that depend from it, are invalid as indefinite. A POSITA’s best guess as to the meaning of this limitation of Claim 9 is that it requires <u>an electrically grounded component to be</u> in electrical contact with the “wireless ground contact connector” without the need to connect or attach wires directly to each other.

438. As discussed above, the limitation “when the modular detonator is received within the gun assembly of the perforating gun system” introduces additional uncertainty into Claim 9. Because a POSITA cannot tell, what, if anything, is meant by this

limitation, Claim 9 fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Therefore, Claim 9 of the ‘938 Patent, and all claims that depend from it, are invalid as indefinite.

439. As discussed above, the ‘938 Patent never describes a detonator that makes electrical contact with a bulkhead or tandem seal adapter “***when*** it is received within a gun assembly.” Therefore, the ‘938 patent’s written description fails to reasonably convey to those skilled in the art that the inventor had possession of the claimed subject matter.

440. A POSITA’s best guess as to the meaning of this limitation of Claim 9 is that it requires an adapter or connector, providing at least part of a fluid seal between two components or from the outside environment and at least partially containing the bulkhead, in electrical contact with the “wireless ground contact connector” without the need to connect or attach wires directly to each other.

B. A POSITA’s common knowledge includes tandem seal adapters

441. A POSITA’s common knowledge includes the use of bulkheads, tandem adapters, and related components to seal the inner components within the carrier from the outside environment and seal the gun assemblies from each other.” (Ex. 1001, the ‘938 Patent, 7:57-63.) A POSITA’s common knowledge includes placing bulkheads inside a perforating gun carrier and attaching them to a gun carrier by threading them either directly to the gun carrier or to other perforating gun components. A

POSITA's common knowledge would include passing electrical signals through electrical connectors passing through bulkheads, including coaxial pin and barrel connectors such as RCA connectors. A POSITA would understand that the two conductors of coaxial cables and connectors are typically known as a "signal line", typically passed through a pin contact, and a "ground line", typically passed through a barrel contact. A POSITA's common knowledge includes carrying a ground or return path signal through metallic outer bodies of tool strings, including perforating gun carriers. A POSITA's common knowledge includes transmitting those ground paths through tandem adapters that seal perforating gun components from each other and the outside environment without connecting any wires to the tandem adapter.

442. A POSITA's common knowledge includes the use of an adapter or connector, providing at least part of a fluid seal between two components or from the outside environment and at least partially containing the bulkhead, in electrical contact with the "wireless ground contact connector" without the need to connect or attach wires directly to each other. A POSITA would understand tandem seal adapters to be metal adapters that are between adjacent perforating guns that also contain a pressure bulkhead and an electrical feedthrough, and are usually the means of connecting the adjacent guns together. Tandem seal adapters are a basic component that have been designed, manufactured and used in countless configurations over the years. Tandem seal adapters provide a generally effective means for connecting multiple guns

together. The ‘938 Patent does not describe what is different or novel about the tandem seal adapter claim(s) versus prior art. Therefore, a POSITA’s common knowledge teaches these limitations of Claims 1 and 9.

C. Schacherer teaches the tandem seal adapter limitations

443. Schacherer teaches a number of variations on electrical coupler 62, including electrical contact pin 68 passing electrical signals through it. (Ex. 1004, Schacherer, 5:10-21, FIGS. 3, 4.) A POSITA would understand that each of the variations includes the coupler 62 housed in a tandem seal adapter.

444. The body of coupler 62 in provides a fluid seal within coupler 30 with seals 74 and includes a ground contact 70 as discussed above. (Ex. 1004, Schacherer, 5:23-31, FIGS. 3, 4.) A POSITA would understand each variation of coupler 62 taught by Schacherer to include a body and seals as taught in FIG. 3. A POSITA would understand each variation of coupler 62 taught by Schacherer to include an electrical contact pin 68 as taught in FIG. 3.

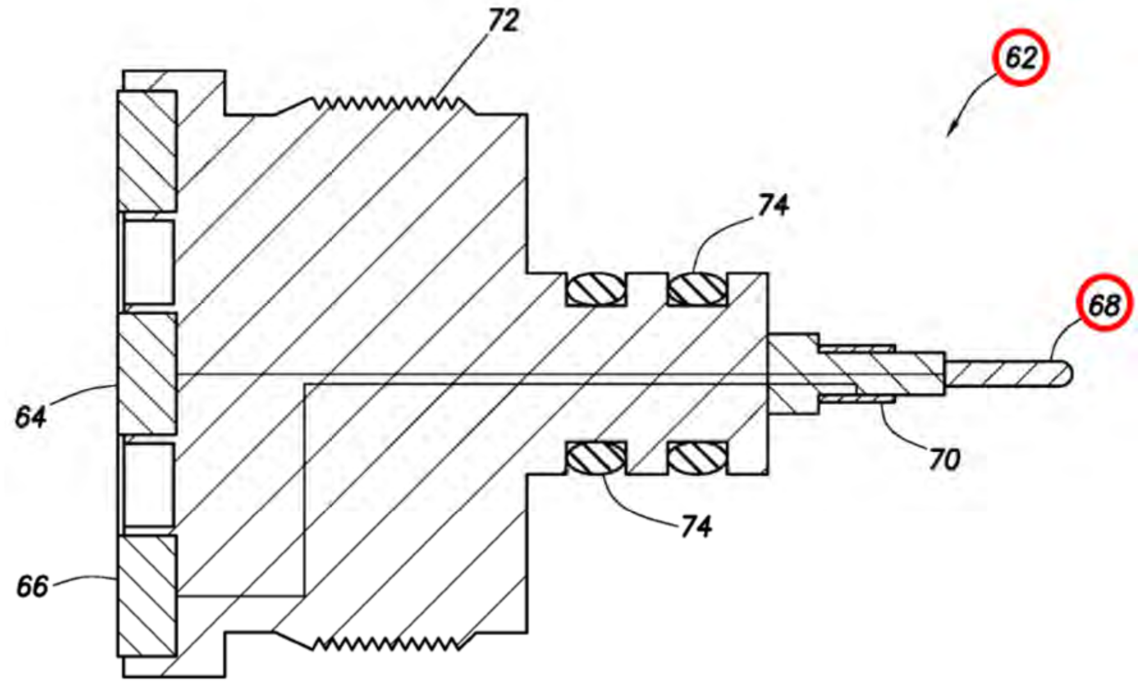


FIG.3

445. Schacherer teaches that electrical contacts 68 and 70 are electrically connected to conductors 98 and 100, which can each function as either a signal-in or a ground to selective firing module 32. (Ex. 1004, Schacherer, 6:13-22, FIGS. 3, 4, 5, 6.)

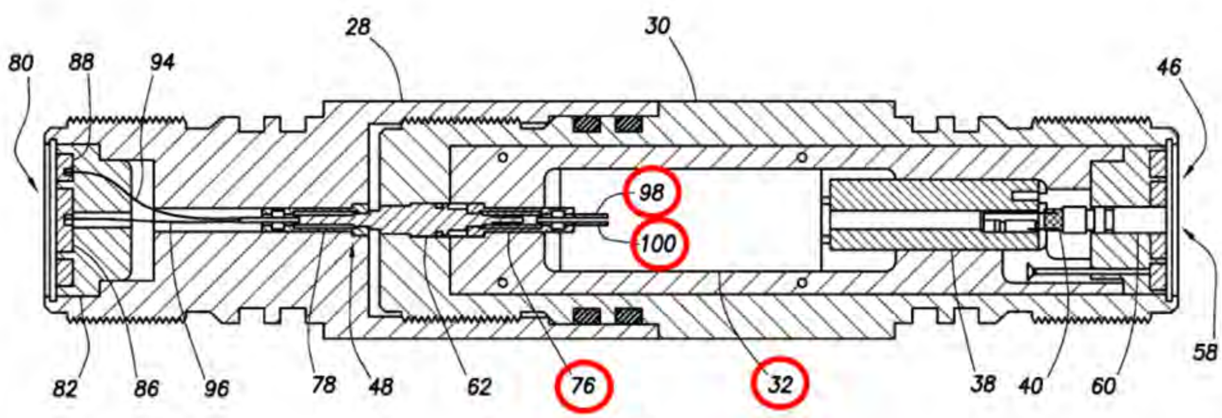


FIG.7

446. A POSITA would understand Schacherer's contact 70 to be in electrical contact with a ground contact connector of a detonator without the need to connect or attach wires to each other. (Ex. 1004, Schacherer, 5:37-42.) Because a POSITA would be used to having the ground signal transmitted through the outer bodies of a tool string, they would tend to place the ground conductor and contacts closer to the outer circumference of the tool than other conductors.

447. A POSITA would understand the body of coupler 62 to be an adapter or connector, providing a fluid seal between two components and from the outside environment and at least partially containing the bulkhead, in electrical contact with the "wireless ground contact connector" without the need to connect or attach wires directly to each other.

448. Schacherer teaches the contact 70 in electrical contact with electrical connector 76 that is electrically coupled to a selective firing module 32. (Ex. 1004, Schacherer, 5:32-36 6:4-8, FIGS. 3, 4, 5, 6.)

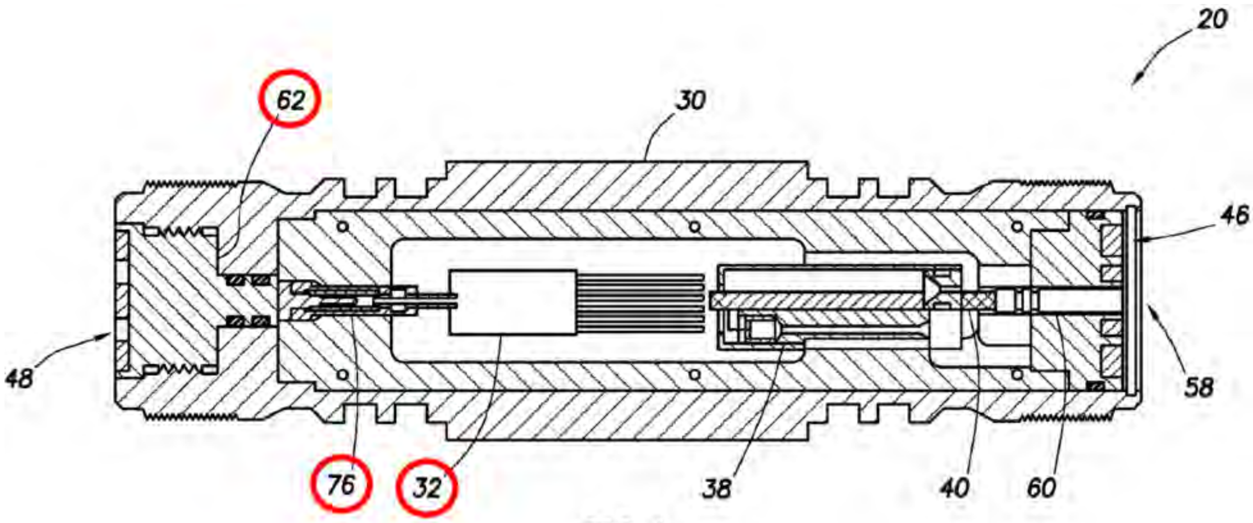


FIG. 4

449. As discussed elsewhere, a POSITA would understand connector 30 to be a part of the gun carrier and Schacherer's coupler 62 is within connector 30.

450. Schacherer teaches both large and small versions of electrical connector 62 fitted in a variety of configurations, housings, and adapters. (Ex. 1004, Schacherer, 5:32-36 6:4-8, FIGS. 3, 4, 5, 6.) Each of the options for electrical connector 62 taught by Schacherer include an electrical contact such as item 70.

451. Schacherer also teaches variations of coupler 62 that are longer, but still "mates with the connector 76, which is sealingly received in the connector 30. This provides additional assurance that pressure and fluid will not be transmitted through the connector 30 between explosive assemblies 20." (Ex. 1004, Schacherer, 5:10-21, 6:4-8, FIGS. 3, 6.)

452. A POSITA would understand Schacherer's teachings regarding electrical connector 62 and associated electrical contacts teach a POSITA the use of an adapter or

connector, providing a fluid seal between two components and from the outside environment and at least partially containing the bulkhead, in electrical contact with the "wireless ground contact connector" without the need to connect or attach wires directly to each other. Therefore, Schacherer teaches these limitations of Claims 1 and 9.

453. Schacherer also teaches that "a single set of conductors could be used for transmitting the signal, with the outer housings 26 and connectors 28, 30 being used for grounding purposes (if they are made of electrically conductive materials, such as steel, etc.)." (Ex. 1004, Schacherer, 6:18-22.) A POSITA would understand that to teach that electrical contact 70 and its associated conductors could be replaced at any point by connection directly to and between the outer housings, 26, 30, 28, and so on of Schacherer to convey the ground path of the communications circuit. For example, a POSITA would know from these teachings of Schacherer that (with reference to FIG 5) the ground path could go from connecter 76 to connecter 62, then to the outer bodies of connector 30, or connector 28, then to outer carriers 26. A POSITA would also know from, the teachings of Schacherer that the ground path could alternatively go from connector 76 directly to the body of connector 30, or the body within connector 30 and from there to the outer housings 26, 28, and 30. A POSITA would be familiar with the methods, techniques, and devices used to transmit the ground path of a circuit through metallic outer housings of downhole

tools as that is the standard ground path for downhole tools, including perforating guns. Schacherer teaches that each of housings 28, 30 and 26 provide seals for providing a fluid seal between two components and from the outside environment. (Ex. 1004, Schacherer, 5:22-24, 6:1-8, 8:41-45, FIGS. 2, 4, 5-7.)

454. Therefore, the outer housings, 26, 28, and 30 teach an adapter or connector, providing a fluid seal between two components and from the outside environment and at least partially containing the bulkhead, in electrical contact with the "wireless ground contact connector" without the need to connect or attach wires directly to each other. Therefore, Schacherer teaches these limitations of Claims 1 and 9.

455. Schacherer teaches a tandem seal adapter in connector 28 in Figures 5 and 7. (Ex. 1004, Schacherer, 4:5-10, 5:37-42, 6:9-22, FIGS. 5, 7.) A POSITA would understand Schacherer's connector 28 to house to contain a contact pin in coupler 78 in electrical contact with a signal-in connector of a detonator without the need to connect or attach wires to each other. (Ex. 1004, Schacherer, 5:37-56.) A POSITA would understand Schacherer's connector to 28 to house a ground contact like item 70 to connect with electrical connection 80. (Ex. 1004, Schacherer, 5:37-56.) Schacherer also teaches rotary electrical couplers 62 and 78 "being sealed and thereby preventing fluid flow through the respective connector 30." (Ex. 1004, Schacherer, 8:41-45.)

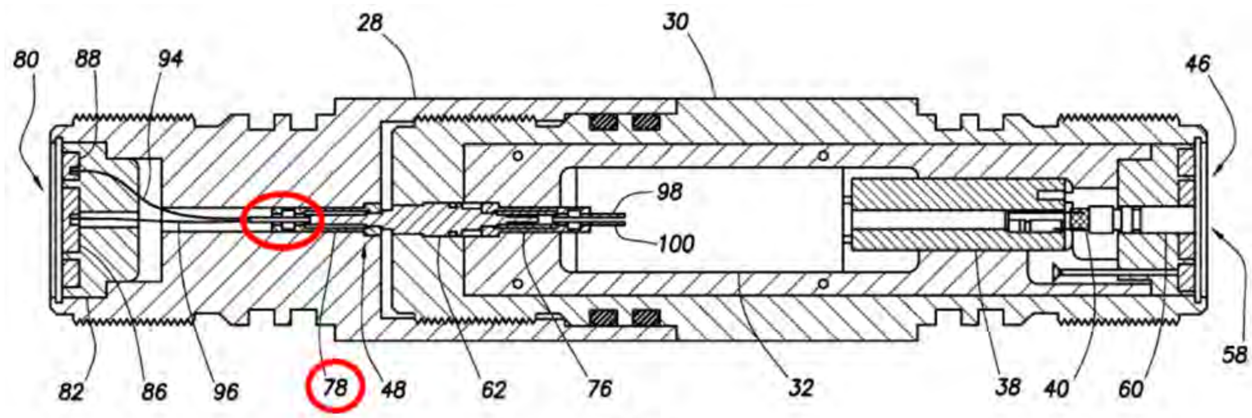


FIG. 7

456. A POSITA would understand Schacherer's coupler 78 to include an electrical contact electrically connected to a ground contact connector of a detonator without the need to connect or attach wires to each other. (Ex. 1004, Schacherer, 5:37-56.) Schacherer teaches that each of housings 28, 30 and 26 provide seals for providing a fluid seal between two components and from the outside environment. (Ex. 1004, Schacherer, 5:22-24, 6:1-8, 8:41-45, FIGS. 2, 4, 5-7.) Schacherer also teaches rotary electrical couplers 62 and 78 "being sealed and thereby preventing fluid flow through the respective connector 30." (Ex. 1004, Schacherer, 8:41-45.)

457. A POSITA would understand Schacherer's teachings regarding connector 28 and electrical coupler 78 and associated seals teach a POSITA the use of an adapter or connector, providing a fluid seal between two components and at least partially containing the bulkhead, in electrical contact with the "wireless ground contact connector" without the need to connect or attach wires directly to each other. Therefore, Schacherer teaches these limitations of Claims 1 and 9.

458. Schacherer teaches multiple tandem seal adapters with electrical contact pins in Figure 6 as circled below. (Ex. 1004, Schacherer, 4:5-10, 5:37-42, 6:9-12, FIGS. 5, 7.)

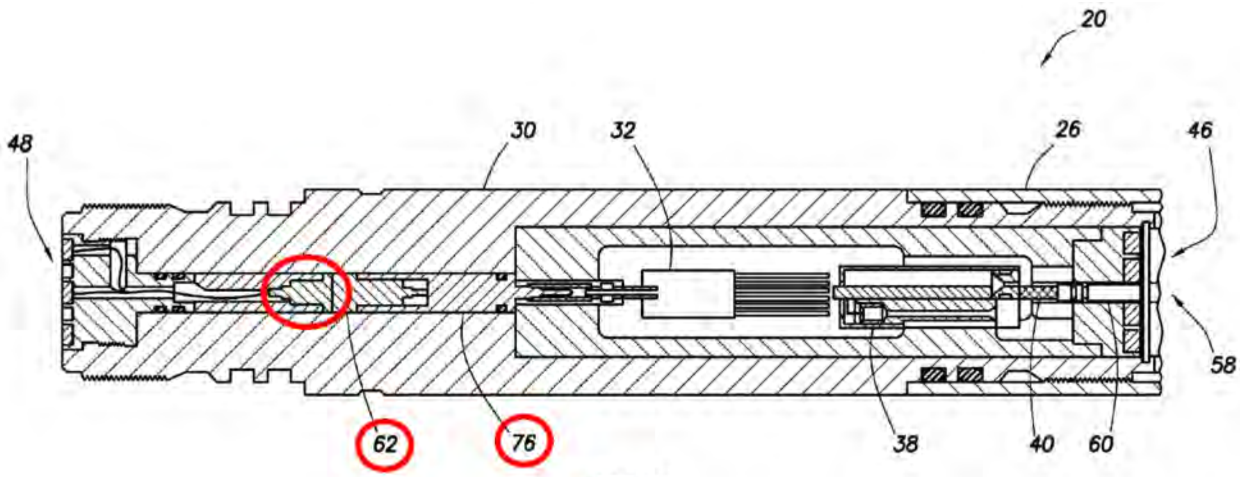


FIG.6

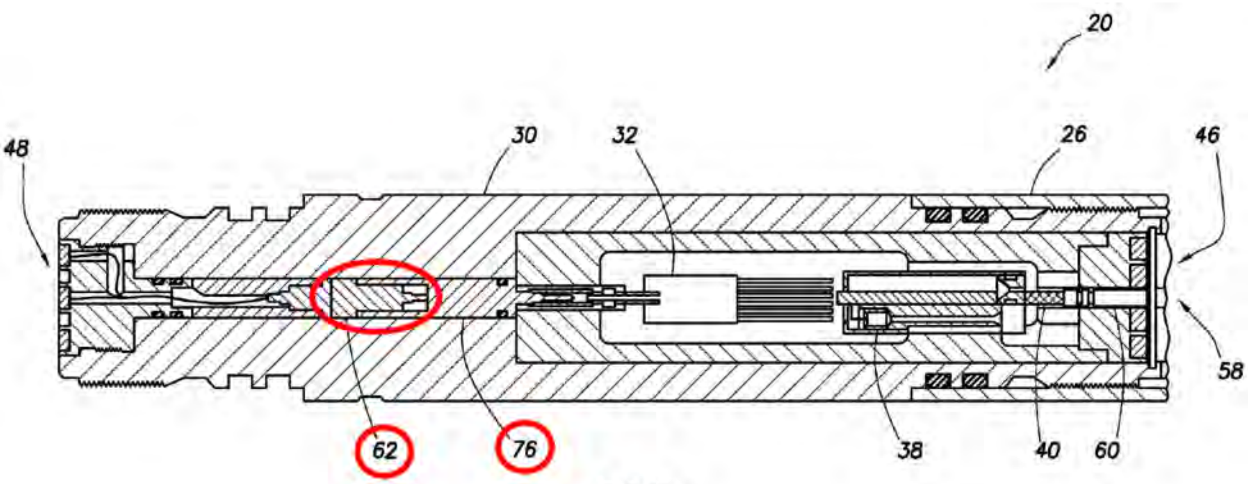


FIG.6

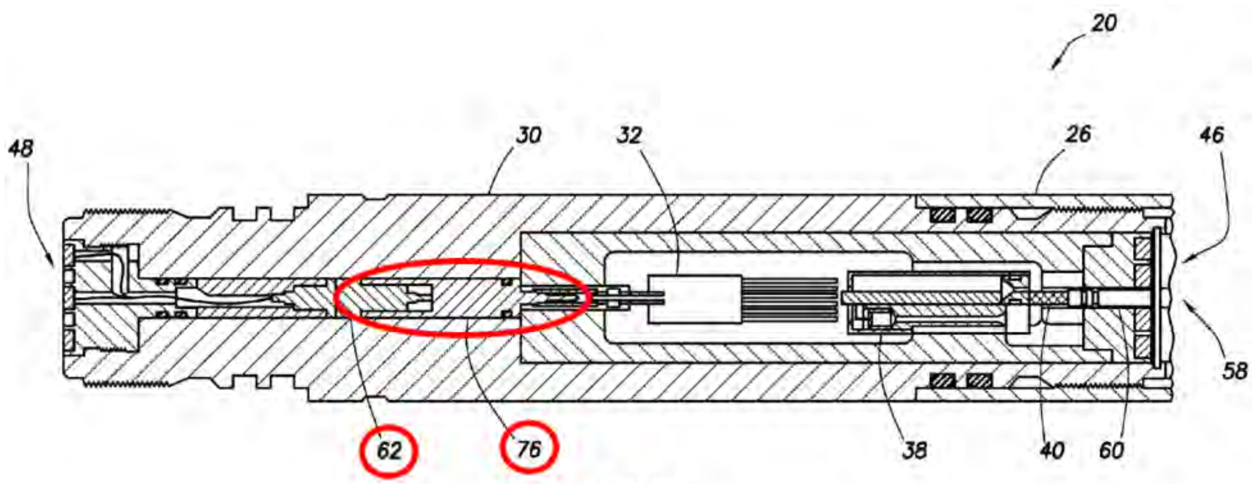


FIG.6

459. A POSITA would understand the circled items above to include a ground contact in electrical contact with a ground contact connector of a detonator without the need to connect or attach wires to each other. (Ex. 1004, Schacherer, 5:37-56.) Schacherer teaches that each of housings 28, 30 and 26 provide seals for providing a fluid seal between two components and from the outside environment. (Ex. 1004, Schacherer, 5:22-24, 6:1-8, 8:41-45, FIGS. 2, 4, 5-7.) Schacherer also teaches rotary electrical couplers 62 and 78 "being sealed and thereby preventing fluid flow through the respective connector 30." (Ex. 1004, Schacherer, 8:41-45.)

460. A POSITA would understand Schacherer's teachings regarding the circled couplers and associated electrical contacts teach a POSITA an adapter or connector, providing a fluid seal between two components or from the outside environment and at least partially containing the bulkhead, in electrical contact with the "wireless ground contact connector" without the need to connect or attach wires directly to each other. Therefore, Schacherer teaches these limitations of Claims 1 and 9.

D. Harrigan teaches the tandem seal adapter limitation

461. Harrigan discloses: "Further, each bulkhead 117, 118 may have a modular feedthru 119, 120 to ultimately provide electrically connectivity between internal components such as the initiator assembly module 125 and communications from surface. Thus, signature commands from surface may reach the initiator assembly module 125 to trigger perforating as noted above." (Ex. 1012, Harrigan, ¶ 0024; Ex. 1028, Harrigan Prov., pp. 5, 6, FIGS. 5, 5 (*sic*).) Harrigan teaches that "communications from bulkhead 117 to bulkhead 118 and beyond are wired through the tube 115." (Ex. 1012, Harrigan, ¶ 0032; Ex. 1028, Harrigan Prov., p. 3, FIG. 1.) Harrigan teaches that bulkheads 117, 118, and feedthru's 119, 120, are within and connected to carrier 110. (Ex. 1012, Harrigan, ¶¶ 0024, 0031, 0035-36, FIGS. 1A, 2A, 5A; Ex. 1028, Harrigan Prov., pp. 3, 5, FIGS. 1, 5.)

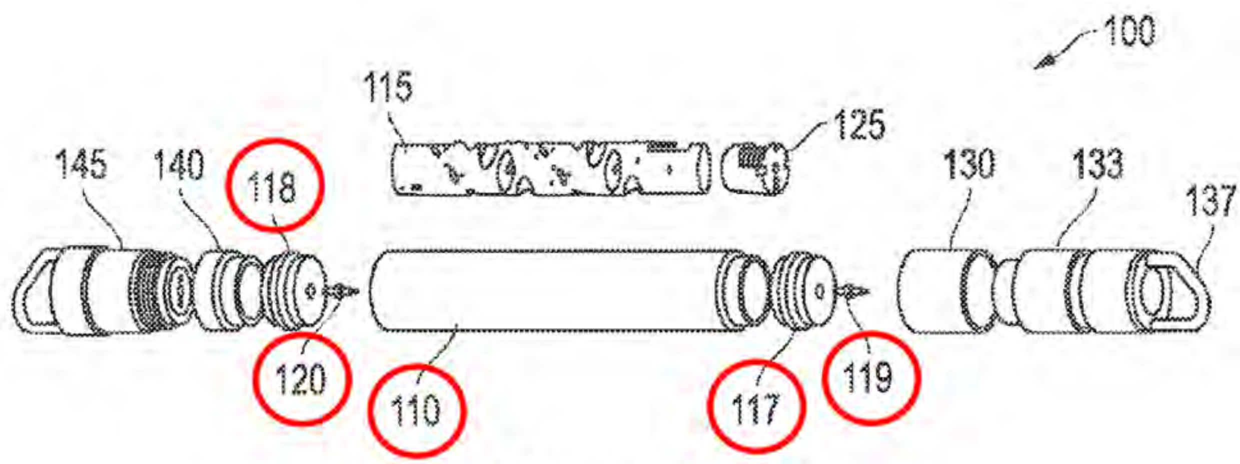


FIG. 1A

462. Harrigan teaches that bulkheads 117 and 118 seal the ends of carrier 110 and loading tube 115. (Ex. 1012, Harrigan, ¶ 0024; Ex. 1028, Harrigan Prov., pp. 3, 5,

FIGS. 1, 5.) Harrigan also teaches “rather than utilizing externally wired initiator and detonator components, manually wired to the gun 100 at the oilfield, a single pre-wired subassembly package 125 of such functionality may be plugged into the loading tube 115.” (Ex. 1012, Harrigan, ¶¶ 0022, 0033; Ex. 1028, Harrigan Prov., pp. 3-5, FIGS. 2-4.) A POSITA would know that the coaxial connectors of Harrigan’s modular feedthrough use pins and barrels to affect their connections. Harrigan teaches that feedthrough 119 includes an electrical connector pin 530 through it. (Ex. 1012, Harrigan, ¶¶ 0043-44, FIG. 5A; Ex. 1028, Harrigan Prov., pp. 5, 6, FIGS. 5, 5 (*sic*).) A POSITA would recognize that Harrigan teaches a pressure barrier and an electrical connection with its bulkhead with feedthrough.

463. Harrigan teaches that “secure ground contact is maintained” by the barrel insert 500 within bulkhead 117, and feedthrough 119. (Ex. 1012, Harrigan, ¶ 0043; Ex. 1028, Harrigan Prov., pp. 4-7, FIGS. 2, 5, 5 (*sic*), 6.) A POSITA would recognize FIG. 5A and 5B of Harrigan as teaching a two-conductor coaxial connector, similar to an RCA connector. (Ex. 1012, Harrigan, ¶¶ 0043-45, FIGS 4A, 4B, 5A, 5B; Ex. 1028, Harrigan Prov., pp. 4-7, FIGS. 2, 5, 5 (*sic*), 6.)

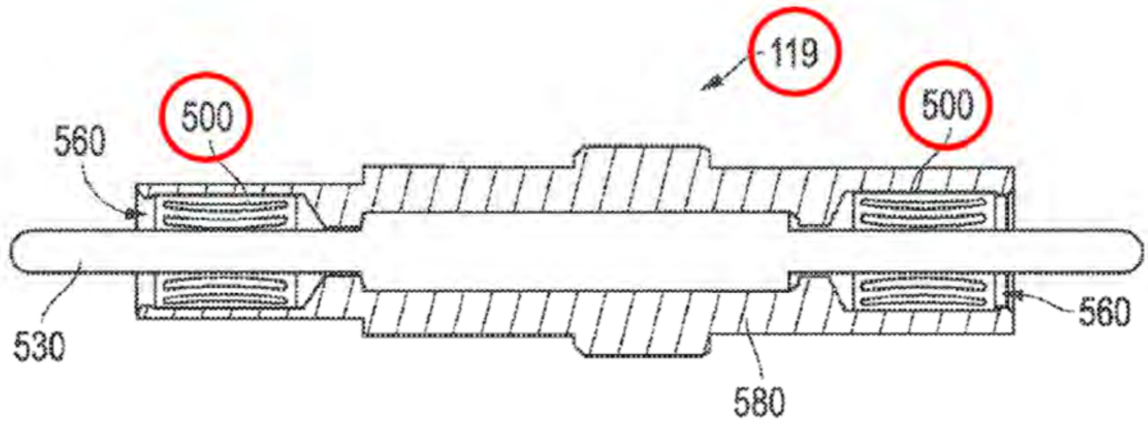


FIG. 5A

464. A POSITA would understand Harrigan's bulkhead and feedthrough to teach an adapter or connector, providing at least part of a fluid seal between two components or from the outside environment and at least partially containing the bulkhead, in electrical contact with the "wireless ground contact connector" without the need to connect or attach wires directly to each other. Therefore, Harrigan teaches these limitations of Claims 1 and 9.

E. Rogman teaches the tandem seal adapter limitations

465. Rogman teaches bulkheads 114, 116, 314, 316 isolating the interior of the perforating gun from wellbore fluids and including conduits for electrical communication through them. (Ex. 1014, Rogman, ¶¶ 0017-19, 0035.)

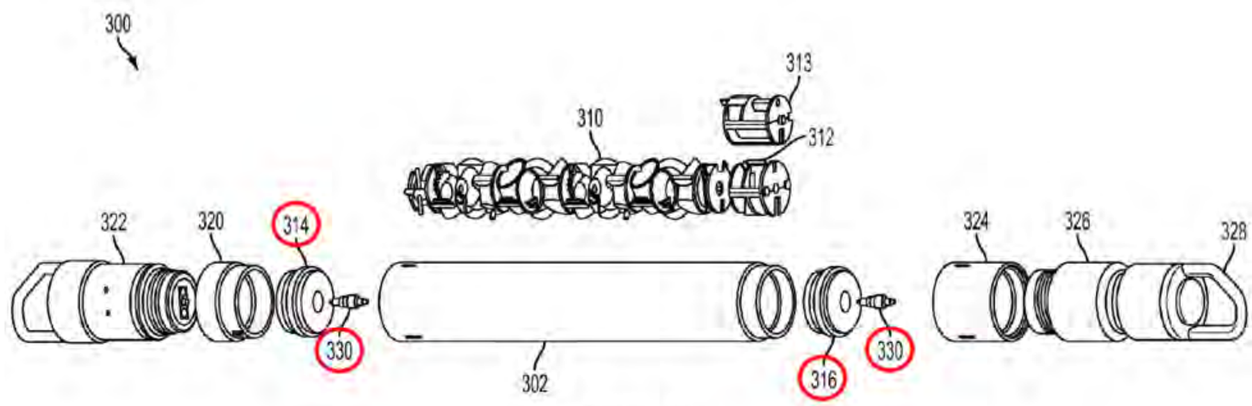


FIG. 3

466. Rogman teaches that "the power cables 502 of each wellbore perforating device in series can be connected to form a string of power cables." (Ex. 1014, Rogman, ¶¶ 0017-19, 0035.) Rogman teaches seals 130, 330, "to maintain fluid isolation of the loading tube 110." (Ex. 1014, Rogman, ¶¶ 0019, 0035, FIGS. 1, 3.) Rogman Prov. teaches "pre-assembled coaxial or twisted pair cables with integrated connectors," and a coaxial connector a POSITA would recognize as an RCA jack and teaches using such a connector through a bulkhead. (Ex. 1020, Rogman Prov., pp. 1, 4, 7, 8.)

467. A POSITA reviewing Rogman would understand seals 130 and 330 to be pressure sealed coaxial connectors designed to mate with the coaxial connectors and RCA jacks taught by Rogman and Rogman Prov. for connecting to the initiator as discussed above. (Ex. 1014, Rogman, ¶¶ 0019, 31, 0035, FIGS. 1, 3; Ex. 1020, Rogman Prov., pp. 1, 4, 7, 8.) A POSITA would understand that the two conductors of coaxial cables and connectors are typically known as a "signal line", typically

passed through a pin contact, and a "ground line", typically passed through a barrel contact. A POSITA would know that coaxial connectors like RCA jacks use pins and barrels to affect their connections. A POSITA would understand Rogman's seals 130, 330, passing through bulkheads 114, 116, 314, and 316, to include barrel contacts consistent with Rogman's teachings of coaxial connectors. (Ex. 1014, Rogman, FIGS. 1, 3.)

468. Rogman Prov. teaches a coaxial feedthrough to engage a coaxial connector on an initiator that also hold pressure in both directions. (Ex. 1020, Rogman Prov., pp. 1, 4, 7, 8.) A POSITA would understand Rogman and Rogman Prov. to teach an electrical contact barrel in bulkhead 114, 116, 314, and 316 that is electrically connected to the ground contact of the initiator.

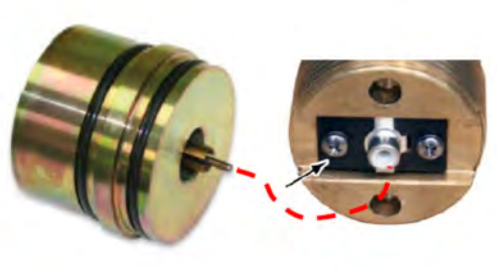
469. A POSITA would recognize that Rogman and Rogman Prov. teach effecting a pressure barrier (via the presence of a bulkhead) and an electrical connection with coaxial connections, using pins and barrels to affect their connections, through the step of connecting one perforating gun assembly to another.

470. A POSITA would recognize Rogman's bulkhead 114, 116, 314, and 316 as including an adapter or connector, providing at least part of a fluid seal between two components or from the outside environment and at least partially containing the bulkhead, in electrical contact with the "wireless ground contact connector" without the need to connect or attach wires directly to each other.

471. A POSITA would recognize Rogman Prov.'s coaxial feedthrus as including an adapter or connector, providing at least part of a fluid seal between two components or from the outside environment and at least partially containing the bulkhead, in electrical contact with the "wireless ground contact connector" without the need to connect or attach wires directly to each other. Therefore, Rogman Prov. teaches these limitations of Claims 1 and 9.

F. EWAPS teaches the tandem seal adapter limitations

472. EWAPS teaches disposable bulkheads with a coaxial RCA type connector for making electrical contact with a corresponding connector on the initiator. (Ex. 1013, EWAPS, pp. 9, 10, 12.) A POSITA would understand the ground path to the initiator to be carried by the barrel in the disposable bulkhead. (Ex. 1013, EWAPS, p. 10.) EWAPS teaches that the disposable bulkheads have o-rings to provide a seal between perforating guns and to seal the perforating guns from the outside environment when received in and connected to the perforating gun carrier. (Ex. 1013, EWAPS, pp. 9, 10, 12.)



Disposable bulkheads

473. A POSITA would understand that the barrel of EWAPS's bulkhead is in electrical contact with the ground contact of the initiator without the need to connect or attach wires directly to each other. A POSITA would understand EWAPS to teach an adapter or connector, providing at least part of a fluid seal between two components or from the outside environment and at least partially containing the bulkhead, in electrical contact with the "wireless ground contact connector" without the need to connect or attach wires directly to each other. Therefore, EWAPS teaches these limitations of Claims 1 and 9.

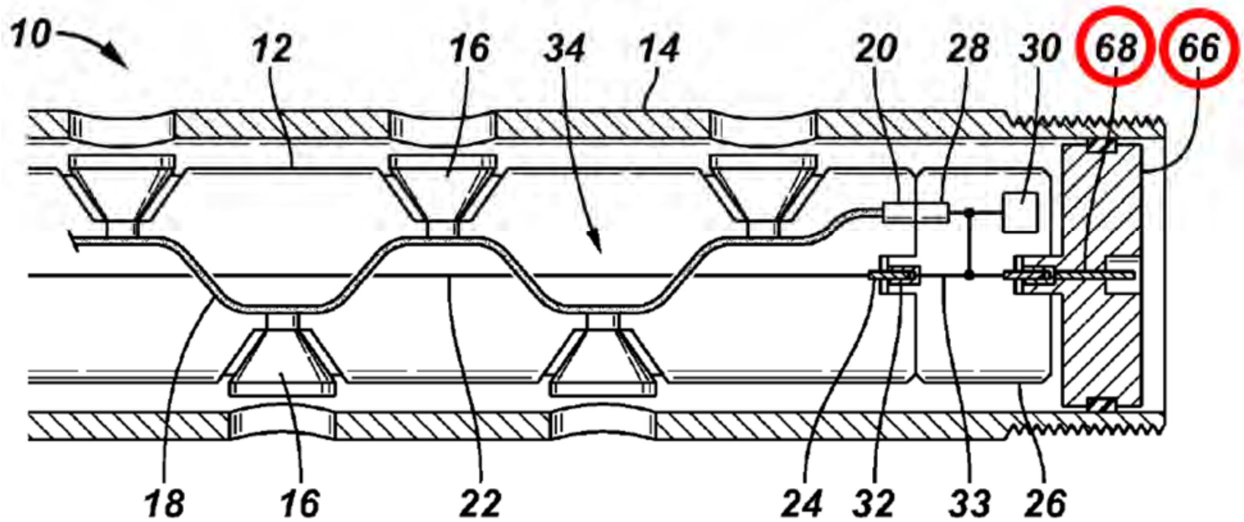
G. Black teaches the tandem seal adapter limitations

474. Black teaches an arming device 26, including a detonator 28, firing electronics 30 (such as an addressable switch), electrical connector 32 and an electrical connector opposite connector 32. (Ex. 1002, Black, ¶¶ 0024-26, 37-38, FIGS. 8, 9.) Black teaches that electrical connectors of arming device 26 can be RCA connectors. (Ex. 1002, Black, ¶ 29.) A POSITA would understand that an RCA connector has two conductive electrical contacts, an inner pin and outer ring or barrel. A POSITA would read Black's electrical connectors 32, 24 and conductors 33, 22 as containing paired conductors, such as coaxial or twisted pair conductors and contacts as would be used with the disclosed RCA connectors.

475. Black teaches a bulkhead 66 containing an electrical feed-through conductor 68 in electrical contact with an electrical connector of arming device 26. (Ex. 1002, Black,

¶¶ 34, 38-40, FIGS. 7, 10.) A POSITA would understand Black's teaching of RCA connectors to apply to the electrical connection between bulkhead 66 and arming device 26. (Ex. 1002, Black, ¶¶ 29, 34, 38, FIGS. 7, 10.)

FIG. 7



476. Black teaches that the bulkhead 66 and feed-through 68 are inserted in and connected to a gun carrier 14. (Ex. 1002, Black, ¶¶ 34-40, FIGS. 7, 10.) Black teaches a seal between the bulkhead 66 and the carrier 14 to seal the interior of the carrier from other perforating guns and from the outside environment. (Ex. 1002, Black, ¶¶ 37, FIGS. 7, 10.)

477. A POSITA would understand that Black teaches that bulkhead 66 is in electrical contact with the ground barrel contact of arming device 26.

478. A POSITA would understand that Black's bulkhead 66 is an adapter or connector, providing at least part of a fluid seal between two components or from the outside environment and at least partially containing the bulkhead, in electrical contact with

the "wireless ground contact connector" without the need to connect or attach wires directly to each other. Therefore, Black teaches these limitations of Claims 1 and 9.

H. Lanclos teaches the tandem seal adapter limitations

479. Lanclos teaches connector subs 116 "for coupling upstream ends of the cartridge subs 68 with an upstream perforating gun" and "electrical communication extends substantially the length of the string 115 via contact between successive connectors 90 and receptacles 92." (Ex. 1015, Lanclos, 7:17-30, FIGS. 3-5.)

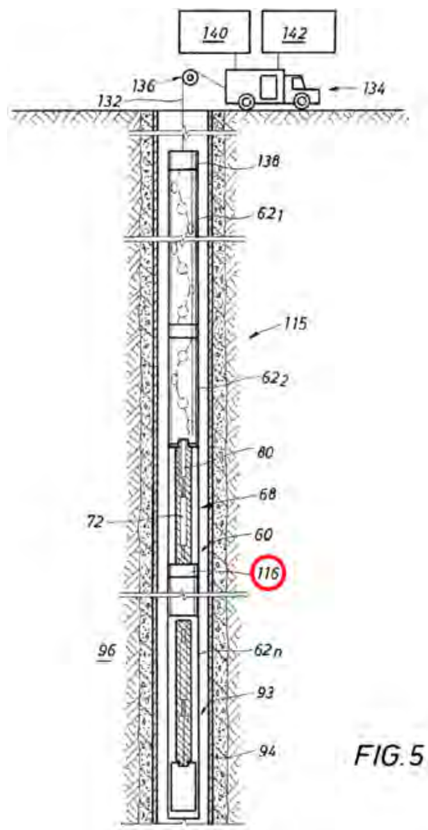


FIG. 5

480. A POSITA would understand that Lanclos teaches connector subs 116 with connectors 90 and receptacles 92. A POSITA would understand that Lanclos teaches connector subs with o-ring seals, and o-ring seals on perforating gun components

generally, for sealing the interior of perforating guns from the outside environment. (Ex. 1015, Lanclos, 2:11-13, FIGS. 2A-D.)

481. A POSITA would understand Lanclos to teach that the connector sub 116 is in electrical contact with the ground contact connecter of the detonator. (Ex. 1015, Lanclos, 6:48-50, FIGS. 3-4.)

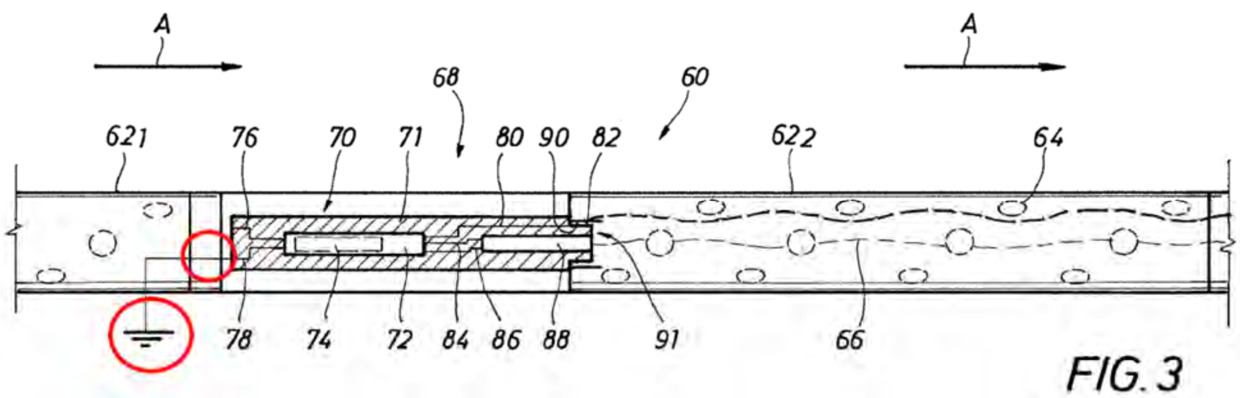


FIG. 3

482. A POSITA would understand that the connector sub 116 is an adapter or connector, providing at least part of a fluid seal between two components or from the outside environment and at least partially containing the bulkhead, in electrical contact with the "wireless ground contact connector" without the need to connect or attach wires directly to each other. Therefore, Lanclos teaches these limitations of Claims 1 and 9.

I. Goodman teaches the tandem seal adapter limitations

483. Goodman teaches a pressure bulkhead 16, 49 engaging connectors 11 and 12 so that it “provides a path for electrical continuity between the earth's surface and the guns in the string.” (Ex. 1018, Goodman, ¶¶ 21-22, 26, FIGS. 2-5.)

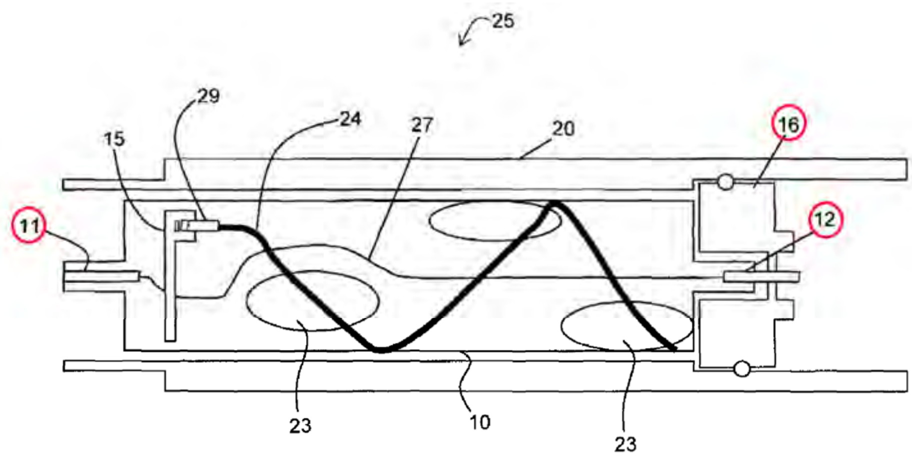


FIG. 2

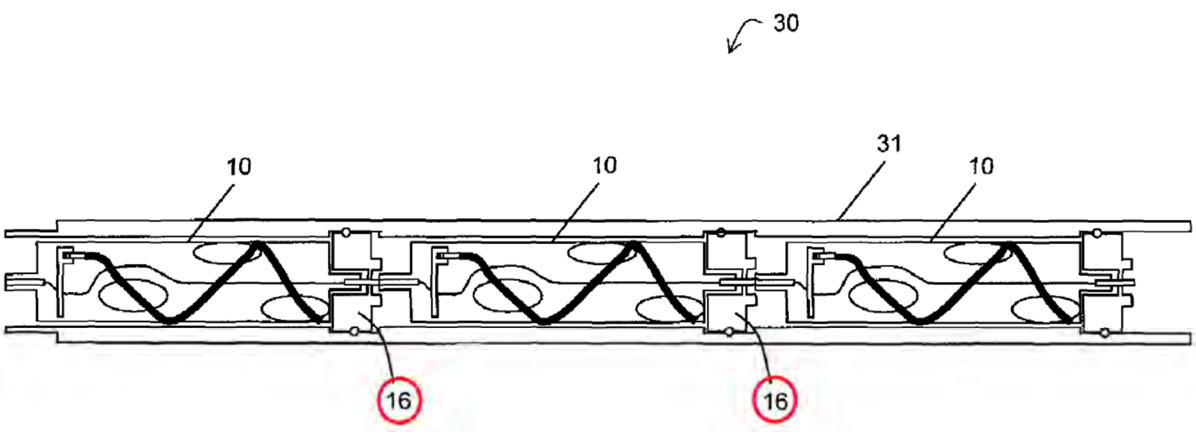


FIG. 3

484. Goodman teaches that pressure bulkhead 16, 49 is within and connected to carrier 20. (Ex. 1018, Goodman, ¶¶ 21-22, 26, FIGS. 2-5.) Goodman teaches that pressure bulkhead 16 "isolates each loading tube assembly from fluids (e.g., wellbore fluids) transported by adjacent loading tube assemblies." (Ex. 1018, Goodman, ¶¶ 21-22, 26, FIGS. 2-5.)

485. A POSITA would understand Goodman's connector 12 to include a signal contact and a ground contact and bulkhead 16 to include corresponding signal and ground contacts to render Goodman's perforating guns functional. A POSITA would understand Goodman's connector 16 to be in electrical contact with the ground contact connector of the detonator without the need to connect or attach wires directly to each other to render Goodman's perforating guns functional. A POSITA would understand Goodman's connector 16 to teach an adapter or connector, providing at least part of a fluid seal between two components or from the outside environment and at least partially containing the bulkhead, in electrical contact with the "wireless ground contact connector" without the need to connect or attach wires directly to each other. Therefore, Goodman teaches these limitations of Claims 1, and 9.

J. Bonavides teaches the tandem seal adapter limitations

486. Ex. 1017, Bonavides teaches that it is well known in the art to use the tubular bodies of perforating guns, subs, and related tools to transmit the ground path of a circuit in a tool string. (Ex. 1017, Bonavides, 2:42-45, 14:51-53.) Thus, the detonator 38 through its ground wire and ground wire contact would also be simultaneously connected to the ground of the tandem seal adapter (connector(s) 28 and 30) and the gun carrier upon assembly, as claimed.

487. Bonavides teaches "[a]lso, a system for actuating downhole tools may, in part, utilize metallic housings of downhole tools as a ground reference of the system." (Ex. Bonavides, 2:42-45.) A POSITA would recognize that, stated another way, Bonavides also teaches that wires are not necessary to transmit all of the ground path of a circuit in a tool string because the bodies of perforating guns, subs, and related tools, which are in contact with each other, are the ground, and that therefore electrical ground connections can and are made merely by contact of the various "ground" components to each other.

488. A POSITA would recognize that Schacherer's electrical couplers, or mating couplers, or couplers 62, shown in FIGS. 3-7, also function as a bulkhead and are contained in connector 30, which is a tandem seal adapter. A POSITA would recognize that Schacherer's various illustrated configurations satisfy "at least a portion of the bulkhead is contained within a tandem seal adapter."

489. A POSITA would recognize that Schacherer teaches the "ground of detonator connected to ground wire and ground contacts in tandem seal adapter, and internal gun assembly ground."

490. A POSITA would be motivated to combine the ground contact teachings of Bonavides with the ground connections and bulkhead teachings of Schacherer to teach, "at least a portion of the bulkhead is contained within a tandem seal adapter, and the wireless ground contact connector is in wireless electrical contact with the tandem seal adapter," as claimed.

K. SLB Catalog teaches the tandem seal adapter limitations

491. SLB Catalog teaches "Bulkheads between guns are simple one-wire feed-throughs." (Ex. 1005, SLB Catalog, p. 243.) SLB Catalog teaches "Sealed ballistic bulkheads and swivels are available for long gun strings to prevent flooding of the entire gun string before firing." (Ex. 1005, SLB Catalog, pp. 287, 424.) These teachings are indicative of a POSITA's common knowledge of bulkheads sealing between guns, electrical connections through bulkheads, and the use of tool bodies as a ground path.

XV. <u>**Claim 13 limitation of "(e) energetically coupling the detonating cord to the detonator…." Claim 10 limitation of "[t]he modular detonator of claim 9, further comprising a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator."**</u>

492. Claim 13 in the '938 Patent includes the limitation "**(e) energetically coupling the detonating cord to the detonator….**" (Ex. 1001, the '938 Patent, 12:51-52.) Claim 10 includes the limitation "**[t]he modular detonator of claim 9, further comprising a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator.**" (Ex. 1001, the '938 Patent, 12:18-22.)

A. The energetically coupled limitation is not support by the written specification

493. The '938 Patent teaches "the gun system also includes a detonator 26 energetically coupled to the detonation cord 20." (Ex. 1001, the '938 Patent, 5:50-51.) The '938 Patent does not define energetically coupled, however a POSITA would understand that a detonator energetically coupled to a detonation cord means that the detonator is sufficiently proximate that it can properly initiate a nearby detonation cord. A POSITA would know that all perforating gun systems and all other systems which use detonators and detonating cord must have the detonator energetically coupled to the detonating cord for the perforating gun or other system to function as intended

and required. The plain and ordinary meaning to a POSITA of the Claim 13 (e) limitation is placing a detonator sufficiently proximate to a detonating cord such that when the detonator is initiated the detonation will be transferred to the detonating cord.

494. In general energetic coupling can be: 1) end-to-end, where the detonating cord inserts into one end of the detonator and is held in position such that detonation is transferable from the end of the detonator to the end of the detonating cord, or 2) side-by-side, where the detonator's output charge is positioned parallel to and as close to touching the detonating cord as possible, and thereby being able to transfer detonation to the cord.

495. The specification discloses the following relevant to this claim: "The elongated opening 247 is flanked by side walls 248 that provide the energetic coupling between the detonator 26 and the detonation cord 20." (Ex. 1001, the '938 Patent, 7:39-42), and "[a]s better shown in FIG. 15 or 18, the top connector 14 may also include a blind hole 45 to contain or house the detonation cord, thus eliminating the need for crimping the detonation cord during assembly." (Ex. 1001, the '938 Patent, 8:46-49), and "a detonation cord connectable to the top connector and to each stackable charge holder;" (Ex. 1001, the '938 Patent, 9:34-35), and "a detonator energetically couplable to the detonation cord," (Ex. 1001, the '938 Patent, 9:40.) The specification of the '938 Patent does not disclose the detonator physically connecting

to, holding onto or otherwise encompassing the detonating cord. “In an embodiment, the top connector 14 provides energetic coupling between the detonator and detonating cord.” (Ex. 1001, the ‘938 Patent, 6:19-20.) However, if the detonating cord is in blind hole 45 as stated in the specification, on the opposite side from side walls 248 and detonator body 102, it would not be energetically coupled to the detonator.

B. Claim construction of the energetically coupled limitations.

496. The only description provided for a structure that can provide energetic coupling is “[t]he elongated opening 247 is flanked by side walls 248 that provide the energetic coupling between the detonator 26 and the detonation cord 20.” (Ex. 1001, the ‘938 Patent, 7:39-42.) However, the ‘938 Patent never describes the detonating cord near side walls 248. Instead the ‘938 Patent describes the detonating cord in blind hole 45, next to the detonator head 100, and on the opposite side of from side walls 248 and detonator body 102. (Ex. 1001, the ‘938 Patent, 8:46-49.) The ‘938 Patent does not inform a POSITA where the explosive component of the detonator is located, in detonator body 102, or detonator head 100. A POSITA would recognize that the most likely contents of the detonator head 100 would be electronics, not explosives, and that energetically coupling detonator and detonating cord requires placing the detonating cord proximate to the explosives in the detonator, not the electronics, and not the electrical connections as in the stated case of blind hole 45.

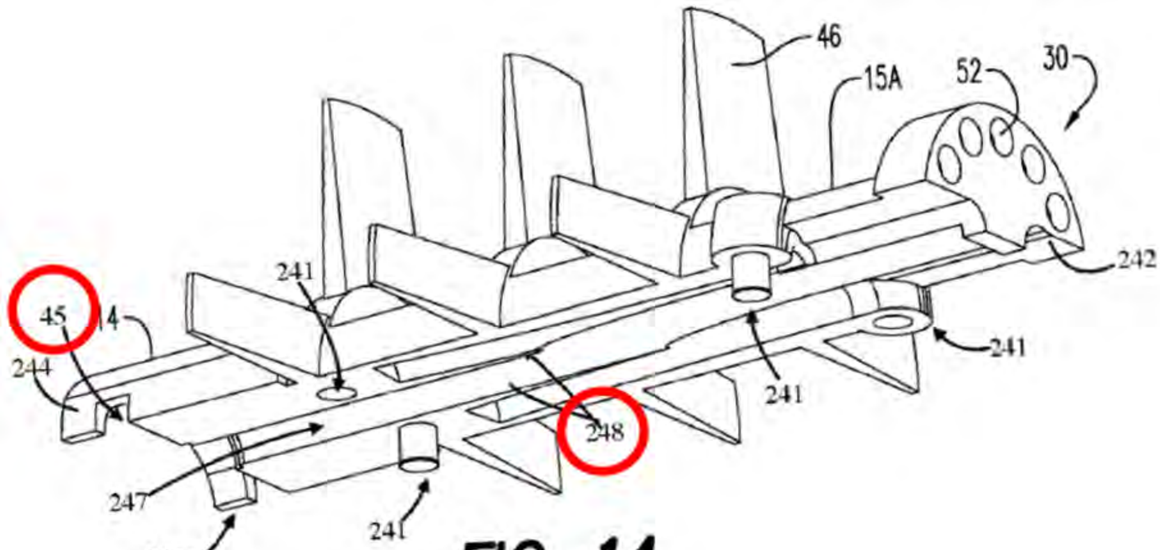


FIG. 14

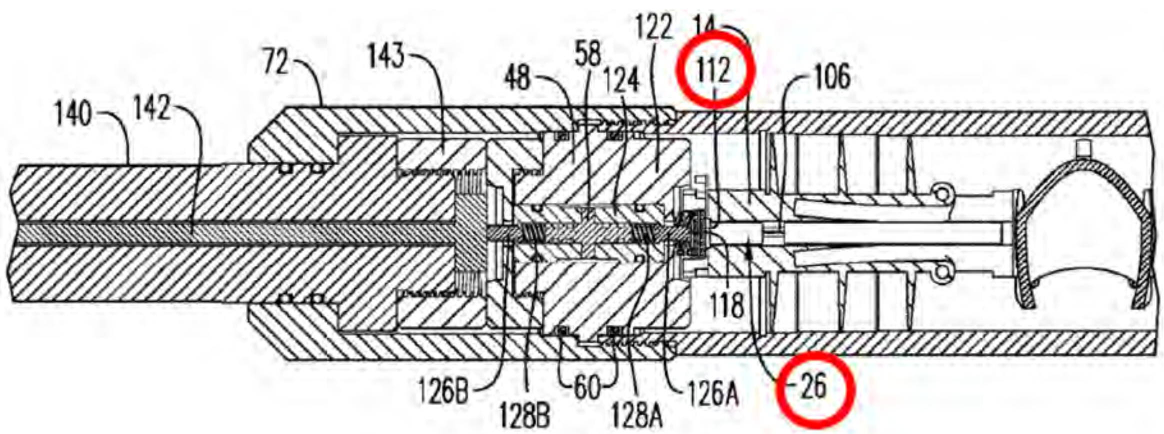


FIG. 33

497. A POSITA would recognize that a detonating cord in blind hole 45 would not be energetically coupled to the detonator 26 in elongated opening 247 by side walls 248 or in any other way. Therefore, the ‘938 specification does not reasonably convey to those skilled in the art that the inventor had possession of a system or method that

includes energetically coupling the detonating cord to the detonator and Claim 13 is invalid for lack of written description support.

C. The energetically coupled limitations are indefinite.

498. Claim 10 requires that **a modular detonator** have a "detonating cord connecting portion." (Ex. 1001, the '938 Patent, 12.18-22.) A POSITA would understand Claim 10 as describing a detonator that is able to connect to a detonating cord in the conventional sense, that is, that the detonating cord inserts into one end of the detonator and is held in position such that detonation is transferable from the detonator to the detonating cord. A POSITA would know that the majority of commercial detonators over many decades had a "detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator."

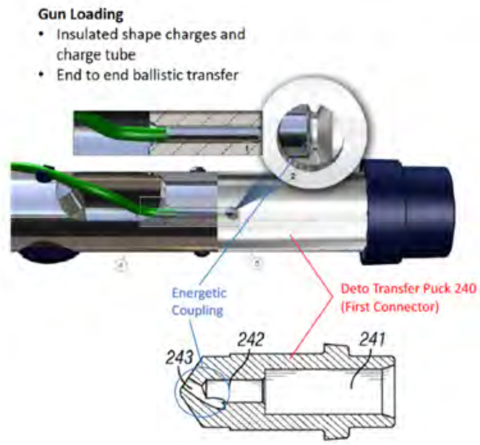
499. However, the '938 Patent provides no discussion of a detonator with a detonating cord connecting potion, but rather describes only detonators that do not have any way to retain a detonating cord. (Ex. 1001, the '938 Patent, FIGS. 27-31.) Instead, the '938 Patent describes a "top connector" for this purpose. (Ex. 1001, the '938 Patent, 3:9-12, 6:19-20, 7:32-36.)

500. The specification of the '938 Patent does not provide information relevant to the sizing of the detonator to retain the detonating cord. In addition, the specification of

the ‘938 Patent does not disclose the detonator physically connecting to, holding onto or otherwise encompassing the detonating cord.

501. From the ‘938 Patent specification a POSITA would understand that the top connector positions the detonator and the detonating cord in side-by-side proximity to each other such that detonation is transferable. The terms “modular detonator” and “detonating cord connecting portion,” are not present in the ‘938 Patent specification, nor is the partial term “cord connecting portion,” or the words “size” or “retain.” The ‘938 Patent lacks written description that reasonably conveys to those skilled in the art that the inventor had possession of the subject matter of Claim 10.

502. Demonstrating the confusion and ambiguity of this claim language, Patent Owner has alleged infringement of Claim 10 by a transfer puck, something that is not a detonator and that Patent Owner alleges is the “first connector,” not a detonator. (Ex. 1006, Infringement Contentions, p. 0031.)

US 10,472,938 Claim 10	Defendant's H-1® Perforating Gun System
10. The modular detonator of claim 9, further comprising a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator.	The deto transfer puck of the H-1 gun system has a detonating cord connecting portion.  FIG. 20D

503. Given the disconnect between the claim language and the description in the '938 patent, Claim 10 fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Therefore, Claim 10 is indefinite.

504. A POSITA's best guess at the meaning of Claim 10 would be a detonator that retains a detonating cord in one end of the detonator and holds it in position such that detonation is transferable from the detonator to the detonating cord.

D. The background of the '938 Patent acknowledges energetically coupling as prior art.

505. The '938 Patent describes prior art perforating guns as having "a detonating cord leading through the gun carrier that is coupled to a detonator." (Ex. 1001, the '938 Patent, 1:40-42, 1:49-53.) This is energetically coupling the detonator and detonating cord as in Claim 13. As described below, a POSITA would understand

that some component would be necessary in the prior art to perform this function to render any perforating gun functional. A POSITA would look to the many commercial detonators available over many decades that had a "detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator," to provide the coupling functionality described in the background of the '938 Patent.

E. A POSITA's common knowledge includes the energetic coupling limitations.

506. A POSITA's common knowledge would include that a typical perforating gun includes a detonator energetically coupled to a detonating cord. Therefore, a POSITA's common knowledge teaches the energetically coupling limitation of Claim 13.

507. A POSITA would know that the majority of commercial detonators in use in perforating guns over many decades had a "detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator." Therefore, a POSITA's common knowledge teaches the limitations of Claim 10.

F. Schacherer teaches the energetically coupling limitations and the detonating cord retaining portion of a detonator limitation.

508. Schacherer teaches a detonator 38 with a detonating cord retaining portion in side-by-side proximity to detonating cord 48, which is energetically coupled to detonating cord 22. (Ex. 1004, Schacherer, 3:33-37, FIGS. 2, 4, 5 and 6.)

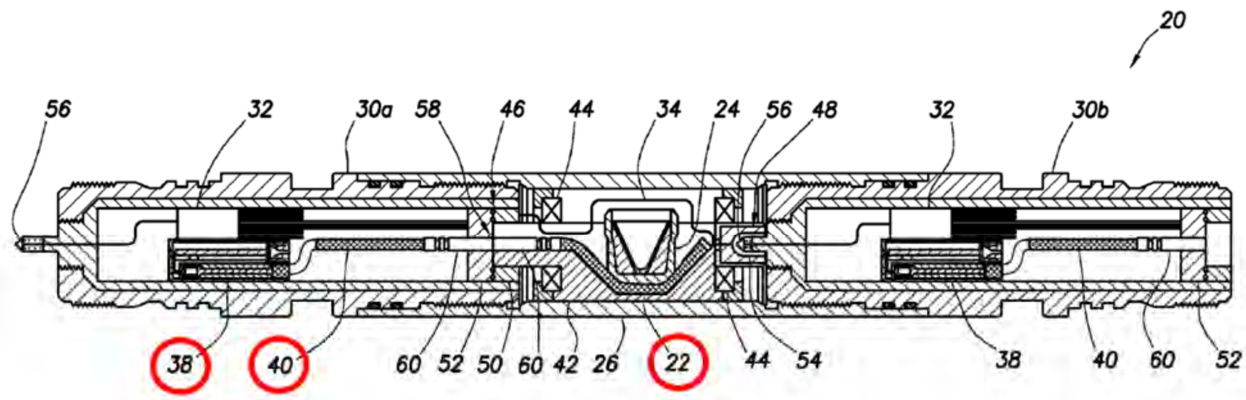


FIG.2

509. A POSITA would recognize that Schacherer teaches energetically coupling the detonating cord to the detonator.

510. A POSITA would recognize that Schacherer teaches detonator with a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator.

511. A POSITA would recognize that Schacherer teaches the detonator and detonating cord in side-by-side energetic coupling and that therefore, in the case of side-by-side energetic coupling, Schacherer teaches "energetically coupling the detonating cord to the detonator," as claimed in the Claim 13 (e) limitation.

512. In order to practice energetic coupling as claimed in the ‘938 Patent Claim 10 limitation, a POSITA would look to the prior art teachings of Carisella (with visual clarification from the SLB Catalog) which describes end-to-end energetic coupling. The Claim 13 (e) limitation, “energetically coupling the detonating cord to the detonator…,” does not differentiate between side-by-side and end-to-end energetic coupling and therefore a POSITA may look to the teachings of each or both of Schacherer and Carisella to find the sufficient prior art.

G. Harrigan teaches the energetically coupling limitations.

513. Harrigan teaches an initiator assembly 125 with a detonator 301. (Ex. 1012, Harrigan, ¶ 0022-23, 0027, 0037-38, FIG 3A; Ex. 2028, Harrigan Prov., p. 5, FIG. 4.) Harrigan teaches the necessity of aligning the detonator 301, which a POSITA would understand is necessary to energetically couple the detonator to the detonating cord. (Ex. 1012, Harrigan, ¶ 0038; Ex. 2028, Harrigan Prov., p. 5, FIG. 4.) A POSITA would find detonating cord attached to the shaped charges, loading tube 115, and detonator inherent in Harrigan because that is how shaped charges are almost universally detonated in perforating guns and a POSITA would assume that connection would be completed in the standard way to make the system of Harrigan functional. (Ex. 1012, Harrigan, ¶¶ 0007, 0022, 0024, 0042, FIGS. 1, 2A, 4B; Ex. 2028, Harrigan Prov., p. 5, FIG. 4.) A POSITA would also know this is necessary through each of Harrigan and Harrigan Prov.’s teaching of the detonator causing

firing of the perforating gun. *Id*. A POSITA would recognize that Harrigan teaches energetically coupling the detonating cord to the detonator.

H. Rogman teaches the energetically coupling limitations.

514. Rogman and Rogman Prov. teach initiator assemblies 112, 312, 313, including detonator 402 plugged into the loading tube and energetically coupled to detonator cord 404. (Ex. 1014, Rogman, ¶¶ 0015, 0021, 0026-27, 0029, FIGS. 1-4; Ex. 1020, Rogman Prov., pp. 1-4, FIGS. 1-5.) Rogman also teaches a portion of the initiator assembly sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator as shown in Figure 4. *Id*.

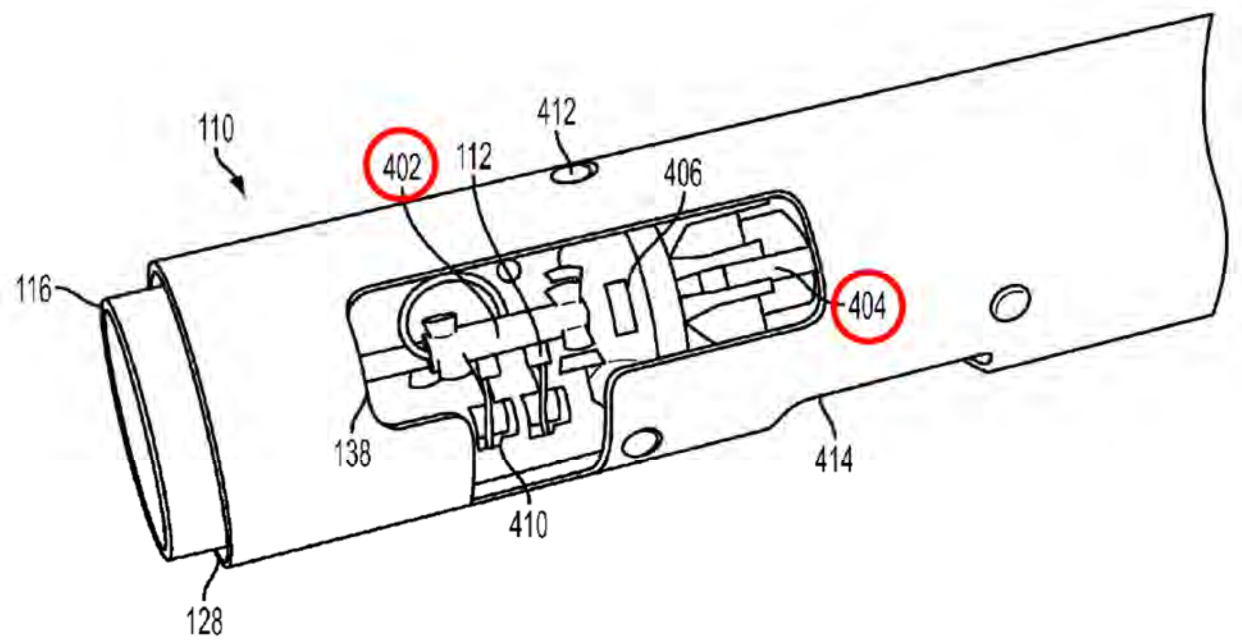


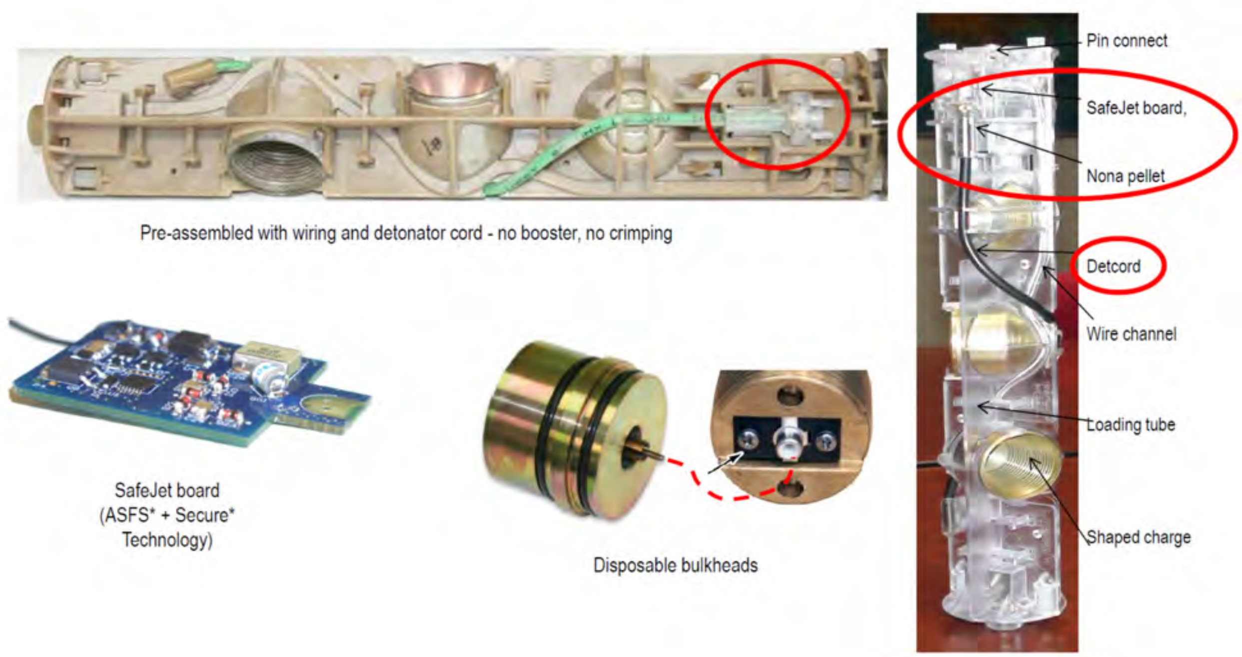
FIG. 4

515. A POSITA would recognize that Rogman teaches energetically coupling the detonating cord to the detonator.

516. A POSITA would recognize that Rogman teaches a detonator with a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator.

I. EWAPS teaches the energetically coupling limitations

517. EWAPS teaches energetically coupling a detonator (SafeJet board) to a detonating cord. (Ex. 1013, EWAPS, p. 10.) EWAPS teaches a detonator with a detonator cord retaining portion as circled in red below. *Id.*



518. A POSITA would understand is necessary to energetically couple the detonator to the detonating cord to render a perforating gun functional and would find a teaching

of such coupling inherent in EWAPS because that is how shaped charges are almost universally detonated in perforating guns and a POSITA would assume that connection would be completed in the standard way to make the system of EWAPS functional.

519. A POSITA would recognize that EWAPS teaches energetically coupling the detonating cord to the detonator.

520. A POSITA would recognize that EWAPS teaches detonator with a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator.

J. Black teaches the energetically coupling limitations.

521. Black teaches that arming device 26 is received in the end of loading tube 12 and fixed in place to align detonator 28 with end 20 of detonating cord 18, energetically coupling them. (Ex. 1002, Black, ¶¶ 0023-24, 0027, 0032, 0034, FIGS. 4, 6, 7.) A POSITA would recognize that Black teaches energetically coupling the detonating cord to the detonator.

522. A POSITA would be motivated to modify the teachings of Black to add a length of detonating cord to detonator 28, retained in detonator 28, as taught by Schacherer to increase the reliability of the energetic transfer to detonating cord 18. A POSITA would recognize that the combination of Black and Schacherer teaches detonator

with a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator. The combination of the detonating cord retaining teachings of Schacherer with Black would be the predictable application of known methods without any unexpected results, simple substitution of those known components for the components taught, the use of those techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of detonators and perforating gun systems that are available with a reasonable expectation of success.

K. Lanclos teaches the energetically coupling limitations.

523. Lanclos teaches a detonator 88 for initiating a detonating cord 66 in a perforating gun, energetically coupling the detonator and the detonating cord. (Ex. 1015, Lanclos, Abstract, 4:47-52, 5:29-34, FIG. 3.)

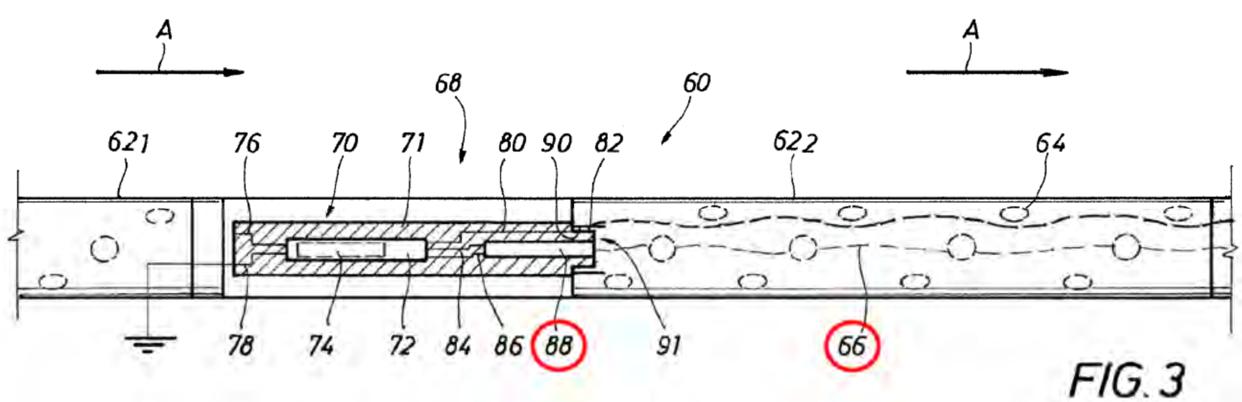
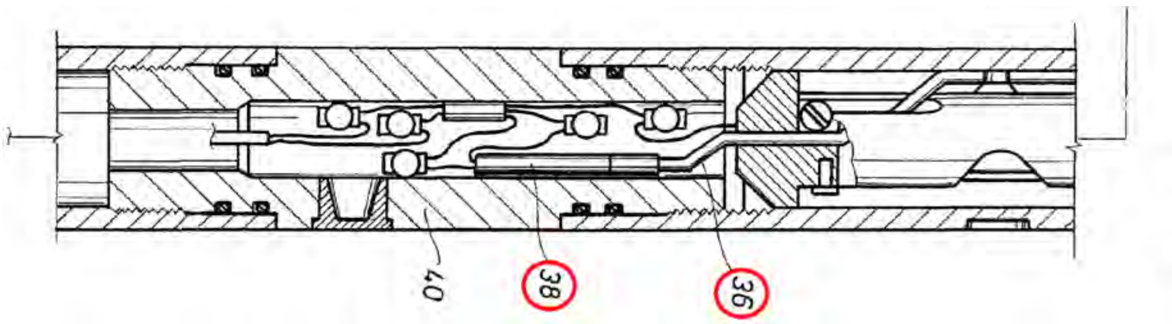


FIG. 3

524. Lanclos also teaches a detonator 88 receiving the end of detonating cord 66. (Ex. 1015, Lanclos, 1:64-2:15, FIG. 2B.) A POSITA would recognize Lanclos FIG. 2B

showing a standard crimp-on type detonator with a detonating cord retaining portion as claimed and would understand that such a detonator could be used in place of detonator 88 as well.



525. A POSITA would recognize that Lanclos teaches energetically coupling the detonating cord to the detonator.

526. A POSITA would recognize that Lanclos teaches a detonator with a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator.

527. A POSITA would be motivated to modify the teachings of Lanclos to add a length of detonating cord to detonator 88, retained in detonator 88, as taught by Schacherer to increase the reliability of the energetic transfer to detonating cord 66. A POSITA would recognize that the combination of Lanclos and Schacherer teaches detonator with a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator. The combination of the detonating cord retaining

teachings of Schacherer with Lanclos would be the predictable application of known methods without any unexpected results, simple substitution of those known components for the components taught, the use of those techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of detonators and perforating gun systems that are available with a reasonable expectation of success.

L. Lendermon teaches the energetically coupling limitations

528. Lendermon teaches detonators 73 and 74 that are energetically coupled to detonating cord 33 and 75 by receiving and being crimped on the end of the detonating cord. (Ex. 1003, Lendermon, 10:47-59, FIG. 1.)

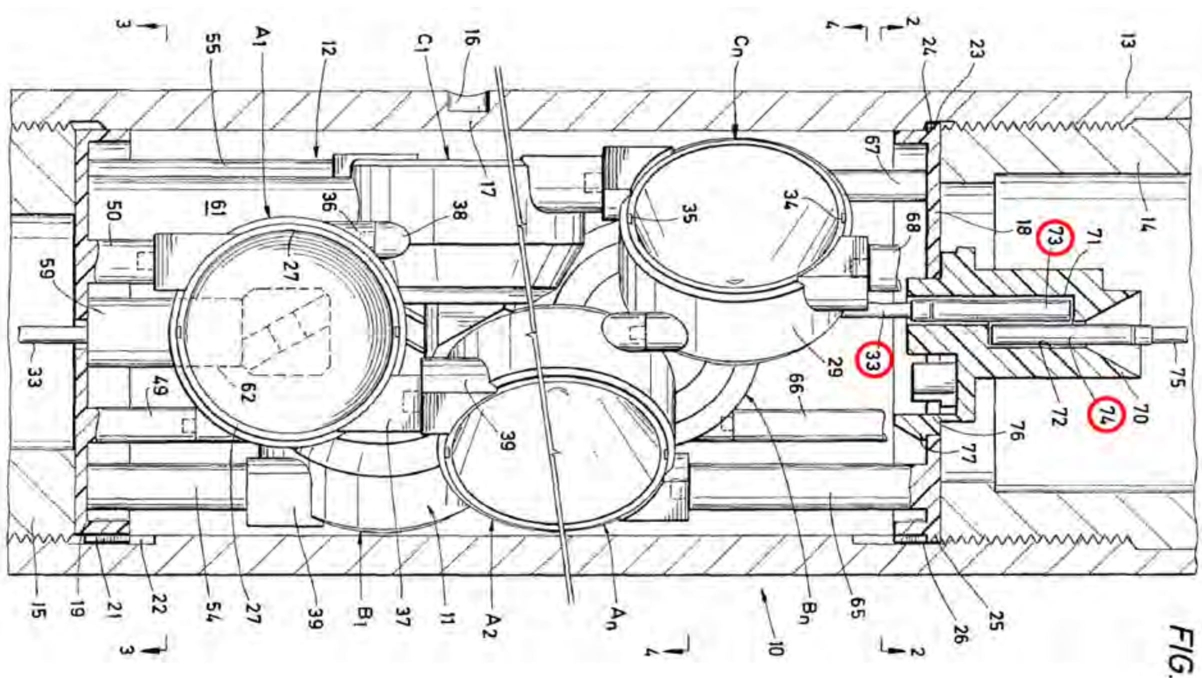


FIG.1

529. A POSITA would recognize that Lendermon teaches energetically coupling the detonating cord to the detonator and a detonator with a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator.

M. Goodman teaches the energetically coupling limitations

530. Goodman teaches a detonator/initiator 15, 45, and 47 and a detonating cord 24 received in a receptacle 14 for energetically coupling the detonator and detonating cord. (Ex. 1018, Goodman, ¶¶ 0005-7, 0018-20, 0023-24, FIGS. 2-3.) Goodman teaches that the end of detonating cord 24 has a booster 29 on it and is retained in a recess in initiator 15. (Ex. 1018, Goodman, ¶¶ 0020, FIGS. 2-3.) A POSITA would understand that the system of Goodman could be operated without booster 29.

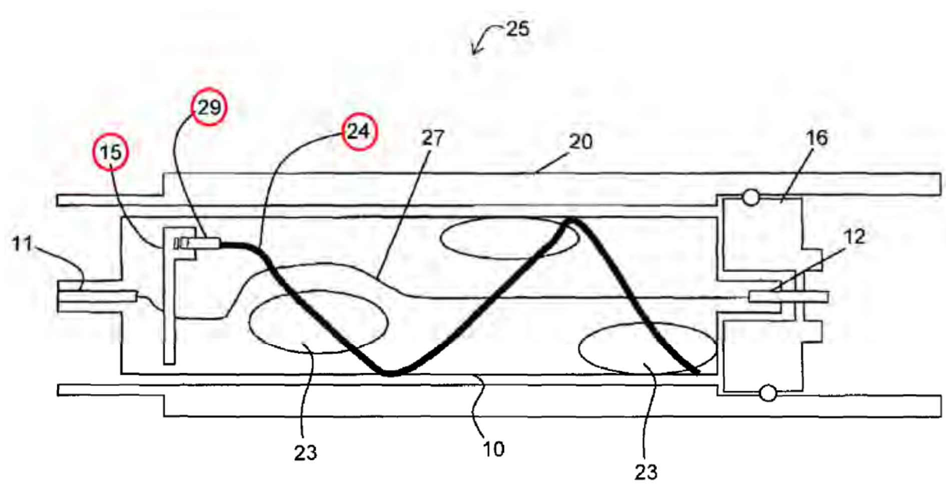


FIG. 2

531. A POSITA would recognize that Goodman teaches energetically coupling the detonating cord to the detonator and a detonator with a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator.

N. Bonavides teaches the energetically coupling limitations

532. Bonavides teaches a perforating gun and controller 105 including a detonator. (Ex. 1017, Bonavides, 5:29-35, 7:24-29.) A POSITA would understand that Bonavides' perforating gun would necessarily include a detonating cord energetically coupled to the detonator for the device to function.

533. Bonavides teaches a POSITA energetically coupling a detonator and detonating cord as claimed.

O. Carisella teaches the energetically coupling and the detonating cord retaining portion of a detonator limitations.

534. Carisella teaches a detonator 26 designed to receive the end of detonating cord 20 and be crimped onto it for energetically coupling the two components. (Ex. 1019, Carisella, 6:3-10 6:53-63, FIGS. 1-3.)

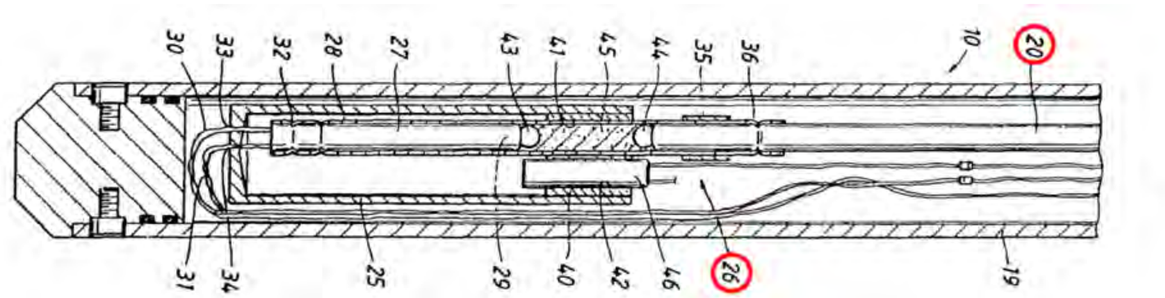


FIG.2

535. A POSITA would recognize that Carisella teaches energetically coupling the detonating cord to the detonator and a detonator with a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator.

536. A POSITA reading Carisella would be motivated to look to the SLB Catalog for further details on detonators like those taught by Carisella to learn from the reference text or choose from the limited number of known detonators. (Ex. 1005, SLB Catalog, p. 12, FIG. 9.)

537. A POSITA would recognize, with or without support from the additional information provided by the SLB Catalog, that in the case of end-to-end energetic

coupling Carisella teaches "energetically coupling the detonating cord to the detonator," as claimed in the Claim 13 (e) limitation.

538. A POSITA wanting to practice the modular detonator of Claim 9 with common knowledge side-by-side detonator to detonating cord energetic coupling as disclosed and described in the '938 Patent specification would look to the teachings of Schacherer. A POSITA wanting to practice the modular detonator of Claim 9 with common knowledge end-to-end detonator to detonating cord explosive coupling as disclosed and described in the '938 Patent's Claim 10 limitation would look to Carisella and/or the SLB Catalog for the teachings. A POSITA would recognize that Schacherer, in combination with Carisella and/or the SLB Catalog, teaches both the modular detonator as disclosed and described in the '938 Patent specification, and the modular detonator as claimed in the Claim 10 limitation, "further comprising a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator." A POSITA knows that combining these teachings would be obvious as the predictable application of known methods to the disclosure of Carisella, Schacherer, and/or SLB Catalog without any unexpected results, simple substitution of the known hollow carrier perforating gun for the perforating devices taught, the use of known hollow carrier perforating guns for their understood benefits, and obvious to try as selecting from the finite number of identifiable and

predictable types of perforating guns that are available with a reasonable expectation of success.

P. Brooks teaches the energetically coupling limitations

539. Brooks teaches energetically coupling a detonator 22, 106, 800 to a detonating cord 24. (Ex. 1021, Brooks, 3:43-47, 4:53-55, FIG. 1A.) Brooks also teaches that detonator 800 “may have the same diameter as the detonating cord 24” it is coupled to. (Ex. 1021, Brooks, 7:43-58.) Claim 26 of Brooks teaches that the detonator housing “is adapted to couple with a detonating cord having a predetermined diameter,” a detonating cord retaining portion sized to retain a detonating cord as claimed. (Ex. 1021, Brooks, 11:33-35.)

540. A POSITA would recognize that Brooks teaches energetically coupling the detonating cord to the detonator and a detonator with a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator.

Q. SLB Catalog teaches energetically coupling

541. SLB Catalog teaches detonators with detonating cord connecting portions as have been common knowledge and in common use in the art and energetic coupling of those detonators to detonating cords. (Ex. 1005, SLB Catalog, pp. 028-030, 032, FIGS. 9, 10, 13.)

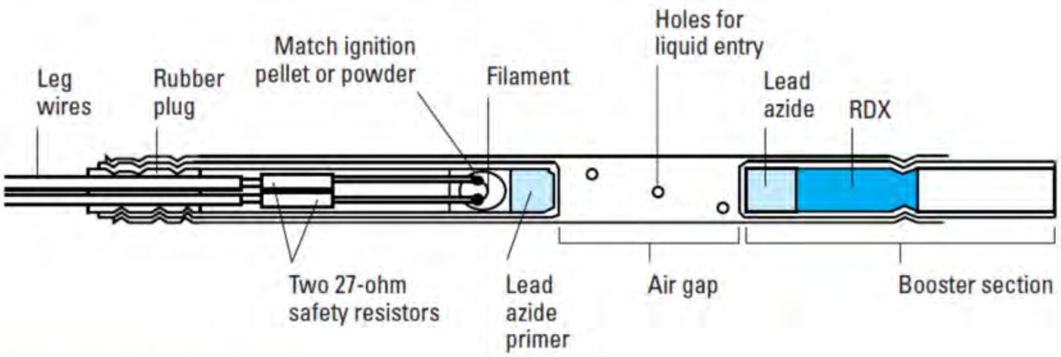


Figure 9. Fluid-desensitized electrical detonator.

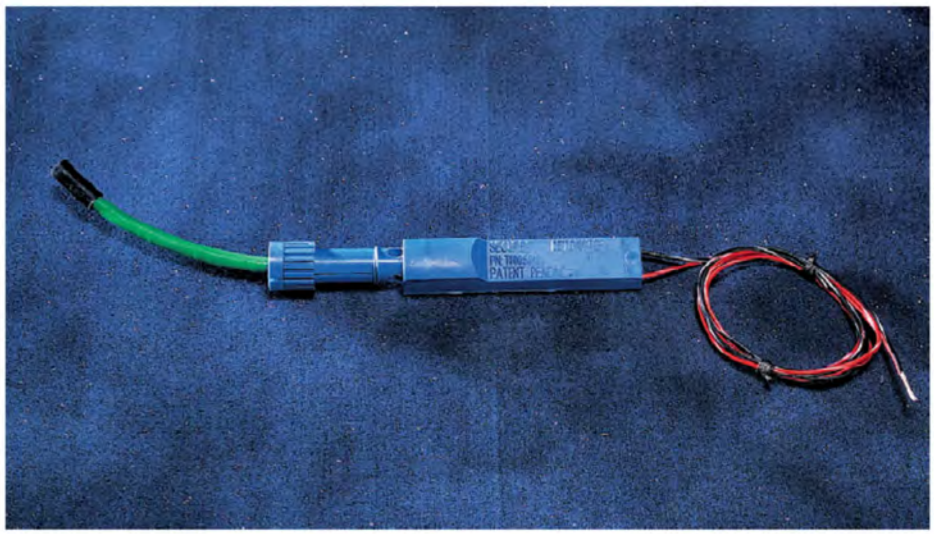


Figure 13. Secure detonator.

542. A POSITA would recognize that SLB Catalog teaches energetically coupling the detonating cord to the detonator and a detonator with a detonating cord connecting portion, wherein the detonating cord connecting portion is sized to retain a detonating cord and positioned to energetically couple the detonating cord to the detonator.

R. A POSITA would find the energetically coupling and detonating cord retaining portion of a detonator limitations obvious

543. Even if a particular piece of prior art did not disclose energetically coupling or a detonator with a detonating cord retaining portion, a POSITA would find it to be an obvious modification of any perforating gun to include those limitations. As discussed above, a POSITA would know that energetically coupling a detonator and a detonating cord is necessary for typical perforating guns to function. As discussed above, a POSITA would also know of the commonly available and used traditional detonators with detonating cord retaining portions. A POSITA implementing any perforating gun system would look to those teachings in the common knowledge, Schacherer, Harrigan, Rogman, Carisella, and/or SLB Catalog to achieve energetic coupling. For example, a POSITA would be motivated to modify the teachings of Black to add a length of detonating cord to detonator 28 as taught by Schacherer to increase the reliability of the energetic transfer to detonating cord 18. The combination of any of these references with the prior art cited in this petition would be the predictable application of known methods without any unexpected results, simple substitution of those known components for the components taught, the use of those techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of detonators and perforating gun systems that are available with a reasonable expectation of success.

544. The fact that the ‘938 Patent does not describe a detonator with a detonating cord retaining portion in any way supports that the limitations of Claim 10 were well known in the art.

545. A POSITA would look to the prior art teachings of Carisella (with visual clarification from the SLB Catalog) which describes end-to-end energetic coupling. The Claim 13 (e) limitation, “energetically coupling the detonating cord to the detonator…,” does not differentiate between side-by-side and end-to-end energetic coupling and therefore a POSITA would look to the teachings of each or both of Schacherer and Carisella to find sufficient prior art.

546. A POSITA would be motivated to combine the initiator and detonator of Harrigan with the energetic coupling teachings of Schacherer, Rogman, Lanclos, Bonavides, Lendermon, Goodman, Carisella, Black, Brooks, EWAPS, SLB Catalog, and/or common knowledge to teach energetically coupling the detonator to the detonating cord because it will not function as intended without energetically coupling as taught in the prior art, and it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of Harrigan without any unexpected results, simple substitution of the known techniques for coupling a detonator/initiator with a detonator cord, the use of known explosive connection techniques with understood benefits, and obvious to try as

selecting from the finite number of identifiable and predictable types of explosive connection techniques that are available with a reasonable expectation of success.

547. A POSITA would be motivated to combine the detonator and detonating cord teachings of Lanclos with the energetic coupling teachings of Schacherer, Rogman, Bonavides, Lendermon, Goodman, Carisella, Black, Brooks, EWAPS, SLB Catalog, and/or common knowledge to teach energetically coupling the detonator to the detonating cord because it will not function as intended without energetically coupling as taught in the prior art, and it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of Lanclos without any unexpected results, simple substitution of the known techniques for coupling a detonator/initiator with a detonator cord, the use of known explosive connection techniques with understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of explosive connection techniques that are available with a reasonable expectation of success.

548. A POSITA would be motivated to combine the detonator and detonating cord teachings of Black with the energetic coupling teachings of Schacherer, Rogman, Lanclos, Bonavides, Lendermon, Goodman, Carisella, Brooks, EWAPS, SLB Catalog, and/or common knowledge to teach energetically coupling the detonator to the detonating cord because it will not function as intended without energetically coupling as taught in the prior art, and it would be obvious to try and would yield

predictable results. This would be the predictable application of known methods to the disclosure of Black without any unexpected results, simple substitution of the known techniques for coupling a detonator/initiator with a detonator cord, the use of known explosive connection techniques with understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of explosive connection techniques that are available with a reasonable expectation of success.

XVI. <u>Claim 13 limitation of "(f) transporting the perforation gun system to a wellbore site, wherein at least one of steps (a), (b), and (d) is performed before transporting the perforation gun system, and step (c) is performed at the well bore site." Claim 17 limitation of "wherein one or more of steps (a), (b)(e), and (d) is performed at a factory or a facility that is not a wellbore site."</u>

549. Claim 13 in the '938 Patent includes the limitation "**(f) transporting the perforation gun system to a wellbore site, wherein at least one of steps (a), (b), and (d) is performed before transporting the perforation gun system, and step (c) is performed at the well bore site.**" (Ex. 1001, the '938 Patent, 12:55-58.) Claim 17 includes the limitation "**wherein one or more of steps (a), (b)(e), and (d) is performed at a factory or a facility that is not a wellbore site.**" (Ex. 1001, the '938 Patent, 13:4-6.)

A. The performance before transporting limitations fail for Indefiniteness, lack of written description, and construction of transporting elements

550. The ‘938 Patent’s very limited mention of transporting provides no clarity about what constitutes “the perforation gun system,” that is being transported. (Ex. 1001, the ‘938 Patent, 9:25-30, 9:63-67.)

551. A POSITA would understand Claim 13 to define the perforation gun system as the thing that is made by following all 6 steps a-f. If that definition is followed, then “the perforation gun system” cannot be transported before step (c) happens because “the perforation gun system” would not yet exist. This alone means that Claim 13 does not inform those skilled in the art about the scope of the invention with reasonable certainty.

552. Alternatively, a POSITA could read Claim 13 as requiring only that **any** product of steps (a), (b), or (d) be transported to the well site. This would mean that the “transporting” step could be met by transporting any of: (a) a carrier holding a charge holder, a detonating cord, and a shaped charge, (b) a top connector in a carrier, or (c) detonator with a “through wire” connected to a “wireless” connector. Even if this interpretation were also valid, it means that Claim 13 does not inform those skilled in the art about the scope of the invention with reasonable certainty.

553. Despite depending from Claim 13, Claim 17 appears to broaden the claim. Claim 13 appears to require that one of (a), (b), or (d) happen away from the wellbore site,

while Claim 17 appears to require only that any of (a), (b), **(e), and (d)** happen away from "a wellbore site". This could be interpreted as adding nothing to Claim 13, since any method meeting the limitations of Claim 13 would also meet those of Claim 17. This is at odds with claim differentiation and renders Claim 17 indefinite for failing to inform those skilled in the art about the scope of the invention with reasonable certainty.

554. Alternatively, this could be interpreted by a POSITA as meaning a method where steps (a), (b), (d), and (e) are all performed at **<u>any</u>** site with a well would be outside the scope of Claim 17. This would appropriately narrow the scope of Claim 17 relative to Claim 18, but the '938 Patent provides no written description to support such a claim limitation.

555. A POSITA would find it impossible to perform the steps in the order as claimed in the Claim 13 (f) limitation, that is, of steps (a), (b), (d) and **then** (c). This is because step (d), "connecting a through wire to the wireless through wire connector," means that a POSITA is connecting the through wire to a component of the detonator, the "wireless through wire connector," which is not yet present. While the wireless through wire connector is not defined in the specification, the claims make numerous references to the wireless through wire connector being a component of the detonator, specifically Claims 1, 2, 8, 9, 12 and 15, where Claim 15 states, "…the ***wireless through wire connector of the detonator***…" (emphasis added) (Ex. 1001,

the ‘938 Patent, 11:23-12:64.) The ‘938 Patent defines a “through wire that goes from the top connector 14 to the bottom connector 22, whose ends are connectors.” (Ex. 1001, the ‘938 Patent, 6:26-28.) If the through wire is an electrical wire traversing the inside of a gun carrier and making contactable connections at one or both ends it is unclear to a POSITA how the through wire could be connected to the detonator before the detonator is inserted into the gun carrier or charge holder as contemplated by Claim 13.

556. A POSITA’s best guess at the meaning of these limitations of Claim 13 and 17 is that perforating guns are at least partially assembled away from a wellsite location and subsequently transported to the wellsite location where the detonator is installed. A POSITA would know that this is/was the normal practice for many decades for perforating operations throughout North America.

B. A POSITA’s common knowledge includes transporting and inserting detonator at well site

557. A POSITA would know that it was for many decades, and still is, a normal practice for perforating operations throughout North America for perforating guns to be at least partially assembled away from a wellsite location and subsequently transported to the wellsite location where the detonator is installed. It has been common practice in the oil and gas industry in North America, in non-remote locations, to completely assemble perforating gun systems, absent the detonator, at a centralized gun shop or

field location, and then transport the assembled perforating gun systems to the wellsite where the detonators are installed as one of the last steps prior to running the gun string in a well. In remote locations, all assembly is often done at the remote location. A POSITA would recognize that Claim 13 step (f) and Claim 17 describe the common practice prior to the priority date of the ‘938 Patent. Accordingly, a POSITA’s common knowledge teaches Claim 13 limitation (f) and Claim 17.

C. Schacherer teaches transporting and inserting detonator at well site

558. Schacherer teaches transporting the explosive assemblies 20 to a wellbore site. (Ex. 1004, Schacherer, 6:23-59, 3:30-41, 8:4-50, FIG. 8.) In FIG. 8 the assembly step at a factory or shop location away from the wellsite is depicted as step 104, and the transportation step is depicted as 106. A POSITA would understand Schacherer teaching that the assembly prior to transportation would include at least one of the steps of (a) inserting a charge holder, (b) inserting a top connector, or (d) connecting a through wire. Schacherer also discusses in the Background section that, “[g]enerally, perforating guns are not transported to a wellsite with an electrical detonator coupled to a detonating cord.” (Ex. 1004, Schacherer, 1:12-13.)

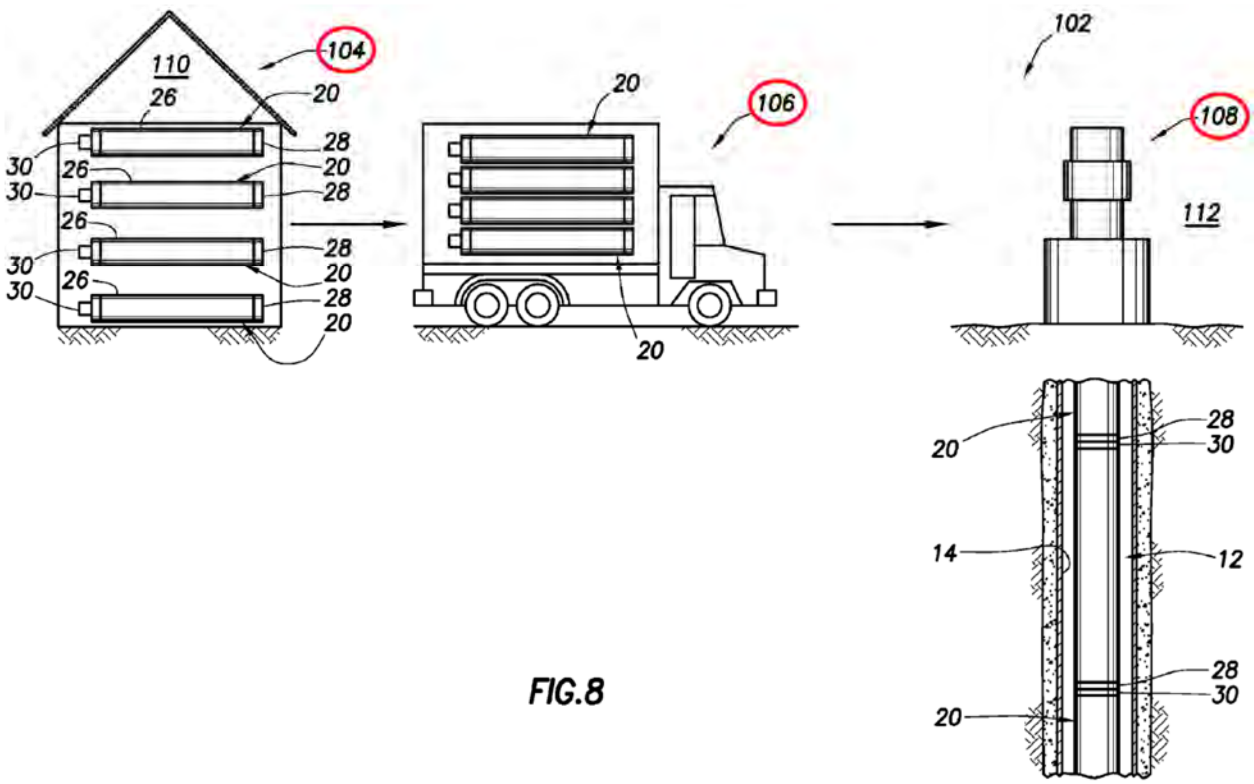


FIG.8

559. Therefore, a POSITA is taught in Schacherer that the standard practice was for a detonator to be coupled to a detonating cord at the wellsite, after transporting the otherwise assembled perforating guns to the wellsite. Therefore Schacherer teaches perforating guns to be at least partially assembled away from a wellsite location and subsequently transported to the wellsite location where the detonator is installed.

560. Ex. 1004, Schacherer teaches assembling a perforating gun system at a factory or a facility that is not a wellbore site: "Beginning on the left-hand side of FIG. 8 an assembling step 104 is depicted, then centered in FIG. 8 a transporting step 106 is depicted, and then on the right-hand side of FIG. 8 an installing step 108 is depicted. The assembling step 104 is preferably performed at a location 110 which is remote

from a well location 112. The remote location 110 could be a manufacturing facility, an assembly shop, etc." (Ex. 1004, Schacherer, 6:25-33, FIG. 8). A POSITA would know that the assembly prior to transportation would include at least one of the steps of (a) inserting a charge holder, (b) inserting a top connector, or (d) connecting a through wire.

561. Schacherer teaches, "[i]n the assembling step 104, preferably each of the explosive assemblies 20 is completely assembled, including coupling the electrical detonator 38 to the explosive component 40 and installing these in the connector 30 with the selective firing module 32." (Ex. 1004, Schacherer, 6:37-41, FIG. 8.) Schacherer teaches "[t]he assembling step 104 may include making a detonation coupling between the electrical detonator 38 and the first explosive component 40. (Ex. 1004, Schacherer, 8:26-28.) Explosive component 40 is detonating cord, "[t]he rotary detonation coupling 58 transfers detonation from the explosive component 40 to the explosive component 22 (both of which are detonating cords in this example)." (Ex. 1004, Schacherer, 4:42-45.)

562. Since Schacherer also couples the detonator to the detonating cord during the assembly step at a remote location 110 (a manufacturing facility, an assembly shop, etc.), Schacherer also teaches step (e), energetically coupling the detonating cord to the detonator, "at a factory or a facility that is not a wellbore site," as claimed. Schacherer teaches in the Background section that, "[g]enerally, perforating guns

are not transported to a wellsite with an electrical detonator coupled to a detonating cord." (Ex. 1004, Schacherer, 1:12-13.) A POSITA is taught in Schacherer that standard practice was for a detonator to be coupled to a detonating cord at the wellsite, after transporting the assembled perforating guns to the wellsite. Therefore Schacherer teaches installing a detonator and coupling the detonator to the detonating cord both during assembly at a factory or facility that is not a wellbore site, and at the wellbore site.

563. A POSITA would recognize that Schacherer teaches all of the limitations of Claim 17, "wherein one or more of steps (a), (b)(e), and (d) is performed at a factory or a facility that is not a wellbore site."

D. Harrigan teaches transporting and inserting detonator at well site

564. Harrigan teaches the desirability of assembling perforating guns away from a wellsite and the reality that "the unarmed gun and detonator are separately delivered to the oilfield location where assembly may be completed prior to deployment of the gun into the well." (Ex. 1012, Harrigan, ¶ 0006; Ex. 1028, Harrigan Prov., p. 3.) Therefore Harrigan teaches perforating guns to be at least partially assembled away from a wellsite location and subsequently transported to the wellsite location where the detonator is installed.

E. Rogman teaches transporting and inserting detonator at well site

565. Rogman teaches "wiring of the initiator to the perforating gun is oftentimes performed at the surface near the well site, instead of at a dedicated manufacturing facility," and "The wiring of the power cable 502 can be completed at an off-site location, prior to arrival at the well site. Accordingly, users in the field can avoid wiring of the loading tube 110 as the loading tube 110 can arrive on-site 'pre-wired'." (Ex. 1014, Rogman, ¶¶ 0002, 0034.) Rogman further teaches "These pre-wired loading tubes 110 can then be delivered on-site, where a user in the field can the insert one or more initiators 112 into the loading tube 110." (Ex. 1014, Rogman, ¶ 0036.) Therefore Rogman teaches perforating guns to be at least partially assembled away from a wellsite location and subsequently transported to the wellsite location where the detonator is installed.

F. Black teaches transporting and inserting detonator at well site

566. As discussed above, a POSITA's common knowledge would include the assembly of perforating guns, less detonator, at a site that is not the well site and arming the gun (inserting the detonator) happening at the well site as standard practice. This is also taught in SLB Catalog. (Ex. 1005, SLB Catalog, p. 021.) A POSITA reading Black in light of their understanding of common industry practices and safety requirements would understand the perforating gun of Black is assembled away from the well site while the "method or process of arming," including inserting the arming

device 26 would take place at the well site. (Ex. 1002, Black, ¶¶ 0026-27.) Therefore Black teaches perforating guns to be at least partially assembled away from a wellsite location and subsequently transported to the wellsite location where the detonator is installed.

G. Lanclos teaches transporting and inserting detonator at well site

567. Lanclos teaches "detonators are connected to the detonating cords in the field just prior to use," and "Perforating guns when delivered to the field generally have the shaped charges and detonating cord installed." (Ex. 1015, Lanclos, 2:22-37.) Therefore Lanclos teaches perforating guns to be at least partially assembled away from a wellsite location and subsequently transported to the wellsite location where the detonator is installed.

H. Goodman teaches transporting and inserting detonator at well site.

568. Ex. 1018, Goodman teaches in its background that building a gun involves, "all the pieces are assembled together except the detonator and shipped to the location where the perforating operation is to be conducted. At that location, the gun is opened and the detonator is installed." (Ex. 1018, Goodman, ¶ 0005.) A POSITA would know that the assembly would include at least one of the steps of (a) inserting a charge holder, (b) inserting a top connector, or (d) connecting a through wire. Therefore, a POSITA is taught in Goodman that a detonator would be coupled to a detonating cord at the wellsite, after transporting the assembled guns to the wellsite.

569. Therefore Goodman teaches perforating guns at least partially assembled away from a wellsite location and subsequently transported to the wellsite location where the detonator is installed.

I. Lerche ‘278 and ‘929 teach transporting and inserting detonator at well site

570. Lerche ‘278 teaches that its system allows, but does not require deviation from the standard procedure of transporting only unarmed perforating guns without detonator. (Ex. 1011, Lerche ‘278, 3:41-44.) A POSITA would understand from this that the system of Lerche is appropriately used in the standard industry method where perforating guns are at least partially assembled away from a wellsite location and subsequently transported to the wellsite location where the detonator is installed.

J. SLB Catalog teaches transporting and inserting detonator at well site

571. SLB Catalog teaches “In most cases, loaded guns may be transported to the wellsite; however, they are never transported while electrically and ballistically armed. The arming procedure is always performed at the wellsite.” (Ex. 1005, SLB Catalog, p. 021.) SLB Catalog also teaches “The completed gun assembly must also be mechanically sound to withstand the rigors of transportation.” (Ex. 1005, SLB Catalog, p. 140.) SLB Catalog teaches “Because loaded capsule guns contain only secondary high explosives (detonating cord, boosters, and charges), they are safe to transport and handle following standard Schlumberger safety procedures,” and

"Exclusive use of secondary explosives—Loaded HSD guns contain only secondary high explosives (detonating cord, boosters, and charges) for safer transport and handling following standard Schlumberger safety procedures," and "Because the loaded guns contain only secondary high explosives (detonating cord, boosters, and charges), they are safe to transport and handle following standard Schlumberger safety procedures." (*Id*. at p. 151, 179, 224, FIGS. 116, 158.) A POSITA would understand SLB Catalog to teach that detonators are only installed in perforating guns at the wellsite, while they are otherwise assembled elsewhere and transported to the well site.

K. Obviousness of transporting and inserting detonator at well site

572. A POSITA wanting to know about detonators being installed at the wellsite after the perforating guns have been assembled and transported to the wellsite. A POSITA designing or operating perforating guns would look to standard industry safety practices, including common knowledge in the art. Such a POSITA would find the teachings of the common knowledge, Schacherer, Harrigan, Rogman, Lanclos, Goodman, and SLB Catalog discussed in this section instructive in common systems and methods for well perforating and would understand that adapting any perforating gun system or method such that perforating guns were at least partially assembled away from a wellsite location and subsequently transported to the wellsite location where the detonator is installed would be the predictable application of known

methods without any unexpected results, simple substitution of known techniques, the use of known systems their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable transportation and assembly operations that are available with a reasonable expectation of success. A POSITA would further be motivated to combine any perforating gun system teachings with the teachings of common knowledge, Schacherer, Harrigan, Rogman, Lanclos, Goodman, and SLB Catalog to at least partially assemble perforating guns away from a wellsite location and subsequently transported to the wellsite location where the detonator is installed to improve safety and reliability. A POSITA implementing EWAPS would be motivated to combine it with the insertion of the detonator at a wellsite teachings of common knowledge, Schacherer, Black, Rogman, Harrigan, Goodman and/or SLB Catalog to improve safety and reliability using common industry practice, which would be obvious to try with predictable results.

573. A POSITA would find the answer by looking to either or both of Schacherer and Goodman. A POSITA would conclude that each of Schacherer and Goodman teach the Claim 13 (f) limitation of, "transporting the perforation gun system to a wellbore site, wherein at least one of steps (a), (b), and (d) is performed before transporting the perforation gun system, and step (c) is performed at the wellbore site." A POSITA would recognize that Claim 13 (f) describes the common practice prior to the priority date of the '938 Patent.

574. A POSITA would be motivated to combine the assembling the gun, shipping it to the wellsite location, and then installing the detonator teaching of Goodman with the performing the arming procedure at the wellsite teachings of the SLB Catalog and/or common knowledge to teach transporting the guns to the wellsite first and then ballistically arming them because the practice of at least partially assembling a perforating gun away from the wellsite and then arming the gun by inserting a detonator at the wellsite is common safety and industry practice that any POSITA would be aware of and motivated to follow to reduce risk of harm, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of Goodman without any unexpected results.

575. A POSITA would be motivated to combine the teachings of delivering unarmed guns to the oilfield location in Harrigan with the performing the arming procedure at the wellsite teachings of the SLB Catalog and/or common knowledge to teach transporting the guns to the wellsite first and then ballistically arming them because the practice of at least partially assembling a perforating gun away from the wellsite and then arming the gun by inserting a detonator at the wellsite is common safety and industry practice that any POSITA would be aware of and motivated to follow to reduce risk of harm, it would be obvious to try and would yield predictable results.

This would be the predictable application of known methods to the disclosure of Harrigan without any unexpected results.

576. A POSITA would be motivated to combine wiring of the power cable prior to arrival teaching of Rogman with the performing the arming procedure at the wellsite teachings of the SLB Catalog and/or common knowledge to teach transporting the guns to the wellsite first and then ballistically arming them because the practice of at least partially assembling a perforating gun away from the wellsite and then arming the gun by inserting a detonator at the wellsite is common safety and industry practice that any POSITA would be aware of and motivated to follow to reduce risk of harm, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of Rogman without any unexpected results.

577. A POSITA would be motivated to combine the delivering of perforating guns with shaped charges and detonating cord installed teaching of Lanclos with the performing the arming procedure at the wellsite teachings of the SLB Catalog and/or common knowledge to teach transporting the guns to the wellsite first and then ballistically arming them because the practice of at least partially assembling a perforating gun away from the wellsite and then arming the gun by inserting a detonator at the wellsite is common safety and industry practice that any POSITA would be aware of and motivated to follow to reduce risk of harm, it would be

obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of Lanclos without any unexpected results.

578. A POSITA implementing EWAPS would be motivated to combine it with the insertion of the detonator at a wellsite teachings of common knowledge, Schacherer, Black, Rogman, Harrigan, Goodman, and/or SLB Catalog to improve safety and reliability using common industry practice, which would be obvious to try with predictable results. Inserting a detonator at the wellsite is common safety and industry practice that any POSITA would be aware of and motivated to follow to reduce risk of harm, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of EWAPS without any unexpected results.

XVII. <u>Claim 7 limitation of "[wherein the detonator includes] a signal-in wire electrically connected to the wireless signal-in connector.", Claim 9 limitation of "[a modular detonator comprising] a signal-in wire electrically connecting at least in part the wireless signal-in connector to at least one of the detonator components.", and Claim 20 limitation of "[wherein the detonator further includes] a signal-in wire electrically connecting at least in part the wireless signal-in connector to at least one of the detonator components."</u>

579. Claim 7 in the '938 Patent includes the limitation "**[wherein the detonator includes] a signal-in wire electrically connected to the wireless signal-in connector.**" (Ex. 1001, the '938 Patent, 11:51-54.) Claim 9 includes the limitation "**[a modular detonator comprising] a signal-in wire electrically connecting at least in part the wireless signal-in connector to at least one of the detonator components.**" (Ex. 1001, the '938 Patent, 12:1-3.) Claim 20 includes the limitation "**[wherein the detonator further includes] a signal-in wire electrically connecting at least in part the wireless signal-in connector to at least one of the detonator components.**" (Ex. 1001, the '938 Patent, 13:19-22.)

A. Claim construction of a signal-in wire

580. For the reasons discussed above, the terms "wireless" and "wireless signal-in connector" introduce uncertainty into the claims. This uncertainty is particularly apparent here where a "wire" is connected to something that is called "wireless." Therefore, Claims 7, 9, and 20 fail to inform those skilled in the art about the scope of the invention with reasonable certainty and are indefinite.

581. For the reasons discussed above with regard to the detonator body limitation, the ‘938 Patent fails to provide a written description corresponding to “detonator components.” For the reasons discussed above with regard to the detonator body limitation, the term “detonator components” is unclear and inserts uncertainty to the scope of the claim to a POSITA. Therefore, Claims 9 and 20 fail to inform those skilled in the art about the scope of the invention with reasonable certainty and are indefinite.

582. As discussed above with respect to the “wireless” connector elements, the term “signal-in” is not given any meaning in the ‘938 Patent.

583. A POSITA’s best guess as to the meaning of this limitation of Claim 7 is that the detonator includes a wire electrically connected to the “wireless signal-in connector.”

584. A POSITA’s best guess as to the meaning of these limitations of Claims 9 and 20 is a wire electrically connected to the “wireless signal-in connector” and some or all parts of a detonator, or a detonator assembly.

B. A POSITA’s common knowledge includes a signal-in wire

585. A POSITA’s common knowledge would include the use of addressable switches with detonators and their requirement for three conductors providing an input path, a ground or return path, and a communications path to the next switch and/or detonator, as also taught by Lerche ‘278, Lerche ‘868, and Lerche ‘090. (Ex. 1011,

Lerche ‘278, Ex. 1023, Lerche ‘868, FIGS. 13, 15, 19A; Ex. 1024, Lerche ‘090, FIGS. 13, 15, 19A.) Accordingly, the use of a detonator assembly having three electrical contacts and associated wires (including a signal-in wire) so that the detonator can be electrically connected to a perforating gun without the need to connect or attach wires directly to each other was within the common knowledge of a POSITA when the ‘938 Patent was filed.

C. Schacherer teaches a signal-in wire

586. Ex. 1004, Schacherer teaches: “When the connectors 28, 30 are connected to each other, at least two electrical conductors 94, 96 in the connector 28 are electrically connected to at least two respective conductors 98, 100 in the connector 30. The signal may be modulated on one set of the conductors 94, 98 or 96, 100, with the other set of conductors being a ground. Alternatively, a single set of conductors could be used for transmitting the signal, with the outer housings 26 and connectors 28, 30 being used for grounding purposes (if they are made of electrically conductive materials, such as steel, etc.).” (Ex. 1004, Schacherer, 6:13-22, FIG. 7.) A POSITA would recognize that the detonator or detonator assembly (e.g., connectors 30 and 28) includes a signal-in wire (e.g., wires 96 & 100) electrically connected to the wireless signal-in connector (e.g., rotary electrical connection 80) and a ground wire (e.g., wires 94 & 98) electrically connected to the wireless ground contact connector (e.g., rotary electrical connection 80).

587. Schacherer teaches a signal wire in the detonator at least as show in the annotated figures below. (Ex. 1004, Schacherer, FIGS. 2, 4-7.)

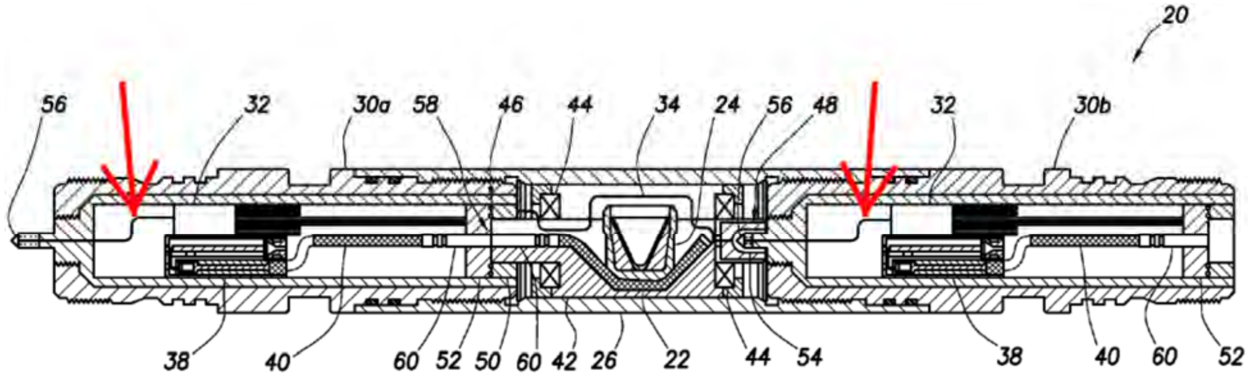


FIG.2

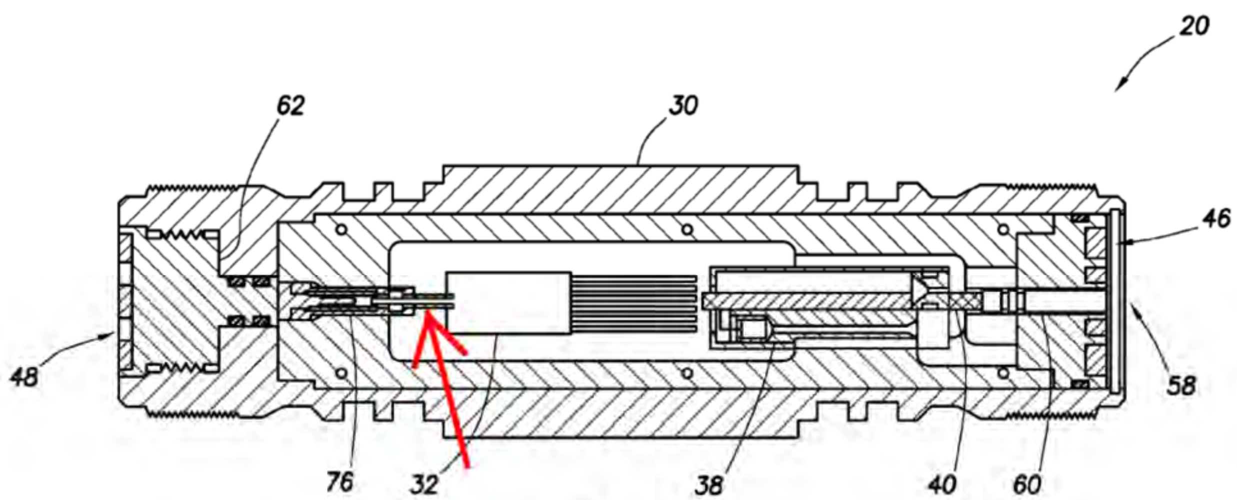


FIG.4

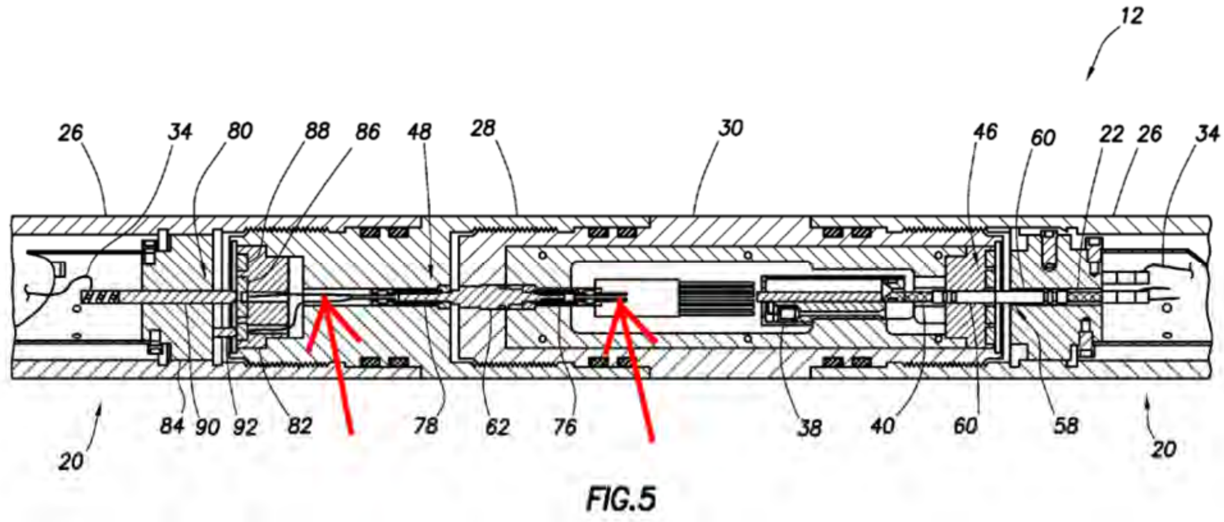


FIG.5

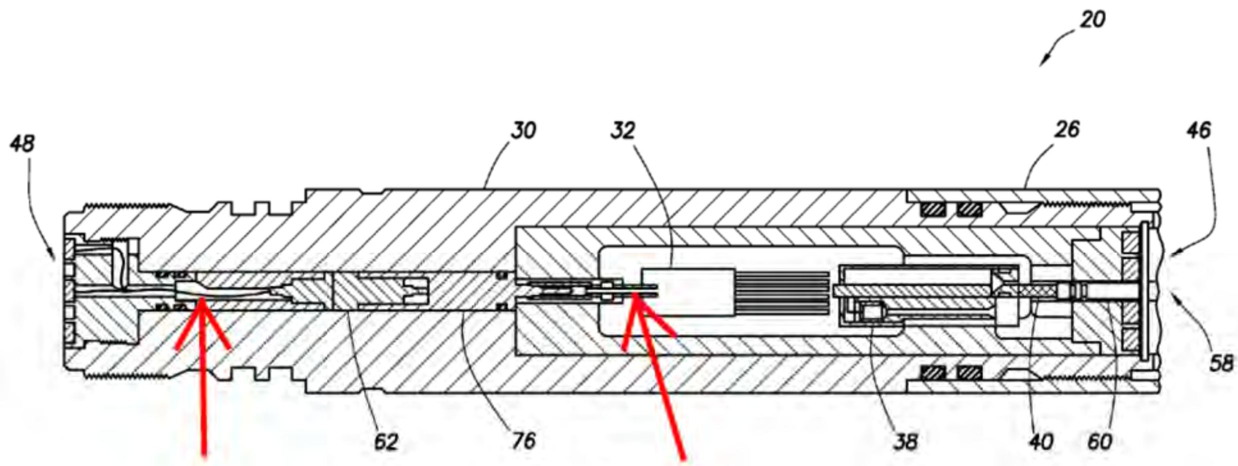


FIG.6

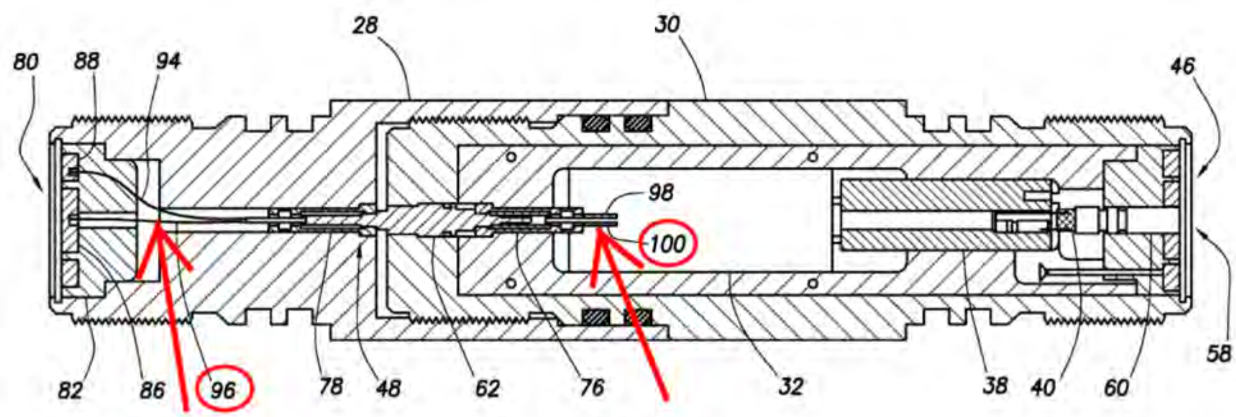


FIG.7

588. A POSITA would recognize that Schacherer teaches a wire electrically connected to the “wireless signal-in connector” and some or all parts of a detonator, or a detonator assembly. Therefore, Schacherer teaches these limitations of Claims 7, 9, and 20.

D. Harrigan teaches a signal-in wire

589. Harrigan teaches a pre-wired initiator assembly module with electrical contacts and a detonator as discussed above. (Ex. 1012, Harrigan, ¶¶ 0022, 27; Ex. 1028, Harrigan Prov., pp. 2-6, FIGS. 2-5.) A POSITA would understand that Harrigan teaches at least one wire inside initiator assembly module 125 connecting the detonator 301 to a signal in contact of the electrical connection 430 for Harrigan to function as described. (Ex. 1012, Harrigan, ¶¶ 0010, 22, 27, 32, 42, and 44; Ex. 1028, Harrigan Prov., p. 5, FIG. 4.) FIG. 3A of Harrigan shows the wires connecting detonator 301 inside initiator assembly module 125. (Ex. 1012, Harrigan, ¶¶ 31, 35-36, Claims 5, 17, 18; Ex. 1028, Harrigan Prov., p. 5, FIG. 4.) A POSITA would recognize that these wires would be electrically connected to the electrical contacts discussed above and that one of these wires would transmit a signal-in and the other a ground or return path.

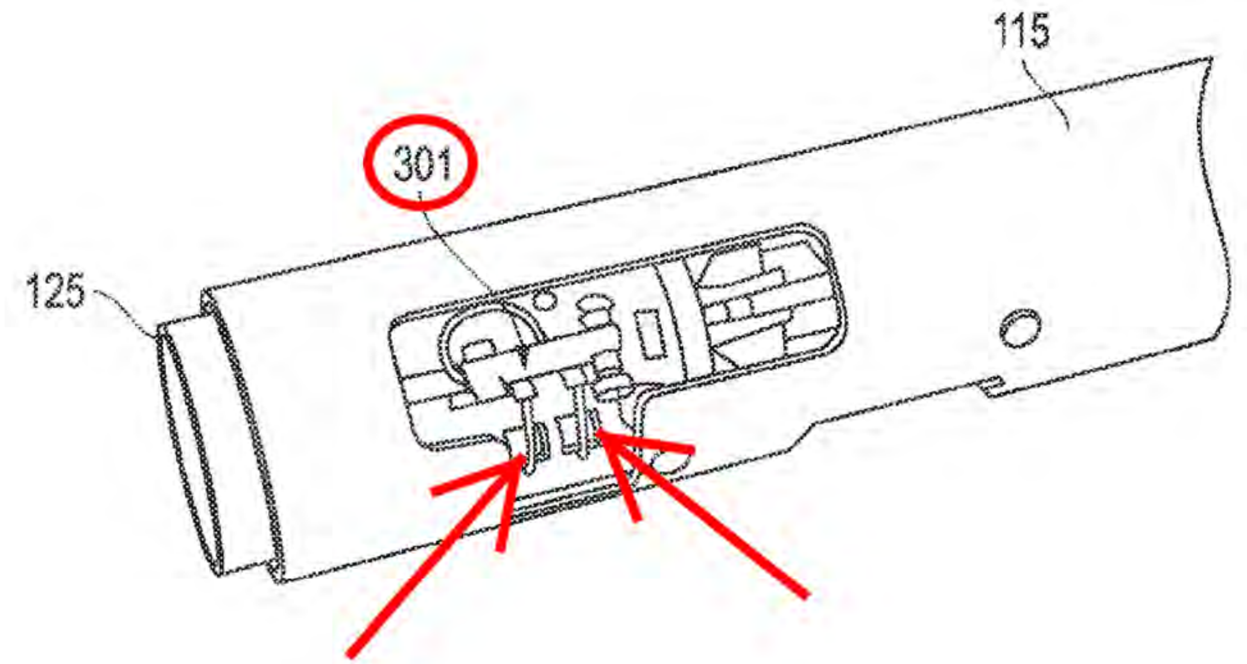


FIG. 3A

590. A POSITA would recognize that Harrigan teaches a wire electrically connected to the “wireless signal-in connector” and some or all parts of a detonator, or a detonator assembly. Therefore, Harrigan teaches these limitations of Claims 7, 9, and 20.

E. Rogman teaches a signal-in wire

591. In addition to the electrical feedthroughs and RCA jacks, Rogman and Rogman Prov. teach connecting the detonator 402 to the circuit board within initiator assembly 112 using insulation displacement connectors 410. (Ex. 1014, Rogman, ¶¶ 31, 35-36, Claims 5, 17, 18; Ex. 1020, Rogman Prov., p. 3.) Rogman and Rogman Prov. show the wires connecting detonator 402 and connectors 410. (Ex. 1014, Rogman, ¶¶ 31,

35-36, Claims 5, 17, 18; Ex. 1020, Rogman Prov., p. 3.) A POSITA would recognize that those wires would be electrically connected to the electrical contacts discussed above one of these wires would transmit a signal-in and the other a ground or return path.

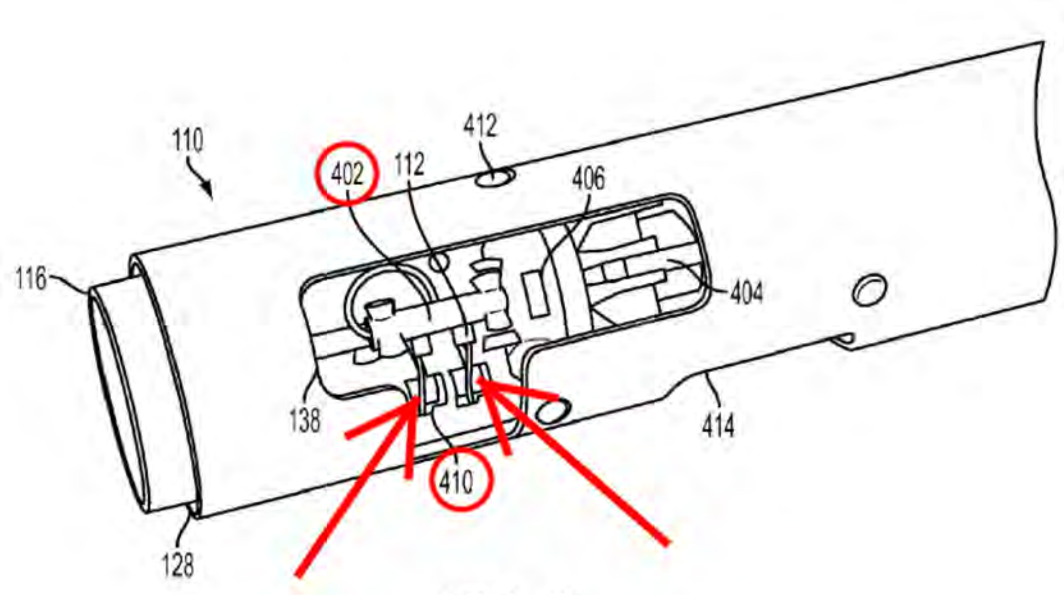


FIG. 4

592. A POSITA would recognize that Rogman teaches a wire electrically connected to the "wireless signal-in connector" and some or all parts of a detonator, or a detonator assembly. Therefore, Rogman teaches these limitations of Claims 7, 9, and 20.

F. EWAPS teaches a signal-in wire

593. EWAPS teaches a signal-in (hot), ground, and feed-thru wires associated with an addressable switch and detonator. (Ex. 1013, EWAPS, p. 6.) As discussed above, EWAPS teaches connecting those wires to RCA electrical connectors. (Ex. 1013, EWAPS, pp. 6, 8.)

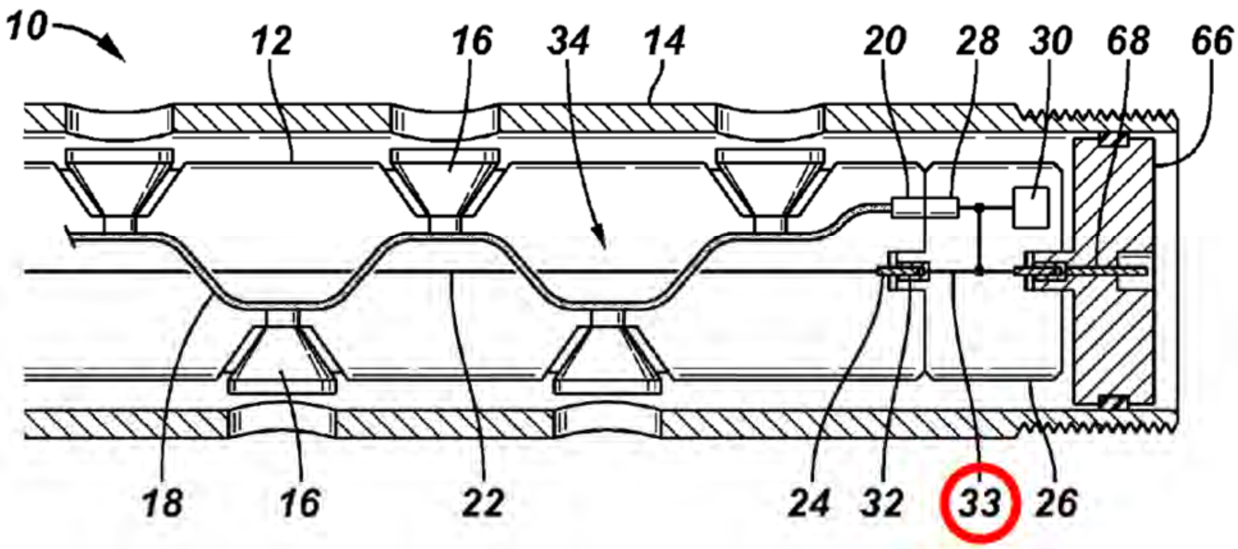
594. A POSITA would recognize that EWAPS teaches a wire electrically connected to the "wireless signal-in connector" and some or all parts of a detonator, or a detonator assembly. Therefore, EWAPS teaches these limitations of Claims 7, 9, and 20.

G. Black teaches a signal-in wire

595. As discussed above, a POSITA would read Black's electrical connectors 32, 24 and conductors 33, 22 as containing paired conductors, such as coaxial or twisted pair conductors and contacts as would be used with the disclosed RCA connectors. (Ex. 1002, Black, ¶¶ 0024, 28, 34, FIGS 2, 4, 6, 7.) A POSITA would understand Black to teach a signal-in electrical contact and electrical path to the addressable switch, a signal out, or through electrical contact and electrical path from the addressable switch to a next perforating gun, and a ground or return electrical contact and electrical path from the addressable switch to complete the necessary communications circuit for addressable perforating and function as described. (Ex. 1002, Black, ¶¶ 0024, 28, 34, FIGS 2, 4, 6, 7.) A POSITA would understand conductor 33 to include a wire inside arming device 26 for transmitting the signal-

in to firing electronics 30 and detonator 28 from the disclosed connectors. (Ex. 1002, Black, ¶¶ 0024, 28, 34, FIGS 2, 4, 6, 7.)

FIG. 7

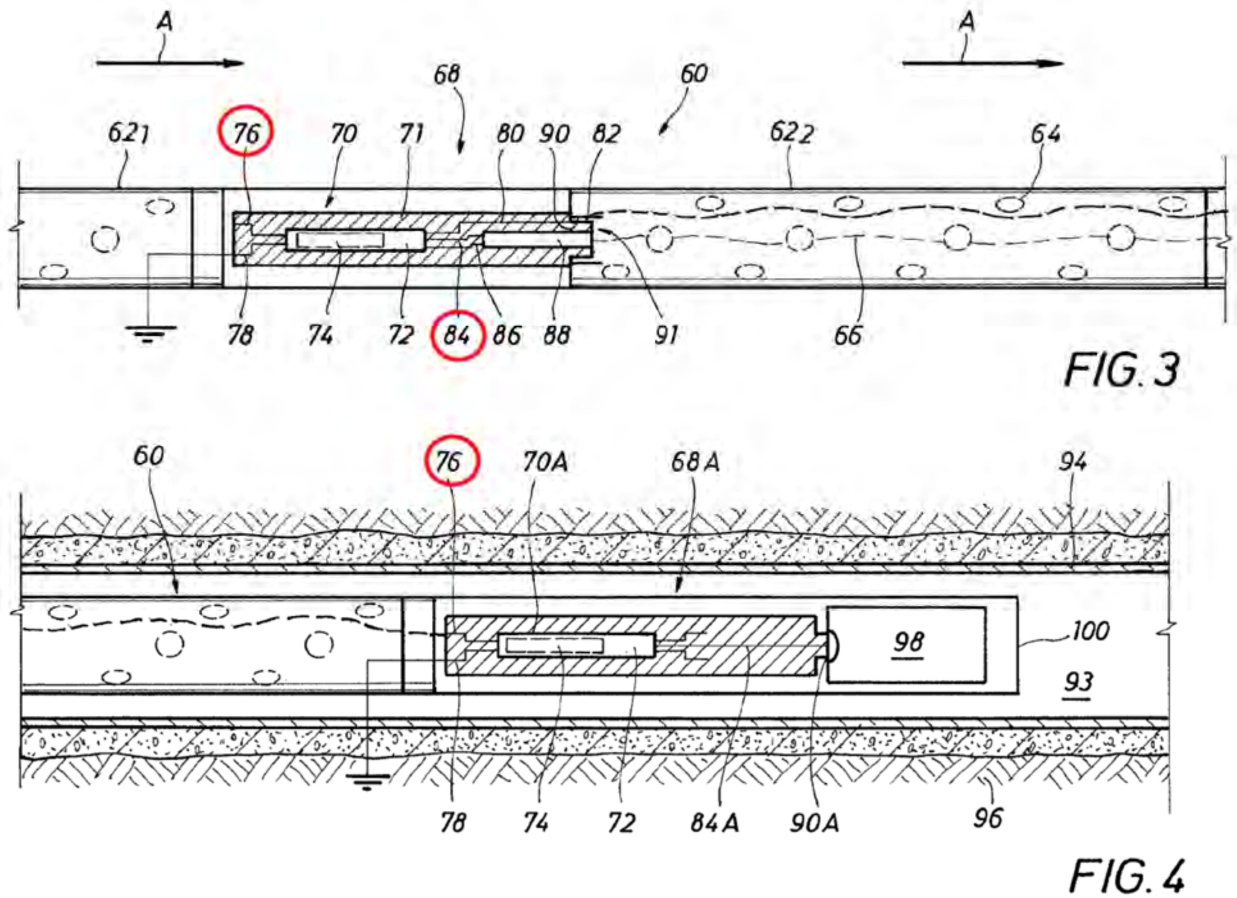


596. A POSITA would recognize that Black teaches a wire electrically connected to the "wireless signal-in connector" and some or all parts of a detonator, or a detonator assembly. Therefore, Black teaches these limitations of Claims 7, 9, and 20.

H. Lanclos teaches a signal-in wire

597. Lanclos teaches that cartridge assembly 70 includes inlet leads 76, 84 electrically connected to the signal-in electrical connectors on the end of cartridge assembly 70 and cartridge sub 68 as discussed above. (Ex. 1015, Lanclos, 4:63-5:23, FIGS 3, 4.) Lanclos teaches that cartridge assembly 70 includes ground leads 78, 86 electrically connected to the ground electrical connectors on the end of cartridge assembly 70 and cartridge sub 68 as discussed above. (Ex. 1015, Lanclos, 4:63-5:23, FIGS 3, 4.)

Lanclos teaches "a supply lead 80 that is in electrical communication with a communication line 82 shown extending within the downstream perforating gun 622." (Ex. 1015, Lanclos, 5:9-12, FIGS 3, 4.)



598. A POSITA would recognize that Lanclos teaches a wire electrically connected to the "wireless signal-in connector" and some or all parts of a detonator, or a detonator assembly. Therefore, Lanclos teaches these limitations of Claims 7, 9, and 20.

I. Goodman teaches a signal-in wire

599. As discussed above, Goodman teaches that its detonator may include an addressable switch, a fireset and an initiator. (Ex. 1018, Goodman, ¶¶ 0005-6, 0016, 0018, 0020.) Goodman teaches a detonator/initiator 15, 45, and 47 having electrical connectors for engaging with receptacle 18 and an electrical receptacle 17 for connecting connectors 11, 12, 43, and 44. (Ex. 1018, Goodman, ¶¶ 0005-7, 0018-20, 0023-24, FIGS. 1-5.) A POSITA would find it inherent in Goodman to have electrical connectors on the initiator to engage with receptacle 18 to make the device of Goodman functional. Goodman teaches wiring 27, 46 that "provides a connection between connectors 11 and 12 and to RF-safe initiator 15," and "interconnects the connectors 43 and 44 at the respective ends of loading tube 41 and is also operatively connected to RF-safe initiator 45 to provide a communication link between equipment at the earth's surface and RF-safe initiator 45." (Ex. 1018, Goodman, ¶¶ 0020, 24, Claims 1, 5, 13.) Goodman teaches "the RF-safe initiator 15 comprises an electronics board, an addressable switch and either an exploding foil initiator or an exploding bridge wire. In other embodiments, the RF-safe initiator 15 comprises an electronics board and either an exploding foil initiator or an exploding bridge wire without an addressable switch." (Ex. 1018, Goodman, ¶ 0020.) A POSITA would understand Goodman's initiator 15, 45, and 47 would include wires for connecting the electrical connectors to the electronics board, addressable switch, and exploding

foil initiator or an exploding bridge wire to make Goodman's device functional, including a signal-in wire electrically connecting the signal in electrical connector to the electronics board and/or addressable switch. (Ex. 1018, Goodman, ¶¶ 0020, 24, Claims 1, 5, 13.) A POSITA would understand that Goodman's wiring includes a signal in wire from the connector 11 or 12 to the initiator 15. (Ex. 1018, Goodman, ¶¶ 0020, 24, Claims 1, 5, 13.)

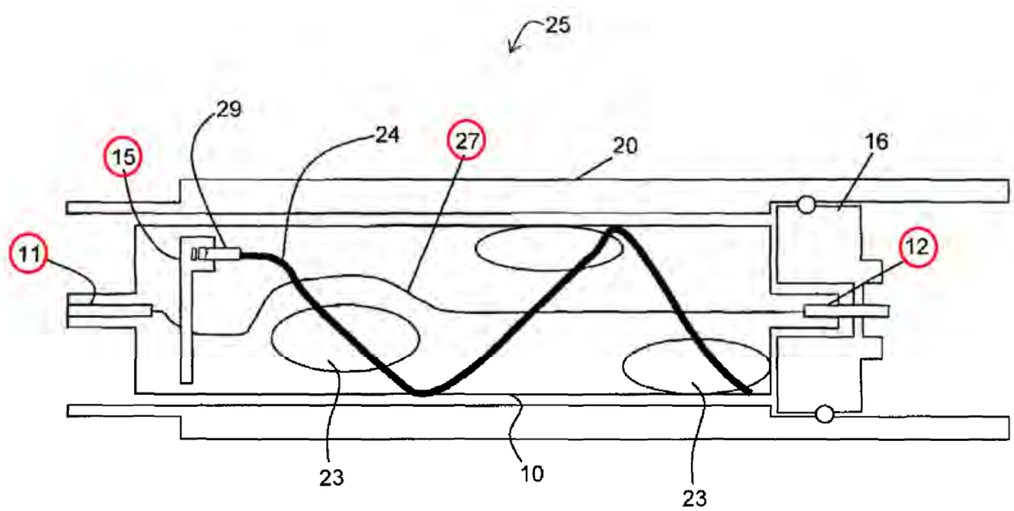


FIG. 2

600. A POSITA would recognize that Goodman teaches a wire electrically connected to the "wireless signal-in connector" and some or all parts of a detonator, or a detonator assembly. Therefore, Goodman teaches these limitations of Claims 7, 9, and 20.

J. A POSITA would find the signal-in wire limitations obvious.

601. A POSITA would be motivated to combine the detonator of Lerche ‘278 with the wiring teachings of Schacherer, Harrigan, Lanclos, Goodman, Black, EWAPS, and/or common knowledge to teach a signal-in wire relaying an electrical signal to the switches and/or detonators because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Lerche ‘278 without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

602. A POSITA would be motivated to combine the detonator of Rogman with the wiring teachings of Schacherer, Harrigan, Lanclos, Goodman, Black, EWAPS, and/or common knowledge to teach a signal-in wire relaying an electrical signal to the switches and/or detonators because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Rogman without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques

for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

603. A POSITA would be motivated to combine the detonator of Bonavides with the wiring teachings of Schacherer, Harrigan, Lanclos, Goodman, Black, EWAPS, and/or common knowledge to teach a signal-in wire relaying an electrical signal to the switches and/or detonators because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Bonavides without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

604. A POSITA would be motivated to combine the detonator of Brooks with the wiring teachings of Schacherer, Harrigan, Lanclos, Goodman, Black, EWAPS, and/or common knowledge to teach a signal-in wire relaying an electrical signal to the switches and/or detonators because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to

Brooks without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

XVIII. <u>The Claim 2 limitation of "a through wire for relaying an electrical signal along a length of the charge holder, wherein the through wire is a wire and the wireless through wire connector is in electrical contact with the through wire." The Claim 13 limitation of "(d) connecting a through wire to the wireless through wire connector." The Claim 15 limitation of "wherein the through wire is a wire, and the wireless through wire connector of the detonator is in electrical contact with the through wire."</u>

605. Claim 2 in the '938 Patent includes the limitation "**a through wire for relaying an electrical signal along a length of the charge holder, wherein the through wire is a wire and the wireless through wire connector is in electrical contact with the through wire.**" (Ex. 1001, the '938 Patent, 11:36-40.) Claim 13 includes the limitation "**(d) connecting a through wire to the wireless through wire connector.**" (Ex. 1001, the '938 Patent, 12:51-52.) Claim 15 includes the limitation "**wherein the through wire is a wire, and the wireless through wire connector of the detonator is in electrical contact with the through wire.**" (Ex. 1001, the '938 Patent, 12:62-64.)

A. Construction of a through wire

606. For the reasons discussed above, the terms “wireless” and “wireless through wire connector” introduce uncertainty into the claims. This uncertainty is particularly apparent here where a “wire” is connected to something that is called “wireless.” This lack of clarity is made worse here where the claims include the limitation “wherein the through wire is a wire” introducing the idea that “a through wire” may not necessarily be a wire. This is particularly pronounced in Claim 15 which appears to add no limitation to Claim 13. Therefore, Claims 2, 13, and 15 fail to inform those skilled in the art about the scope of the invention with reasonable certainty and are indefinite.

607. As discussed above with respect to the “wireless” connector elements, the term “through wire” is not given any specific meaning in the ‘938 Patent. The ‘938 Patent variously describes a “through wire” as either part of the detonator, or a conductor traversing the length of the charge holder outside of the detonator. (Ex. 1001, the ‘938 Patent, 2:65-67, 6:24-28, 8:6-19, 8:37-39, 953-55, FIG. 35B.) Although Claim 2 refers to the function of the through wire is for “relaying an electrical signal along a length of the charge holder,” it still unclear whether it is referring to a wire inside the detonator that “relays” signals that then traverse some length of the charge holder, a wire that physically traverses the full length of the charge holder, or something else. Claims 13 and 15 don’t include even that vague language, leaving

the possibility that the “through wire” could be ***any*** wire that is electrically connected to the “wireless through wire connector” at ***any*** point. Therefore, Claims 2, 13, and 15 fail to inform those skilled in the art about the scope of the invention with reasonable certainty and are indefinite.

608. A POSITA’s best guess as to the meaning of the limitations of Claim 2 is a wire traversing the length of the charge holder and electrically connected to the “wireless through wire connector.”

609. A POSITA’s best guess as to the meaning of these limitations of Claim 13 and 15 is electrically connecting a wire to the “wireless through wire connector”.

B. A POSITA’s common knowledge includes a through wire

610. A POSITA’s common knowledge would include the use of addressable switches with detonators and their requirement for three conductors providing an input path, a ground or return path, and a communications path to the next detonator, as also taught by Lerche ‘278, Lerche ‘868, and Lerche ‘090. (Ex. 1011, Lerche ‘278, Ex. 1023, Lerche ‘868, FIGS. 13, 15, 19A; Ex. 1024, Lerche ‘090, FIGS. 13, 15, 19A.) Accordingly, the use of a detonator assembly having three electrical contacts and associated wires (including a through wire) so that the detonator can be electrically connected to a perforating gun without the need to connect or attach wires directly to each other was within the common knowledge of a POSITA when the ‘938 Patent was filed.

C. Schacherer teaches a through wire

611. Ex. 1004, Schacherer teaches, "rotary electrical connection 46 may electrically connect the selective firing module 32 to an electrical conductor 34 extending along the respective explosive assembly 20." (Ex. 1004, Schacherer, 7:66-8:1.) A POSITA would recognize that FIG. 5 illustrates a thru wire 34 as traversing the entire length of the inside of gun carriers 20. Schacherer further teaches: "The electrical conductor 34 is electrically connected to the selective firing modules 32 in the connectors 30a,b via rotary electrical connections 46, 48. The rotary electrical connections 46, 48 are used, because the electrical conductor 34 rotates along with the explosive components 22, 24, eccentric weight 42, etc., within the outer housing 26." (Ex. 1004, Schacherer, 4:5-10.) A POSITA would recognize that electrical conductor 34 is a wire and the rotary electrical connections 46, 48 are "wireless" in that they couple electronic signals, power, ground, etc., by contact and without manually connecting wires.

612. Schacherer's electrical conductor 34 (through wire) is show in Figures 2 and 5 below. (Ex. 1004, Schacherer, FIGS. 2, 5.)

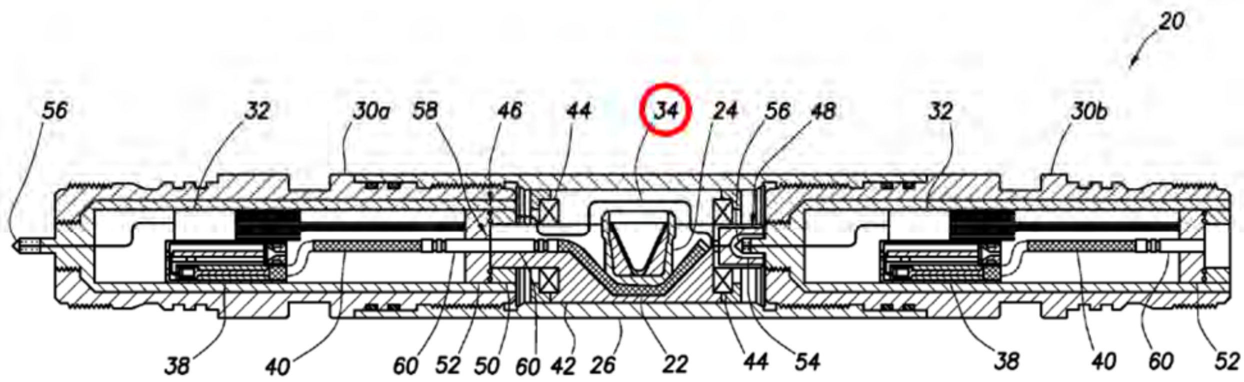


FIG.2

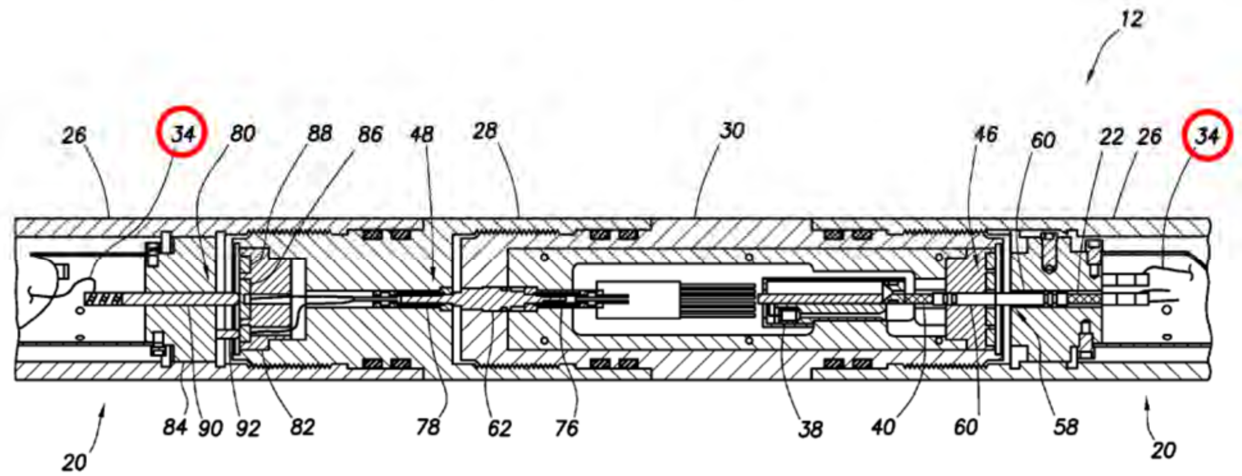


FIG.5

613. A POSITA would recognize that Schacherer teaches a wire traversing the length of the charge holder and electrically connected to the "wireless through wire connector." Therefore, Schacherer teaches these limitations of Claims 2, 13, and 15.

D. Harrigan teaches a through wire

614. Harrigan teaches a pre-wired initiator assembly module with electrical contacts and a detonator as discussed above. (Ex. 1012, Harrigan, ¶¶ 0022, 27; Ex. 1028, Harrigan Prov., pp. 2-6, FIGS. 2-5.)

615. Harrigan teaches that "communications from bulkhead 117 to bulkhead 118 and beyond are wired through the tube 115." (Ex. 1012, Harrigan, ¶¶ 0032, 27; Ex. 1028, Harrigan Prov., p. 3, FIG. 1.) Harrigan goes on to say "it may nevertheless be advantageous to retain such wiring away from certain locations of the loading tube 115 such as at the central axis, at shaped charge locations, etc. Thus, this particular wiring or line may be spiraled through the loading tube 115 and held by securely at predetermined locations by the noted fasteners 215." (Ex. 1012, Harrigan, ¶¶ 0032, 27.)

616. A POSITA would understand that Harrigan teaches at least one wire traversing the length of the charge holder 115 electrically connecting a through wire connector of the initiator assembly 125 to a next initiator assembly for Harrigan to function as described. (Ex. 1012, Harrigan, ¶¶ 0010, 22, 27, 32, 42, 44; Ex. 1028, Harrigan Prov., p. 2, FIG. 1.) Therefore, Harrigan teaches these limitations of Claims 2, 13, and 15.

E. Rogman teaches a through wire

617. Rogman and Rogman Prov. teach that a through wire (power cable 502) is pre-wired in the loading tube 110 and traverses the length of the loading tube 110 with electrical wire holders 136, 504 to give wires a dedicated path through the loading tube and protect wires from being pinched. (Ex. 1014, Rogman, ¶¶ 20, 33, 34; Ex. 1020, Rogman Prov., pp. 1, 6-8.)

618. A POSITA would recognize that Rogman and Rogman Prov. teach a wire traversing the length of the charge holder and electrically connected to the "wireless through wire connector." Therefore, Rogman and Rogman Prov. teach these limitations of Claims 2, 13, and 15.

F. EWAPS teaches a through wire

619. EWAPS teaches a signal-in (hot), ground, and feed-thru wires associated with an addressable switch and detonator. (Ex. 1013, EWAPS, p. 6.) As discussed above, EWAPS teaches connecting those wires to RCA electrical connectors. (Ex. 1013, EWAPS, pp. 6, 8.) A POSITA would understand EWAPS teaches the loading tube including a wire channel for the through wire to traverse the length of the loading tube. (Ex. 1013, EWAPS, p. 10.)

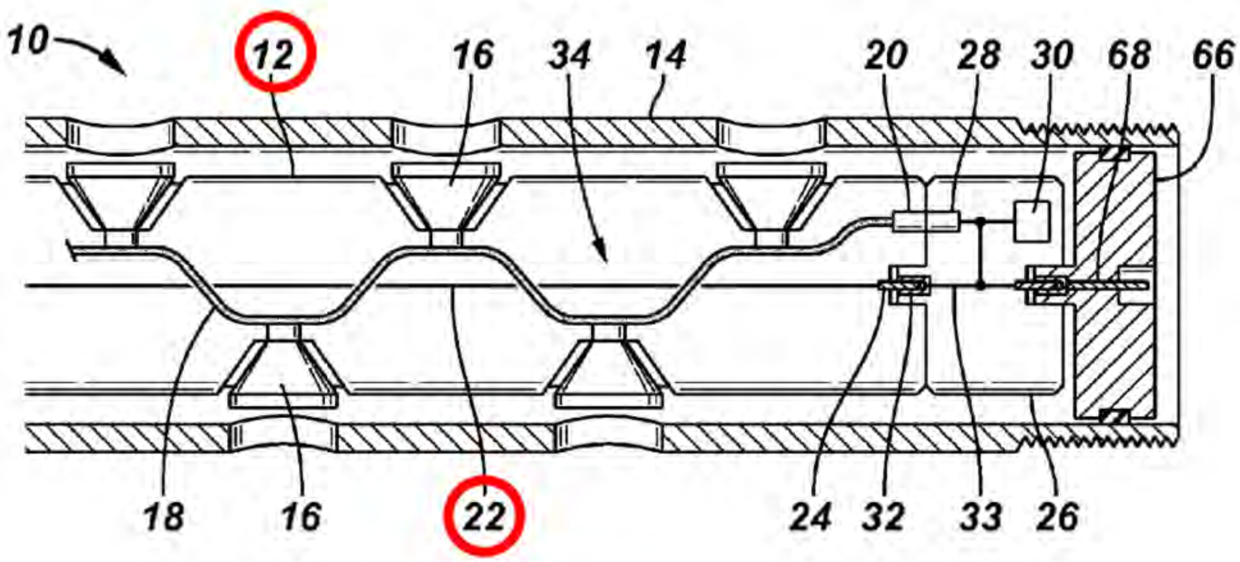
620. A POSITA would recognize that EWAPS teaches a wire traversing the length of the charge holder and electrically connected to the "wireless through wire connector." Therefore, EWAPS teaches these limitations of Claims 2, 13, and 15.

G. Black teaches a through wire

621. As discussed above, a POSITA would read Black's electrical connectors 32, 24 and conductors 33, 22 as containing paired conductors, such as coaxial or twisted pair conductors and contacts as would be used with the disclosed RCA connectors. (Ex. 1002, Black, ¶¶ 0024, 28, 34, FIGS 2, 4, 6, 7.) A POSITA would understand Black to teach a signal-in electrical contact and electrical path to the addressable

switch, a signal out, or through electrical contact and electrical path from the addressable switch to a next perforating gun, and a ground or return electrical contact and electrical path from the addressable switch to complete the necessary communications circuit for addressable perforating and function as described. (Ex. 1002, Black, ¶¶ 0024, 28, 34, FIGS 2, 4, 6, 7.) Black teaches conductor 22 electrically connected to connector 32 (including the through wire connector) and traversing the length of loading tube 12. (Ex. 1002, Black, ¶¶ 0024, 28, 34, FIGS 2, 4, 6, 7.)

FIG. 7



622. A POSITA would recognize that Black teaches a wire traversing the length of the charge holder and electrically connected to the "wireless through wire connector." Therefore, Black teaches these limitations of Claims 2, 13, and 15.

H. Lanclos teaches a through wire

623. Lanclos teaches that cartridge assembly 70 includes inlet leads 76, 84 electrically connected to the signal-in electrical connectors on the end of cartridge assembly 70 and cartridge sub 68 as discussed above. (Ex. 1015, Lanclos, 4:63-5:23, FIGS 3, 4.) Lanclos teaches that cartridge assembly 70 includes ground leads 78, 86 electrically connected to the ground electrical connectors on the end of cartridge assembly 70 and cartridge sub 68 as discussed above. (Ex. 1015, Lanclos, 4:63-5:23, FIGS 3, 4.) Lanclos teaches "a supply lead 80 that is in electrical communication with a communication line 82 shown extending within the downstream perforating gun 62_2." (Ex. 1015, Lanclos, 5:9-12, FIGS 3, 4.)

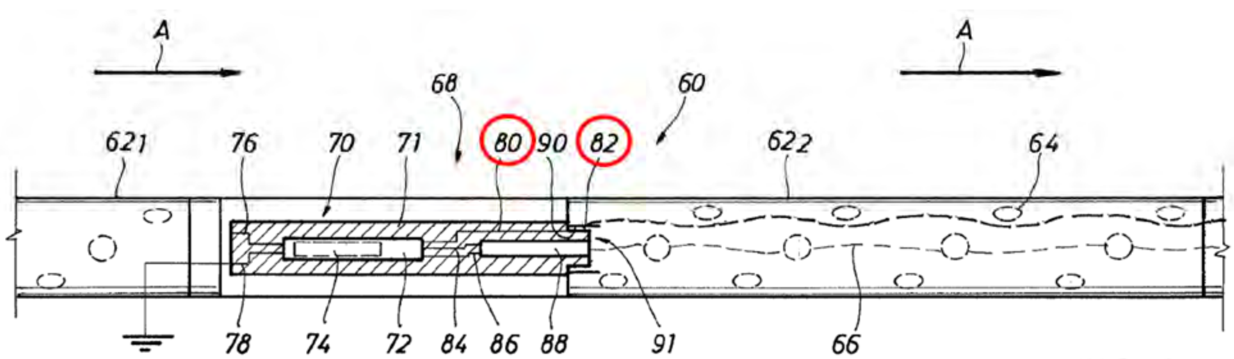


FIG. 3

624. A POSITA would recognize that Lanclos teaches a wire traversing the length of the charge holder and electrically connected to the "wireless through wire connector." Therefore, Lanclos teaches these limitations of Claims 2, 13, and 15.

I. Goodman teaches a through wire

625. As discussed above, Goodman teaches that its detonator may include an addressable switch, a fireset and an initiator. (Ex. 1018, Goodman, ¶¶ 0005-6, 0016, 0018, 0020.) Goodman teaches a detonator/initiator 15, 45, and 47 having electrical connectors for engaging with receptacle 18 and an electrical receptacle 17 for connecting connectors 11, 12, 43, and 44. (Ex. 1018, Goodman, ¶¶ 0005-7, 0018-20, 0023-24, FIGS. 1-5.) A POSITA would find it inherent in Goodman to have electrical connectors on the initiator to engage with receptacle 18 to make the device of Goodman functional. Goodman teaches wiring 27, 46 that "provides a connection between connectors 11 and 12 and to RF-safe initiator 15," and "interconnects the connectors 43 and 44 at the respective ends of loading tube 41 and is also operatively connected to RF-safe initiator 45 to provide a communication link between equipment at the earth's surface and RF-safe initiator 45." (Ex. 1018, Goodman, ¶¶ 0020, 24, Claims 1, 5, 13.) Goodman teaches "the RF-safe initiator 15 comprises an electronics board, an addressable switch and either an exploding foil initiator or an exploding bridge wire. In other embodiments, the RF-safe initiator 15 comprises an electronics board and either an exploding foil initiator or an exploding bridge wire without an addressable switch." (Ex. 1018, Goodman, ¶ 0020.) A POSITA would understand that Goodman's wiring includes a through wire from electrical contacts

of the initiator to the connector 11 or 12. (Ex. 1018, Goodman, ¶¶ 0020, 24, Claims 1, 5, 13.)

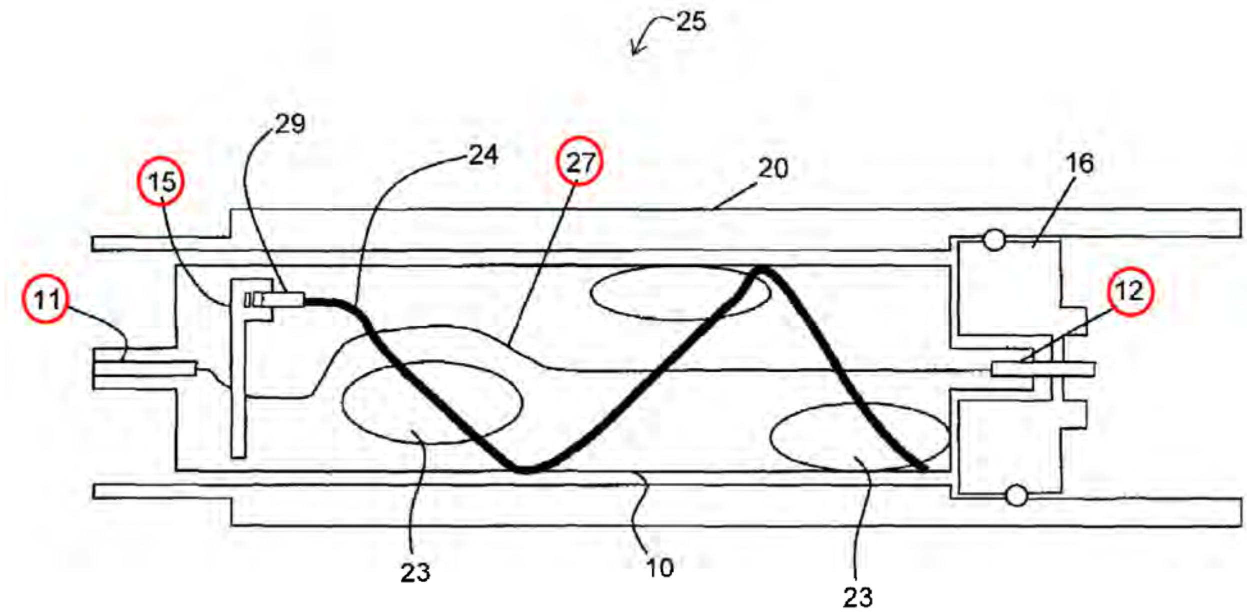


FIG. 2

626. A POSITA would recognize that Goodman teaches a wire traversing the length of the charge holder and electrically connected to the "wireless through wire connector." Therefore, Goodman teaches these limitations of Claims 2, 13, and 15.

J. A POSITA would find the through wire limitations obvious.

627. A POSITA would be motivated to combine the detonator of Lerche '278 with the wiring teachings of Schacherer, Harrigan, Rogman, Lanclos, EWAPS, and/or common knowledge to teach a through wire relaying an electrical signal along the

length of the charge holder because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Lerche '278 without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

628. A POSITA would be motivated to combine the detonator of Bonavides with the wiring teachings of Schacherer, Harrigan, Rogman, Lanclos, EWAPS, and/or common knowledge to teach a through wire relaying an electrical signal along the length of the charge holder because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Bonavides without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

629. A POSITA would be motivated to combine the detonator of Goodman with the wiring teachings of Schacherer, Harrigan, Rogman, Lanclos, EWAPS, and/or common knowledge to teach a through wire relaying an electrical signal along the length of the charge holder because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Goodman without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

630. A POSITA would be motivated to combine the detonator of Black with the wiring teachings of Schacherer, Harrigan, Rogman, Lanclos, EWAPS, and/or common knowledge to teach a through wire relaying an electrical signal along the length of the charge holder because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Black without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of

identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

631. A POSITA would be motivated to combine the detonator of Brooks with the wiring teachings of Schacherer, Harrigan, Rogman, Lanclos, EWAPS, and/or common knowledge to teach a through wire relaying an electrical signal along the length of the charge holder because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Brooks without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

XIX. The Claim 7 limitation of "[wherein the detonator includes] a ground wire electrically connected to the wireless ground contact connector." The Claim 11 limitation of "the modular detonator further comprising a ground wire electrically connected to the wireless ground contact connector."

632. Claim 7 in the '938 Patent includes the limitation "**[wherein the detonator includes] a ground wire electrically connected to the wireless ground contact connector.**" (Ex. 1001, the '938 Patent, 11:53-54.) Claim 11 includes the limitation "**the modular detonator further comprising a ground wire electrically connected to the wireless ground contact connector.**" (Ex. 1001, the '938 Patent, 12:23-25.)

A. Indefiniteness and construction of a ground wire

633. For the reasons discussed above, the terms "wireless" and "wireless signal-in connector" introduce uncertainty into the claims. This uncertainty is particularly apparent here where a "wire" is connected to something that is called "wireless." Therefore, Claims 7 and 11 fail to inform those skilled in the art about the scope of the invention with reasonable certainty and are indefinite.

634. A POSITA's best guess as to the meaning of this limitation of Claim 7 and 11 is a wire electrically connected to the "wireless ground contact connector."

B. A POSITA's common knowledge includes a ground wire

635. A POSITA's common knowledge would include the use of addressable switches with detonators and their requirement for three conductors providing an input path,

a ground or return path, and a communications path to the next detonator, as also taught by Lerche ‘278, Lerche ‘868, and Lerche ‘090. (Ex. 1011, Lerche ‘278, Ex. 1023, Lerche ‘868, FIGS. 13, 15, 19A; Ex. 1024, Lerche ‘090, FIGS. 13, 15, 19A.) Accordingly, the use of a detonator assembly having three electrical contacts and associated wires (including a ground wire) so that the detonator can be electrically connected to a perforating gun without the need to connect or attach wires directly to each other was within the common knowledge of a POSITA when the ‘938 Patent was filed.

C. Schacherer teaches a ground wire

636. Ex. 1004, Schacherer teaches “When the connectors 28, 30 are connected to each other, at least two electrical conductors 94, 96 in the connector 28 are electrically connected to at least two respective conductors 98, 100 in the connector 30. The signal may be modulated on one set of the conductors 94, 98 or 96, 100, with the other set of conductors being a ground. Alternatively, a single set of conductors could be used for transmitting the signal, with the outer housings 26 and connectors 28, 30 being used for grounding purposes (if they are made of electrically conductive materials, such as steel, etc.).” (Ex. 1004, Schacherer, 6:13-22, Ref. FIG. 7.) A POSITA would recognize that the detonator or detonator assembly (e.g., connectors 30 and 28) includes a ground wire (e.g., wires 94 & 98) electrically connected to the wireless ground contact connector (e.g., rotary electrical connection 80).

637. Schacherer teaches a ground wire in the detonator at least as show in the annotated figures below. (Ex. 1004, Schacherer, FIGS. 2, 4-7.)

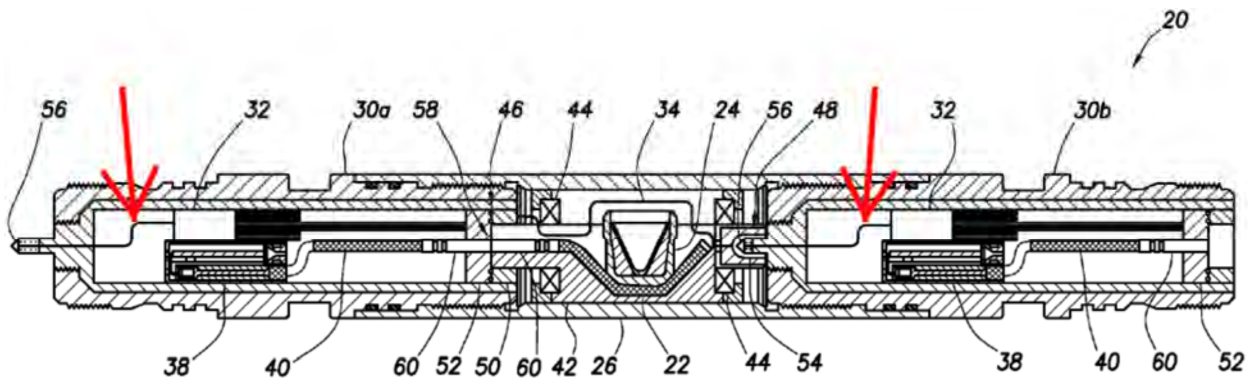


FIG.2

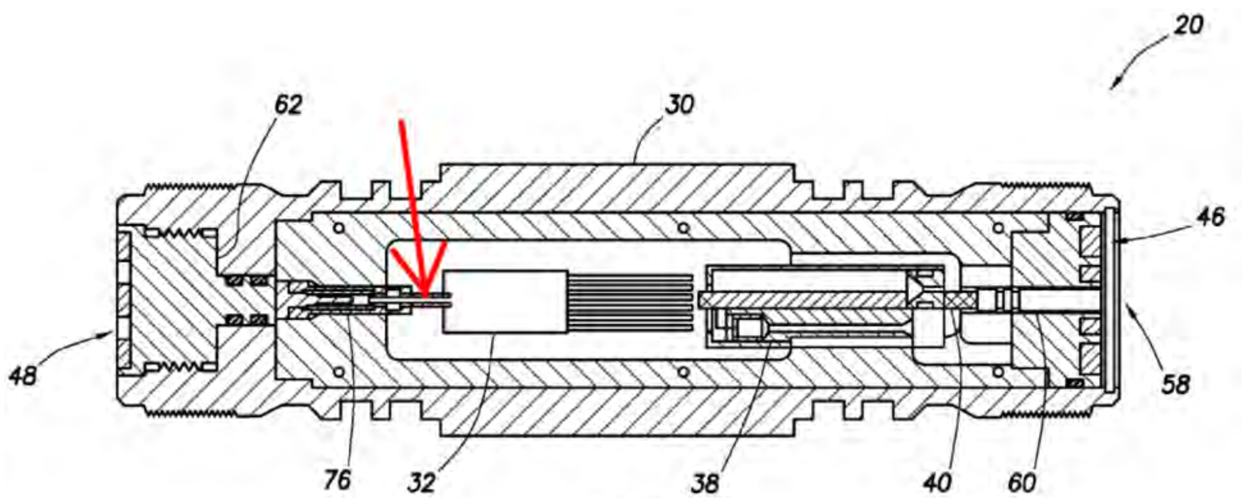


FIG.4

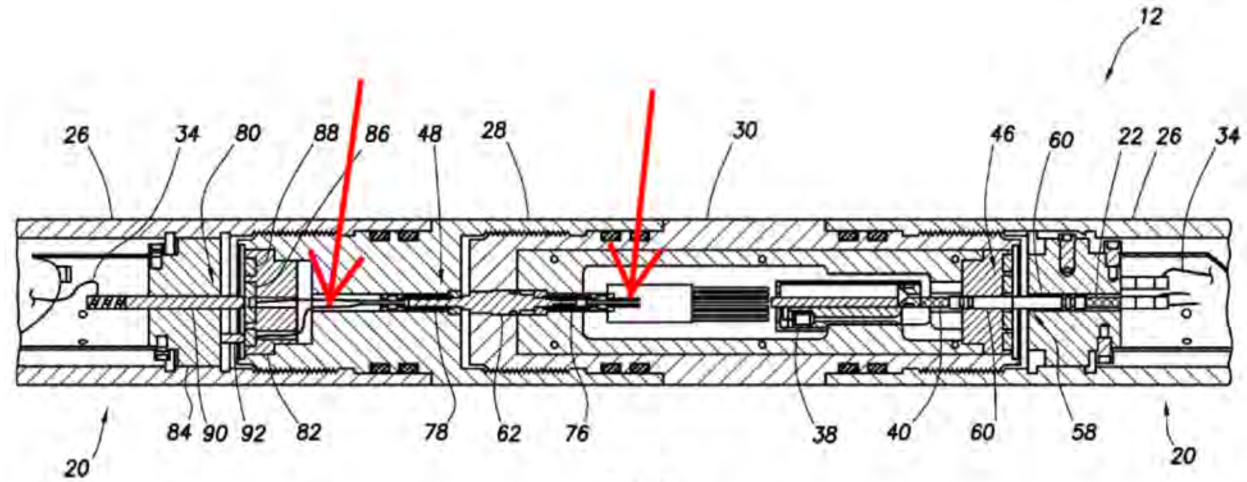


FIG.5

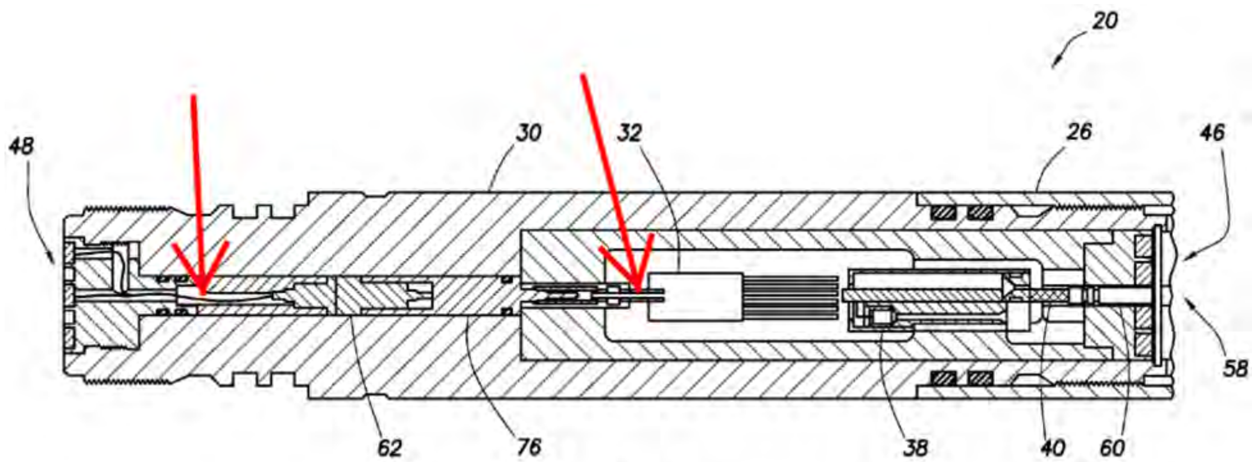


FIG.6

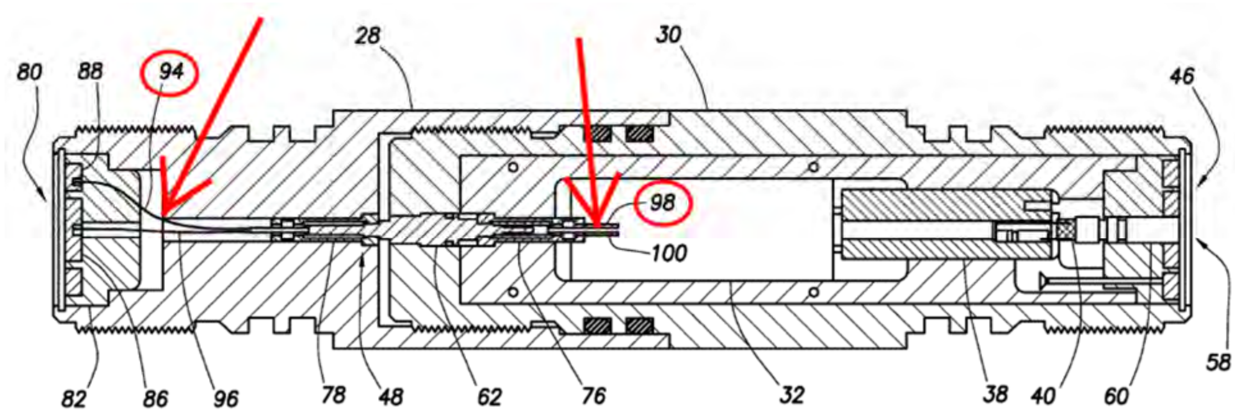


FIG.7

638. A POSITA would recognize that Schacherer teaches a ground wire in the detonator electrically connected to the "wireless ground contact connector." Therefore, Schacherer teaches these limitations of Claims 7 and 11.

D. Harrigan teaches a ground wire

639. Harrigan teaches a pre-wired initiator assembly module with electrical contacts and a detonator as discussed above. (Ex. 1012, Harrigan, ¶¶ 0022, 27; Ex. 1028, Harrigan Prov., pp. 2-6, FIGS. 2-5.) A POSITA would understand that Harrigan teaches at least one wire inside initiator assembly module 125 connecting the detonator 301 to a ground contact of the electrical connection 430 for Harrigan to function as described. (Ex. 1012, Harrigan, ¶¶ 0010, 22, 27, 32, 42, 44; Ex. 1028, Harrigan Prov., p. 5, FIG. 4.) FIG. 3A of Harrigan shows the wires connecting detonator 301 inside initiator assembly module 125. (Ex. 1012, Harrigan, ¶¶ 31, 35-36, Claims 5, 17, 18; Ex. 1028, Harrigan Prov., p. 5, FIG. 4) A POSITA would recognize that these wires would be electrically connected to the electrical contacts discussed above and that one of these wires would transmit a signal-in and the other a ground or return path.

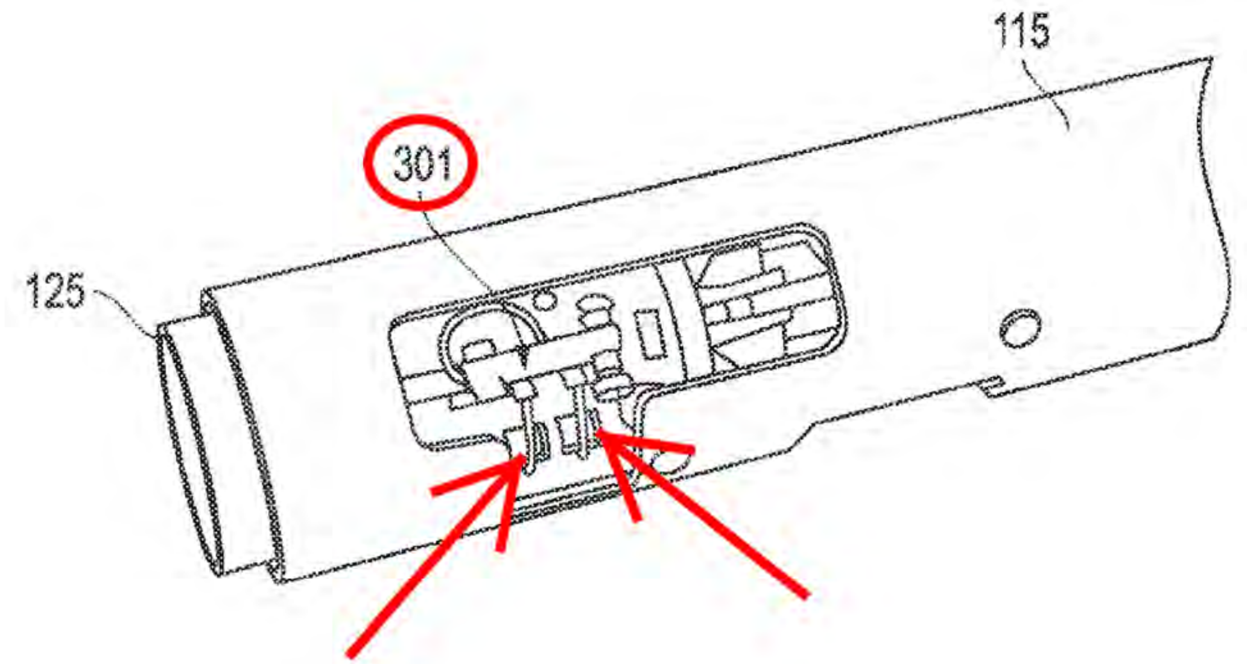


FIG. 3A

640. A POSITA would recognize that Harrigan teaches a ground wire in the detonator electrically connected to the "wireless ground contact connector." Therefore, Harrigan teaches these limitations of Claims 7 and 11.

E. Rogman teaches a ground wire

641. In addition to the electrical feedthroughs and RCA jacks, Rogman and Rogman Prov. teach connecting the detonator 402 to the circuit board within initiator assembly 112 using insulation displacement connectors 410. (Ex. 1014, Rogman, ¶¶ 31, 35-36, Claims 5, 17, 18; Ex. 1020, Rogman Prov., p. 3.) Rogman and Rogman Prov. show the wires connecting detonator 402 and connectors 410. (Ex. 1014, Rogman, ¶¶ 31,

35-36, Claims 5, 17, 18; Ex. 1020, Rogman Prov., p. 3.) A POSITA would recognize that those wires would be electrically connected to the electrical contacts discussed above one of these wires would transmit a signal-in and the other a ground or return path.

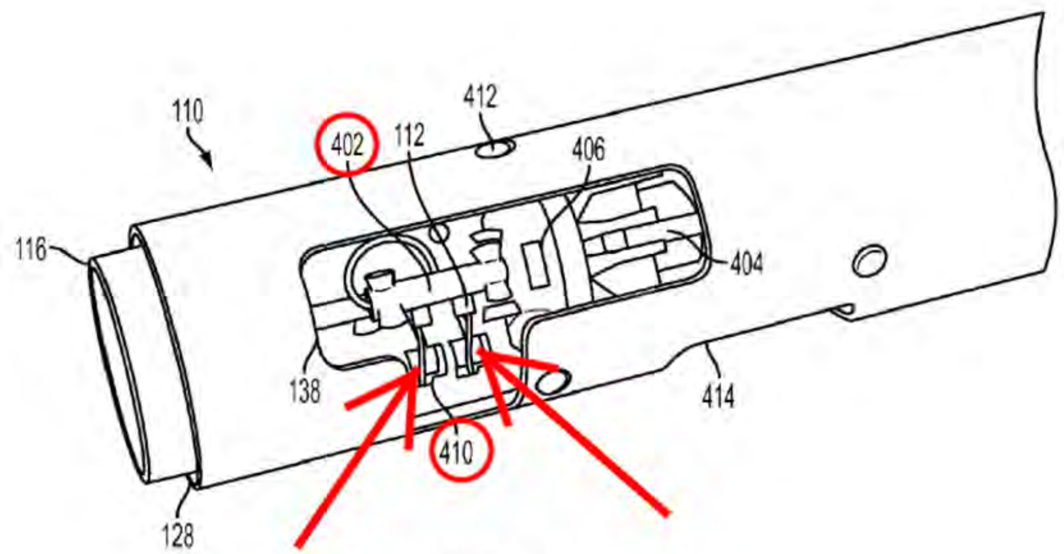


FIG. 4

642. A POSITA would recognize that Rogman and Rogman Prov. teach a ground wire in the detonator electrically connected to the "wireless ground contact connector." Therefore, Rogman and Rogman Prov. teach these limitations of Claims 7 and 11.

F. EWAPS teaches a ground wire

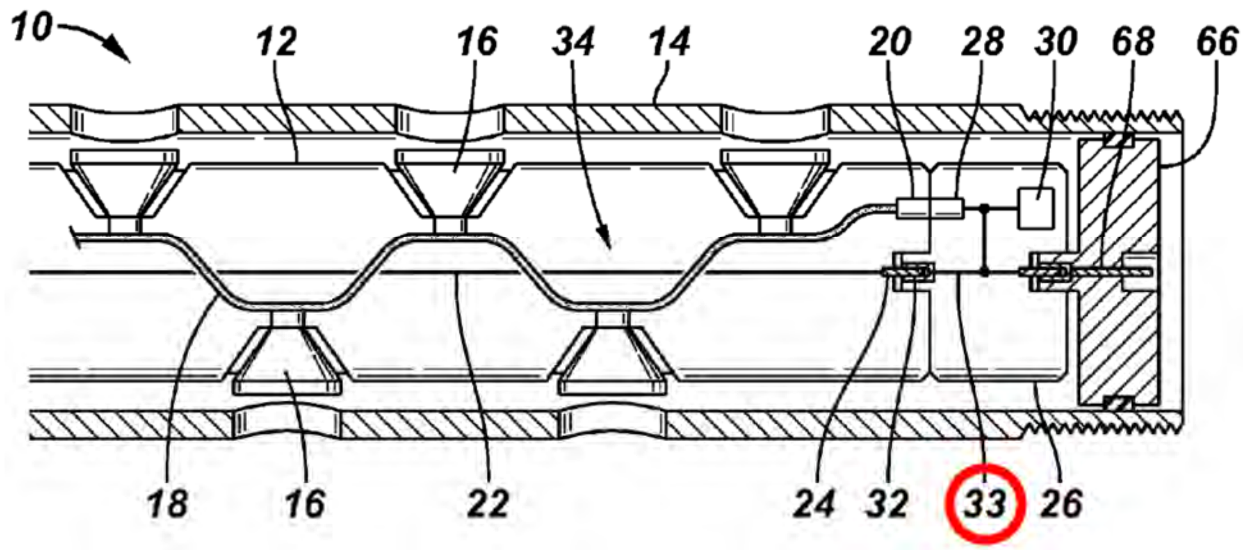
643. EWAPS teaches a signal-in (hot), ground, and feed-thru wires associated with an addressable switch and detonator. (Ex. 1013, EWAPS, p. 6.) As discussed above, EWAPS teaches connecting those wires to RCA electrical connectors. (Ex. 1013, EWAPS, pp. 6, 8.)

644. A POSITA would recognize that EWAPS teaches a ground wire in the detonator electrically connected to the "wireless ground contact connector." Therefore, EWAPS teaches these limitations of Claims 7 and 11.

G. Black teaches a ground wire

645. As discussed above, a POSITA would read Black's electrical connectors 32, 24 and conductors 33, 22 as containing paired conductors, such as coaxial or twisted pair conductors and contacts as would be used with the disclosed RCA connectors. (Ex. 1002, Black, ¶¶ 0024, 28, 34, FIGS. 2, 4, 6, 7.) A POSITA would understand Black to teach a signal-in electrical contact and electrical path to the addressable switch, a signal out, or through electrical contact and electrical path from the addressable switch to a next perforating gun, and a ground or return electrical contact and electrical path from the addressable switch to complete the necessary communications circuit for addressable perforating and function as described. (Ex. 1002, Black, ¶¶ 0024, 28, 34, FIGS. 2, 4, 6, 7.) A POSITA would understand conductor 33 to include a wire inside arming device 26 for transmitting ground path to firing electronics 30 and detonator 28 from the disclosed connectors. (Ex. 1002, Black, ¶¶ 0024, 28, 34, FIGS. 2, 4, 6, 7.)

FIG. 7



646. A POSITA would recognize that Black teaches a ground wire in the detonator electrically connected to the "wireless ground contact connector." Therefore, Black teaches these limitations of Claims 7 and 11.

H. Lanclos teaches a ground wire

647. Lanclos teaches that cartridge assembly 70 includes inlet leads 76, 84 electrically connected to the signal-in electrical connectors on the end of cartridge assembly 70 and cartridge sub 68 as discussed above. (Ex. 1015, Lanclos, 4:63-5:23, FIGS. 3, 4.) Lanclos teaches that cartridge assembly 70 includes ground leads 78, 86 electrically connected to the ground electrical connectors on the end of cartridge assembly 70 and cartridge sub 68 as discussed above. (Ex. 1015, Lanclos, 4:63-5:23, FIGS. 3, 4.) Lanclos teaches "a supply lead 80 that is in electrical communication with a

communication line 82 shown extending within the downstream perforating gun 622." (Ex. 1015, Lanclos, 5:9-12, FIGS. 3, 4.)

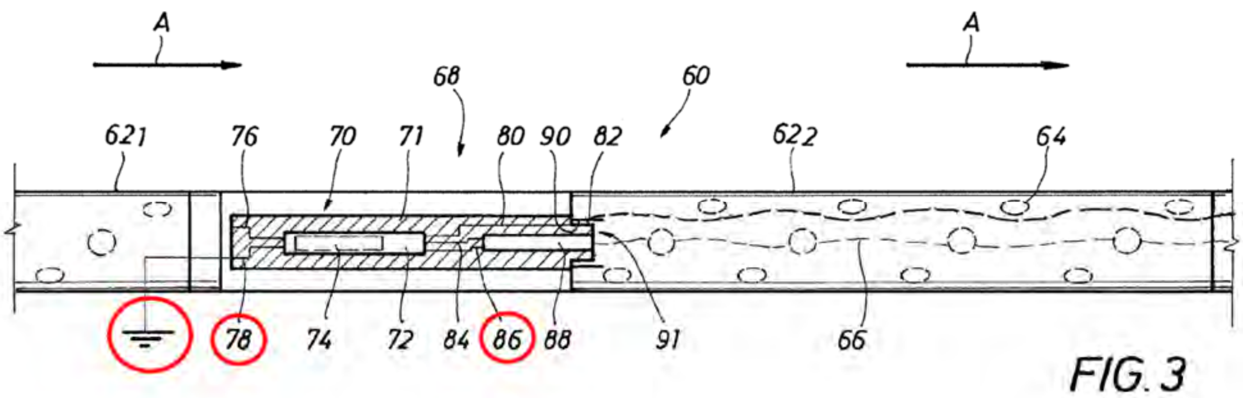


FIG. 3

648. A POSITA would recognize that Lanclos teaches a ground wire in the detonator electrically connected to the "wireless ground contact connector." Therefore, Lanclos teaches these limitations of Claims 7 and 11.

I. Goodman teaches a ground wire

649. As discussed above, Goodman teaches that its detonator may include an addressable switch, a fireset and an initiator. (Ex. 1018, Goodman, ¶¶ 0005-6, 0016, 0018, 0020.) Goodman teaches a detonator/initiator 15, 45, and 47 having electrical connectors for engaging with receptacle 18 and an electrical receptacle 17 for connecting connectors 11, 12, 43, and 44. (Ex. 1018, Goodman, ¶¶ 0005-7, 0018-20, 0023-24, FIGS. 1-5.) A POSITA would find it inherent in Goodman to have electrical connectors on the initiator to engage with receptacle 18 to make the device of Goodman functional. Goodman teaches wiring 27, 46 that "provides a connection between connectors 11 and 12 and to RF-safe initiator 15," and "interconnects the

connectors 43 and 44 at the respective ends of loading tube 41 and is also operatively connected to RF-safe initiator 45 to provide a communication link between equipment at the earth's surface and RF-safe initiator 45.” (Ex. 1018, Goodman, ¶¶ 0020, 24, Claims 1, 5, 13.) Goodman teaches “the RF-safe initiator 15 comprises an electronics board, an addressable switch and either an exploding foil initiator or an exploding bridge wire. In other embodiments, the RF-safe initiator 15 comprises an electronics board and either an exploding foil initiator or an exploding bridge wire without an addressable switch.” (Ex. 1018, Goodman, ¶ 0020.) A POSITA would understand Goodman’s initiator 15, 45, and 47 would include wires for connecting the electrical connectors to the electronics board, addressable switch, and exploding foil initiator or an exploding bridge wire to make Goodman’s device functional, including a ground wire electrically connecting the ground contact electrical connector to the electronics board and/or addressable switch. (Ex. 1018, Goodman, ¶¶ 0020, 24, Claims 1, 5, 13.) A POSITA would understand that Goodman’s wiring includes a ground wire from the connector 11 or 12 to the initiator 15. (Ex. 1018, Goodman, ¶¶ 0020, 24, Claims 1, 5, 13.)

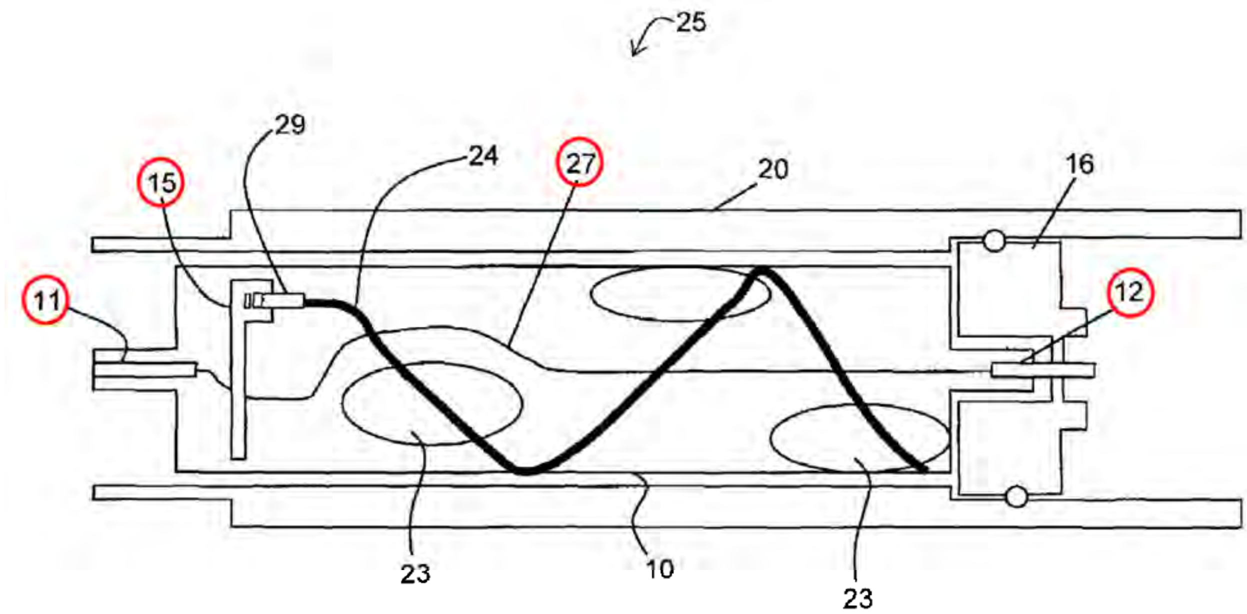


FIG. 2

650. A POSITA would recognize that Goodman teaches a ground wire in the detonator electrically connected to the "wireless ground contact connector." Therefore, Goodman teaches these limitations of Claims 7 and 11.

J. A POSITA would find the ground wire limitations obvious

651. A POSITA would be motivated to combine the detonator of Lerche '278 with the wiring teachings of Schacherer, Lanclos, EWAPS, and/or common knowledge to teach a ground wire coupled between the switches and/or detonators and the adaptors/subs/gun carriers, etc. because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would

yield predictable results. This would be the predictable application of known methods to Lerche '278 without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

652. A POSITA would be motivated to combine the detonator of Harrigan with the wiring teachings of Schacherer, Lanclos, EWAPS, and/or common knowledge to teach a ground wire coupled between the switches and/or detonators and the adaptors/subs/gun carriers, etc. because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Harrigan without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

653. A POSITA would be motivated to combine the detonator of Rogman with the wiring teachings of Schacherer, Lanclos, EWAPS, and/or common knowledge to teach a ground wire coupled between the switches and/or detonators and the

adaptors/subs/gun carriers, etc. because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Rogman without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

654. A POSITA would be motivated to combine the detonator of Bonavides with the wiring teachings of Schacherer, Lanclos, EWAPS, and/or common knowledge to teach a ground wire coupled between the switches and/or detonators and the adaptors/subs/gun carriers, etc. because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Bonavides without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

655. A POSITA would be motivated to combine the detonator of Goodman with the wiring teachings of Schacherer, Lanclos, EWAPS, and/or common knowledge to teach a ground wire coupled between the switches and/or detonators and the adaptors/subs/gun carriers, etc. because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Goodman without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

656. A POSITA would be motivated to combine the detonator of Black with the wiring teachings of Schacherer, Lanclos, EWAPS, and/or common knowledge to teach a ground wire coupled between the switches and/or detonators and the adaptors/subs/gun carriers, etc. because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Black without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the

finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

657. A POSITA would be motivated to combine the detonator of Brooks with the wiring teachings of Schacherer, Lanclos, EWAPS, and/or common knowledge to teach a ground wire coupled between the switches and/or detonators and the adaptors/subs/gun carriers, etc. because that is a common industry practice, it is required for the tool to function as designed, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to Brooks without any unexpected results, simple substitution of the known wiring techniques for the perforating devices taught, the use of known wiring techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of wiring options that are available with a reasonable expectation of success.

XX. The Claim 3 limitation of "wherein the charge holder is an injection molded part." The Claim 6 limitation of "wherein the top connector is an injection molded part."

658. Claim 3 in the '938 Patent includes the limitation "**wherein the charge holder is an injection molded part.**" (Ex. 1001, the '938 Patent, 11:41-42.) Claim 6 includes the limitation "**wherein the top connector is an injection molded part.**" (Ex. 1001, the '938 Patent, 11:49-50.)

A. Construction of the injection molded limitations

659. The '938 Patent provides an example where "components of the assembly may include molded parts, which may also be manufactured to house the wiring integrally, through, for instance, overmolding, to encase the wiring and all connectors within an injection molded part. For example, the charge holder 16 could be overmolded to include the through wire." (Ex. 1001, the '938 Patent, 6:29-34.) The '938 Patent provides an example where "The top and bottom connector, as well as the spacer, in an embodiment, are made of 15% glass fiber reinforced, injection molding PA6 grade material, commercially available from BASF under its ULTRAMID® brand, and can provide a positive snap connection for any configuration or reconfiguration." (Ex. 1001, the '938 Patent, 6:64-7:2.)

660. A POSITA's understanding of the plain and ordinary meaning of these terms is simply the claim language as it is written.

B. A POSITA's common knowledge includes the injection molded limitations

661. A POSITA would be familiar with the use of injection molded composites in downhole tools, their reduced costs, and suitability for construction of any components not exposed to the wellbore environment as part of common knowledge. A sense of the age of injection molding manufacturing processes as prior art can be learned from US Patent 8,165,714 by Mier et al., Ex. 1027. In it, Mier discloses, "HYATT patented the first injection molding machine in 1872." (Ex. 1027, Mier, 1:23-24.) A POSITA's common knowledge would include the construction of charge holders from injection molded composites. A POSITA's common knowledge would include the construction of connectors for holding detonators and energetically coupling them to detonating cords from injection molded composites. This is supported by the '938 Patent leaving the entirety of the "how" and "why" these parts might be injection molded to the common knowledge of a POSITA.

C. Obvious to modify Schacherer to include the injection molded limitations

662. Schacherer acknowledges that perforating gun components are made out of non-metallic composite materials as opposed to electrically conductive materials such as steel. (Ex. 1004, Schacherer, 6:18-22.) Schacherer also inherently teaches the use of insulating composite materials in its descriptions of electrical coupler 62 because

without the insulating composite the coupler 62 would not function as described. (Ex. 1004, Schacherer, 5:11-21, FIG. 3; Ex. 1010, Final Written Decision, p. 22-24.)

663. A POSITA using the teachings of Schacherer to design and/or build a perforating gun system would look to Lendermon to teach injection molding parts because it is a common cost effective technique to make such components in volume, the combination would be obvious to try and would produce a predictable result.

664. A POSITA using the teachings of Schacherer to practice its perforating gun system would look to Goodman's teachings of injection molded parts because injection molding is a common cost effective technique to make such components in volume, the combination would be obvious to try and would produce a predictable result.

665. Because Schacherer presumes the use of composite materials and a POSITA would be familiar with the use and applicability of injection molded composites to internal components of perforating guns, it would be obvious to modify Schacherer to make either the charge holder or bodies 46, 58, or the body of the cartridge assembly of an injection molded composite. This would be the predictable application of known methods to the disclosure of injection molded perforating gun parts without any unexpected results, simple substitution of the known injection molded parts for the parts taught, the use of known injection molding techniques for their understood benefits, and obvious to try as selecting from the finite number of identifiable and

predictable types of materials that are available with a reasonable expectation of success.

D. Harrigan teaches the injection molded limitations

666. Harrigan teaches manufacturing connector 530 of a molded material, centralizer rings 200 of a durable plastic or other suitable material, initiator assembly module 115 blast wall of sacrificial plastic. (Ex. 1012, Harrigan, ¶¶ 0034, 42, 44; Ex. 1028, Harrigan Prov., pp. 4-7, FIGS. 2-6.) A POSITA would understand from the figures of Harrigan that at least its centralizer rings 200, initiator assembly module 115, and connector 400 are injection molded parts. (Ex. 1012, Harrigan, FIGS. 1A, 2B, 3A, 4A; Ex. 1028, Harrigan Prov., pp. 4-7, FIGS. 2-6.) Therefore, Harrigan teaches a top connector that is an injection molded in centralizer rings 200 and connector 400. Therefore, Harrigan teaches this limitation of Claim 6.

E. Rogman teaches the injection molded limitations

667. Rogman teaches "The component parts of the wellbore perforating device 100 can be formed from any material. For example, … plastic, composite materials, … thermoplastic materials, such as polymers, elastomers, rubbers, and the like." (Ex. 1014, Rogman, ¶ 0022.) Rogman then provides a long list of thermoplastic materials, many of which are primarily used in injection molding parts. Rogman teaches "At least the loading tube 310 and/or carrier 302 can be formed from any thermoplastic material," and provides the example that "the loading tube 310 can be

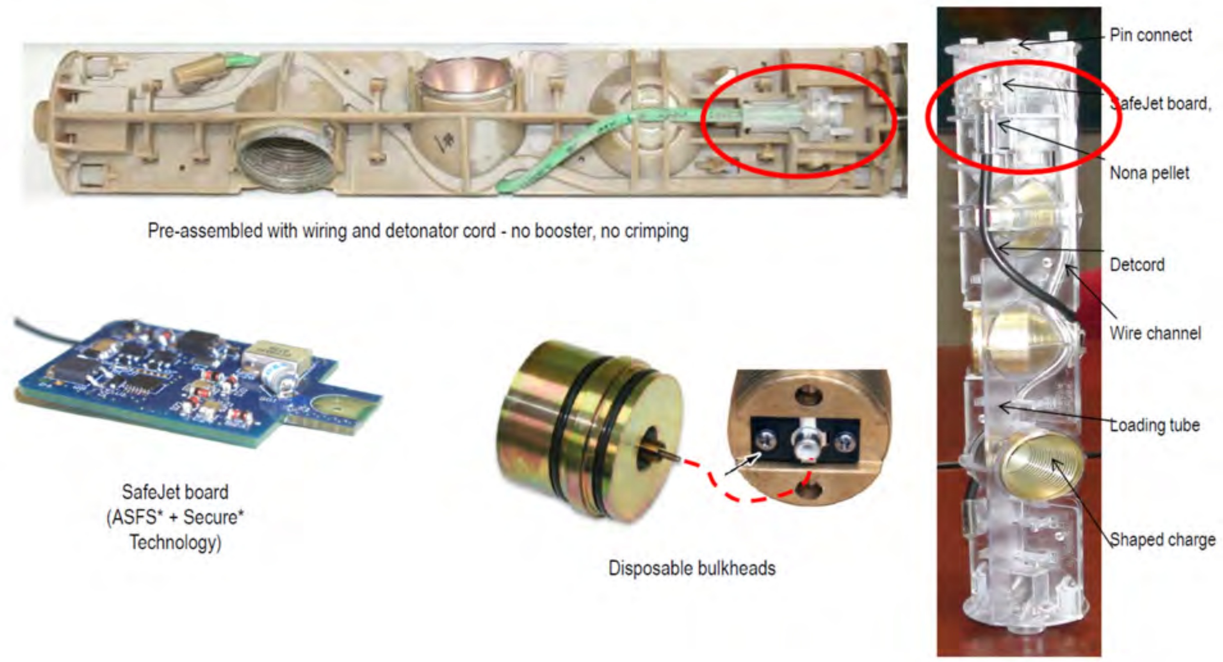
completely formed or molded from a thermoplastic material.” (Ex. 1014, Rogman, ¶ 0027.) Rogman teaches that loading tube 110 can be made from “cellulose, Styrofoam, expanded polystyrene, plastic, composite materials, ceramics, plaster, or the like,” materials that are generally molded. (Ex. 1014, Rogman, ¶ 0025.) Rogman teaches that “initiator assembly 112 can be at least partially formed from a thermoplastic material.” (Ex. 1014, Rogman, ¶ 0032.) Ex. 1020, Rogman Prov. teaches, "[m]olded plastic pieces for complex shaped parts to reduce cost;" (Ex. 1020, Rogman Prov., p. 6, 4th bullet point.) A POSITA would recognize that many of the components disclosed in the Rogman Prov. and as illustrated in the figures are injection molded parts, including the initiator module.

668. A POSITA reviewing Rogman Prov. would see that at least an initiator assembly, loading tube, and lower connector that are injection molded parts. (Ex. 1020, Rogman Prov., pp. 2-4.)

669. Therefore, Rogman and Rogman Prov. teach a charge holder and a top connector that are injection molded parts, teaching the limitations of Claims 3 and 6.

F. EWAPS teaches the injection molded limitations

670. EWAPS teaches a POSITA a detonator (SafeJet board) in an injection molded housing adjacent to one end of a charge holder (loading tube) that is also injection molded. (Ex. 1013, EWAPS, p. 0010.)



671. Therefore, EWAPS teaches a charge holder and a top connector that are injection molded parts, teaching the limitations of Claims 3 and 6.

G. Black teaches the injection molded limitations

672. A POSITA would find it obvious to modify parts to be made of injection molded material. A POSITA would understand the examples of arming device 26 would be best made from injection molded material to produce the interlocking features described.

H. Lanclos teaches the injection molded limitations

673. Lanclos teaches that a POSITA could produce the described systems using different materials, motivating them to look to teachings of alternative materials. (Ex. 1015, 4:34-37.)

I. Lendermon teaches the injection molded limitations

674. Ex. 1003, Lendermon teaches "Regardless of the particular operating characteristics required for a given set of the shaped charges 11, the inner charge cases 27 are respectively mounted within complementally-shaped hollow containers or outer cases, as at 29, which, in the illustrated embodiment of the present invention, are preferably made from a suitable high-strength thermoplastic material that enables the cases to be economically fabricated by means such as an appropriate injection molding process." (Ex. 1003, Lendermon, 6:14-23.) This is further illustrated in FIGS. 1 and 4-7. A POSITA would know that a suitable high strength thermoplastic would be formed using an injection molded process.

675. Lendermon teaches "Regardless of the particular operating characteristics required for a given set of the shaped charges 11, the inner charge cases 27 are respectively mounted within complementally-shaped hollow containers or outer cases, as at 29, which, in the illustrated embodiment of the present invention, are preferably made from a suitable high-strength thermoplastic material that enables the cases to be economically fabricated by means such as an appropriate injection molding process.

Although it has been found that a preferred material for these outer containers 29 as well as the upper and lower base supports 18 and 19 is a glass-filled nylon such as presently marketed by the DuPont Corporation under the trademark of "Zytel', those skilled in the art will recognize that other plastics with similar high-temperature and high-strength characteristics may also be used for fabricating the outer cases 29 as well as the base supports 18 and 19." (Ex. 1003, Lendermon, 6:14-31.) This is further illustrated in FIGS. 1 and 4-7. A POSITA would recognize the upper base support of Lendermon to be the top connector of the '938 Patent. A POSITA would know that a suitable high strength thermoplastic would be formed using an injection molded process.

676. A POSITA using the teachings of Schacherer to practice the perforating gun system of Claim 5 would look to Lendermon to teach the Claim 6 limitation of, "[t]he perforating gun of Claim 5, wherein the top connector is an injection molded part," because injection molding is a common cost effective technique to make such components in volume, the combination would be obvious to try and would produce a predictable result.

677. Therefore, Lendermon teaches a charge holder and a top connector that are injection molded parts, teaching the limitations of Claims 3 and 6.

J. Goodman teaches the injection molded limitations

678. Ex. 1018, Goodman teaches "With reference to FIG. 1, there is illustrated an embodiment of a loading tube 10 in accordance with the present invention. Loading tube 10 may, for example, be fabricated by a molding process and comprises a receptacle 18 for receiving an initiator, receptacles 13 for receiving shaped charges, and a receptacle 14 for receiving a detonating cord." (Ex. 1018, Goodman, ¶ 0019.) A POSITA would know that fabricated by a molded process would mean an injection molded process. Therefore, a POSITA would recognize that Goodman teaches the limitation that the charge holder is an injection molded part as claimed in Claim 3. As discussed above, a POSITA reading Goodman would understand that some component must hold the detonator close to the detonating cord and would understand that to be an injection molded part as a component of loading tube 10.

K. Obviousness of the injection molded limitations

679. A POSITA would be motivated to combine the charge holder of Schacherer with the injection molding teachings of Harrigan, Rogman, Lendermon, Goodman, EWAPS, and/or common knowledge to teach injection molding of the top connector and charge holder because that is a common industry practice, the parts would be electrically insulating and therefore safer, the manufacturing process is more economical for large volume parts of complex geometry, it would be obvious to try and would yield predictable results. This would be the predictable application of

known methods to the disclosure of Schacherer without any unexpected results, simple substitution of the known perforating components taught, and obvious to try as selecting from the finite number of identifiable and predictable types of manufacturing methods that are available with a reasonable expectation of success.

680. A POSITA would be motivated to combine Lanclos with the Harrigan, Rogman, Lendermon, Goodman, EWAPS, and/or common knowledge to teach injection molding of the top connector and charge holder because that is a common industry practice, the parts would be electrically insulating and therefore safer, the manufacturing process is more economical for large volume parts of complex geometry, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of Lanclos without any unexpected results, simple substitution of the known perforating components taught, and obvious to try as selecting from the finite number of identifiable and predictable types of manufacturing methods that are available with a reasonable expectation of success.

681. A POSITA would be motivated to combine Black with the Harrigan, Rogman, Lendermon, Goodman, EWAPS, and/or common knowledge to teach injection molding of the top connector and charge holder because that is a common industry practice, the parts would be electrically insulating and therefore safer, the manufacturing process is more economical for large volume parts of complex

geometry, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of Black without any unexpected results, simple substitution of the known perforating components taught, and obvious to try as selecting from the finite number of identifiable and predictable types of manufacturing methods that are available with a reasonable expectation of success.

XXI. <u>The Claim 4 limitation of "the contact pin transfers an electrical signal from a previous wellbore tool to the wireless signal-in connector."</u>

682. Claim 4 in the '938 Patent includes the limitation "**the contact pin transfers an electrical signal from a previous wellbore tool to the wireless signal-in connector.**" (Ex. 1001, the '938 Patent, 11:43-45.)

A. Construction of transferring signal from previous tool

683. As discussed above, the terms "wireless" and "wireless signal-in connector" in the claims introduce ambiguity about the scope of the claims and causes them to fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. This ambiguity about the scope of the claims causes them to fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Therefore, Claim 4 of the '938 Patent, is invalid as indefinite.

684. It is also not clear what is meant by a "previous wellbore tool" or whether it requires a certain order of assembly or certain direction of communication through the contact pin. The '938 Patent does not use the term "previous wellbore tool" outside of Claim 4. "A previous wellbore tool" could mean an adjacent perforating gun, or a distant, cable head, or any number of tools that might be in a wellbore. This ambiguity about the scope of Claim 4 causes it to fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention.

685. The ‘938 Patent neither describes nor teaches the contact pin transferring an electrical signal as claimed. Rather, the ‘938 Patent uses the following language: "[h]ence, the top connector 14 and bulkhead 58 accommodate electrical and ballistic transfer to the charges of the next gun assembly for as many gun assembly units as required, ..." (Ex. 1001, the ‘938 Patent, 7:63-66, Ref. FIG. 19), and "[t]he bulkhead 124 includes spring connector end interfaces comprising contact pins 126A, 126B, linked to coil springs 128A, 128B." (Ex. 1001, the ‘938 Patent, 8:31-33, FIGS. 32, 33 and 35B), and "[t]he detonator head 100 further includes a through wire connector element 112 connected to the through wire 106 (not shown), a ground contact element 114 for connecting the ground wire 110 to the tandem seal adapter (also not shown), through ground springs 116, and a bulkhead connector element 118 for connecting the signal-in wire 108 to the bulkhead assembly 58 (also not shown)." (Ex. 1001, the ‘938 Patent, 8:12-19.)

686. In addition to the varying descriptive terms used throughout, the terms "wellbore tool" and "wireless signal-in connector" are absent from the specification.

687. Therefore, the ‘938 Patent’s written description does not reasonably convey to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date of the patent.

688. A POSITA's best guess as to the meaning of the limitations of Claim 4 is that the contact pin is electrically connected with another wellbore tool and a signal-in connector of the detonator.

B. A POSITA's common knowledge includes transferring signal from previous tool

689. A POSITA would readily recognize that all multiple tool systems, be they perforating gun assemblies or any other tools which operate with electrical signals throughout, must transfer electrical signal(s) from one tool or gun assembly to the next in order to function as expected and required.

690. A POSITA's common knowledge includes the use of bulkheads that include conductive pins for transferring an electrical signal from a previous wellbore tool to a next wellbore tool, including from one perforating gun to another, and placing those bulkheads within and connected to gun carriers. Therefore, a POSITA's common knowledge teaches the limitations of Claim 4.

C. Schacherer teaches transferring signal from previous tool

691. Ex. 1004, Schacherer teaches transferring electrical signal(s) from one perforating gun assembly to the next, "[t]he electrical connector 82 includes electrical contacts 86, 88. The electrical connector 84 includes electrical contacts 90, 92 in the form of spring-loaded pins which make sliding electrical contact with the respective contacts 86, 88." (Ex. 1004, Schacherer, 5:60-63, FIG. 5.)

692. Schacherer teaches "The explosive assemblies 20 are interconnected to each other via connectors 28, 30." (Ex. 1004, Schacherer, 2:33-34.) Schacherer teaches "The electrical conductors 34 (e.g., wires, conductive ribbons or traces, etc.) electrically connect the selective firing modules 32 to a source (e.g., a wireline, a telemetry transceiver, etc.) of an electrical signal." (Ex. 1004, Schacherer, 2:33-34.) Schacherer teaches that the electrical conductor 34 is connected to the selective firing modules 32 "via rotary electrical connections 46, 48." (Ex. 1004, Schacherer, 4:5-13.) As discussed above, Schacherer teaches a number of options for rotary electrical connections and each of them includes a contact pin transmitting a signal to the signal-in contact of the detonator. (Ex. 1004, Schacherer, 4:14-39, 5:1-67, 6:1-22.)

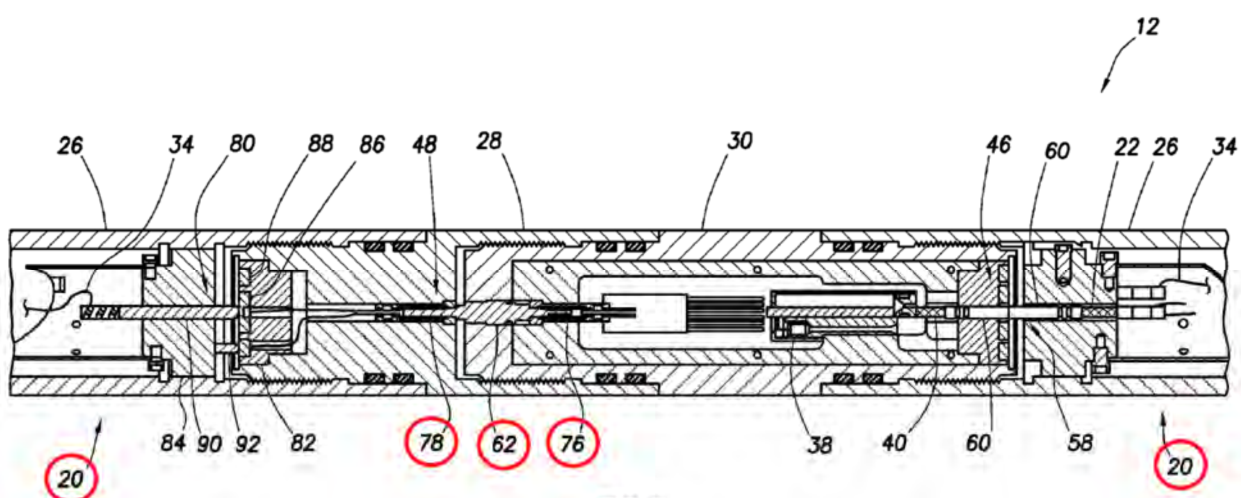


FIG.5

693. A POSITA would understand that Schacherer teaches that each of the contact pins discussed above with respect to the "bulkhead" limitation are electrically connected

to both another perforating gun (or other tools) and a signal-in contact of the detonator. (Ex. 1004, Schacherer, 2:33-34, 2:53-67, 4:14-39, 5:1-67, 6:1-22, FIGS 1-8.)

694. A POSITA would understand Schacherer's contact 68 to be a contact pin in electrical contact with a signal-in connector of a detonator without the need to connect or attach wires to each other. (Ex. 1004, Schacherer, 5:37-42.)

695. A discussed above, a POSITA would understand Schacherer's teachings regarding electrical coupler 78 and associated electrical contacts teach a POSITA conductive pins for transferring an electrical signal from a previous wellbore tool to a next wellbore tool, including from one perforating gun to another.

696. A discussed above, a POSITA would understand Schacherer's teachings regarding the contact pins shown in FIG. 6 and associated electrical contacts teach a POSITA conductive pins for transferring an electrical signal from a previous wellbore tool to a next wellbore tool, including from one perforating gun to another.

697. Schacherer teaches that the contact pin is electrically connected with another wellbore tool and a signal-in connector of the detonator. Therefore, Schacherer teaches the limitations of Claim 4.

D. Harrigan teaches transferring signal from previous tool

698. Harrigan teaches that "communications from bulkhead 117 to bulkhead 118 and beyond are wired through the tube 115." (Ex. 1012, Harrigan, ¶ 0032; Ex. 1028,

Harrigan Prov., p. 3, FIG. 1.) Harrigan teaches that modular feedthrough 119, 120 "provide electrically connectivity between internal components such as the initiator assembly module 125 and communications from surface." (Ex. 1012, Harrigan, ¶ 0024; Ex. 1028, Harrigan Prov., pp. 5, 6, FIGS. 5, 5 (*sic*).) Harrigan teaches that bulkheads and feedthrus can provide "secure communicating connection to other modular components" including a plug and shoot module, a setting tool, correlation tool, or other device. (Ex. 1012, Harrigan, ¶ 0026; Ex. 1028, Harrigan Prov., pp. 2, 4, FIGS. 2, 3.) Harrigan teaches that feedthrus 119, 120 "support continuous communicative connection through the gun 100." (Ex. 1012, Harrigan, ¶ 0031, FIG. 1A; Ex. 1028, Harrigan Prov., pp. 2, 4-6, FIGS. 1, 5, 5 (*sic*).) Harrigan teaches the connector 530 connected to the initiator and a crossover 130 at the other end. (Ex. 1012, Harrigan, ¶ 0044, FIGS. 1A, 5A; Ex. 1028, Harrigan Prov., pp. 3, 6, FIGS. 1, 5.)

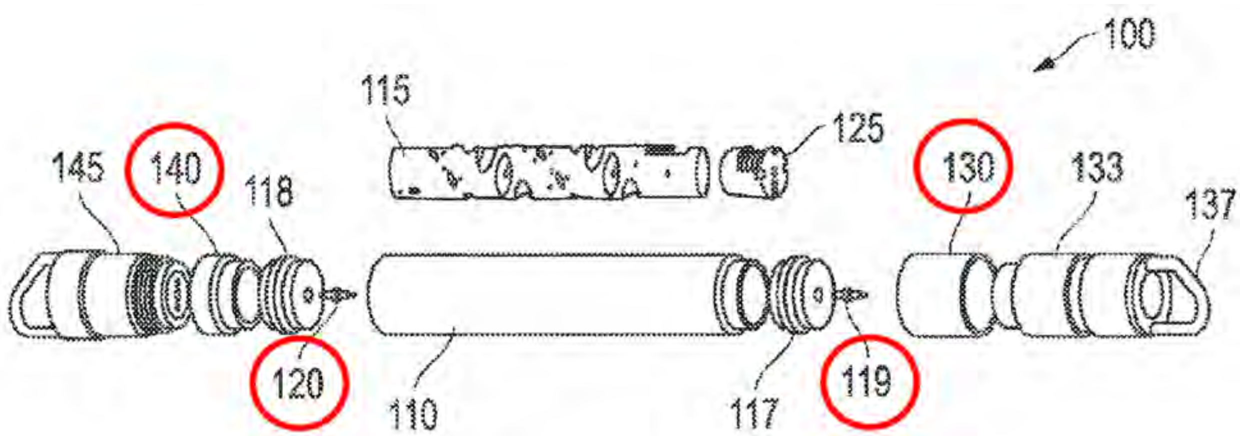


FIG. 1A

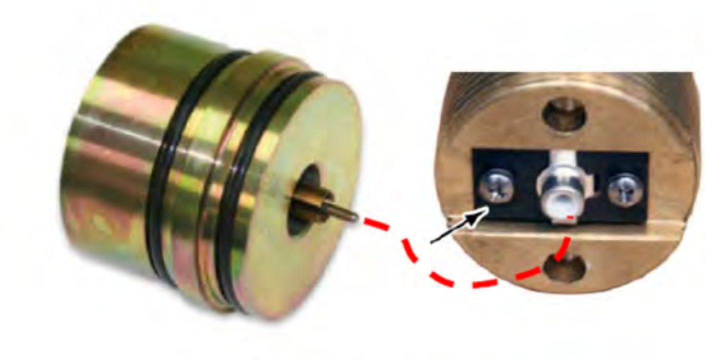
699. A POSITA would understand that the contact pin 530 of Harrigan is electrically connected with another wellbore tool and a signal-in connector of the detonator. Therefore, Harrigan teaches the limitations of Claim 4.

E. Rogman teaches transferring signal from previous tool

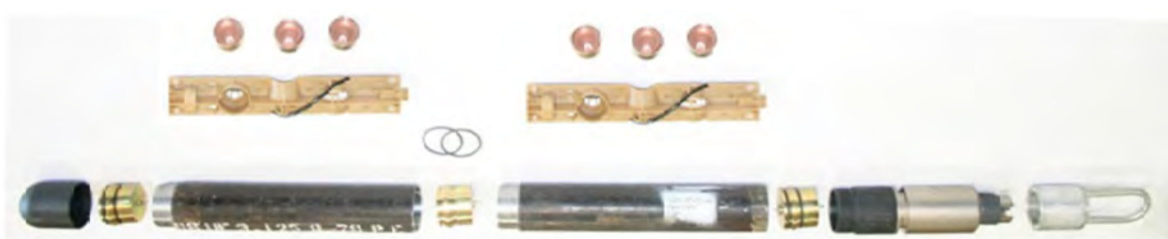
700. Rogman teaches bulkheads 114, 116, 314, 316 isolating the interior of the perforating gun from wellbore fluids and including conduits and seals 130, 330 for electrical communication through them. (Ex. 1014, Rogman, ¶¶ 0017-19, 0035, FIG. 3.) Rogman teaches crossovers 320, 324 connected to bulkheads and associated electrical contacts to couple the perforating gun and detonator to other wellbore tools including: one or more wellbore perforating devices, a plug and shoot 326, conveyance system, wireline, slickline, coil tubing, drill pipe, or to other systems that can have sensing, actuating, and/or structural purposes. (Ex. 1014, Rogman, ¶ 0028, FIG. 3.) Rogman Prov. teaches that perforating guns screw directly together and use coaxial feedthroughs to communicate between perforating guns in a tool string. (Ex. 1020, Rogman Prov., pp. 1, 6-8.) A POSITA would understand that the contact pins taught by Rogman and Rogman Prov. are electrically connected with another wellbore tool and a signal-in connector of the detonator. Therefore, Rogman and Rogman Prov. each teach the limitations of Claim 4.

F. EWAPS teaches transferring signal from previous tool

701. EWAPS teaches that the disposable bulkheads with RCA connectors including pins to electrically connect another perforating gun or other tools to a signal-in contact of an initiator. (Ex. 1013, EWAPS, pp. 9, 10, 12.)



Disposable bulkheads



702. EWAPS teaches that the contact pin of its bulkhead is electrically connected with another wellbore tool and a signal-in connector of the detonator. Therefore, EWAPS teaches the limitations of Claim 4.

G. Black teaches transferring signal from previous tool

703. Black teaches bulkheads 66 including "an electrical feed-through conductor 68 which is electrically connected to electrical conductor 22 of loading tube 12 via electrical conductor 33 of arming device 26 which provides electrical continuity between the surface of the well and the perforating gun string." (Ex. 1002, Black, ¶ 0034.) Black teaches electrically connecting multiple perforating guns together in a string communicating through bulkhead 66 from electrical connector 12 of a loading tube of a first perforating gun 14a to arming device 26 of the next perforating gun 14b. (Ex. 1002, Black, ¶¶ 0038-41, FIG 10.) Black's feed through conductor 68 is electrically connected with a signal-in connector of the detonator. Black teaches that the contact pin of feed through conductor 68 is electrically connected with another wellbore tool and a signal-in connector of the detonator. Therefore, Black teaches the limitations of Claim 4.

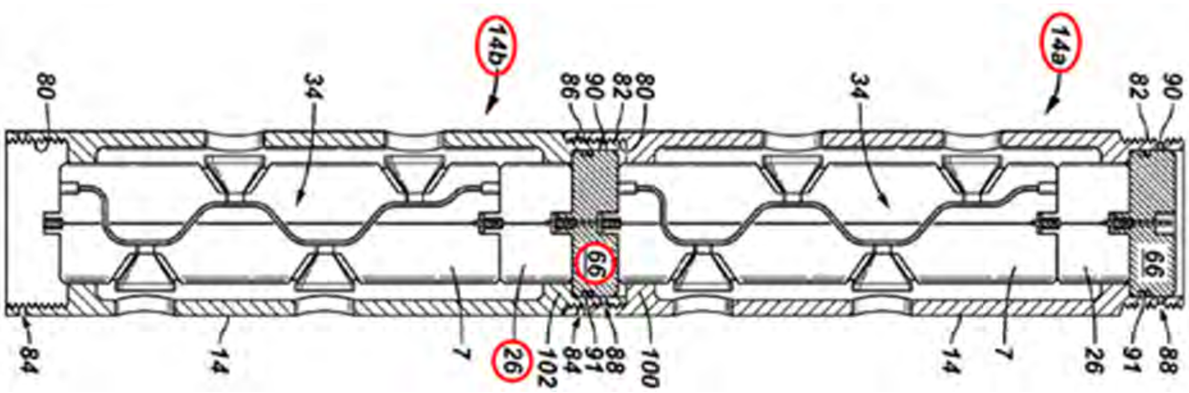


FIG. 10

H. Lanclos teaches transferring signal from previous tool

704. Lanclos teaches connector subs 116 "for coupling upstream ends of the cartridge subs 68 with an upstream perforating gun" and "electrical communication extends substantially the length of the string 115 via contact between successive connectors 90 and receptacles 92." (Ex. 1015, Lanclos, 7:17-30, FIGS. 3-5.) Lanclos teaches a perforating gun string with perforating guns 62_1 through 62_n connected electrically and mechanically by connectors 116 and cartridge subs 68. (Ex. 1015, Lanclos, 7:1-30, FIGS. 3-5.)

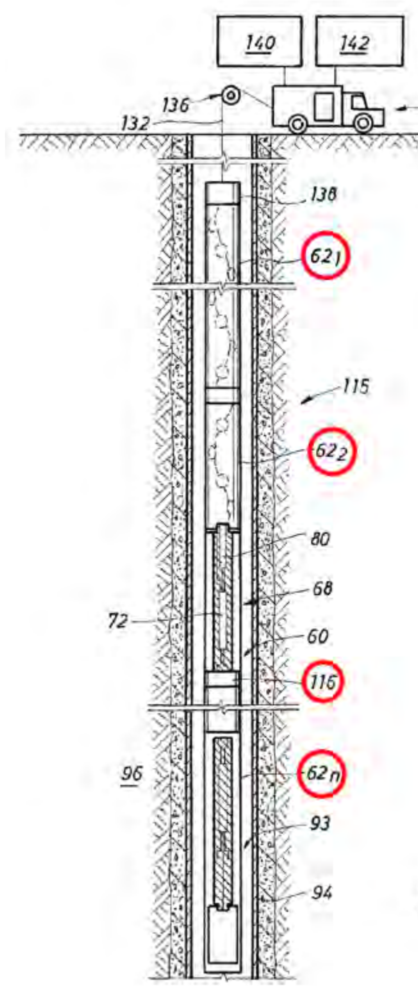


FIG. 5

705. Lanclos teaches that the contact pin of connector subs 116 is electrically connected with another wellbore tool and a signal-in connector of the detonator. Therefore, Lanclos teaches the limitations of Claim 4.

I. Goodman teaches transferring signal from previous tool

706. Goodman teaches a pressure bulkhead 16, 49 engaging connectors 11 and 12 so that it "provides a path for electrical continuity between the earth's surface and the guns in the string." (Ex. 1018, Goodman, ¶¶ 21-22, 26, FIGS. 2-5.)

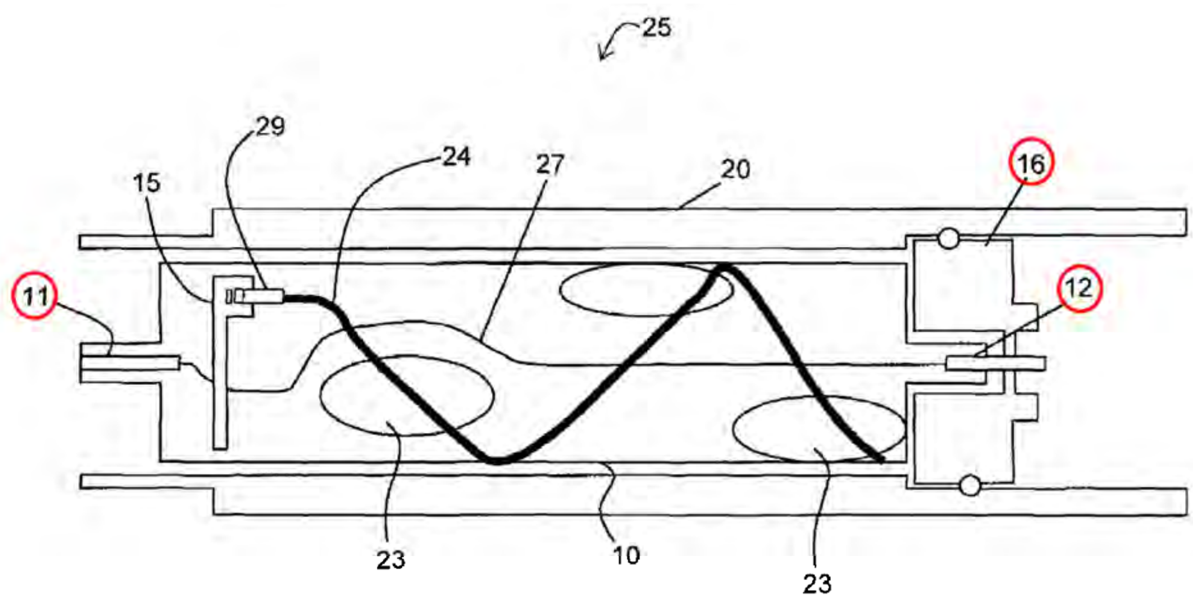


FIG. 2

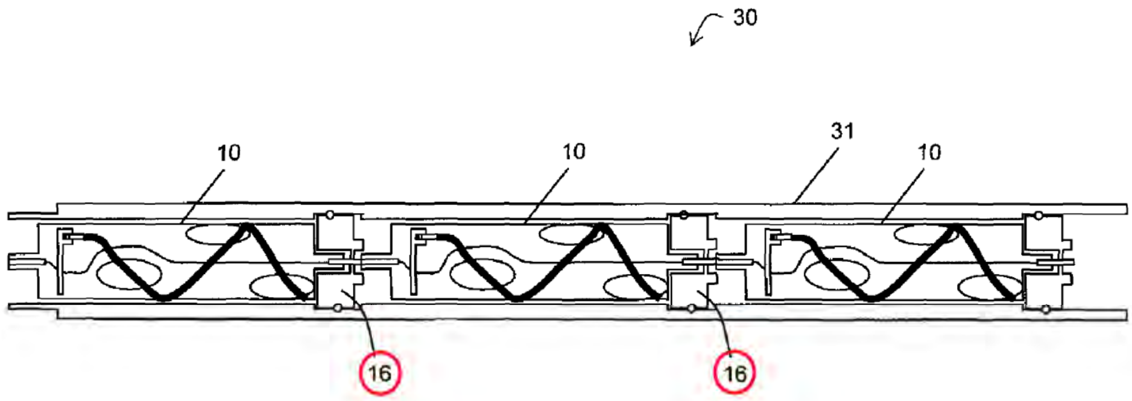


FIG. 3

707. A POSITA would understand Goodman's connector 12 to include a signal contact and a ground contact and bulkhead 16 to include corresponding signal and ground contacts to render Goodman's perforating guns functional.

708. Goodman teaches that the contact pin of connector 12 is electrically connected with another wellbore tool and a signal-in connector of the detonator. Therefore, Goodman teaches the limitations of Claim 4.

J. SLB Catalog teaches transferring signal from previous tool

709. SLB Catalog teaches "Bulkheads between guns are simple one-wire feed-throughs." (Ex. 1005, SLB Catalog, p. 243.) These teachings are indicative of a POSITA's common knowledge of bulkheads providing electrical connections between perforating guns, electrical connections through bulkheads, and the use of tool bodies as a ground path.

XXII. <u>Claim 18 limitation of "performing a continuity test to ensure continuity between one or more electrical connections of the perforation gun system."</u>

710. Claim 18 in the '938 Patent includes the limitation "**performing a continuity test to ensure continuity between one or more electrical connections of the perforation gun system.**" (Ex. 1001, the '938 Patent, 13:7-9.)

A. Construction of a continuity test

711. The '938 Patent specification does not discuss "performing a continuity test to ensure continuity between one or more electrical connections of the perforation gun system," but instead discloses, "…and carrying out a continuity test to ensure complete connectivity of the detonating chord." (Ex. 1001, the '938 Patent, 9:65-67.) A POSITA would not be familiar with a continuity test for ensuring connectivity of *detonating cord.* Because nothing in the originally filed specification describes a continuity test to ensure continuity on one or more electrical connections, the written description does not reasonably convey to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date of the patent.

712. The plain and ordinary meaning of this limitation would be "performing an electrical integrity and/or continuity test to ensure continuity between one or more electrical connections of the perforation gun system."

B. A POSITA's common knowledge includes a continuity test

713. A POSITA would know that a continuity test is performed on electrical components prior to running a perforating gun string into the wellbore, generally before detonators are electrically and ballistically connected. A POSITA would know that such a test is performed on all perforating gun systems prior to being operationally run into the wellbore to conduct the perforating operation. This is standard procedure, industry wide, worldwide, for all companies performing perforating operations with electrical components.

C. Schacherer teaches a continuity test

714. Ex. 1004, Schacherer discloses, "[s]uitable ways of constructing and utilizing selective firing modules are described in U.S. Publication Nos. 2009/0272529 and 2010/0085210, the entire disclosures of which are incorporated herein by this reference." (Ex. 1004, Schacherer, 3:1-4.) U.S. Publication No. 2009/0272529, referred to herein, is Ex. 1022, Crawford.

715. Ex. 1022, Crawford, teaches: "In one embodiment, logic module 154 is operable to communicate via communication link 104 (FIG. 2) with downhole controller 106. Logic module 154 is operable to issue commands to the downhole controller 106 and receive information from the downhole controller 106. As an example, logic module 154 may issue an enable command which initiates a status check of downhole controller 106 as well as a status check of the downhole remote units 114,

116, 118, 120. The status information returned to logic module 154 may include the operational or short/fault/non operational status of each of the downhole remote units." (Ex. 1022, Crawford, ¶ 0034.)

716. Crawford further teaches: "In this case, logic module 164 relays this command to each of the downhole remote units 114, 116, 118, 120. After each of the operational downhole remote units responds to logic module 164, logic module 164 returns the status information, such as the operational or short/fault/non operational status of each of the downhole remote units to surface controller 102." (Ex. 1022, Crawford, ¶ 0037.)

717. Crawford teaches still further: "In the case of a perforating gun system implementation, … In this configuration, the circuitry of the downhole device may be held at ground or shunted as a safety feature until such time as device controller 172 is instructed to allow a current to pass thereto. This feature allows all downhole remote units to be fully tested without inadvertently initializing one of the downhole devices. (Ex. 1022, Crawford, ¶ 0038.)

718. A POSITA would know and understand that the diagnostics tests Crawford teaches are referring to a comprehensive electrical system check, including an (electrical) continuity test as claimed.

719. A POSITA would find a continuity test inherent in any description of a well perforating operation because industry practice and regulation would not allow

perforating operations to begin without testing at least some of the electrical connections in the perforating gun system.

D. Harrigan teaches a continuity test

720. Harrigan teaches “the armed gun 100 may be hooked up, a brief electronics diagnostic check run, and the gun 100 deployed.” (Ex. 1012, Harrigan, ¶ 0028.) A POSITA would understand this to include an electrical integrity and/or continuity test to ensure continuity between one or more electrical connections of the perforation gun system. Therefore, Harrigan teaches a performing a continuity test to ensure continuity between one or more electrical connections of the perforation gun system.

E. Black teaches a continuity test

721. Ex. 1002, Black teaches, "[i]n the park position, electrical continuity is established across perforating gun 10 and diagnostic tests and such can be performed on perforating gun 10, including firing electronics 30, without arming perforating gun 10." (Ex. 1002, Black, ¶ 0026.) A POSITA would know and understand that the diagnostics tests Black teaches are referring to a complete electrical systems check, including an (electrical) continuity test as claimed. Therefore, Black teaches performing a continuity test to ensure continuity between one or more electrical connections of the perforation gun system.

F. Lanclos teaches a continuity test

722. Lanclos teaches the importance of "proper continuity between the wireline 16 and the detonator(s) 38." (Ex. 1015, Lanclos, 2:18-21.) Given the emphasis on continuity in Lanclos, a POSITA would be motivated to look to the teachings of Crawford on operational methods to ensure continuity, including performing a continuity test. Therefore, it would be obvious to a POSITA to modify the teachings of Lanclos by performing a continuity test to ensure continuity between one or more electrical connections of the perforation gun system.

G. Lerche '278 teaches a continuity test

723. Lerche '278 teaches sending "wake up" commands and receiving back status update responses to check proper electrical operation prior to perforating. (Ex. 1011, Lerche '278, 6:64-7:27.) Therefore, Lerche '278 teaches performing a continuity test to ensure continuity between one or more electrical connections of the perforation gun system. Therefore, Lerche '278 teaches the limitations of Claim 18.

H. Brooks teaches a continuity test

724. Brooks teaches a number of functional capabilities of its system, including "switching modes to open or close reselected circuit," and "enables sensor mode to monitor signal from sensors (e.g., pressure, temperature, tilt angle, current, voltage, etc.)" (Ex. 1021, Brooks, 9:46-61.) A POSITA would understand that this functionality would include performing a continuity test to ensure continuity

between one or more electrical connections of the perforation gun system. Therefore, Brooks teaches the limitations of Claim 18.

I. Obviousness of a continuity test

725. A POSITA would be motivated to combine the teachings of Black with the teachings of Schacherer via the teachings of Crawford because the testing that Black teaches would be for a simple perforating system whereas the teachings of Crawford and Schacherer would be for a more complicated perforating system involving addressable style communications and switches to individual perforating gun assemblies. Therefore a POSITA would recognize that each of Black and Schacherer/Crawford teach, “performing a continuity test to ensure continuity between one or more electrical connections of the perforation gun system,” as claimed.

726. A POSITA would be motivated to combine Rogman with Schacherer, Crawford (incorporated by reference into Schacherer), Harrigan, Lanclos, Black, Brooks, and/or common knowledge to teach performing a continuity test because it is a common industry practice, it demonstrates the safety of the perforating gun string, it checks the electrical integrity of the gun string, it is less expensive than having a misrun, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of Rogman without any unexpected results, simple addition of known testing methods for their

understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of testing that are available with a reasonable expectation of success.

727. A POSITA would be motivated to combine Lanclos with Schacherer, Crawford (incorporated by reference into Schacherer), Harrigan, Black, Brooks, and/or common knowledge to teach performing a continuity test because it is a common industry practice, it demonstrates the safety of the perforating gun string, it checks the electrical integrity of the gun string, it is less expensive than having a misrun, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of Lanclos without any unexpected results, simple addition of known testing methods for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of testing that are available with a reasonable expectation of success.

728. A POSITA would be motivated to combine Goodman with Schacherer, Crawford (incorporated by reference into Schacherer), Harrigan, Lanclos, Black, Brooks, and/or common knowledge to teach performing a continuity test because it is a common industry practice, it demonstrates the safety of the perforating gun string, it checks the electrical integrity of the gun string, it is less expensive than having a misrun, it would be obvious to try and would yield predictable results. This would

be the predictable application of known methods to the disclosure of Goodman without any unexpected results, simple addition of known testing methods for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of testing that are available with a reasonable expectation of success.

729. A POSITA would be motivated to combine EWAPS with Schacherer, Crawford (incorporated by reference into Schacherer), Harrigan, Lanclos, Black, Brooks, and/or common knowledge to teach performing a continuity test because it is a common industry practice, it demonstrates the safety of the perforating gun string, it checks the electrical integrity of the gun string, it is less expensive than having a misrun, it would be obvious to try and would yield predictable results. This would be the predictable application of known methods to the disclosure of EWAPS without any unexpected results, simple addition of known testing methods for their understood benefits, and obvious to try as selecting from the finite number of identifiable and predictable types of testing that are available with a reasonable expectation of success.

XXIII. <u>**Claim 19 limitation of "wherein performing steps (a) to (e) a first time with a first set of components completes a first perforating gun segment and the method further comprises: performing steps (a) to (e) a second time with a second set of components to complete a second perforating gun segment; and connecting the second perforating gun segment to the first perforating gun segment."**</u>

730. Claim 19 in the '938 Patent includes the limitation "**wherein performing steps (a) to (e) a first time with a first set of components completes a first perforating gun segment and the method further comprises: performing steps (a) to (e) a second time with a second set of components to complete a second perforating gun segment; and connecting the second perforating gun segment to the first perforating gun segment.**" (Ex. 1001, the '938 Patent, 13:10-18.)

A. Construction of making a second gun

731. A POSITA would know that a perforating gun string very often contains more than one perforating gun and that the multiple guns must necessarily be connected to each other. FIG. 1 of the '938 Patent illustrates two guns connected together. (Ex. 1001, the '938 Patent, FIG. 1.) The '938 Patent specification refers to multiple guns being connected together as follows: "[h]ence, the top connector 14 and bulkhead 58 accommodate electrical and ballistic transfer to the charges of the next gun assembly for as many gun assembly units as required, each gun assembly unit having all the components of a gun assembly." (Ex. 1001, the '938 Patent, 7:63-67), and "threading a subsequent gun assembly onto the first gun assembly or threading a top sub

(element 72 in FIGS. 1, 23 and 24) onto a topmost assembled gun assembly, for connection to a quick change assembly." (Ex. 1001, the '938 Patent, 10:11-14.)

732. The '938 Patent does not discuss or mention what a "perforating gun segment" is. It is unclear how, if at all, a "perforating gun segment" differs from a "perforating gun assembly," "perforation gun system," and/or a "perforating gun." Because of this lack of clarity, Claim 19 does not inform those skilled in the art about the scope of the invention with reasonable certainty.

733. Claim 13 requires at least some assembly steps happen before transportation and some after. It is unclear how that requirement is to be interpreted here, whether Claim 19 requires steps (a)-(e), including inserting the detonator after transport, happen a first time, before those steps are performed "a second time." Because of this uncertainty, this claim fails inform those skilled in the art about the scope of the invention with reasonable certainty.

734. A POSITA's best guess of meaning of this limitation would be assembling at least two perforating guns and connecting at least two perforating guns together.

B. A POSITA's common knowledge includes making a second gun

735. A POSITA's common knowledge would include the assembly of perforating gun strings where multiple perforating guns are assembled and then joined together for insertion into a well. As discussed above, a POSITA's common knowledge teaches performing steps (a)-(e) of Claim 13. Therefore, a POSITA's common knowledge

teaches assembling at least two perforating guns and connecting at least two perforating guns together as in Claim 19.

C. Schacherer teaches making a second gun

736. Ex. 1004, Schacherer teaches: "The method 102 can include assembling multiple explosive assemblies 20 at a location 110 remote from the well location 112, with the assembling comprising: (a) installing an electrical detonator 32 and a first explosive component 40 in a connector 30, and (b) connecting the connector 30 to an outer housing 26; and then transporting the explosive assemblies 20 from the remote location 110 to the well location 112." (Ex. 1004, Schacherer, 8:6-14.)

737. It further teaches: "The method 102 may include, after the transporting step 106, interconnecting the explosive assemblies 20 and installing the explosive assemblies 20 in the wellbore 14, …." (Ex. 1004, Schacherer, 8:19-21.)

738. It then teaches: "The disclosure above also describes a well perforating method which can include assembling multiple perforating guns (e.g., explosive assemblies 20), each perforating gun comprising an outer gun body (e.g., outer housing 26), at least one perforating charge (e.g., explosive component 24) which rotates relative to the outer gun body, and a selective firing module 32 which causes detonation of the perforating charge in response to a predetermined signal associated with the selective firing module 32." (Ex. 1004, Schacherer, 8:51-59.)

739. A POSITA will readily recognize that Schacherer teaches all the limitations of Claim 19, "wherein performing steps (a) to (e) a first time with a first set of components completes a first perforating gun segment and the method further comprises: performing steps (a) to (e) a second time with a second set of components to complete a second perforating gun segment; and connecting the second perforating gun segment to the first perforating gun segment."

740. As discussed above, Schacherer teaches performing steps (a)-(e) of Claim 13. A POSITA would understand that assembling multiple guns would necessarily include repeating those steps. Therefore, Schacherer teaches assembling at least two perforating guns and connecting at least two perforating guns together as in Claim 19.

D. Harrigan teaches making a second gun

741. Harrigan teaches crossovers 130, 140 for attaching other devices. (Ex. 1012, Harrigan, ¶ 0026.) A POSITA would understand the Perforating guns of Harrigan are designed to be connected directly to each other through the carrier's box by pin or male and female ends. (Ex. 1012, Harrigan, FIG. 1A, 2A.) As discussed above, Harrigan teaches performing steps (a)-(e) of Claim 13. A POSITA would understand that assembling multiple guns would necessarily include repeating those steps. A POSITA would find it obvious to repeat steps of assembling perforating guns.

E. Rogman teaches making a second gun

742. Rogman teaches connecting "one or more wellbore perforating devices 300 in series." (Ex. 1014, Rogman, ¶ 0028.)

743. Rogman teaches: "Any number of wellbore perforating devices 100 can be lowered downhole via a wireline or other system. For example, 2, 3, 4, 5, 7, 9, or more wellbore perforating devices can be arranged in series and lowered in a single wellbore on a single pass. For example, the first bulkhead 114 of a first or lower wellbore perforating device (not shown) can be mate with or connect to a second bulkhead 116 of an adjacent second or upper wellbore perforating device (not shown.) The power cables 502 of each wellbore perforating device in series can be connected to form a string of power cables." (Ex. 1014, Rogman, ¶ 0035.)

744. A POSITA would understand the Perforating guns of Rogman and Rogman Prov. are designed to be connected directly to each other through the carrier's box by pin or male and female ends. (Ex. 1014, Rogman, FIGS. 1, 3; Ex. 1020, Rogman Prov., pp. 1-2.) Rogman Prov. teaches, "[c]arriers screw directly into each other (no adapters in gun string);" (Ex. 1020, Rogman Prov., p. 6, second last bullet point), and "[m]ultiple guns can be combined in the same string;" (Ex. 1020, Rogman Prov., p. 8, 6th bullet point.)

745. As discussed above, Rogman and Rogman Prov. teach performing steps (a)-(e) of Claim 13. A POSITA would understand that assembling multiple guns would

necessarily include repeating those steps. Therefore, Rogman and Rogman Prov. teach assembling at least two perforating guns and connecting at least two perforating guns together as in Claim 19.

F. EWAPS teaches making a second gun

746. EWAPS teaches assembling multiple guns in series, which would necessarily include repeating the assembly steps. (Ex. 1013, EWAPS, pp. 5-6, 8, 11, 12.)

747. A POSITA would understand the perforating guns of EWAPS are designed to be connected directly to each other through the carrier's box by pin or male and female ends. (Ex. 1013, EWAPS, pp. 9, 12.) As discussed above, EWAPS teaches performing steps (a)-(e) of Claim 13. A POSITA would understand that assembling multiple guns would necessarily include repeating those steps. Therefore, EWAPS teaches assembling at least two perforating guns and connecting at least two perforating guns together as in Claim 19.

G. Black teaches making a second gun

748. Black teaches assembling multiple perforating guns in carriers 14a and 14b together in detail. (Ex. 1002, Black, ¶¶ 0035-41, FIG 10.)

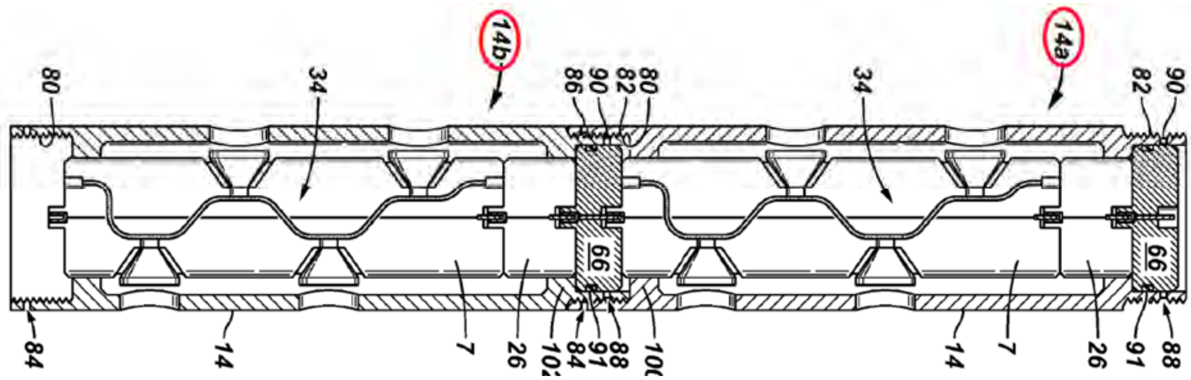


FIG. 10

749. As discussed above, Black teaches performing steps (a)-(e) of Claim 13. A POSITA would understand that assembling multiple guns would necessarily include repeating those steps. Therefore, Black teaches assembling at least two perforating guns and connecting at least two perforating guns together as in Claim 19.

H. Lanclos teaches making a second gun

750. Lanclos teaches assembling multiple perforating guns 62_1, 62_2, …, 62_n together in detail. (Ex. 1015, Lanclos, 4:44-5:57, 7:1-30, FIG 3.)

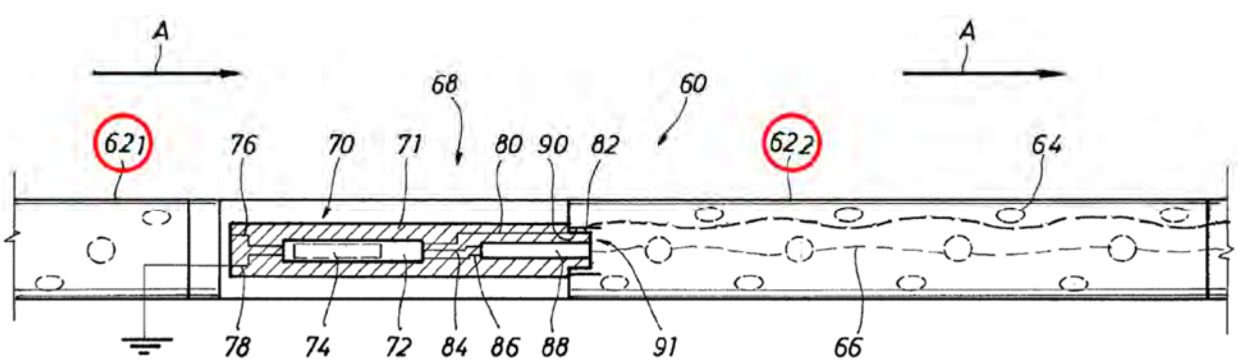


FIG. 3

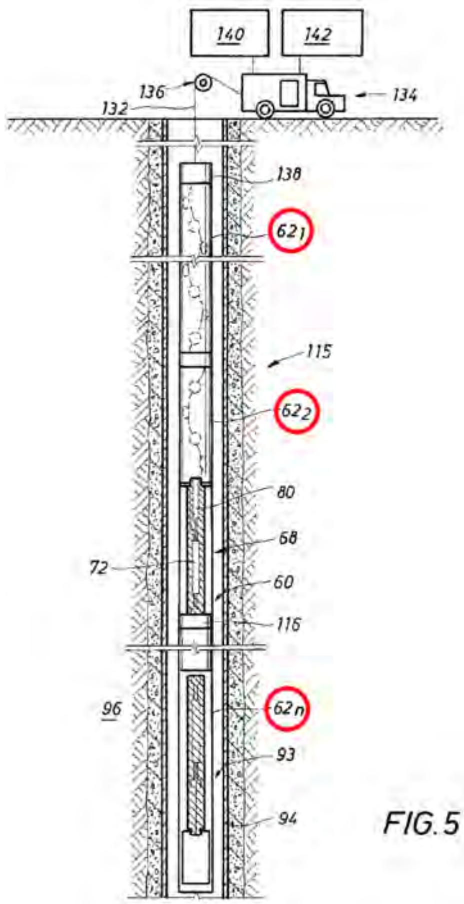


FIG. 5

751. Lanclos teaches that it is describing components for use in a perforating string, and that perforating systems typically have "one or more perforating guns strung together, these strings of guns can sometimes surpass a thousand feet of perforating length." (Ex. 1015, Lanclos, 1:35-41.) As discussed above, Lanclos teaches performing steps (a)-(e) of Claim 13. A POSITA would understand that assembling multiple guns would necessarily include repeating those steps. Therefore, Lanclos teaches assembling at least two perforating guns and connecting at least two perforating guns together as in Claim 19.

I. Goodman teaches making a second gun

752. Goodman teaches assembling multiple perforating guns together, "[o]ne or more of the guns may be connected together to form a pre-assembled and pre-armed perforating gun string." (Ex. 1018, Goodman, ¶¶ 0022, 26-27, FIG. 3, 5.)

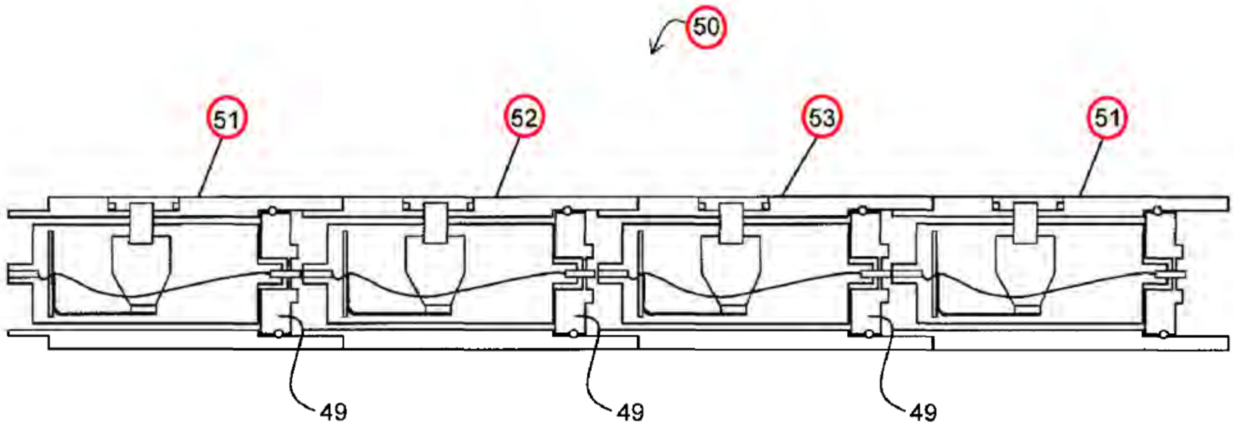


FIG. 5

753. As discussed above, Goodman teaches performing steps (a)-(e) of Claim 13. A POSITA would understand that assembling multiple guns would necessarily include repeating those steps. Therefore, Goodman teaches assembling at least two perforating guns and connecting at least two perforating guns together as in Claim 19.

XXIV. My Understanding of Invalidation Principles for a Post Grant Review

754. My understanding of Claim Construction Principles for purposes of a Post Grant Review is that claim terms are generally given their plain-and-ordinary meaning. The plain and ordinary meaning of a term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention. Although the specification may aid in interpreting the meaning of claim language, particular embodiments and examples appearing in the specification will not generally be read into the claims. Although extrinsic evidence can also be useful, it is less significant than the intrinsic record in determining the legally operative meaning of claim language. Technical dictionaries may be helpful, but they may also provide definitions that are too broad or not indicative of how the term is used in the patent. The "only two exceptions to [the] general rule" that claim terms are construed according to their plain and ordinary meaning are when the patentee (1) acts as his/her own lexicographer or (2) disavows the full scope of the claim term either in the specification or during prosecution. To act as his/her own lexicographer, the patentee must clearly set forth a definition of the disputed claim term, and clearly express an intent to define the term. To disavow the full scope of a claim term, the patentee's statements in the specification or prosecution history must represent a clear disavowal of claim scope. When an applicant's statements are amenable to multiple reasonable interpretations, they cannot be deemed clear and unmistakable.

Under the doctrine of claim differentiation, a court presumes that each claim in a patent has a different scope. The presumption is rebutted when, for example, the construction of an independent claim leads to a clear conclusion inconsistent with a dependent claim. The presumption is also rebutted when there is a contrary construction dictated by the written description or prosecution history. The presumption does not apply if it serves to broaden the claims beyond their meaning in light of the specification.

755. My understanding of Means-Plus Function Claiming for purposes of a Post Grant Review is that a patent claim may be expressed using functional language. A structure may be claimed as a "means . . . for performing a specified function" and that an act may be claimed as a "step for performing a specified function." While there is a presumption that applies when the claim language includes "means" or "step for" terms, and that it does not apply in the absence of those terms, the presumption stands or falls according to whether one of ordinary skill in the art would understand the claim with the functional language, in the context of the entire specification, to denote sufficiently definite structure or acts for performing the function. When means plus function claim structure applies, the scope of the functional term is limited to only the structure, materials, or acts described in the specification as corresponding to the claimed function and equivalents thereof. Construing a means-plus-function limitation involves multiple steps. The first step .

. . is a determination of the function of the means-plus-function limitation. The next step is to determine the corresponding structure disclosed in the specification and equivalents thereof. A structure disclosed in the specification is "corresponding" structure only if the specification or prosecution history clearly links or associates that structure to the function recited in the claim. The focus of the "corresponding structure" inquiry is not merely whether a structure is capable of performing the recited function, but rather whether the corresponding structure is clearly linked or associated with the recited function. The corresponding structure must include all structures that actually performs the recited function. For means-plus-function limitations implemented by a programmed general-purpose computer or microprocessor, the corresponding structure described in the patent specification must include an algorithm for performing the function. The corresponding structure is not a general-purpose computer but rather the special purpose computer programmed to perform the disclosed algorithm.

756. My understanding of Indefiniteness for purposes of a Post Grant Review is that patent claims must particularly point out and distinctly claim the subject matter regarded as the invention.

757. A patent claim is invalid for indefiniteness if, read in light of the specification delineating the patent, and the prosecution history, it fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention.

758. A claim, when viewed in light of the intrinsic evidence, must inform those skilled in the art about the scope of the invention with reasonable certainty. Whether a claim is indefinite is determined from the perspective of one of ordinary skill in the art as of the time the application was filed. A means-plus-function claim is indefinite if the claim fails to disclose adequate corresponding structure to perform the claimed functions. The disclosure is inadequate when one of ordinary skill in the art would be unable to recognize the structure in the specification and associate it with the corresponding function in the claim. Computer-implemented means-plus-function claims are indefinite unless the specification discloses an algorithm to perform the function associated with the limitation.

759. For purposes of a Post Grant Review it is my understanding that the specification of a patent as filed must contain a Written Description of the invention.

760. A specification has an adequate written description when it reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date of the patent. The test requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art to show that the inventor actually invented the invention claimed. The specification does not provide adequate structure to perform the functions cited in the claims when the specification does not demonstrate that the Patent Owner has made an invention that achieves the claimed function because the invention is not

described with sufficient detail such that a POSITA can reasonably conclude that the inventor had possession of the claimed invention. The written description inquiry looks to the four corners of the specification to discern the extent to which the inventor(s) had possession of the invention as broadly claimed. A patentee cannot always satisfy the written description requirement in supporting expansive claim language, merely by clearly describing one embodiment of the thing claimed. The purpose of the written description requirement is to ensure that the scope of the right to exclude, as set forth in the claims, does not overreach the scope of the inventor's contribution to the field of art as described in the patent specification. A broad claim is invalid when the entirety of the specification clearly indicates that the invention is of a much narrower scope.

XXV. **Declaration Signature**

I declare under the penalty of perjury that the foregoing is true and correct.

Executed on this date of August 11, 2020.

ROBERT A. PARROTT