UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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HUNTING TITAN, INC.

Petitioner

v.

DYNAENERGETICS EUROPE GMBH

Patent Owner

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Case PGR 2020-00080
Patent 10,472,938

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DECLARATION OF JOHN RODGERS, Ph.D.

I, John Rodgers, hereby declare as follows:

I. Background

1. I have been retained by Patent Owner, DynaEnergetics Europe GmbH ("DynaEnergetics") in connection with the above-captioned Post Grant Review ("PGR") proceeding involving U.S. Patent No. 10,472,938 ("the '938 Patent") (Ex. 1001).

2. I have been asked by DynaEnergetics to offer opinions regarding the '938 Patent and the grounds on which Hunting Titan, Inc. ("Petitioner") challenges Claims 1-20 of the '938 Patent, as set forth in the Petition for PGR ("the Petition"),[1] including Petitioner's asserted prior art references, positions regarding invalidity of the challenged claims, and evidence submitted with the Petition. This declaration sets forth the opinions I have reached to date regarding these matters.

3. I am being compensated by DynaEnergetics at my standard hourly consulting rate of $230 per hour for my time spent on this matter. My compensation is not contingent on the outcome of the IPR or on the substance of my opinions.

4. I have no financial interest in Petitioner or DynaEnergetics.

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[1] *Hunting Titan, Inc. v. DynaEnergetics GmbH & Co. KG*, Paper 1 (PTAB Aug. 12, 2020).

II. Education and Work History

5. I have a B.S.E. in mechanical engineering and materials science and a second major in mathematics from Duke University. I have a M.S. from the Massachusetts Institute of Technology ("MIT") and a Ph.D. from MIT, both from the Department of Aeronautics and Astronautics. In my research and academics at MIT, I worked with active material systems and their application to structural actuation and vibration control. Much of the work involved the development of actuation systems for helicopter vibration control and other industrial and defense applications. In addition, I worked on the development of novel piezoelectric material systems for use in actuation and sensing applications.

6. I am a professional engineer licensed in Texas, North Dakota, and Connecticut and have over fifteen years of experience in the oilfield industry. I founded and have worked in my engineering consulting business, Starboard Innovations, LLC, since 2000. In my career, I have worked on a wide variety of applications across many industries, though the bulk of my work has come in the development of downhole tools. I have developed new mechanical tools and software tools focused on a variety of different downhole applications. Several of the tools focused on measuring and analyzing the dynamic response of downhole tools and the surrounding wellbore and formation. Other tools that I have developed

involved mechanical actuation systems such as firing heads, frac sleeves, cementing sleeves, and plugging devices. One example was a through-tubing bridge plug, designed for high expansion-ratio applications, which is now a product used in the field. Another design involved an autonomous, self-navigating wellbore plug with the option for dissolvable components. I have developed or worked on downhole tool designs for several other applications including: acoustic telemetry, measurements while drilling (MWD), test valves, fracture and cementing sleeves, and wireline fluid sensing. My involvement with many of these development projects included designing, performing engineering analyses and simulations, developing manufacturing processes, building prototypes, running qualification tests, and supporting field trials.

7. More specifically, the largest part of my oilfield experience has come in the area of perforating technology. I have worked extensively with Halliburton's Jet Research Center (JRC) over this time. This work has included heading several failure investigations and leading a decade-long effort to better understand the dynamic response of the perforating gun string, wellbore, and formation to the detonation of shaped charges during perforating. I have developed modeling and simulation tools to predict the dynamic response of these systems. I have designed, qualified, and fabricated a perforation evaluation tool for measuring the dynamic

pressures, loads, accelerations, and temperature within the gun string, adjacent to detonating explosives. I have also helped to design or redesign a number of firing head systems for actuating tubing-conveyed guns.

8. In the course of the above projects, I worked on-site at JRC with testing perforating gun systems. I worked with explosives technicians in the gun-loading shop and witnessed the loading of charges, detonating cord, and RED detonators in preparation for live explosive tests. I am familiar with many of the safety procedures used in the gun-loading environment, in the handling of the loaded guns, and the firing of the guns. I have worked on instrumenting guns for collecting data from the detonation, including direct measurements of the deformation of the gun carriers and the internal pressure due to the blast. I have supported numerous field trials including the providing of instrumentation and downhole tool prototypes, performing the forensic examination of guns and gun system elements returned from the field, and performing analysis on field data.

9. I have developed finite element analysis (FEA) methods for simulating the detonation of perforating gun detonation. The efforts have focused on understanding the behavior of novel gun system geometries, identifying potential failure modes for the gun carriers and other components of the system, evaluating the damage caused to nearby loaded guns with select-fire detonations occur in

adjacent zones, evaluating shaped-charge interactions, and optimizing detonation timing in independently-controlled firing systems to minimize shock loading.

10. I am the sole and/or contributing author of over fifteen publications relating to this field. A comprehensive list of publications is in my attached *curriculum vitae*. I am a member of the Society of Petroleum Engineers (SPE) and American Society of Mechanical Engineers (ASME).

11. I have been named as an inventor on over thirty U.S. Patents. A comprehensive list of my patents is contained in my attached C.V. A number of these patents involve developments related to the perforating projects described above.

12. Attached as Appendix A is a copy of my current C.V. further elaborating on my professional background and qualifications.

III. Materials Considered

13. In forming my opinions, I have reviewed the ’938 Patent and its prosecution history. I have reviewed and considered the references cited by the Petitioner, the Petition itself, the Declaration of Robert Parrott (Ex. 1007) submitted with the Petition, and other documents and information as set forth in this declaration. I have also been consulting with DynaEnergetics and its attorneys on the creation of 3D computer-aided design (CAD) models to illustrate systems

described in certain of the references relied upon by the Petition in this proceeding. I have described those models in this declaration and have included illustrations.

14. In reaching my opinions, I have relied upon my experience in the field and also considered the viewpoint of a person of ordinary skill in the art ("POSITA") at the time of the earliest claimed priority date of the '938 Patent. As explained below, I am familiar with the level of a person of ordinary skill in the art regarding the technology at issue as of that time.

IV. Overview of the Technology

15. The technology at issue relates to oil and gas wellbore perforating equipment, specifically perforating guns and methods of assembly thereof. Perforating guns are specialized assemblies that include explosives and are deployed into oil and gas wells where the explosives are detonated to "perforate" hydrocarbon-containing underground formations, for extracting fossil fuels and natural gas from the underground formations.

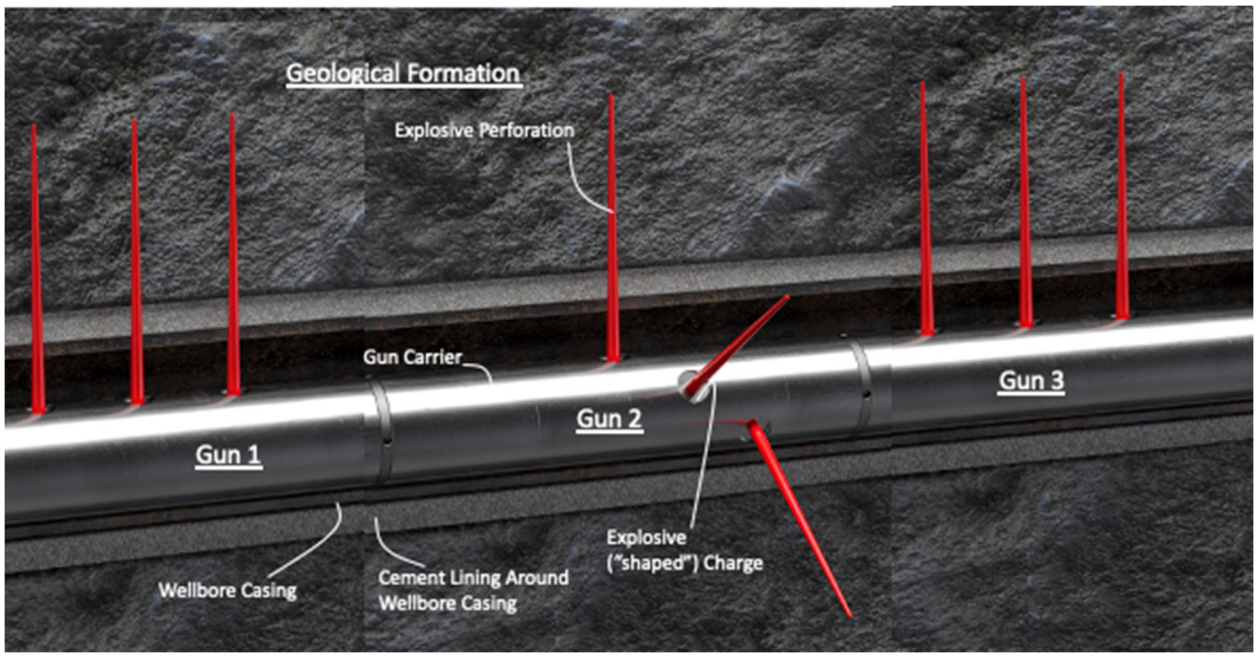
16. More specifically, the perforating process involves carrying explosive charges downhole (into the well) and positioning them at a desired depth in order to open up communication to the rock and embedded hydrocarbons upon detonation of the explosives. The shaped charges open up tunnels through the wellbore casing lining the well and radially outward into the surrounding formation. The perforation

tunnels act as conduits through which reservoir fluids flow from the formation into the wellbore and up to the surface during the production phase of the well. Each perforation creates a channel that allows the oil and/or gas to leave the rock and enter the oil or gas well. The same tunnels can be used during hydraulic fracturing and stimulation processes to aid in freeing the hydrocarbons from the formation.

17. Perforating guns are the vessels used to transport and deliver the explosive shaped charges within the wellbore and they come in a variety of sizes and configurations. Operators may install a particular type of well equipment to accommodate a perforation system that is suitable for a specific reservoir based on its characteristics. Many factors are considered in the design and selection of the gun system and other elements of the gun string—the assembly of tools threaded end-to-end that make up the full system used to perforate the wellbore. The design must factor in the objectives of maximizing communication with the surrounding reservoir over a desired interval or length (i.e., the pay zone), the system and operational costs, and safety and reliability. Safety is always the utmost concern for all personnel handling these highly energetic materials.

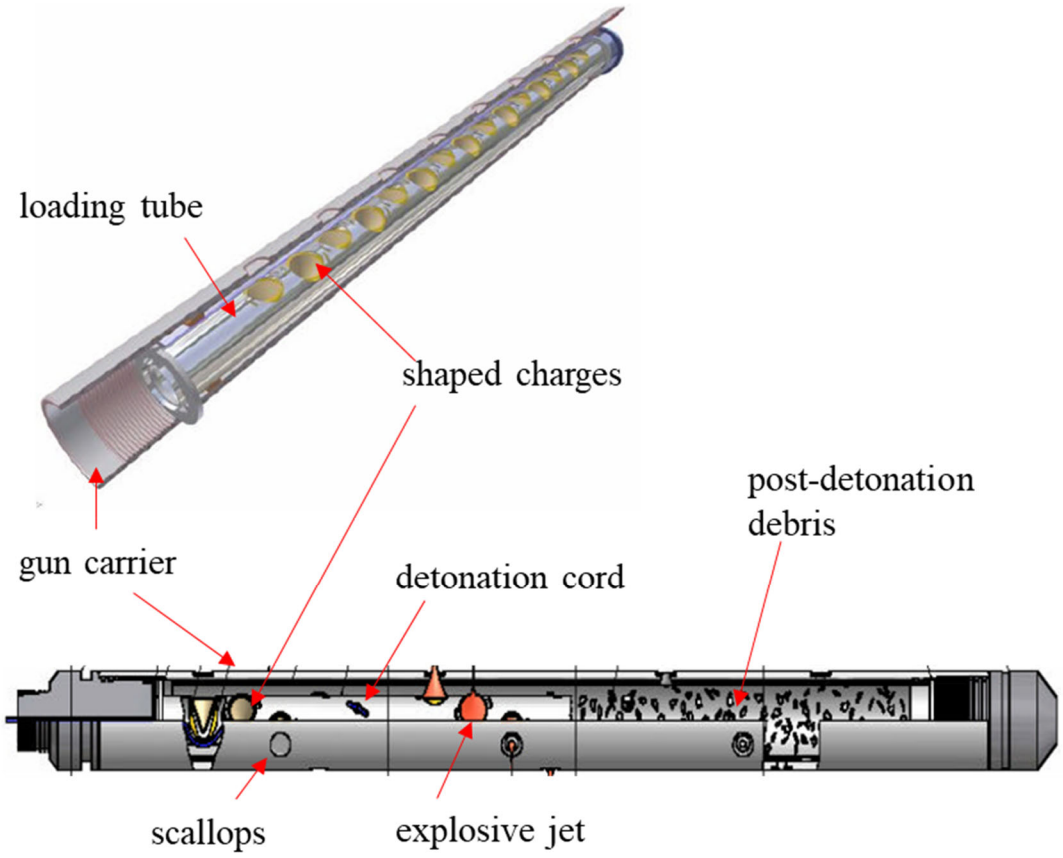
18. Perforating guns are typically loaded with explosive shaped charges and deployed into underground wellbores deep below the surface. Once in the proper position, the charges are detonated, and the resulting explosions radiate outward

from the perforating gun assembly, pierce the wellbore casing, go through the cement sheath, and perforate the surrounding formation, facilitating the flow of hydrocarbons from the formation and into the wellbore:



19. Further detail of a single gun assembly is shown in the following figure. A gun assembly is shown with a portion of the gun carrier cut away to expose the explosive shaped charges within. The lower part of the figure further cuts through the interior components. The primary elements are the shaped charges which are supported in receptacles in a loading tube. The loading tube is typically made of steel and the receptacles are machined into the loading tube. The detonating cord is a thin rope-like material that runs from end to end of the gun assembly making contact with the back side of each shaped charge along the way. The detonating cord

provides the ballistic transfer of the detonation so that the shaped charges detonate in sequence from one end to the other. In conventional perforating guns like the one shown in the figure below, the detonating cord extends through the perforation gun and transfers ballistic energy to a detonating cord of an adjacent gun (not shown below) through a tandem connector joining the guns.



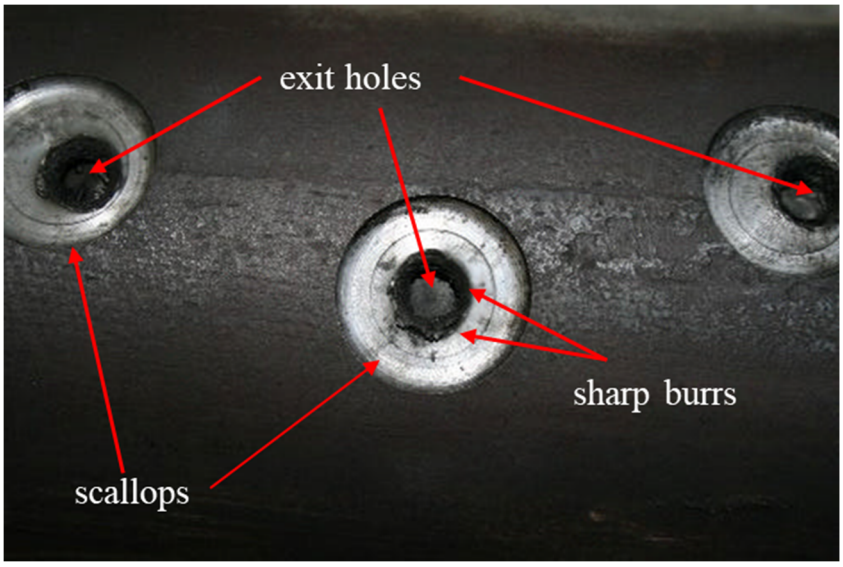
20. Referring again to the figure above, the gun body or carrier is a pressure housing, much like a pipe, that protects the explosives from the wellbore environment and delivers them to the desired location in the wellbore for firing. The

carrier has a threaded, sealed tandem connector on each end to complete and seal the assembly where one or more guns are to be stacked for perforating a longer interval or length of the wellbore. As will be discussed further below, separate guns may be detonated at different times or may be detonated in the same perforating event.

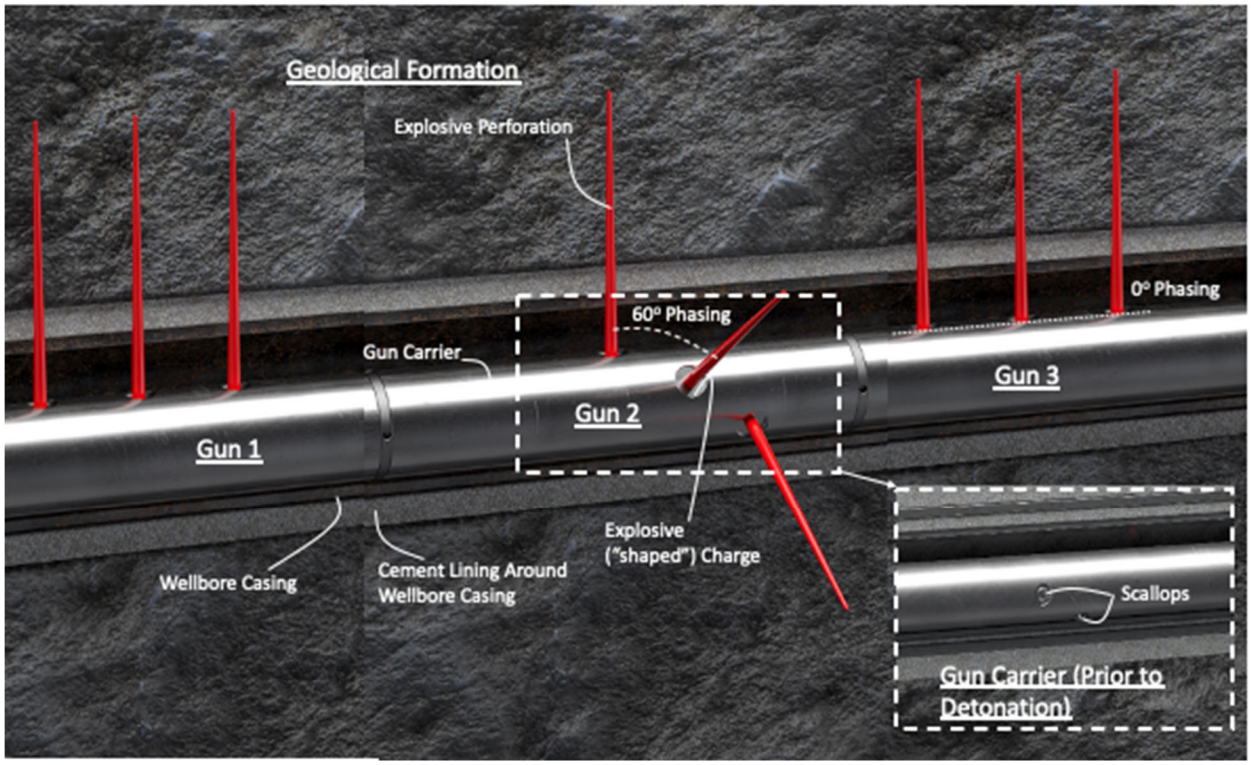
21. In the conventional perforating gun design, the shaped charges are positioned within a charge holder tube that sets the linear spacing and azimuthal orientation (i.e., the angular position around the circumference), together referred to as the shot phasing, to achieve a desired shot pattern. Different shot phasing patterns are illustrated in the previous figure in paragraph 18 above for the three guns. Each of the charge cases are mounted within the receptacles in the charge tube. The gun carrier is typically fabricated with "scallops"—circular recesses on the outer surface of the gun carrier that align precisely with the internal shaped charges. Upon assembly, the orientation of shaped charges in the loading tube inside the gun carrier must align with the scallop pattern machined into the carrier.

22. In the figure below, a photo of the outside of a gun carrier is shown after detonation of the shaped charges. The lighter-colored circles are the scallops machined into the steel carrier, fabricated from a type of steel pipe. The dark circles within each scallop are the exit holes left by the charge detonation. Around the edges of the exit holes, the metal is pushed outward leaving sharp burrs of hard steel. The

purpose of the scallops is to recess those burrs so that they do not extend beyond the outer diameter of the gun carrier. Without scallops, the burrs could drag along the wall of the wellbore casing when the spent guns are removed from the wellbore, degrading the casing integrity.



23. The shot phasing is a critical aspect of a gun design that is selected by a completions engineer to optimize perforation performance and thus, the eventual hydrocarbon production from the well. The phasing for a conventional gun is fixed by the design and manufacture of the loading tube and carrier components. The loading tube is designed to fit inside a particular carrier and to hold a specific charge. Both are designed and built for a particular shot phasing pattern. As shown below, three guns are illustrated in the string.



In the first and third of the guns, a 0-degree shot phasing is shown in which all shots are oriented in the same direction and with a constant linear spacing (e.g., 13 shots per meter). In the middle gun, the shot phasing is a spiral pattern with each successive charge oriented 60 degrees from the last (e.g., 0°, 60°, 120°, …) and with a constant linear spacing (e.g., 20 shots per meter).

24. A detonator is a critical component of a perforating gun that initiates the ballistic chain of events resulting in detonation of the shaped charges. The detonator, upon receiving an electric signal or current or a pressure increase (depending upon the type of firing system) from the surface, starts the explosive chain reaction which transfers along the detonating cord from the detonator to the

shaped charges via the detonating cord. As shown previously, each gun assembly may have a separate length of detonating cord. Absent a separate ballistic or explosive element, intimate contact is required to ensure detonation transfer from detonator to detonating cord. Providing a confined space also helps to ensure a reliable energetic coupling.

25. When perforating guns are conveyed into the wellbore using a wireline, which is a cable that holds the weight of the string and also provides electrical connectivity, then a wired connection can be made directly from the surface to the detonator located within or near the guns. To detonate charges in a perforating gun, equipment operators can relay an electrical signal or current from the surface via electrical wires to one or more detonators within a string of perforating guns.

26. Selective perforating (or detonation) is the practice of firing a subset of the perforating guns on a single string. With selective perforation, equipment operators can perforate one zone or interval of a wellbore, move the perforating gun string, and then perforate a second zone. This process provides efficiency gains and cost savings to the operator during the well completion process. Selective or select-fire systems also require more advanced technology to safely and efficiently send the firing commands to the detonators in each subset of the gun string. Modern firing systems use digital communication with each detonator having a unique digital

address. This enables commands to be safely and reliably sent to a single detonator and for operating status and other information to be communicated back to surface. This also eliminates the possibility of stray signals inadvertently causing a detonation.

27. In the development of oil fields, the design of each well completion tends to be fairly unique as the nature of the Earth's crust and the nature and distribution of the hydrocarbons trapped within it tend to vary greatly from well to well. This variation means that every perforating job is unique. Service companies and perforating gun providers have developed gun systems in order to meet the wide variety of specific needs for each wellbore encountered. Gun carriers are made in different diameters and with differing pressure ratings. Shaped charges are designed in a wide range of sizes and with differing penetration characteristics. For example, some charges are designed to create a deep, narrow tunnel while others are designed to create a shallow, wide tunnel. In conventional perforating guns, the charge loading tubes and carriers are also built with a variety of different, fixed shot patterns, i.e., charge phasing. In conventional gun systems, the loading tubes and carriers are factory-built metal tubes that must be selected in advance and delivered to the local shop location for each upcoming perforating job. The phasing is important because it can be used to optimize the fractures that develop in the rock

from the perforating and subsequent fracking operations. Each gun that is to be used must have the right combination of components to work as designed.

28. Once a gun system is selected, the next challenge is delivering the guns to the wellsite and then down into the well for detonation. Historically, the components have been delivered to a regional gun shop where the dangerous and tedious job of gun loading is performed. Trained technicians must load the charges and detonating cord into the loading tubes and insert them into the carriers. With select-fire systems, the gun assembly process also includes a wiring aspect. As shown below, the loading tube subassembly may be delivered to the loading shop.

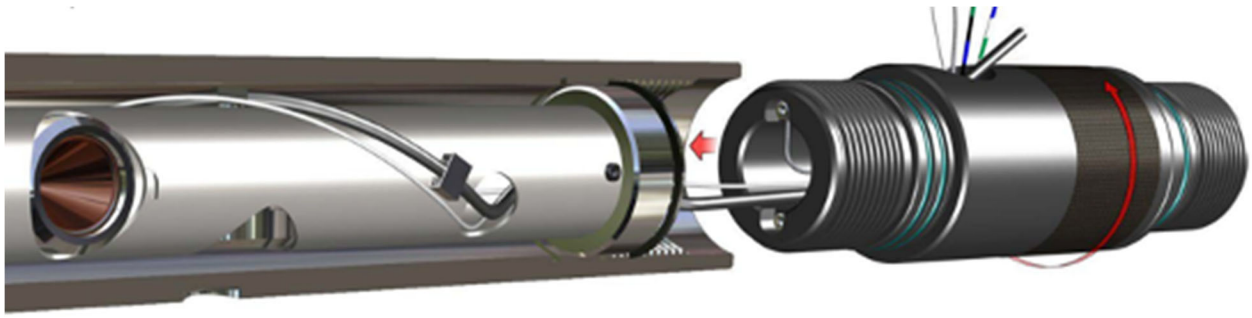
29. As shown below, the loading tube, made of thin steel, has cut-outs sized to hold a specific shaped charge design. The charges are inserted into the cut-outs and locked in place. The detonating cord is then positioned across the back end of each charge to ensure ballistic transfer will occur as the detonation progresses along the length of the gun. Once all charges are loaded, the loading tube can be inserted into the carrier.

Figure 40

Ex. 2005 at 40.

30. The entire loading process requires attention to safety protocols given the energetic materials involved. The explosives require specialized handling, storage, and transportation that must meet local regulations. If the assembly is not done correctly, the gun may not fire properly, resulting in a misfire. For example, the ballistic chain can be broken if the detonating cord is damaged at some point along the loading tube. Once a gun is loaded, it is transferred to the wellbore site without a detonator connected to other explosive components, to eliminate any risk of an unplanned detonation of the detonating cord and/or shaped charges. As a result, the gun assembly process must be continued at the well site, again requiring an array of safety and regulatory requirements to be met.

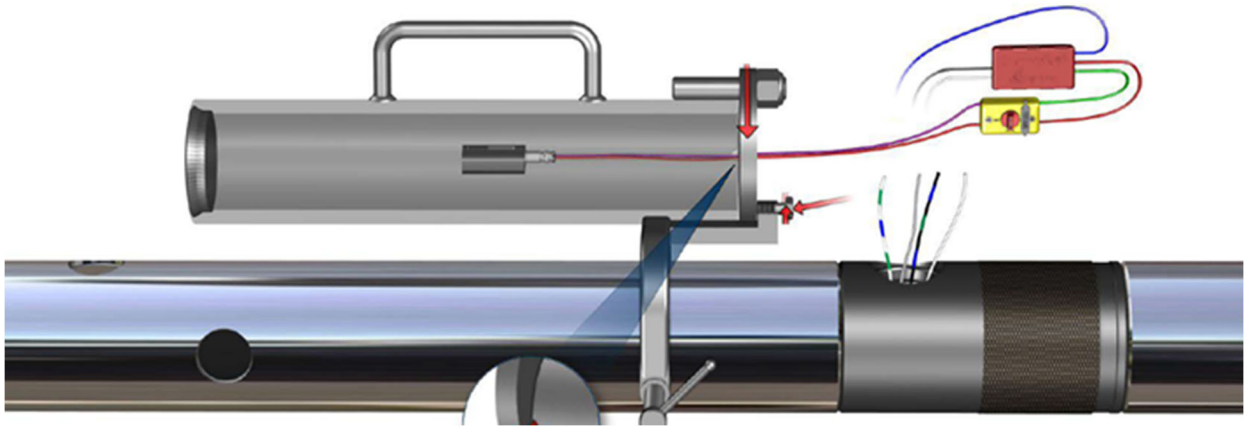
31. Once at the well site, the critical step is connecting the detonator and the electrical system to the loaded guns. To do this, a firing sub is used to house the detonator and interface with the wireline that conveys the guns into the well and provides electrical communication to the surface. For example, Petitioner's Gun Loading Manual (Ex. 2004) and User Manual (Ex. 2005) illustrate and describe assembly and wiring procedure for conventional perforation gun systems. In the figure below, the firing sub on the right is shown as it interfaces the gun.



Ex. 2004 at 15.

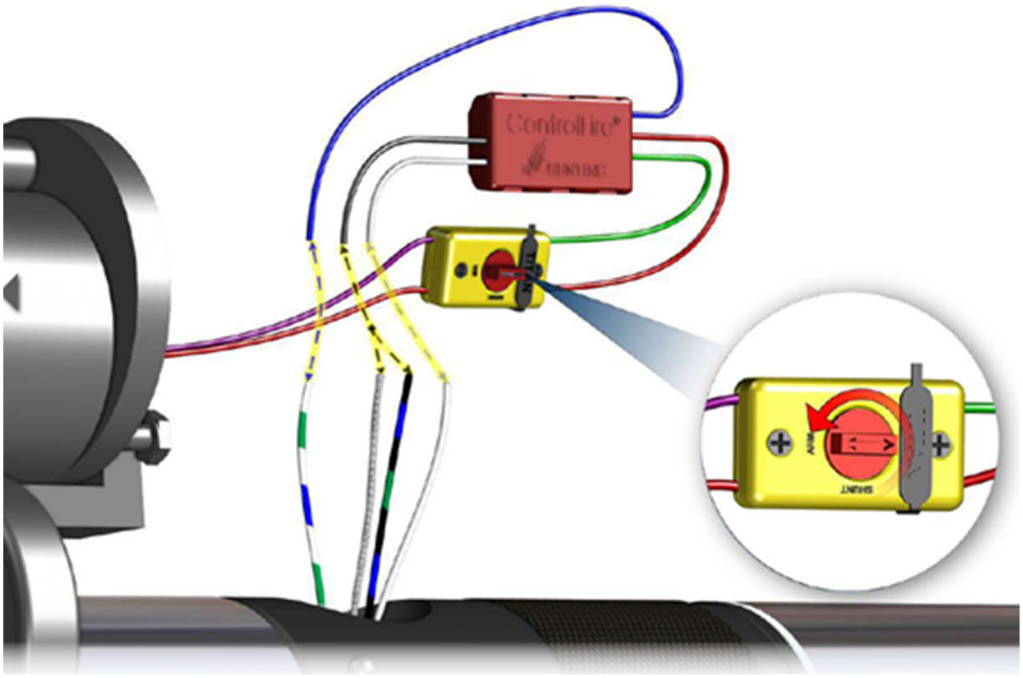
32. The electrical wires and the detonating cord from the gun must be pulled into the firing sub and out through a port in the side wall called a port plug. Next, the electrical connections are made to the detonator, followed by the ballistic connection to the detonating cord as illustrated in the figure below. Traditional detonators are prone to radio-frequency interference and static electricity that could create stray voltages in the wiring of the gun system and in a worst case, cause a

detonator to fire unintentionally. As an extra safety precaution, the detonator is temporarily housed in a section of pipe clamped to the side of the gun while electrical connections are made. All radio communications are silenced during critical steps in the operation and all wellsite operations are ceased until the armed guns are safely located at least 200 feet deep in the wellbore. Ex. 2008 at 5. The safety pipe or blasting cap chamber clamped to the gun is illustrated in the figure below.



Ex. 2004 at 23.

33. Wire connections are made up using electrician's tools including wire cutters, wire strippers, and crimp connectors, following the industry standard Electrically Arming Before Ballistically Arming ("EBBA") protocol. Connections are made between the detonator (housed in the pipe), the switch, and the wires running to the gun. The figures below illustrate the connections.



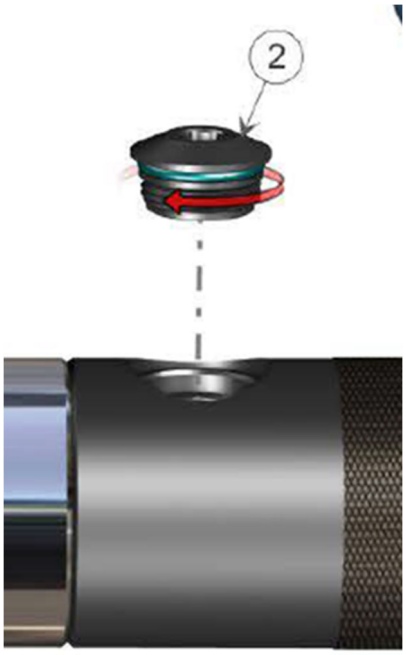
Ex. 2004 at 25.

Figure 47

Figure 48

Ex. 2005 at 43.

34. Once the electrical connections have been tested, the detonator is attached to the detonating cord, completing the ballistic system. The components are pushed into the firing sub through the port plug opening. The port plug can then be installed to seal the opening and finalize the assembly process as illustrated below.



Ex. 2004 at 28.

35. The conventional process of assembling and arming wireline guns is tedious, dangerous, and rife with opportunities for errors that can cause misfires. Every electrical connection must be properly made and care must be taken to avoid pinched wires or shorts to the steel of the firing sub and guns. This leaves many opportunities for miswiring or other electrical integrity issues that can disable a gun such that it will not fire when commanded. The two most common causes for

misfires during wireline perforating operations have historically been wiring issues and leaking o-ring seals, such as on the port plug. Ex. 2008 at 6.

V. The '938 Patent

36. The '938 Patent is generally directed to a perforating gun and methods of assembly thereof in the oil and gas perforating industry. As explained above, key benefits of the invention claimed in the '938 Patent include providing factory assembled modular components and simplifying electrical assembly of perforation gun strings at a wellbore site to enhance reliability and safety. Representative Claim 1 of the '938 Patent, which shares many of the same features as Claim 9, recites, with reference to Figure 32 below:

1. 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.

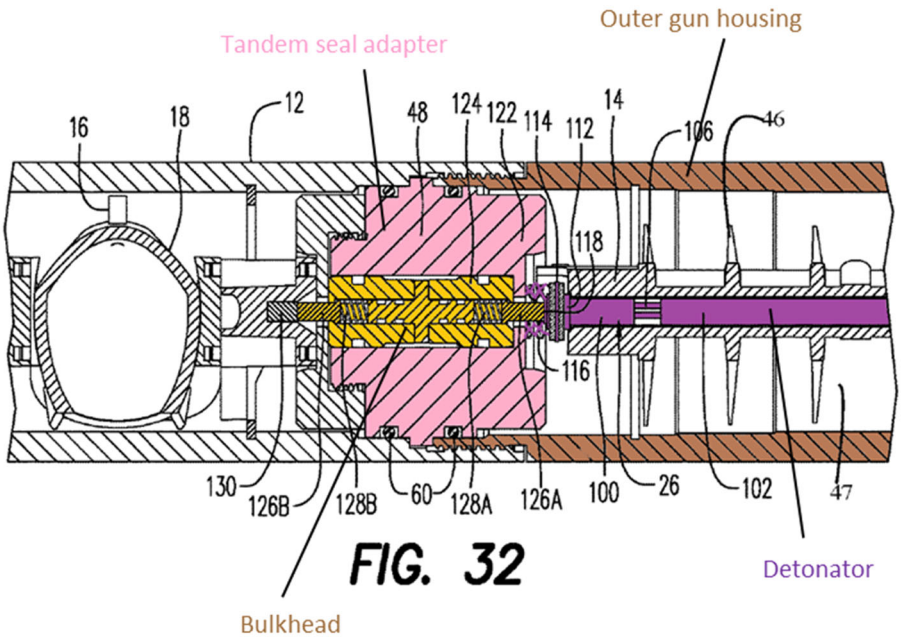
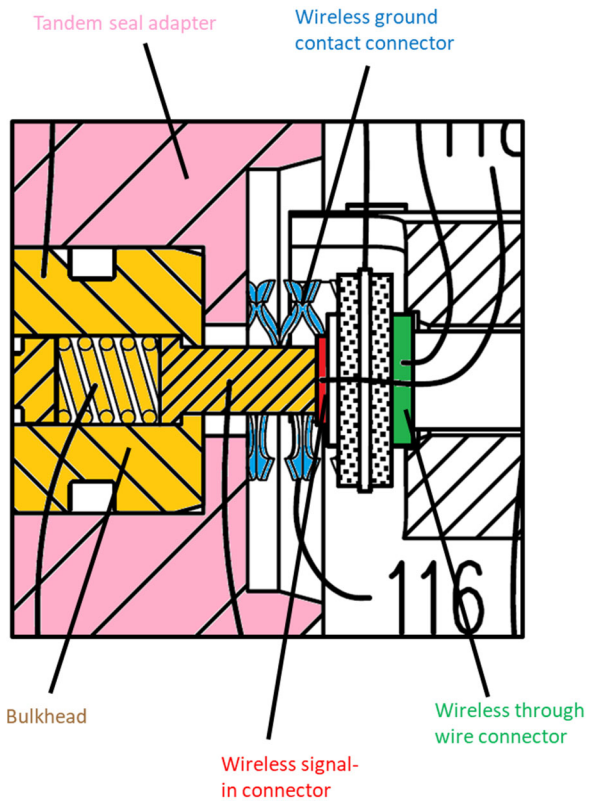


FIG. 32



37. Representative Claim 13 of the ’938 Patent recites, with reference to the Figure 32 above and the Figure 18 below:

> 13. A method for assembling a perforation gun system, comprising:
>
> (a) 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;
>
> (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, 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;

(d) connecting a through wire to the wireless through wire connector;

(e) energetically coupling the detonating cord to the detonator; and,

(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 wellbore site.

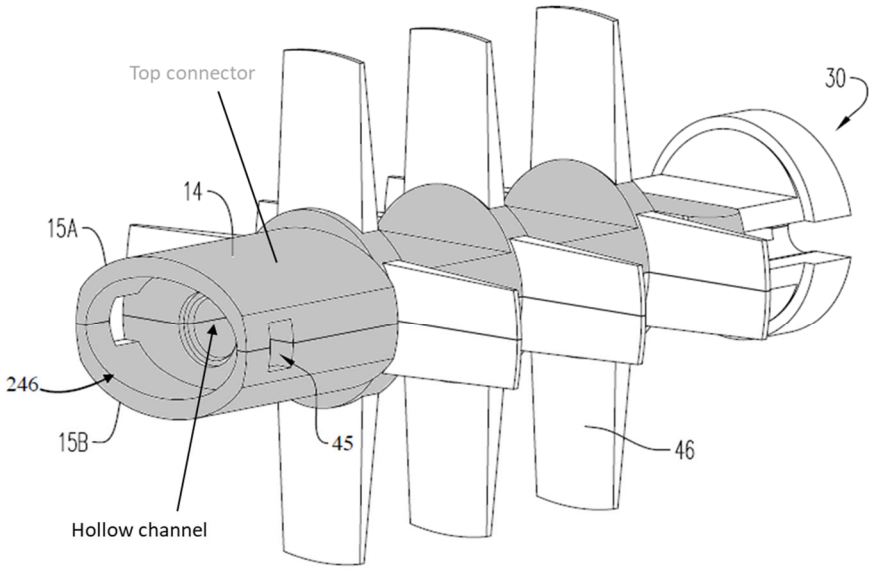


FIG. 18

VI. Construction of Claim Terms

38. I understand that claim terms in a post grant review should be accorded their ordinary and customary meaning as understood by one of ordinary skill in the art at the time of the invention in light of the patent specification and the prosecution history pertaining to the patent.

39. I am aware and understand that the Petition sets forth proposed constructions for a number of limitations of the challenged claims. I do not agree that proposed constructions are necessary or appropriate for every term, except as specifically addressed below.

1. "tandem seal adapter"

40. The term "tandem seal adapter" is not a common or accepted industry term. However, the term is well-defined and described in the claims and specification, and a POSITA would understand from the plain language of Claims 1 and 9 that a tandem seal adapter ("TSA") is a component that creates a seal between two gun housings and provides a channel to receive or accommodate a bulkhead.

41. The '938 Patent specification and figures support this understanding of a POSITA. For example, the '938 patent explains that "[t]he tandem seal adapter 48 is configured to seal the inner components within the carrier 12 from the outside environment, using sealing means 60 (shown herein as o-rings). Thus, the tandem seal adapter 48 seals the gun assemblies from each other." Ex. 1001, 7:55-8:5. This establishes that the TSA is a component that creates a seal between two gun housings. The seals are positioned to prevent fluid leakage from the wellbore through the threaded connection between two adjacent carriers that could flood either gun.

42. The '938 Patent further describes "the tandem seal adapter 48 . . . fully contains the bulkhead assembly 58" (Ex. 1001, 7:55-8:5), this "pin connector assembly including the bulkhead 124 . . . is positioned within the tandem seal adapter 48," (*id.*, 8:28-39) and "pushing in a bulkhead (element 58 in FIG. 19) onto [*sic* –

into] the tandem seal adapter" (*id.*, 10:1-14). This establishes that the TSA provides a channel or through hole to accommodate a bulkhead.

43. The figures of the '938 Patent further support a POSITA's understanding that the TSA 48 provides a seal between adjacent gun housings through o-rings 60, and also provides a channel (outlined in green below) to receive a bulkhead 58, as illustrated by exemplary Figure 19 below:

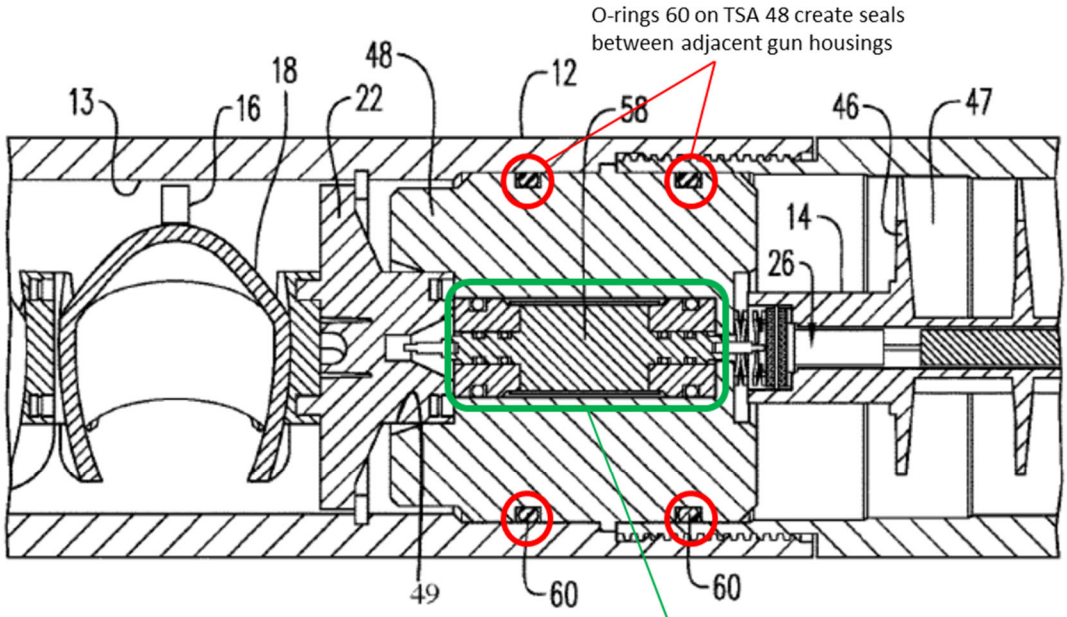


FIG. 19

44. A POSITA would therefore understand that the term "tandem seal adapter" as used in the '938 Patent means "***a component that creates a seal between adjacent gun housings and provides a channel to receive a bulkhead***."

2. "bulkhead"

45. The term "bulkhead," on the other hand, is a common and accepted industry term, and it is generally understood to include a device that pressure isolates adjacent guns and passes an electrical signal between the adjacent guns.

46. The '938 Patent, including the specification, figures, and Claims 1 and 9 describe the bulkhead exactly as understood and used in the industry. So while a construction is not strictly necessary, because the term is used throughout the cited art in slightly different ways, it is important to specify that "bulkhead" means "a component that seals adjacent guns (when positioned within the TSA) and provides for electrically connecting adjacent guns."

47. For example, the '938 Patent explains that "the tandem seal adapter seals the gun assemblies from each other along with the bulkhead 58." Ex. 1001, 7:55-8:5. This establishes that the bulkhead creates a pressure seal to prevent fluid leakage from one end of the TSA to the other.

48. Figure 19 of the '938 Patent illustrates a bulkhead 58 positioned in a TSA 48 wherein both the TSA and the bulkhead are provided with seals:

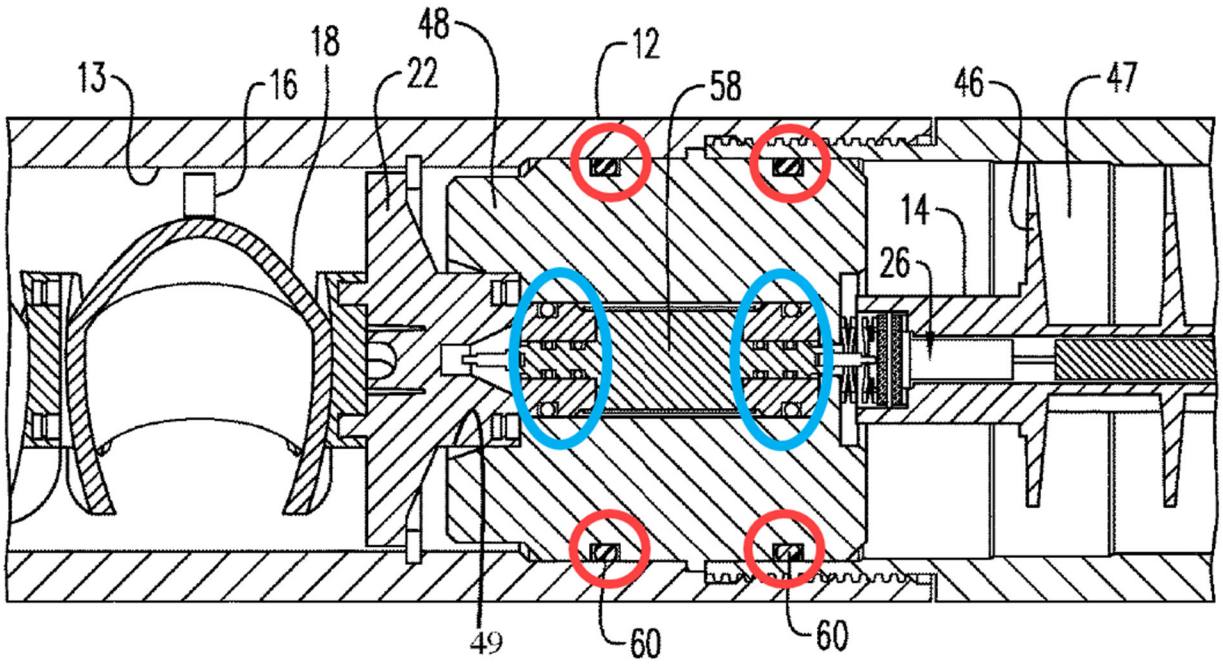


FIG. 19

49. The '938 Patent further describes that the TSA "can accommodate or house an electrical connection through a bulkhead assembly." Ex. 1001, 6:35-7:8. Additionally, the '938 Patent notes connecting the wireless connectors of the detonator to the bulkhead assembly. *Id.*, 8:12-19. Then, the '938 Patent further explains:

> The bulkhead 124 includes spring connector end interfaces comprising contact pins 126A, 126B, linked to coil springs 128A, 128B. This dual spring pin connector assembly including the bulkhead 124 and coil springs 128A, 128B is positioned within the tandem seal adapter 48 extending from a conductor slug 130 to the bulkhead connector element. The dual spring pin connector assembly is connected to the through wire 106 of the detonator assembly 26.

Id., 8:28-39. Thus, as described in the '938 Patent and as generally understood in the industry, the bulkhead provides for electrically connecting adjacent guns.

50. Exemplary Figure 32 of the '938 Patent illustrates the electrical connection between adjacent guns outlined in red below:

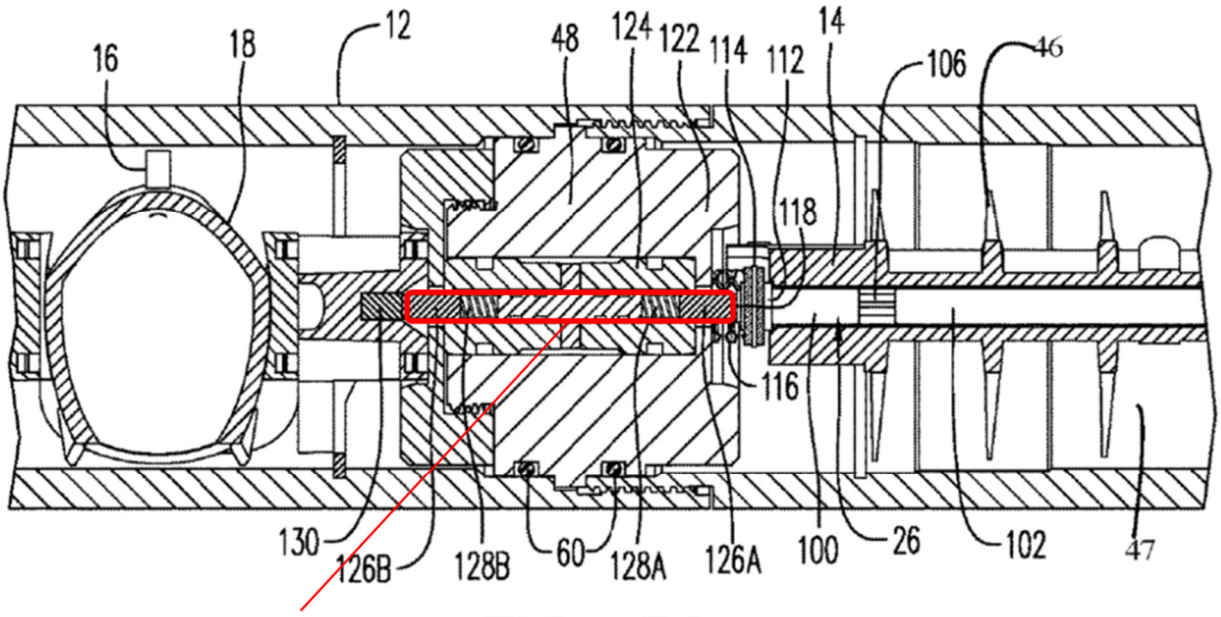


FIG. 32

51. A POSITA would therefore understand that, consistent with the industry usage of the term, the term "bulkhead" as used in the claims of the '938 Patent means ***"a component that seals adjacent guns (when positioned within the TSA) and provides for electrically connecting adjacent guns***."

VII. Petitioner's Asserted Grounds of Unpatentability of the Challenged Claims

A. Anticipation Ground

1. Schacherer Does Not Anticipate the Challenged Claims (Ground 3)

52. Petitioner alleges that Schacherer anticipates Claims 1-2, 4-5, and 7-20.

53. Schacherer is generally directed to a perforating gun system (i.e., explosive assembly 20) including a housing 26 within which explosive components (detonation cord and shaped charge) 22, 24 are freely rotatable relative to the housing 26. See Ex. 1004, Abstract, 2:30-34, Figs. 2, 5 (below). The free rotation in combination with eccentric weights enable a gravity-oriented shot pattern via explosive components (charges) 24 mounted on bearings 44 (highlighted in blue) for use in deviated (non-vertical) wellbores. Schacherer describes that a connector or sub 28, 30 connects adjacent gun housings 26 in such a way that allows free rotation of the explosive components (highlighted in red) within the housing 26, while providing transfer of electrical signals and ballistics by screwing the sub 30 to the gun housing 26. *Id*., at 4:5-13, Abstract, Figs. 2, 5. The connector or sub 28, 30 is connected to the gun housing(s) 26 at the wellbore site. Ex. 1004, 6:30-45.

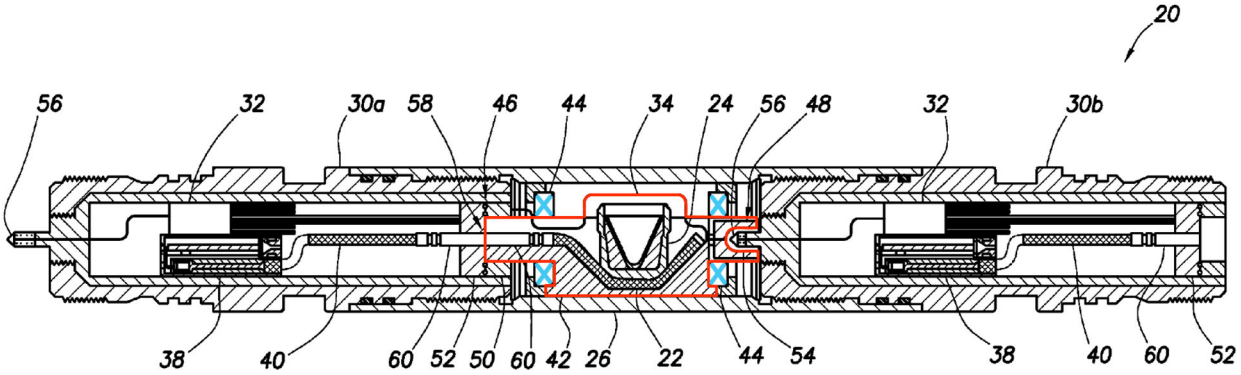


FIG.2

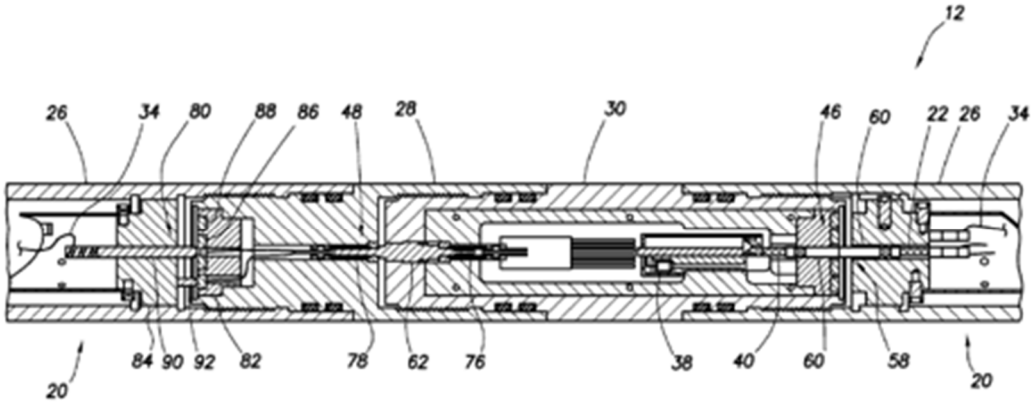


FIG.5

a) Schacherer fails to disclose a detonator including…a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in Claims 1, 9, and 13.

54. Independent Claim 1 recites "the detonator including . . . a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector." Independent Claims 9 and 13 claim similar limitations.

55. The Petition never specifically identifies any structure of Schacherer as particularly corresponding to a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector.

56. Petitioner cites rotary electrical connections 46, 48, 80, 82; contacts 64, 66, 68, 70; electrical connector 76; and electrical couplers 62, 68, 78 as "wireless electrical connectors." Pet. at 26-29. Petitioner asserts that "conductors 94, 96, 98, and 100 carry a signal and ground that pass through the connectors." *Id.* at 28. Petitioner and Mr. Parrott make no allegation that any of these structures are the specifically claimed wireless ground contact connector, without specifying which, if any, of these structure are supposed to correspond to the wireless connectors of Claims 1, 9, and 13.

b) Schacherer fails to disclose that the wireless ground contact connector is in wireless electrical contact with the TSA, as claimed in independent Claims 1 and 9.

57. Independent Claim 1 requires "a detonator contained entirely within the outer gun carrier . . . wherein . . . the wireless ground contact connector is in wireless electrical contact with the tandem seal adapter."

58. The wireless ground contact connector is claimed as an element of a detonator that is contained "entirely within" the outer gun carrier. Claim 9 claims similar limitations with regard to the wireless ground contact connector and the TSA.

As shown in the ’938 Patent, an excerpt of Fig. 32 is shown below wherein the detonator 26 (highlighted in pink) is contained entirely within the outer gun carrier (highlighted in yellow) the wireless ground contact connector 116 (highlighted in blue) is in wireless electrical contact with the TSA 48 (shoulder portion highlighted in orange) thus grounding the detonator 26 by wireless electrical contact with the TSA:

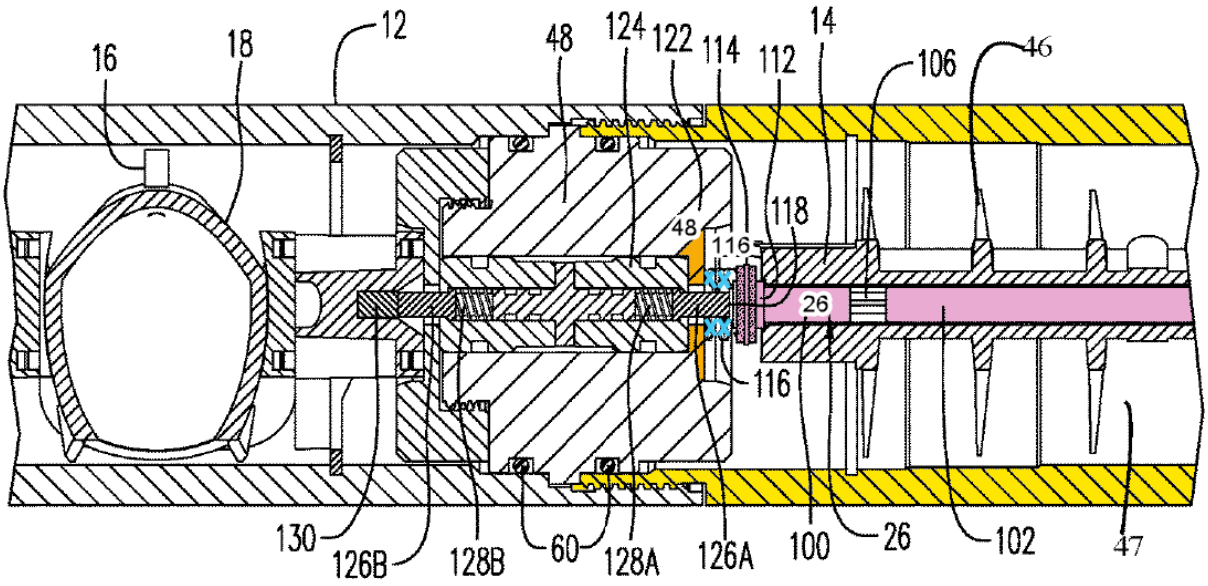


FIG. 32

59. In any event, as best as can be understood, Petitioner offers two theories regarding why Schacherer discloses a wireless ground contact connector in wireless electrical contact with a TSA: (1) that the outer housing (not the TSA, as claimed) is in contact with the “ground contact” (Pet. at 9-10); or, alternatively, (2) a piecing

of parts of Schacherer that does not address even the precise wording of the individual limitations, much less the structure of the claims as a whole: a tandem that "provides a fluid seal" and that "each of housings 28, 30 and 26 can serve as tandem seals in contact with the ground contact of the detonator and provide a fluid seal…[t]he circled parts above 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 and provide a fluid seal." *Id.* at 73-77.

60. The Petition generally alleges that the blue shaded portions below are the detonator of Schacherer:[2] Pet. at 12-14.

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[2] Petitioner also argues in the alternative that the entire structure 30 of Schacherer is a detonator. This argument is self-defeating because structure 30 is not contained entirely with any other structure as recited in Claim 1. Any interpretation that considers structure 30 (either alone or in combination with structure 28) of Schacherer to be the equivalent structure of the claimed detonator does not satisfy the limitation of independent claim 1 that reads "a detonator contained entirely within the outer gun carrier." Further, a POSITA would clearly understand that the

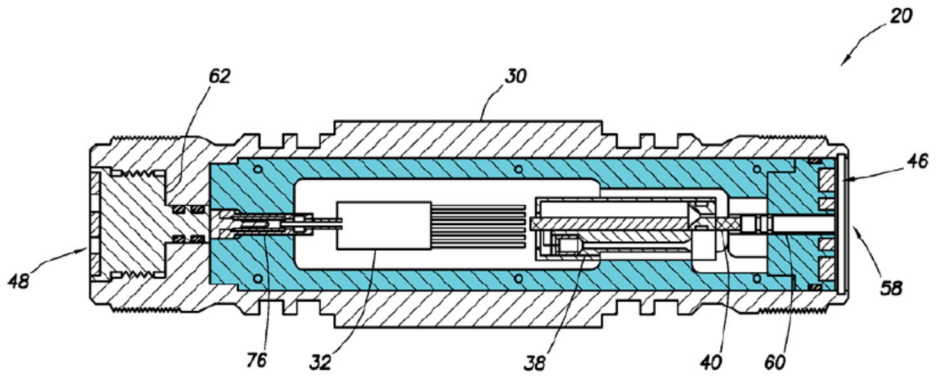

FIG. 4

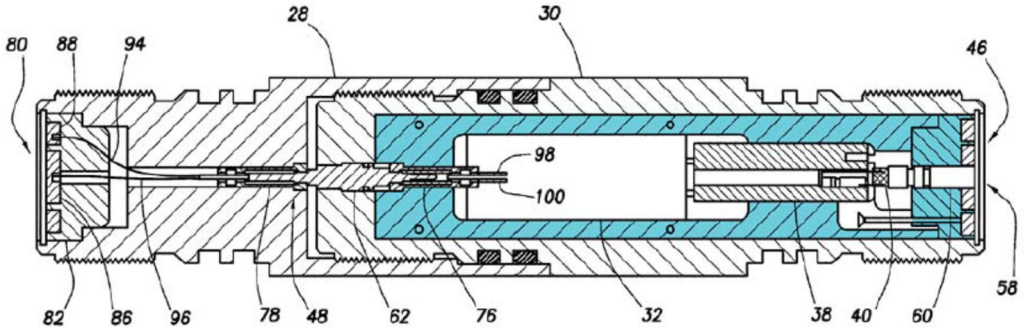

FIG. 7

61. As noted above, Petitioner never identifies any particular connector of the blue shaded region as corresponding to a wireless ground contact connector. Rather, Petitioner argues that Schacherer purportedly discloses that the outer housing (the gun housing 26, not the connector 28, 30) is in contact with the wireless

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structure 30 of Schacherer is a type of sub, more akin to the claimed tandem seal adapter ("TSA"), and not a detonator.

ground portion. Pet. at 9-10. Claims 1 and 9 require that the wireless ground contact connector is in **wireless** electrical contact with the **TSA**, not the outer gun housing.

62. Regarding conductors 94, 96 cited by Petitioner, Figure 7 shows that these are clearly wires, and conductors 98, 100 are connected between electrical coupler 76 and selective firing module 32. Ex. 1004, 6:13-18, Fig. 7. Thus, conductors 98, 100 are not wireless ground contact connectors and do not make wireless electrical contact with a TSA. Assuming that one of the various recited features - rotary electrical connections 46, 48, 80, 82; contacts 64, 66, 68, 70; electrical connector 76; and electrical couplers 62, 78 - is the claimed "wireless ground contact connector," (which Petitioner does not assert), there is no teaching in Schacherer that the wireless ground contact connector makes a wireless electrical contact with the tandem seal adapter. In addition, even under Petitioner's interpretation of the "detonator," coupler 62 cannot be considered part of the detonator either as described by Schacherer or as presented in the Petition. Thus, at least rotary electrical connections or contacts 48, 64, 66, 68, 70, 80, and 82, associated variously with embodiments of the coupler 62 (i.e., bulkhead/TSA), do not correspond to the claimed three separate and distinct wireless connectors included with the detonator. Schacherer shows and describes the remaining connections as only signal connections for the switch assembly 32.

63. Petitioner further states that "each of housing 28, 30, and 26 can serve as 'tandem seals in contact with the ground contact of the detonator.'" Pet. at 75. Connector 30 cannot be a TSA because Petitioner simultaneously suggests that it is part of the outer gun housing. If connector 30 is in fact considered to be a TSA as Petitioner argues, then the detonator would no longer contained entirely within the gun carrier as claimed in Claim 1. Further, if connector 30 is understood to be the TSA, Petitioner does not identify how the wireless ground contact connector (which is never particularly identified) is in wireless electrical contact with connector 30.

64. Claims 1 and 9 do not merely require the tandem be in contact with the ground contact of the detonator (as such language includes wired electrical contact), but rather, they require that the TSA be in wireless electrical contact with the wireless ground contact connector. Therefore, even if one of structures 28, 30, or 26 of Schacherer is electrically connected to a ground contact, there is still no disclosure of the "wireless" electrical contact of Claims 1 and 9. It is worth noting that structure 28 is a gun connector intended to couple to a tandem sub 30 on one end, so it cannot be a TSA. Likewise, structure 26 is a gun carrier which certainly cannot be a TSA.

65. As a result, Schacherer does not disclose that the wireless ground contact connector is in wireless electrical contact with the tandem seal adapter, as claimed in independent Claims 1 and 9.

c) Schacherer fails to disclose a detonator contained entirely within the outer gun carrier, as claimed in Claim 1.

66. As noted above, Petitioner generally regards the blue shaded portions below as the detonator of Schacherer, which are not contained entirely within the outer gun carrier of the gun assembly in Schacherer. Pet. at 12-14.

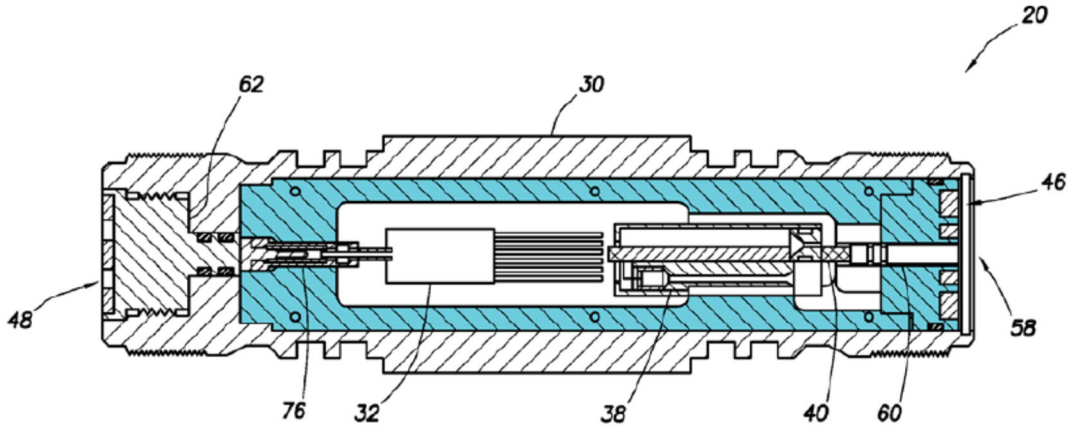

FIG.4

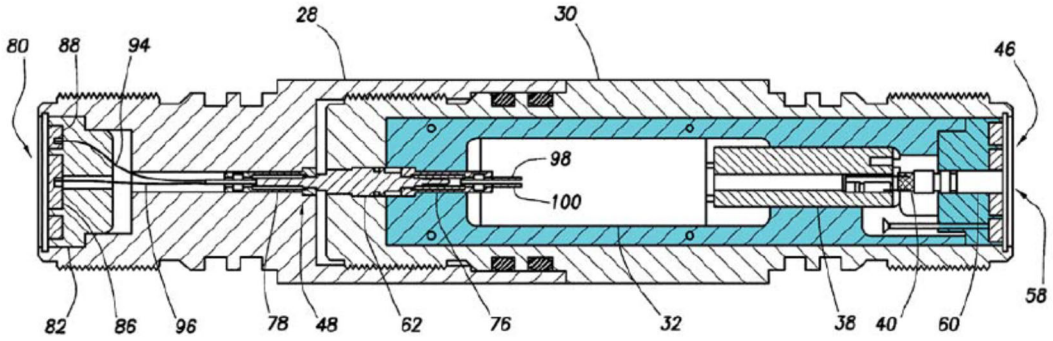

FIG.7

67. Petitioner also argues that structure 30 is part of the outer gun housing. *Id.* at 126-127. However, a POSITA would understand that an outer gun carrier is a structure that includes a shaped charge. Schacherer does not disclose any embodiments in which a shaped charge is provided within connector 30; instead, the shaped charge is exclusively provided within outer housing 26.[3] Accordingly, connector 30 is clearly not an outer gun housing as the term would be understood by a POSITA. A POSITA would identify connector 30 as a tandem sub, a type of gun connector. Further, there is no embodiment of Schacherer in which the purported detonator is provided within the outer gun housing 26. In fact, Schacherer is designed to do just the opposite – to house the detonator in a separate sub that can be ballistically coupled to the gun housing after all wiring is complete. Schacherer, then, does not disclose a detonator contained entirely within the outer gun carrier, as claimed in Claim 1.

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[3] It is important to note that the inventors of Schacherer themselves consistently refer to structure 26 as the "outer housing" and structure 30 as a "connector." Accordingly, not even the inventors of Schacherer consider structure 30 to be part of the outer gun housing.

d) Schacherer fails to disclose all of the steps of Claim 13.

68. Claim 13 claims in part "(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, . . . (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 wellbore site."

69. Regarding steps (b) and (c), Petitioner first suggests that "Schacherer teaches a detonator inserted within connector 30, which is inserted in carrier adjacent the charge holder." Pet at 113. While it is not explicit, this statement seems to imply that Petitioner considers connector 30 to be the top connector. However, this is inconsistent with Petitioner's other arguments in which connector 30 is alleged to be part of the outer gun carrier. *Id.* at 126-27. If connector 30 is indeed considered to be part of the outer gun housing, then it defies logic that the connector 30 (as top connector) would be inserted into itself (as the outer gun housing). Further, connector 30 is not adjacent to the charge holder. As seen in Figure 2 of Schacherer below, bearings 44, detonation boosters 60, and a significant amount of space are provided between connector 30 and the charge holder. Accordingly, connector 30 cannot be the claimed top connector.

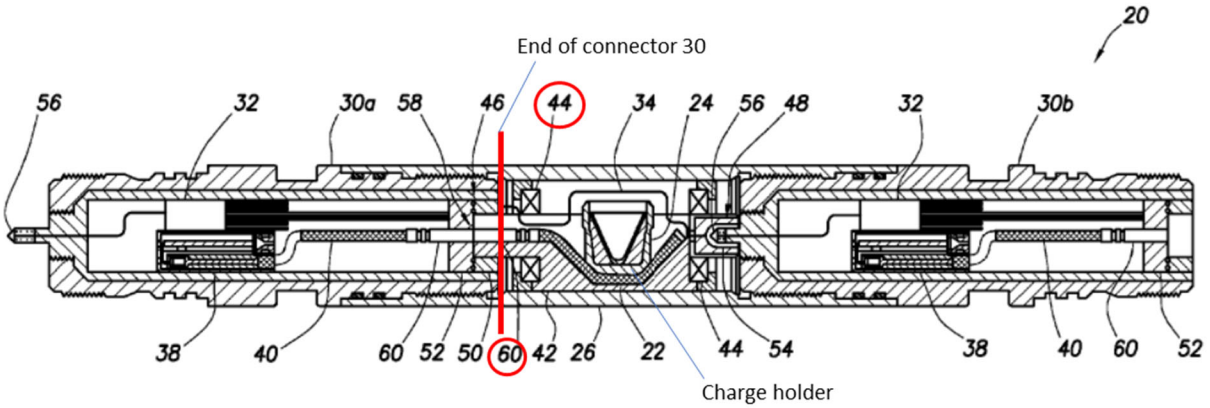


FIG.2

70. Next, Petitioner states that "each of the items in Schacherer discussed above as teaching a detonator body also teach the claimed top connector because they all hold a detonator and couple it to the detonating cord and are within the carrier." Pet. at 114. It is important to note that the detonator and the top connector are specifically claimed as separate and distinct structures (e.g., "inserting a detonator into a hollow channel of the top connector").

71. Petitioner further suggests that structures 46, 58 are top connectors. *Id.* However, Figure 5 of Schacherer, reproduced below, shows that structures 46, 58 are substantially solid and only include a narrow channel for a detonation cord. Component 46 is described as a rotary electrical connection with a small hole for holding a booster in position to provide ballistic transfer across an air gap to the adjacent gun. Ex. 1004, 4:5-10. Component 58 is described as a rotary detonation coupling that similarly provides for rotary electrical connections in addition to a

small hole for positioning the booster on the end of the detonating cord. *Id.*, 4:49-52. Together, components 46 and 58 provide for electrical connections and ballistic transfer from one sub to another, such as between a connector sub and a gun carrier.

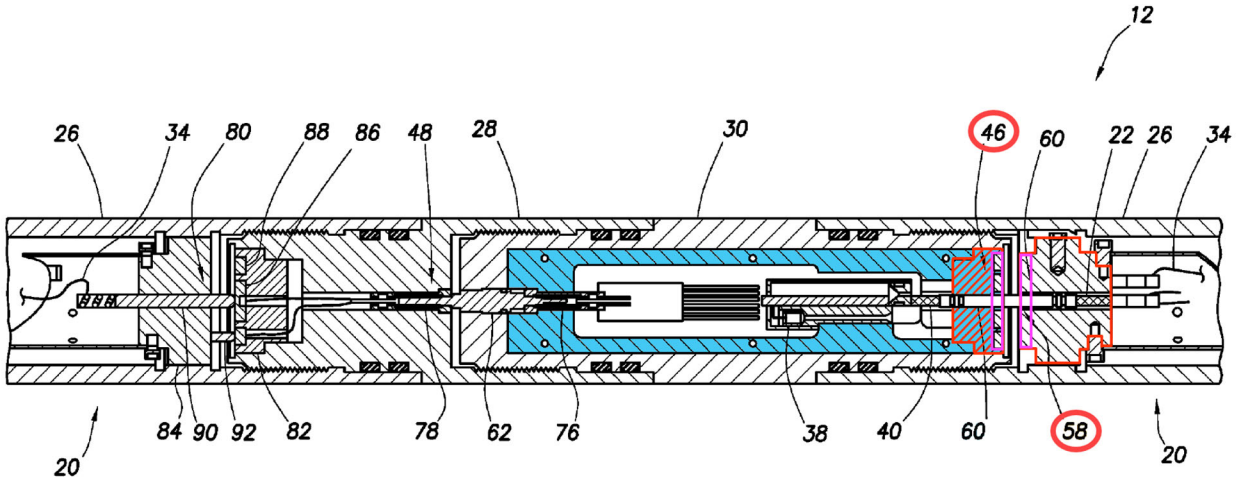


FIG.5

72. It is impossible for the detonator of Schacherer, at least as described by Petitioner, to be inserted into either of structures 46, 58. As described in Schacherer, structures 46 are rotary electrical connections and structure 58 is a rotary detonation coupling. A POSITA might reasonably understand that each of these structures 46, 58 are positioned in the respective bodies as highlighted (and unlabeled in Schacherer). Thus, the body that houses structure 46 is inserted into the end of the purported "detonator" (the blue shaded structure within connector 30), so structure 46 cannot be a top connector into which the detonator is inserted, as required in

Claim 13. The assertion that structure 58 is the top connector just does not make any sense.

73. Regarding the remaining steps, Petitioner states that "Schacherer teaches '[g]enerally, perforating guns are not transported to a wellsite with an electrical detonator coupled to a detonating cord.'" Pet at 146. This is a reference to the background section of Schacherer on how detonators were handled in the past. In any event, Petitioner does not use the language of the claim. Claim 13 does not merely claim that the perforating guns are not transported to a wellsite with an electrical detonator coupled to a detonating cord. Instead, Claim 13 specifically claims that the step of "inserting the detonator into the hollow channel of the top connector" is performed at the wellbore site.

74. While the tandem sub 30 of Schacherer could be threaded onto a gun at the wellsite, the detonator itself would have been necessarily installed in the tandem sub 30 back at the shop. There is no possibility for a detonator to be installed at the wellbore site. Schacherer describes a typical Halliburton RED detonator housed in connector sub into which the detonation cord is inserted to enable the ballistic coupling. This connection is made internal to the connector sub using a short length of detonation cord terminating in a booster. The detonation cord in the mating gun similarly positions the end of the detonation cord with a booster. When the connector

sub is threaded onto the gun carrier, the two boosters are positioned end-to-end to completely the ballistic chain from the detonator to the shaped charges. For example, in conventional systems, the detonator may be hand-wired to the system (*see supra* ¶¶30-35), or a detonator may be energetically coupled to a detonation cord without use of any top connector having a hollow channel. In most conventional gun systems, the detonation cord in the gun is provided with extra length so that it can extend into the mating connector sub which houses the detonator. The detonator can be coupled to the detonation cord by inserting the cord into the receiving feature of the detonator.

75. Additionally, the example presented in Schacherer discloses the exact opposite of inserting the detonator at the well site. Figure 8 of Schacherer, reproduced below, shows that the detonator is connected to the gun system remote from the wellsite, i.e., at the factory. Ex. 1004, 9:14-18. The connector sub 30 is shown coupled to the gun housing 26 in the loading shop at location 110, remote from the well site at location 112.

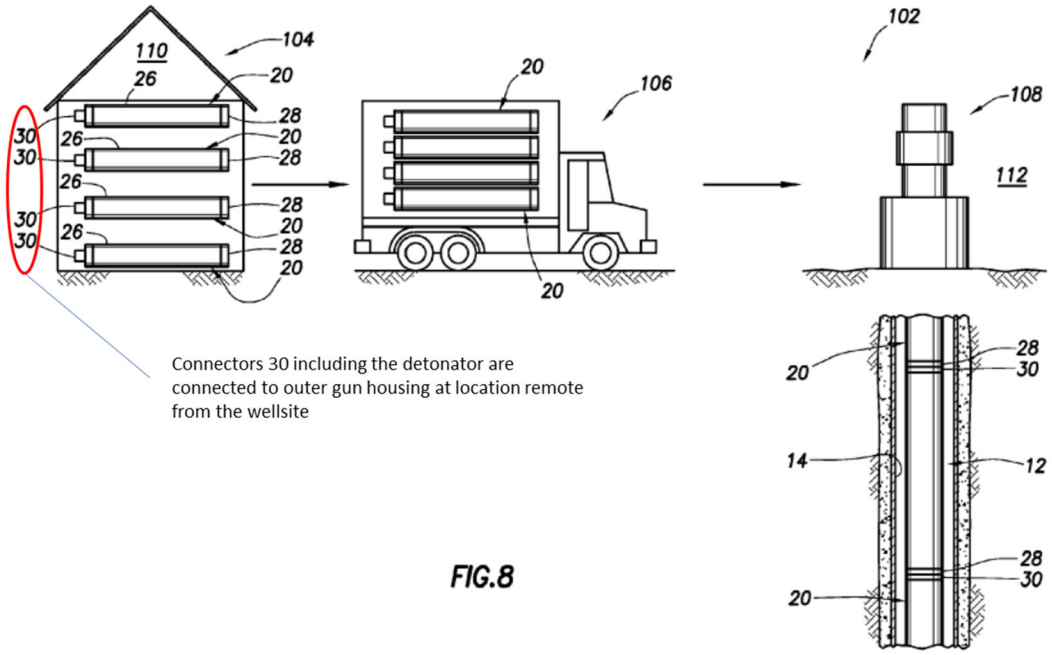


FIG.8

76. The specification of Schacherer further explains that "in 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." *Id.*, 6:37-41.

2. Harrigan Does Not Anticipate the Challenged Claims (Ground 14)

77. The Petition alleges that Harrigan anticipates Claims 1-9 and 11-20 of the '938 Patent. I understand that DynaEnergetics contends that Harrigan is only prior art for teachings supported in the provisional application (Ex. 1028, "Harrigan Provisional"), because Harrigan (Ex. 1012) as cited and applied in the Petition (Ex.

1012 "Harrigan") was not filed until May 2, 2014, after the priority date of the '938 Patent. While the Petition focuses on features of Harrigan, this Declaration will primarily address features as described and illustrated in the Harrigan Provisional. I will refer to a three-dimensional CAD model created to represent parts of the Schlumberger gun system described in Harrigan to aid in my explanations below.

78. The Harrigan Provisional is generally directed to a perforating gun "that is fully assembled including the initiator at a location other than the wellsite." Ex. 1028 at 3, Figs. 1 and 3. The "perforating gun with integrated initiator module" includes a loading tube (for positioning shaped charges), and a bulkhead that is "designed to support [the] initiator." *Id.* at 1 Figs. 1 (annotated to point out three features of the perforating gun discernable to a POSITA but not expressly described in the Harrigan Provisional), 3 and 5a (annotated to include the word "pin" as may be inferred by a POSITA though not expressly described in the Harrigan Provisional).

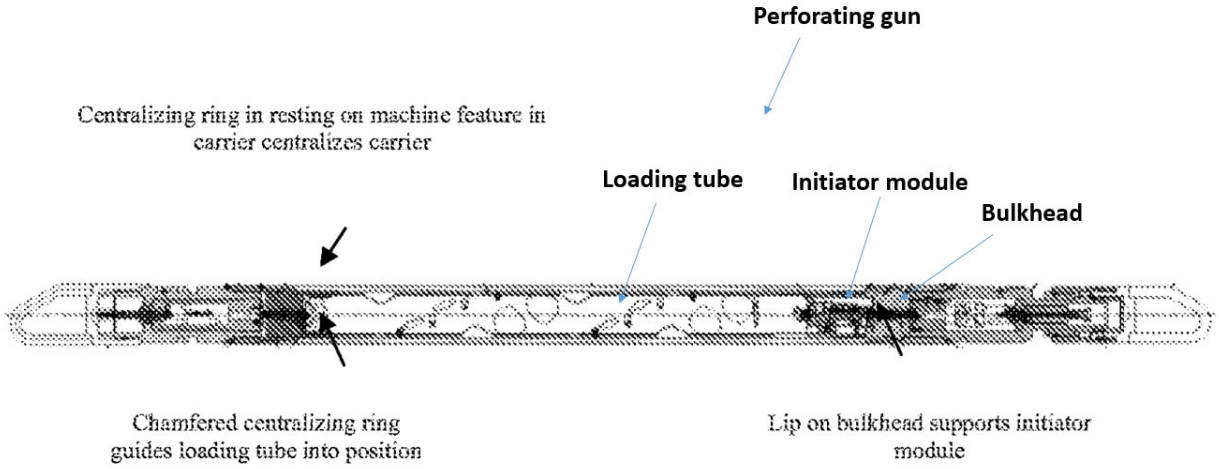


Fig. 1: Fractal Assembly

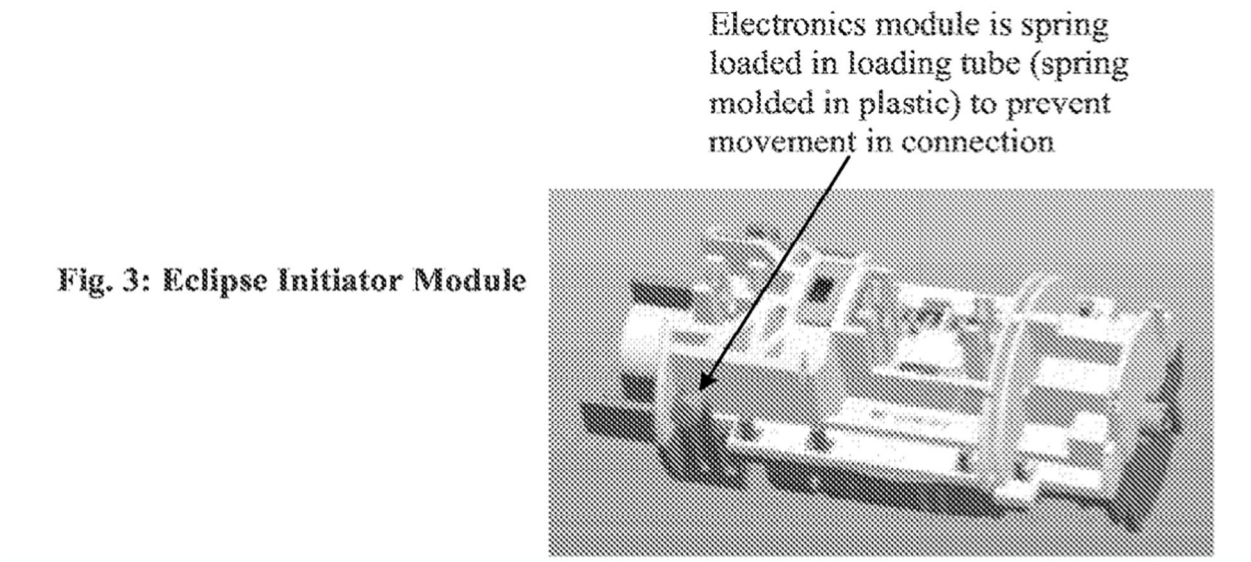


Fig. 3: Eclipse Initiator Module

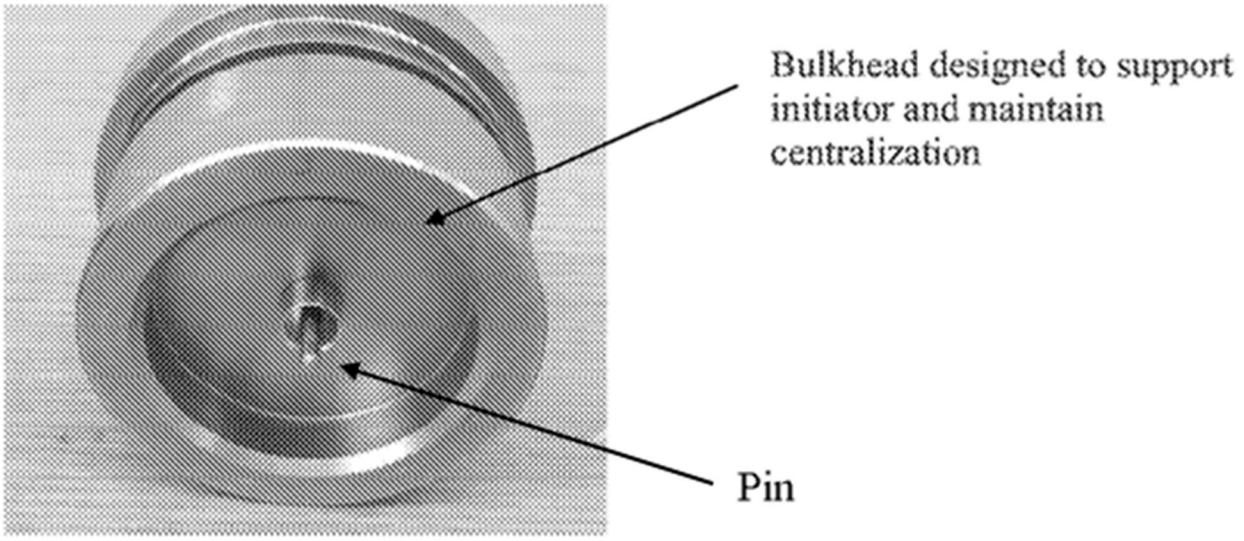


Fig. 5a: Bulkhead End

79. The Harrigan Provisional further describes a feedthru (*sic*) with a pin for "contact to RCA connector." *Id.*, Fig. 5b.

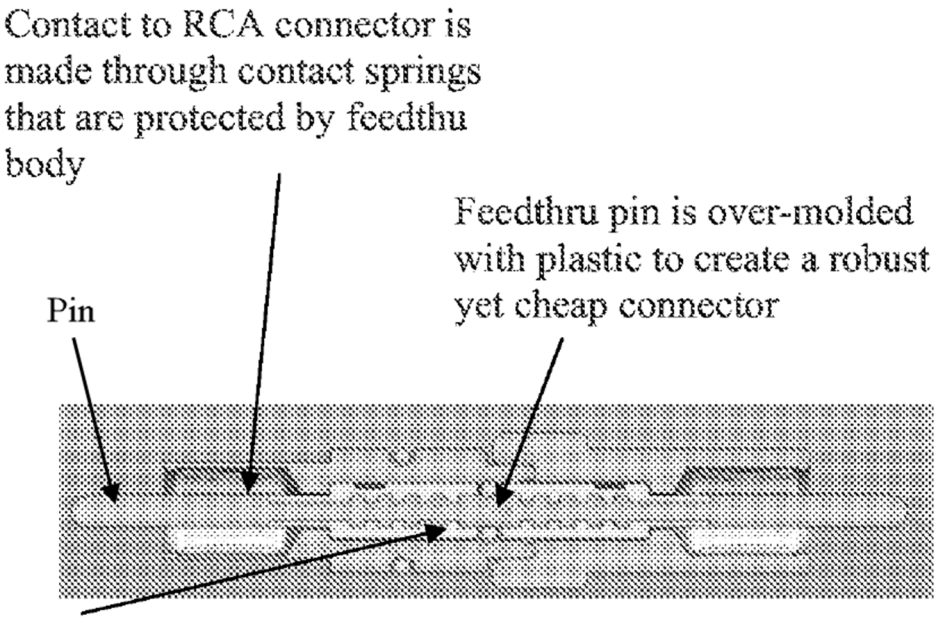
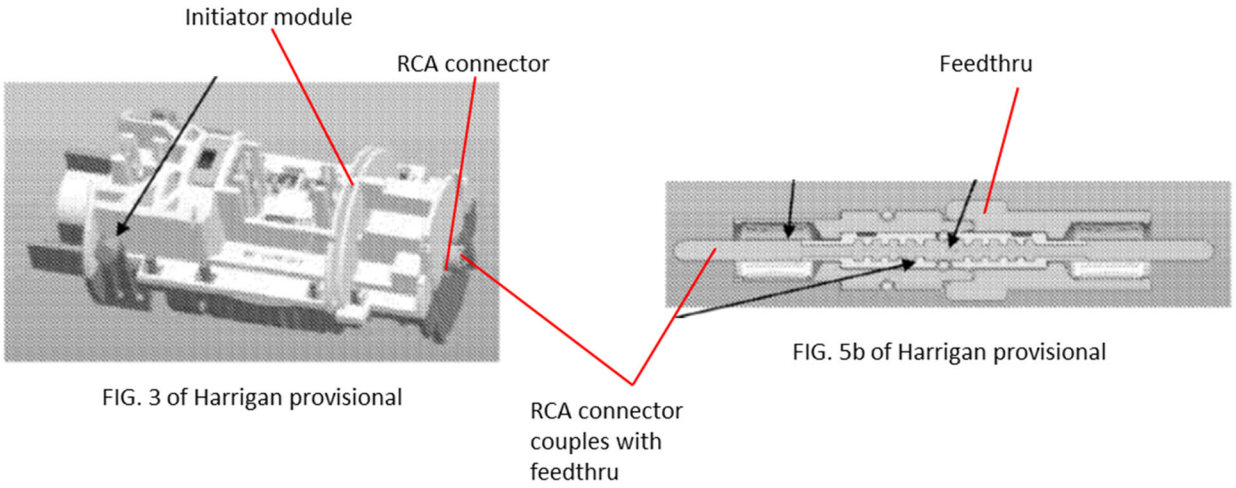


Fig. 5b: Feedthru

80. While the Harrigan Provisional does not explicitly describe, nor can it be seen clearly in the figures of the Harrigan Provisional, it appears that the outer end of the initiator module includes an RCA connector (see also Fig. 2) that receives the feedthru pin depicted in Fig. 5b below. *Id.*, Figs. 3 and 5b (annotated).



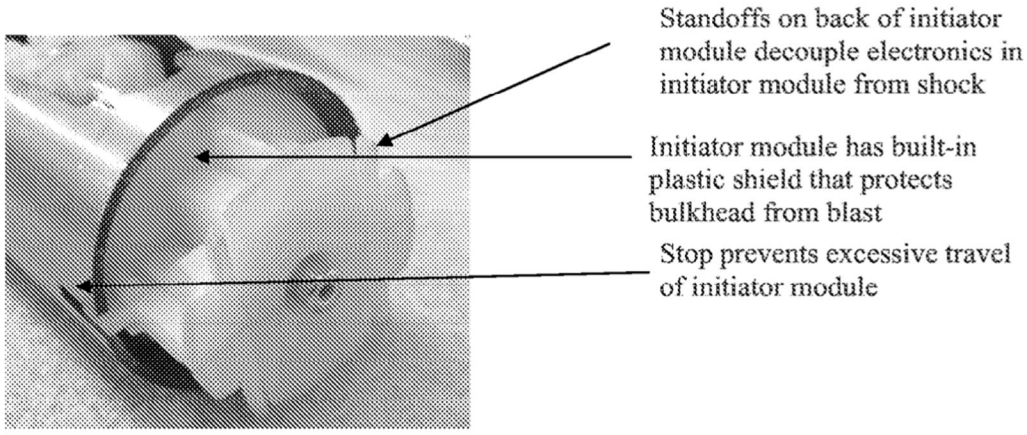
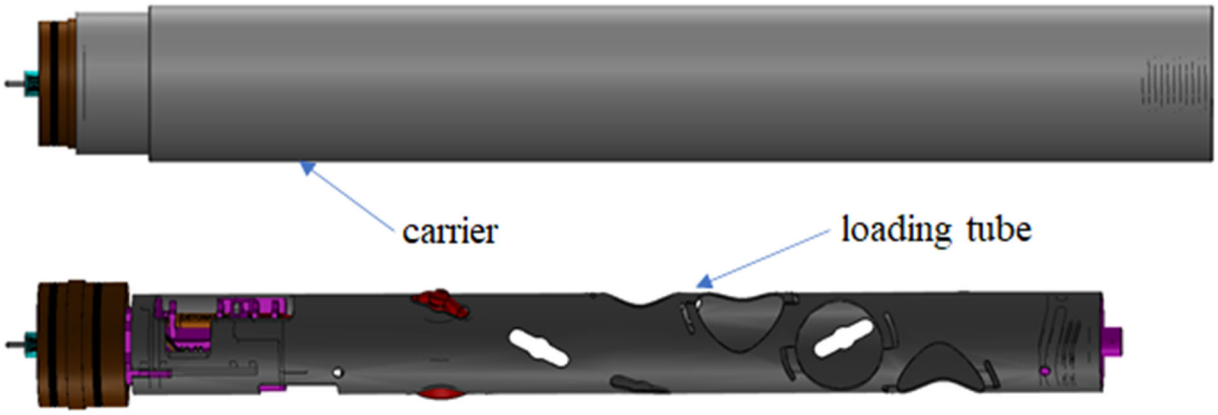


Fig. 2: Loading Tube End

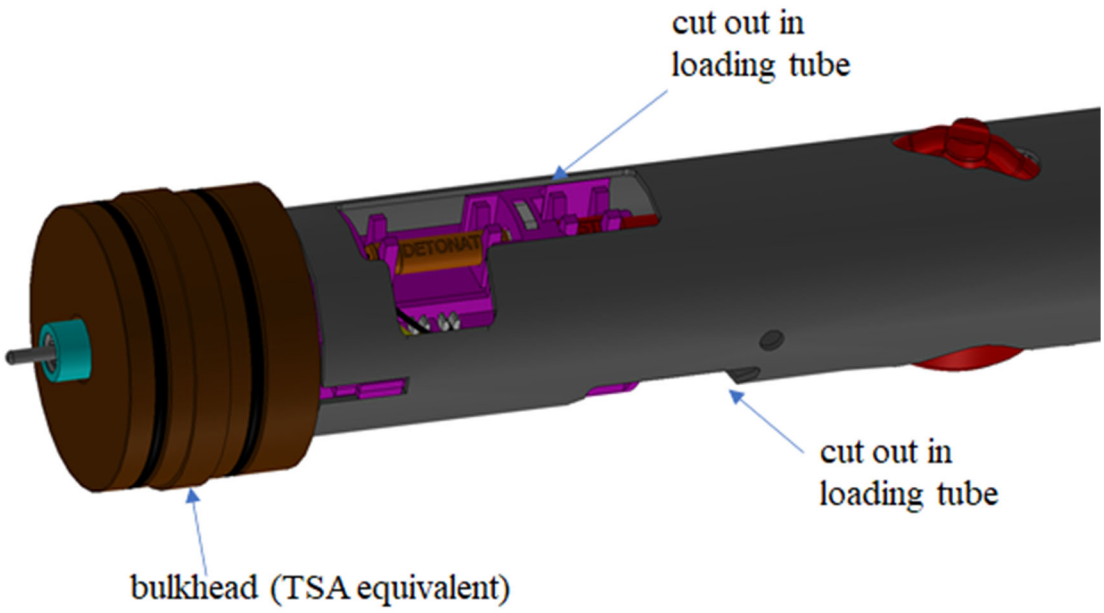
81. The feedthru passes an electrical signal between adjacent guns, appears to show an o-ring in the over-mold and thus a POSITA may reasonably infer that the feedthru corresponds to the bulkhead as the term is used in the '938 Patent.

82. The CAD model representation discussed above of the Harrigan assembly is provided in the figures below, with and without the gun carrier.[4]

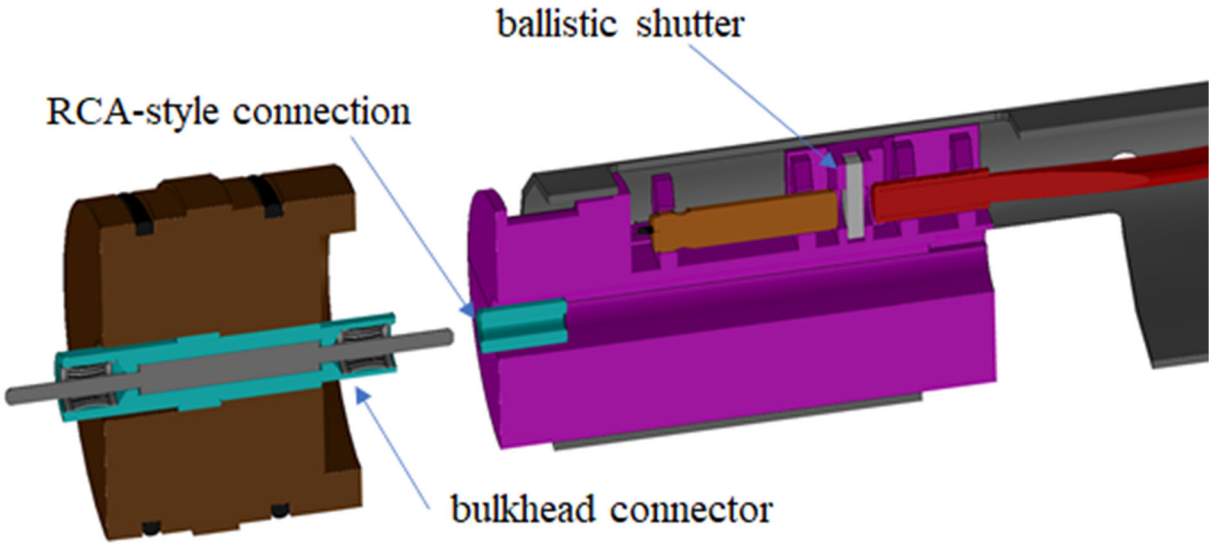
[4] It should be noted that these CAD models are based on the descriptions of the Harrigan publication, not the Harrigan Provisional. But for purposes of the CAD illustrations, the differences – for example, the TSA shape and the fact that the TSA is only described as having one o-ring in the Harrigan Provisional instead of two, as shown – do not take away from the helpful and accurate aspects of the models.

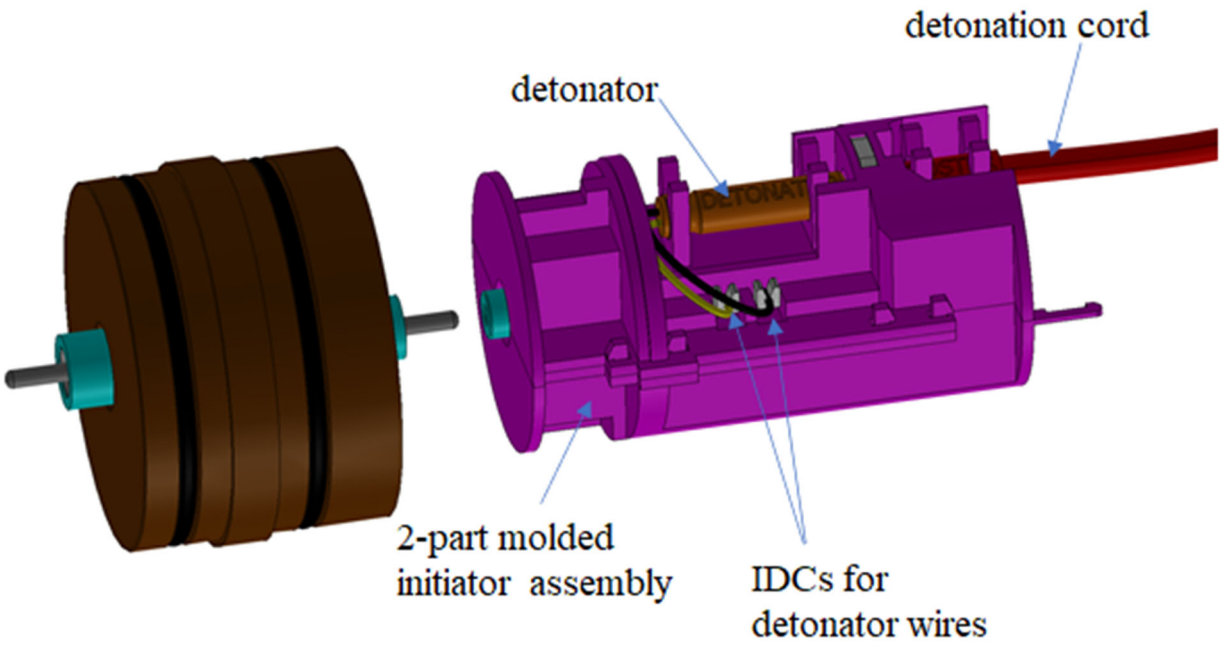


83. A closer view of the left end of the model is shown below. A POSITA may reasonably infer that Harrigan's bulkhead (brown) corresponds to the TSA as used in the '938 Patent, including an o-ring seal between adjacent gun carriers, and appears to provide a channel to receive the bulkhead/feedthru. The feedthru pin/bulkhead is included within the TSA in the CAD model. Cut outs in the loading tube (dark grey) on top and bottom provide access to the detonator and wiring.



The CAD model images below provide further orientation as to the relative placement and details of the bulkhead and initiator module components. Two views are included: the upper provides a cross section through the assembly shown in the lower. The initiator module (purple) is a 2-part molded assembly that houses a circuit board (not shown), a wired detonator (orange), a detonation cord (red) not aligned with the detonator, and a ballistic shutter (grey) positioned between the detonation cord and the detonator. The ballistic shutter is used to block the path of ballistic transfer until electrically commanded to retract and arm the device.





84. As described above, it may reasonably be inferred by a POSITA (though not explicitly shown nor described in the Harrigan Provisional) that the feedthru is housed in the bulkhead such that when the bulkhead is positioned in the gun housing, the feedthru pin is inserted into the RCA connector of the initiator module thus providing a wireless electrical contact to the initiator module. The feedthru pin is included in the bulkhead connector in the CAD model images above as may reasonably be understood by a POSITA. The Harrigan Provisional further describes and depicts that a wired "detonator and loading tube latch in [the] initiator module." *Id.*, Fig. 4. The initiator module further includes (not shown) a circuit board with insulation displacement connectors (IDCs) built in. *Id.* "A hand tool [is]

used to make connectors between the detonator wires and the IDC." Ex. 1028 at 2. Thus, a POSITA might reasonably infer that the initiator module is wirelessly electrically connected using the RCA and the feedthru pin, but there is no disclosure as to how the RCA is connected to the circuit board itself. In the CAD model cross-section image above, the connections between the RCA connector and any components of the initiator assembly are not shown as they are not described in Harrigan. The wired connections within the initiator assembly are generally accessible through the cut outs in the loading tube provided on both the top and bottom sides. The detonator is clearly wired to the circuit board via the IDCs. *Id.*, Fig. 4. This is illustrated in the second figure below from the CAD model. The black and yellow detonator wires can be pushed into the fork of the IDC. The image in the lower right provides detail on how the IDC makes contact with the conductor.

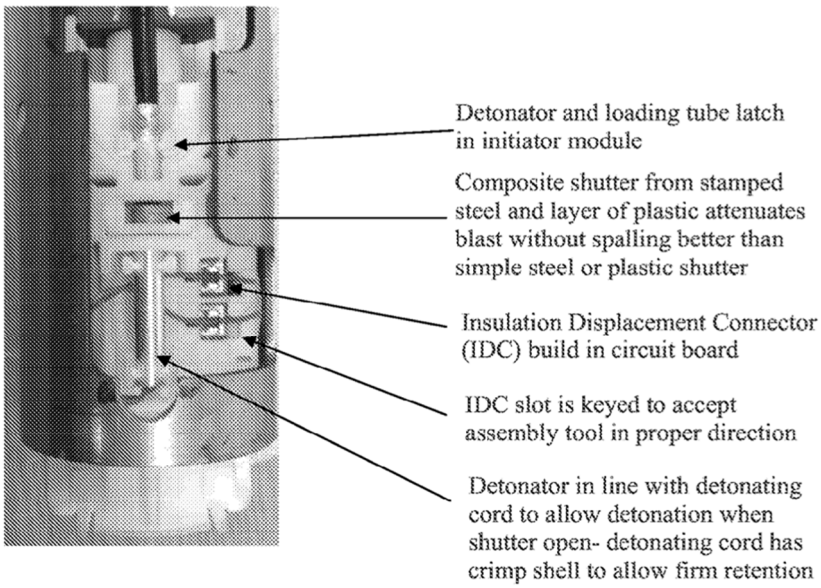
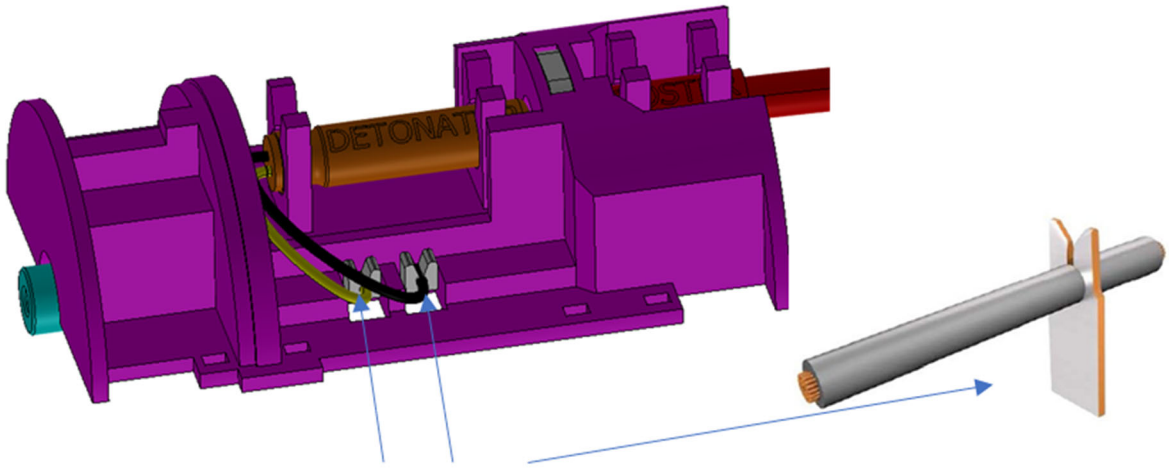


Fig. 4: Loading Tube End (Top)



a) Harrigan fails to disclose a detonator including…a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in Claims 1, 9, and 13.

85. Independent Claim 1 claims in relevant part "the detonator including . . . a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector." Independent Claims 9 and 13 claim have similar limitations.

86. The Petition never explains what specific structures of the initiator module of Harrigan or the Harrigan Provisional correspond to the wireless signal-in connector, the wireless through wire connector, and the wireless ground contact connector. Instead, Petitioner cites a variety of connectors in Harrigan and merely suggests that these connectors teach the claimed wireless connectors. Pet. at 29-31.

87. The Petition asserts that the initiator module corresponds to the detonator. *Id.* at 14-15. The Petition further asserts that "Harrigan teaches electrical connections 430, 440 on both ends of initiator 125 for connection to a feedthrough. . ." *Id.* at 30. As set forth above, Harrigan describes the initiator assembly including a wireless (RCA) connector. Even assuming that the initiator assembly is the detonator, and assuming that one of the "connections" of the RCA connector is a wireless ground contact connector and the other is a wireless signal-in connector, there is no description that the initiator assembly has a wireless through wire

connector. There is simply no description of how Harrigan transfers the signal through the gun.

88. Even if the initiator assembly is a structure that corresponds to the claimed detonator the Petition does not identify with particularity which of the claimed connectors are described by Harrigan.

89. Petitioner further suggests that Harrigan's structure "requires at least three electrical contacts for a signal-in to the initiator, a signal through the initiator to a next initiator, and a ground connection to function." *Id.* at 31-32. Even if this is true, Petitioner has failed to establish that all three of these electrical contacts are made via wireless electrical contacts.

90. Thus, Harrigan does not disclose a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in Claims 1, 9, and 13.

b) Harrigan fails to disclose that the wireless ground contact connector is in wireless electrical contact with the TSA, as claimed in Claims 1 and 9.

91. As noted above, Petitioner has failed to establish with any particularity what structure of the initiator module of Harrigan corresponds to the wireless ground contact connector, but appears to argue that the wireless ground contact could be part of the feedthru pin-to-RCA connection. Regarding a TSA, Petitioner argues

that the bulkhead of Harrigan corresponds to the claimed TSA. Pet. at 77. However, the RCA of the initiator assembly never makes wireless electrical contact with any portion of the TSA in Harrigan. Instead, as seen below, the bulkhead/feedthru pin is connected to the initiator assembly. The RCA connector of the initiator is best viewed in the cross-section of the CAD model, also included below. The contact springs (barrel springs)[5] make contact between the outer conductor of the RCA and the outer body of the feedthru.

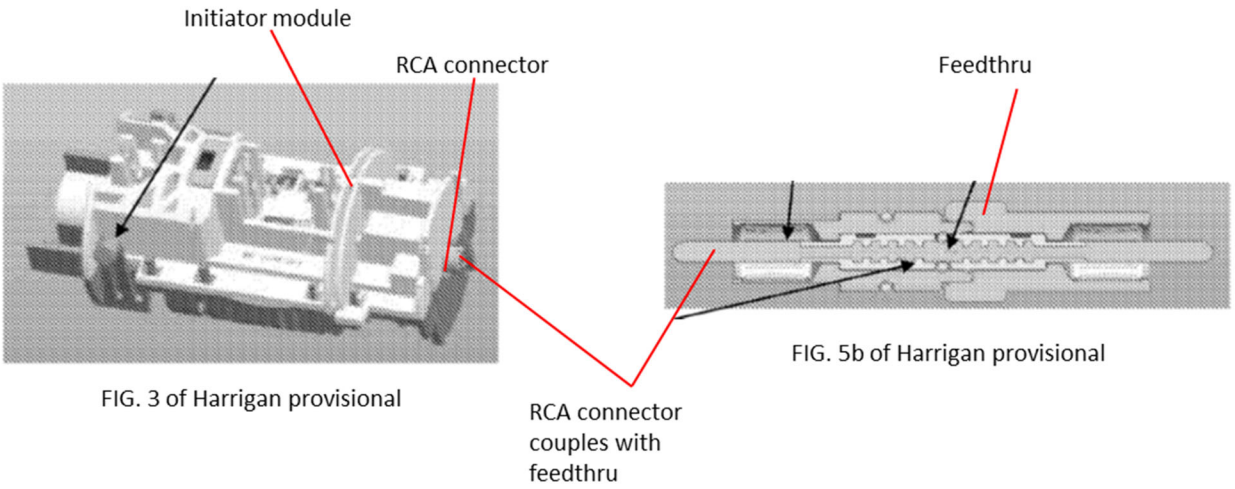


FIG. 3 of Harrigan provisional

FIG. 5b of Harrigan provisional

[5] As described only in Harrigan. No such description is provided in the Harrigan Provisional.

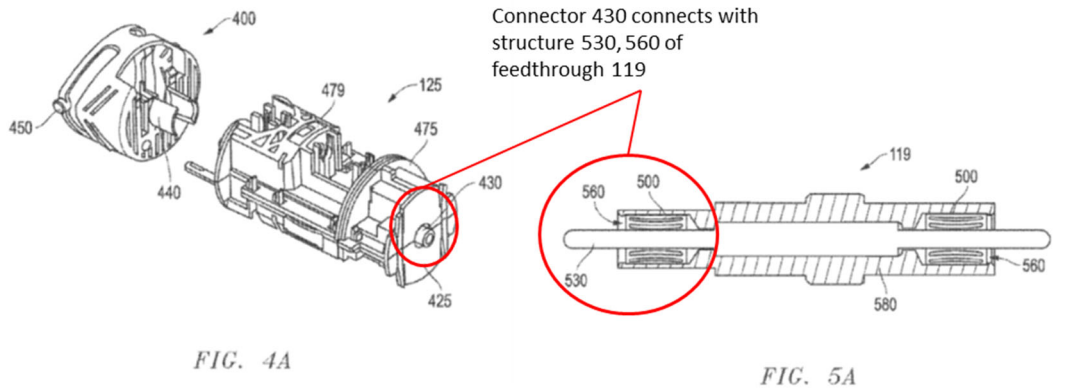
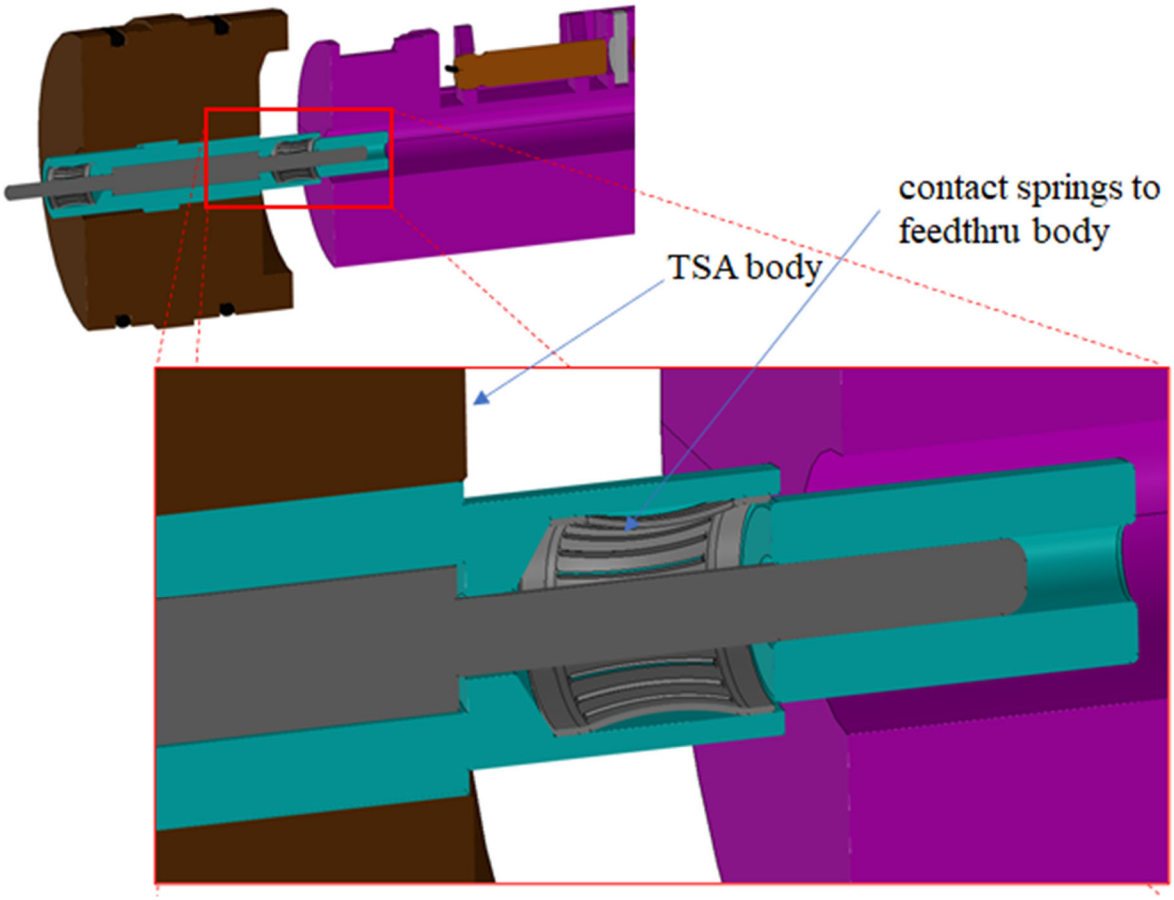


FIG. 4A

FIG. 5A



92. The pin connection of the bulkhead/feedthru is isolated from the outer body of the bulkhead connector and the surrounding structure. Thus, there is no contact at all between the RCA connector of the initiator module with the TSA.

93. In other words, Harrigan does not disclose that "the wireless ground contact connector [not shown in the Petition] is in wireless electrical contact [not possible based on the Harrigan Provisional (Ex. 1028)] with the tandem seal adapter [Harrigan's bulkhead]," as claimed in Claims 1 and 9.

c) Harrigan does not disclose all of the steps of Claim 13.

94. Claim 13 claims in relevant part, "(c) inserting a detonator into the hollow channel of the top connector . . . wherein . . . step (c) is performed at the wellbore site." Ex. 1001, at 12:34-58 (emphasis added). Harrigan expressly states its purpose of pre-assembly of the perforating gun before shipment by describing a perforating gun "that is fully assembled including the initiator at a location other than the wellsite." Ex. 1028 at 3, Figs. 1 and 3 (emphasis added). The ballistic shutter enables the off-site assembly, with the shutter only being removed on command after the gun system is safely in the wellbore. Thus, Harrigan does not disclose "inserting a detonator into the hollow channel of the top connector at the wellbore site."

95. Turning to the claimed step of "(d) connecting a through wire to the wireless through wire connector," and as noted above, the Petition has not established with any particularity what structures of Harrigan correspond to the

specifically claimed wireless through wire connector. In any event, the Petition does not directly address step (d) of Claim 13 with regard to Harrigan.

96. Moreover, the Harrigan Provisional does not discuss anything regarding connecting a through wire to a wireless through wire connector. Without describing this connection, Harrigan cannot possibly describe connecting a through wire to the wireless through wire connector, as claimed in Claim 13.

97. Thus, Harrigan does not disclose connecting a through wire to the wireless through wire connector, as claimed in Claim 13.

3. Rogman Does Not Anticipate the Challenged Claims (Ground 11)

98. Petitioner alleges that Rogman anticipates Claims 1-17 and 19-20 of the ’938 Patent. Rogman is very similar and cumulative to Harrigan and does not anticipate the challenged claims for many of the same reasons. Rogman generally describes a perforating gun including an initiator assembly 112 with a wired detonator 402 wired via IDCs to a circuit board (not shown) and a loading tube 110 (for positioning shaped charges). Ex. 1014 ¶[0036], Figs. 1 and 4.

a) Rogman fails to disclose a detonator including…a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in claims 1, 9, and 13.

99. Petitioner proposes that initiators 112, 312, 313 of Rogman correspond to the claimed detonator. Pet. at 16-17. Petitioner further suggests that "Rogman's power cable and RCA jacks would provide for a signal-in to the initiator, a signal through the initiator to a next initiator, and a ground connection without the need to manually attach wires." Pet. at 33.

100. Rogman does not actually disclose an RCA connector corresponding to each of the claimed wireless signal-in connector, wireless through wire connector, and wireless ground contact connector. The only illustration of what appears to be a coaxial/RCA-style connector is labeled "power cable 502" is provided on "bulkhead 116" in Fig. 5, and described at Ex. 1014 ¶[0033]:

From Rogman Publication

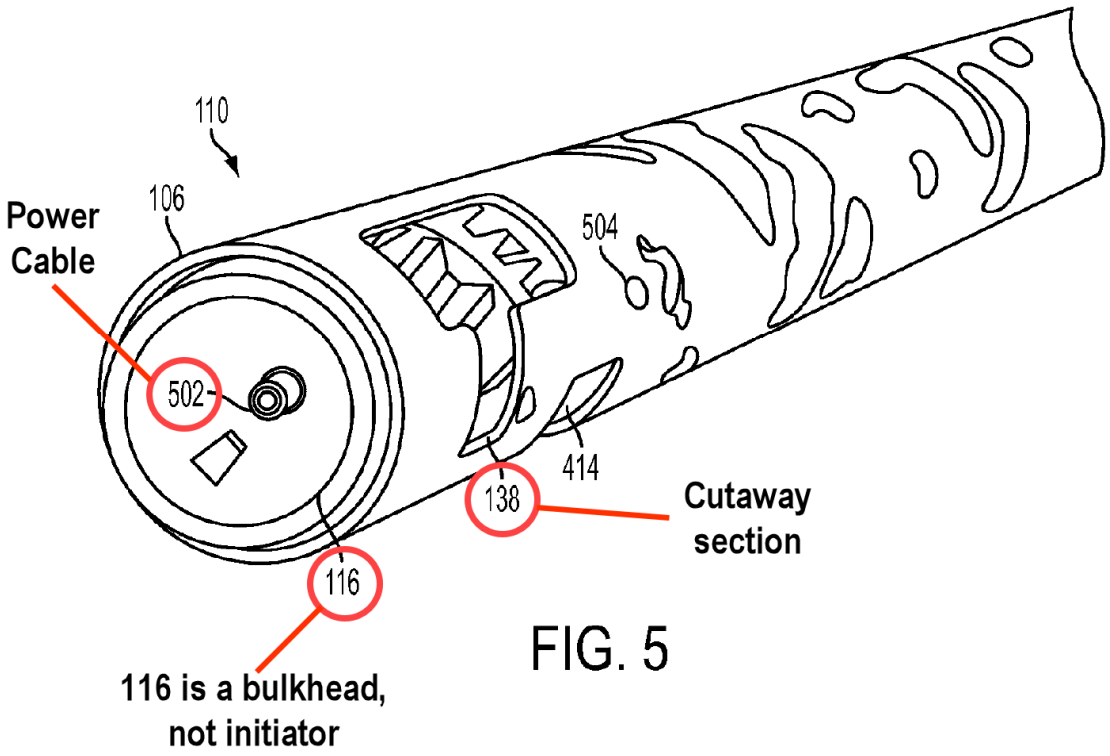


FIG. 5

101. Rogman further describes, "[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." *Id.* ¶[0019], Fig. 5.

102. Rogman further describes (without any illustration or further detail): "[t]he circuit board can also be connected to the power cable and other perforating systems through multi-use connectors such as an RCA jack." *Id.* ¶[0031].

103. Thus, Rogman does not disclose a detonator including a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in Claims 1, 9, and 13.

b) Rogman fails to disclose that the wireless ground contact connector is in wireless electrical contact with the TSA, as claimed in Claims 1 and 9.

104. As noted above, Petitioner has failed to establish what structures of Rogman correspond to the wireless ground contact connector. The Petition further argues that "Rogman teaches a tandem" reciting bulkheads 114, 116, 314, 316, and concluding that these bulkheads include "a ground contact connected to a ground contact of the initiator." Pet. at 79-80.

105. Assuming for the sake of argument that the bulkhead 114, 116, 314, 316 of Rogman corresponds to the claimed TSA, there is simply no disclosure that requires that the wireless ground contact connector (not found in Rogman nor specifically alleged in the Petition), and there is certainly no disclosure that such a connector is in wireless electrical contact with the bulkhead 114, etc.

106. With reference to an enlarged highlighted "lower end" of the perforating device of Figure 1, it is readily seen that there is no disclosure in Rogman to a wireless ground contact connector, much less a wireless electrical contact of the wireless connector with the TSA.

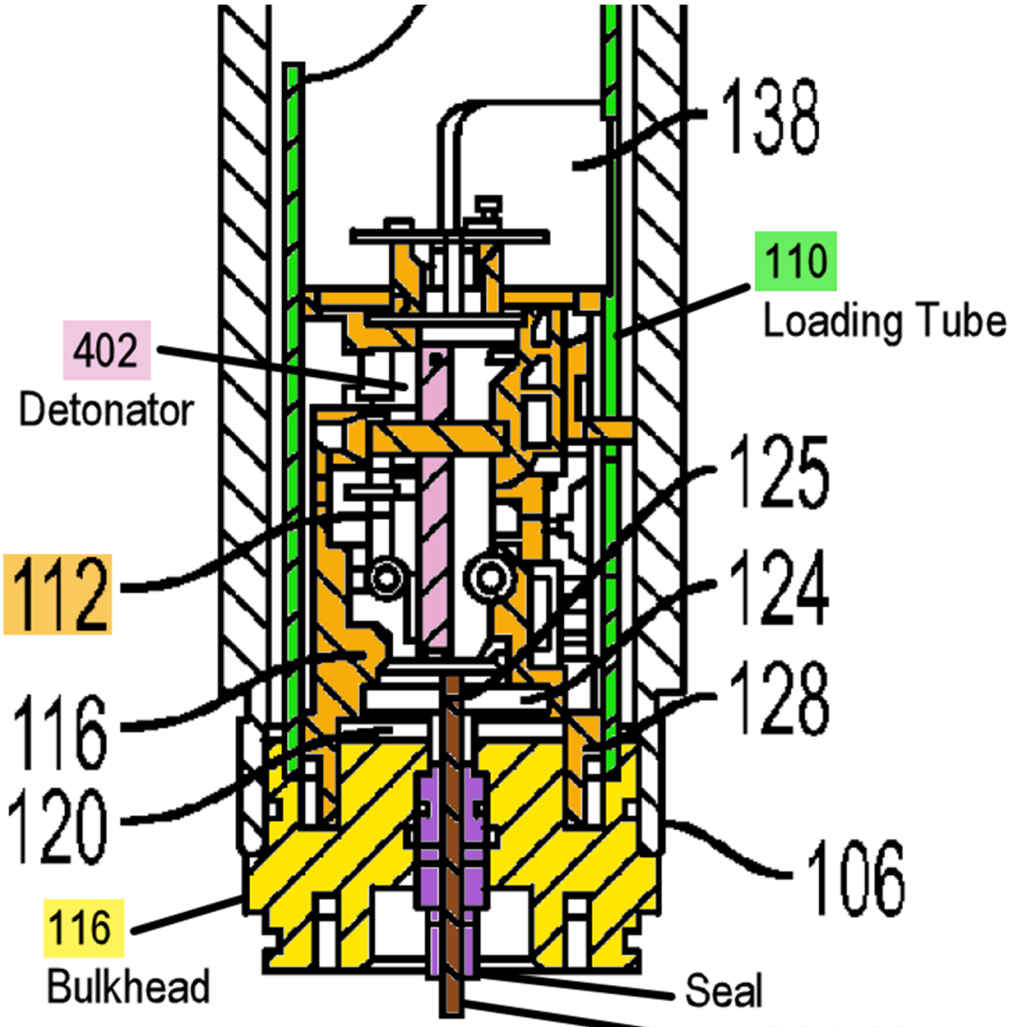
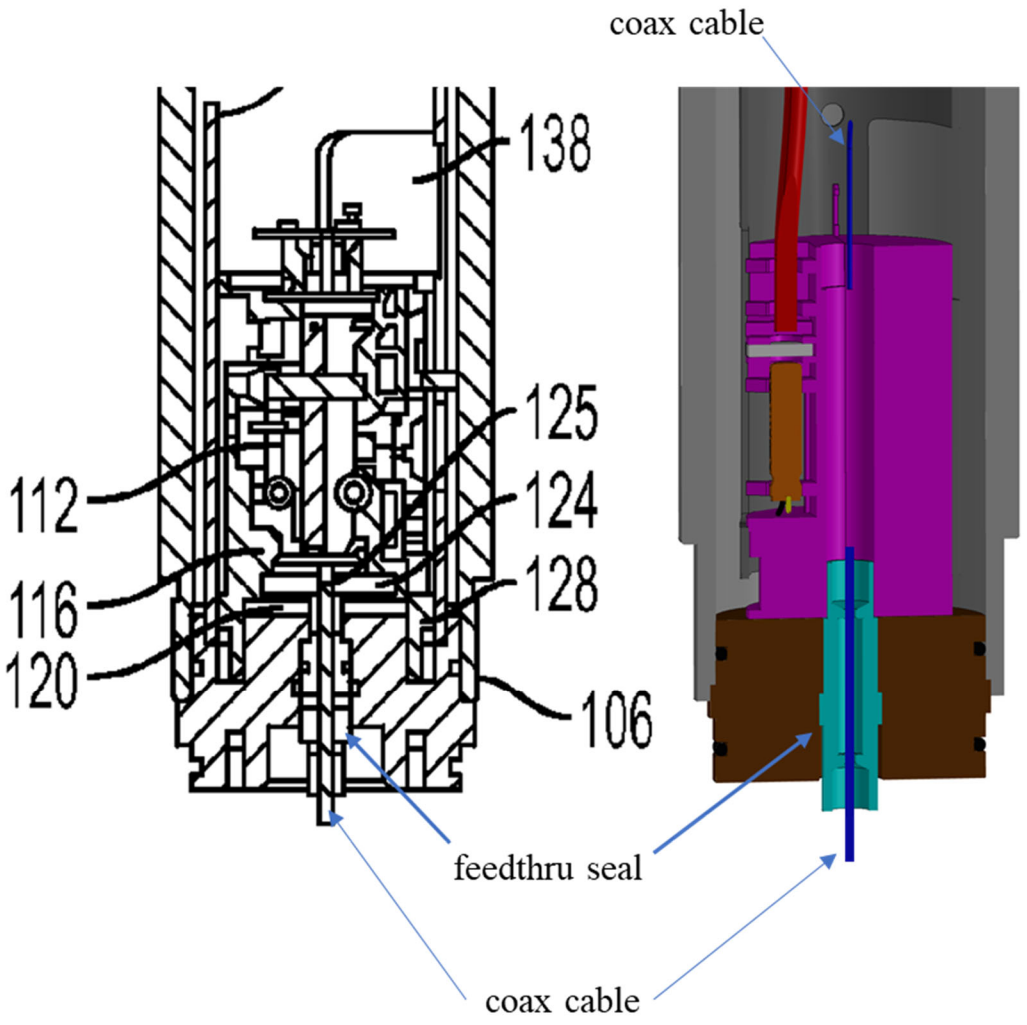


FIG. 1



107. The bulkhead 116 (brown) is visible at the bottom of both Fig. 1 and the CAD model cross section above. As shown more clearly in the CAD model, the lower coaxial cable (blue) extends through the sealed bulkhead feedthrough, though it is not clear how a seal is made to the cable. While no details of the coaxial cable are given, a POSITA would understand "coax" to mean two wires and further that one wire would be the signal-in wire and the other wire would be the ground wire.

It is typical to position the ground connection in the outer shell of a coax cable to reduce electrical noise in the signal. As highlighted in this excerpt, however, it is clear that there is simply no teaching in Rogman as to how such a cable would attach to the initiator assembly 112 (purple). Indeed, the figure shows the coaxial cable dead-ending into an unlabeled space, presumably within the lower end of the initiator assembly 112. Further, a POSITA might understand that the cable connects to the circuit board (not shown or described in detail anywhere in Rogman), and that such connection could be through another RCA-style connector. Ex. 1014 ¶¶[0031].

108. There is no disclosure, however, that the "wireless ground contact connector is in wireless electrical contact with the tandem seal adapter" as claimed. In fact, upon examination of Fig. 1, the coaxial cable (colored in blue) extends through the bulkhead 116 without making any contact since it is completely surrounded by the seal (colored in turquoise and described as seal 330 with reference to Fig. 3) and the coax cable would further have an insulated jacket. *Id.* ¶[0031].

109. Thus, Rogman does not disclose that the wireless ground contact connector is in wireless electrical contact with the tandem seal adapter, as claimed in Claims 1 and 9.

c) Rogman does not disclose all of the steps of Claim 13.

110. Claim 13 claims in part, "(d) connecting a through wire to the wireless through wire connector." As noted above, the Petition does not specify which structures of Rogman purportedly correspond to the specifically claimed wireless through wire connector. Further, the Petition never addresses limitation (d) of Claim 13 even once with regard to any of the cited references, including Rogman.

111. Further, Rogman actually discloses the opposite of what is claimed in Claim 13. For example, paragraph [0036] of Rogman describes that power cables 502 (the coaxial cable extending from, for instance, the bulkhead 116 as shown in Fig. 5) are pre-wired into loading tube 110. Ex. 1014 ¶[0036]. The upper power cable (blue), typically considered a through wire, is also visible in the previous CAD figure above, terminating in the upper end of the initiator assembly. As further explained, IDCs 410 are pushed into the circuit board to connect the pre-wired power cable 502 to the initiator 112. *Id*. Thus, the circuit board directly receives the signal from the cable 502. *Id.* ¶ [0033]. There is no teaching in Rogman as to how the detonator is connected to the circuit board, but Figure 4 of Rogman clearly shows that connections between the detonator 402 and the IDCs 410 are wired connections, and not wireless connections. The CAD model representation is also shown for clarity along with a detailed image of an IDC.

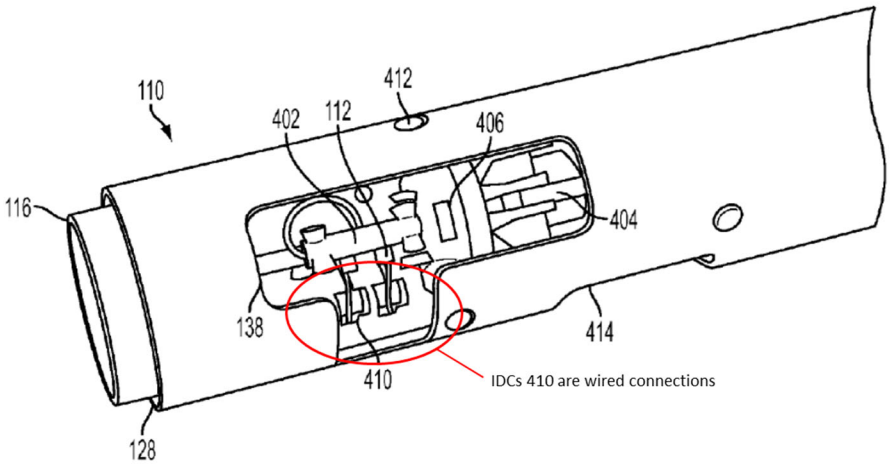
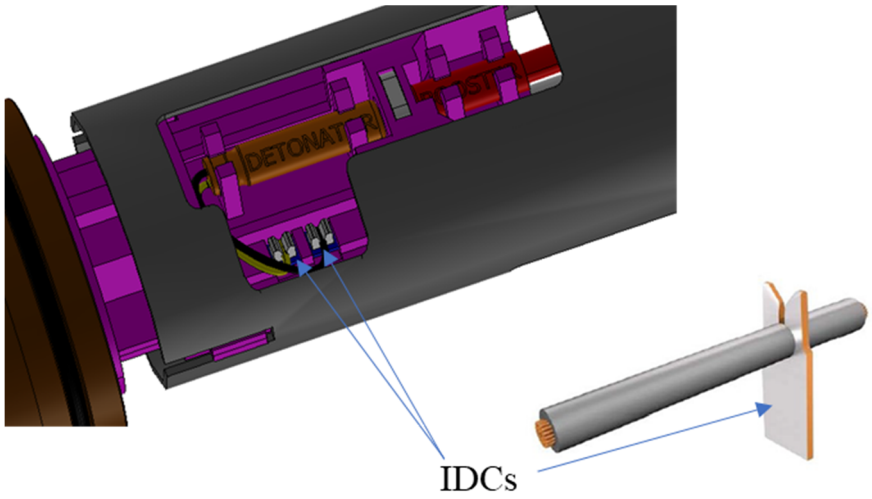


FIG. 4



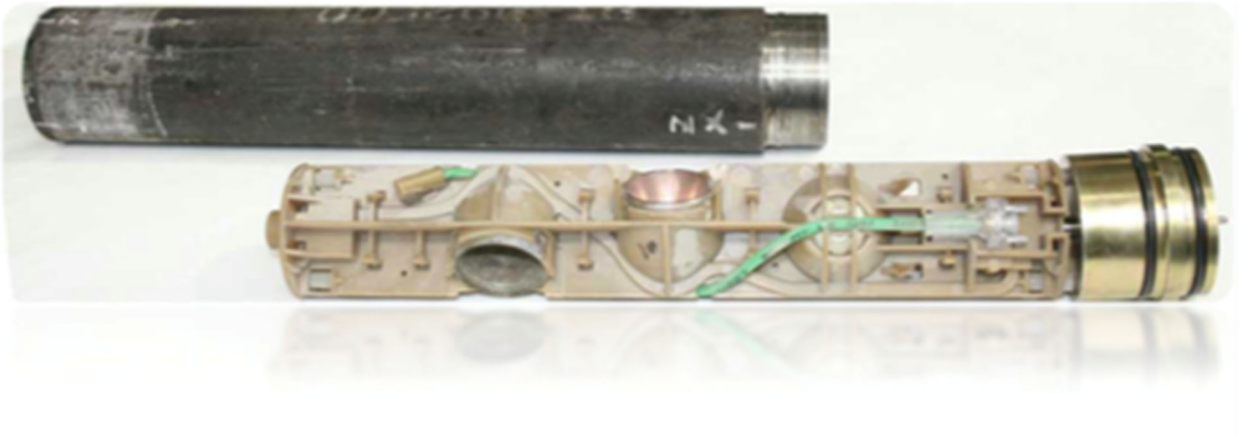
112. Thus, Rogman does not disclose connecting a through wire to the wireless through wire connector, as claimed in Claim 13.

4. EWAPS Does Not Anticipate the Challenged Claims (Ground 16)

113. The Petition alleges that EWAPS anticipates Claims 1-6, 8-10, and 12 of the ’938 Patent. EWAPS is an industry presentation that discloses essentially the

same system as is described in Harrigan and Rogman, but with even less detail or disclosure, and it fails for many of the same reasons. Ex. 1013.

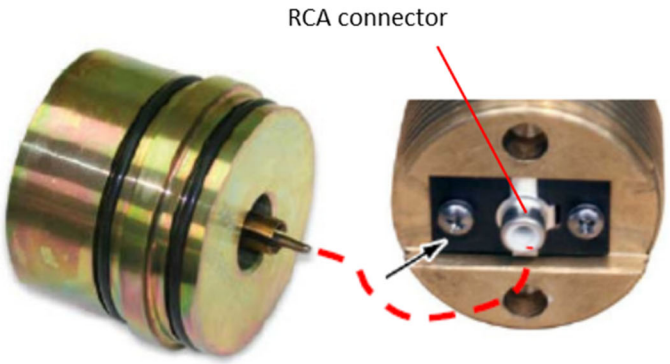
114. EWAPS generally describes a gun system that is transported in a fully assembled form. *Id.* at 9. The photo shows a fully assembled interior assembly laying side-by-side with a perforating gun housing. *Id*. The loading tube is replaced with a unitary, molded charge-holder structure that includes shaped charges, det cord, and wire channel, and a bulkhead with what appears to be a pin extending from the bulkhead to the end of the loading tube:



a) EWAPS fails to disclose a detonator including…a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in Claims 1 and 9.

115. The Petition points generally to the end of the loading tube to which the bulkhead attaches and asserts "EWAPS teaches the claimed detonator body." Pet. at 18-19. Not only does the Petition not cite with any particularity what specific

structure of the EWAPS loading tube is the claimed detonator, it similarly does not identify with any particularity how the detonator includes specific features that correspond to the separate and distinct claimed wireless connectors: the wireless signal-in connector, the wireless through wire connector, and the wireless ground contact connector. Instead, Petitioner argues generally that EWAPS discloses "coaxial RCA connectors." *Id.* at 33. The images in EWAPS, however, only show what appears to be a single RCA connector on a photo showing two metallic structures and labeled "disposable bulkheads" (Ex. 1013 at 10):



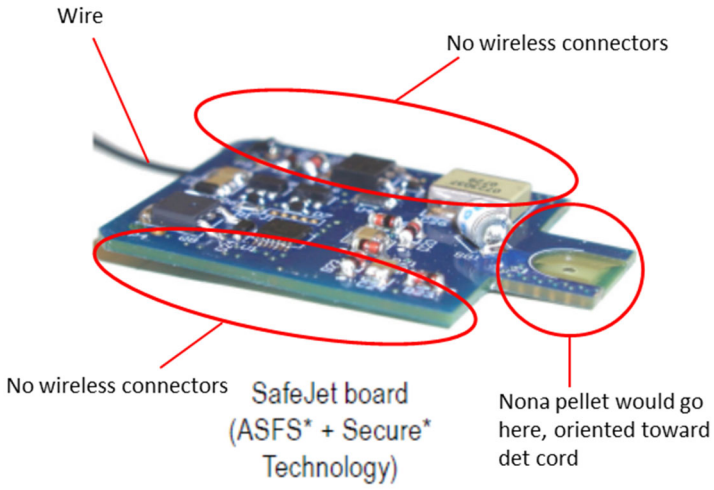
116. In fact, while EWAPS appears to show a single female RCA connector, this connector is shown protruding from what appears to be another metallic structure labeled as a bulkhead but assumed to be part of the pre-assembled charge-holder structure. In the fully assembled interior assembly photo shown on page 9 of

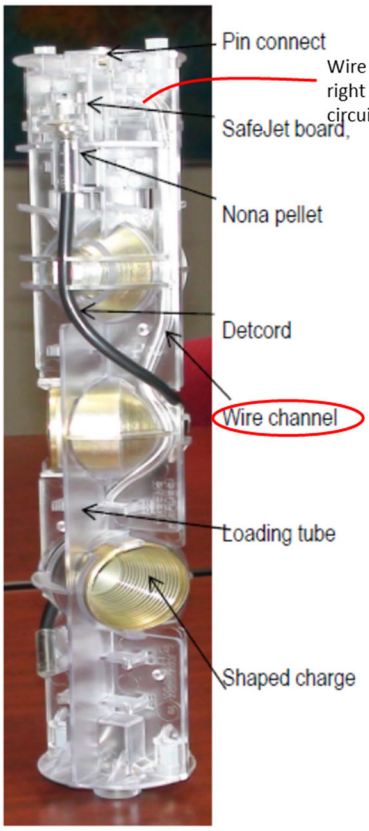
EWAPS, no structure is shown corresponding to an RCA connector and the photo from page 10 merely describes a "pin connect." *Id.* at 9.

117. Assuming for the sake of argument that Petitioner is correct that the RCA connector shown associated with the disposable bulkhead is used at the end of the charge-holder structure to receive the pin from the bulkhead (which is not described in EWAPS), this would at best only account for two of the three specifically separate and distinct claimed wireless connectors, and the Petition does not even allege with any particularity which two wireless connectors the RCA connector is supposed to represent.

118. The Petition also suggests that EWAPS teaches "a signal-in [], ground, and feed-thru wires associated with an addressable switch and detonator connected to coaxial RCA connectors on each end of a loading tube." Pet. at 33-34. As set forth above, EWAPS does not specifically teach an RCA connector associated with the detonator, much less that such a connector is positioned "on each end of a loading tube." A POSITA would assume that the detonator is integrated within the SafeJet board, shown below from EWAPS page 10, and that the energetic output is coupled to a 'Nona pellet' at the right end to step up the energy to detonate the end of the detonation cord. In any event, EWAPS makes no mention whatsoever of a third

wireless connector as part of the detonator and no wireless through wire connector is visible as part of the detonator:





119. Based on the above photographs from EWAPS, it is clear that any through wire provided in the wire channel would have to be connected to the circuit board through a wired connection as shown by the wire extending from the left side of the circuit board in the photo. In other words, EWAPS clearly does not disclose or even suggest the possibility of a "wireless through wire connector." Indeed, while a POSITA might understand that the slot positioned on the right side of the circuit board (opposite the wire) is the "position" for contacting the Nona pellet, a POSITA is completely uninformed as to how the RCA connector (assuming there is one) connects to the circuit board as no internal connectors are shown within the interior of the gun assembly.

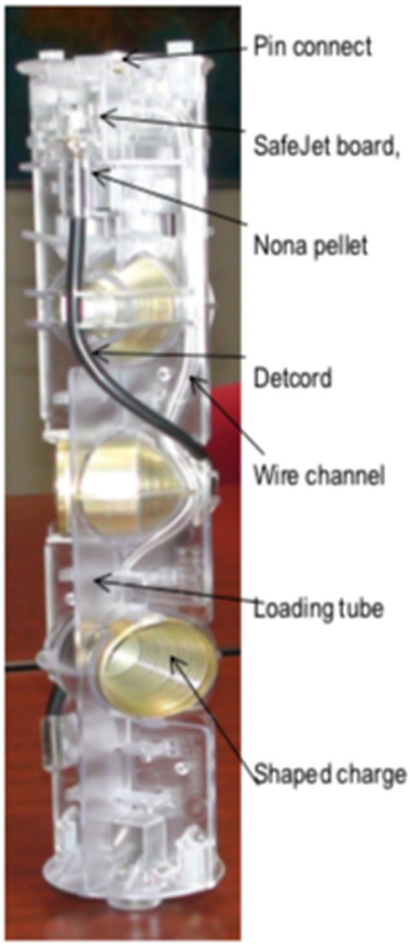
120. Thus, Petitioner has failed to meet its burden of showing that EWAPS discloses a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in Claims 1 and 9.

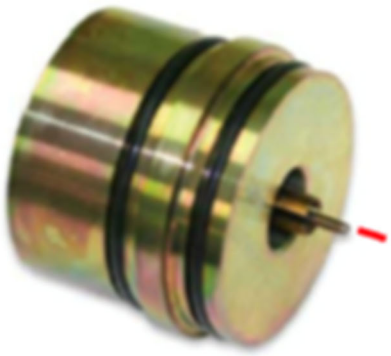
b) EWAPS fails to disclose a wireless ground contact connector in wireless electrical contact with the TSA, as claimed in Claims 1 and 9.

121. As mentioned above, the Petition does not explain what structure in EWAPS corresponds to the claimed "wireless ground contact connector." Further, the Petition has not specified which structure of EWAPS corresponds to the "tandem seal adapter." The Petition includes the same photograph above regarding the

disposable bulkheads, but does not label which portion it believes to be the claimed TSA.

122. To the extent that EWAPS discloses a wireless ground contact connector (as part of the RCA connector) and TSA, the Petition does not address how wireless electrical contact is made between these structures because it does not do so. Based on a fair read of EWAPS, a POSITA may infer (though it is not disclosed) that the wireless ground contact connector is part of the "pin connect" shown at the end of the loading tube:

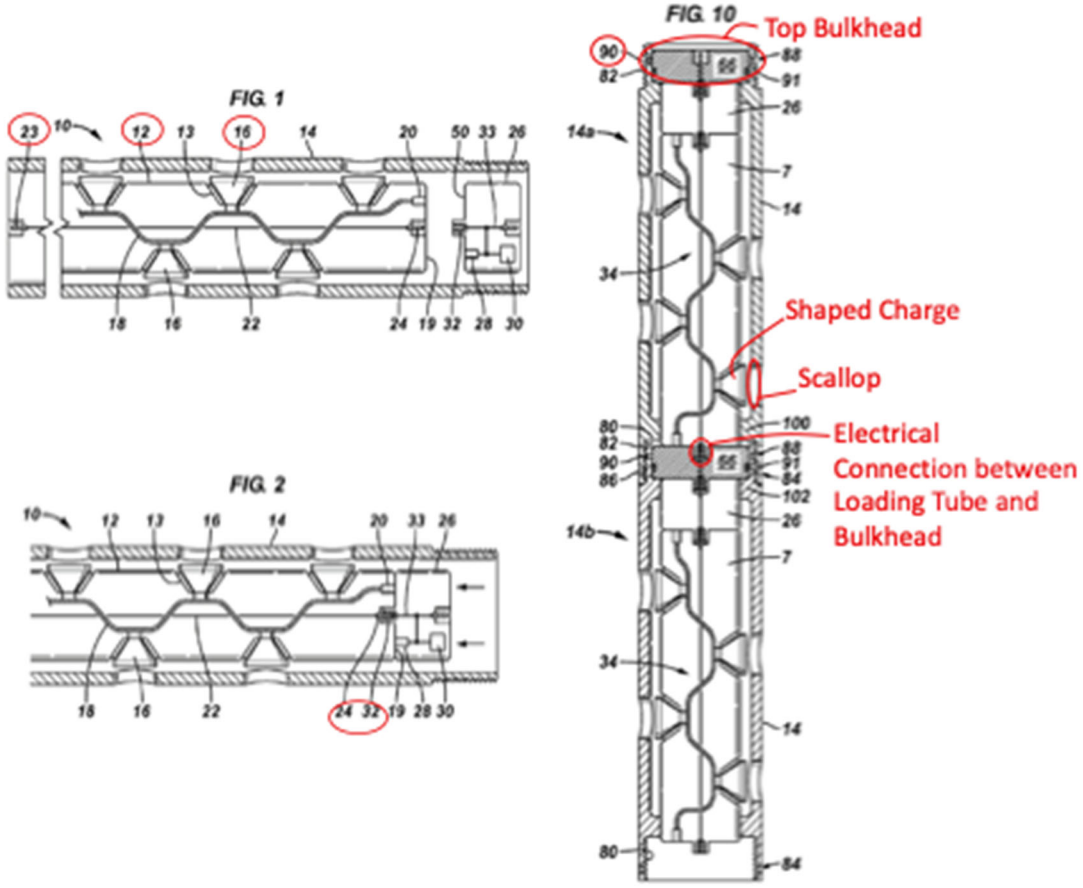




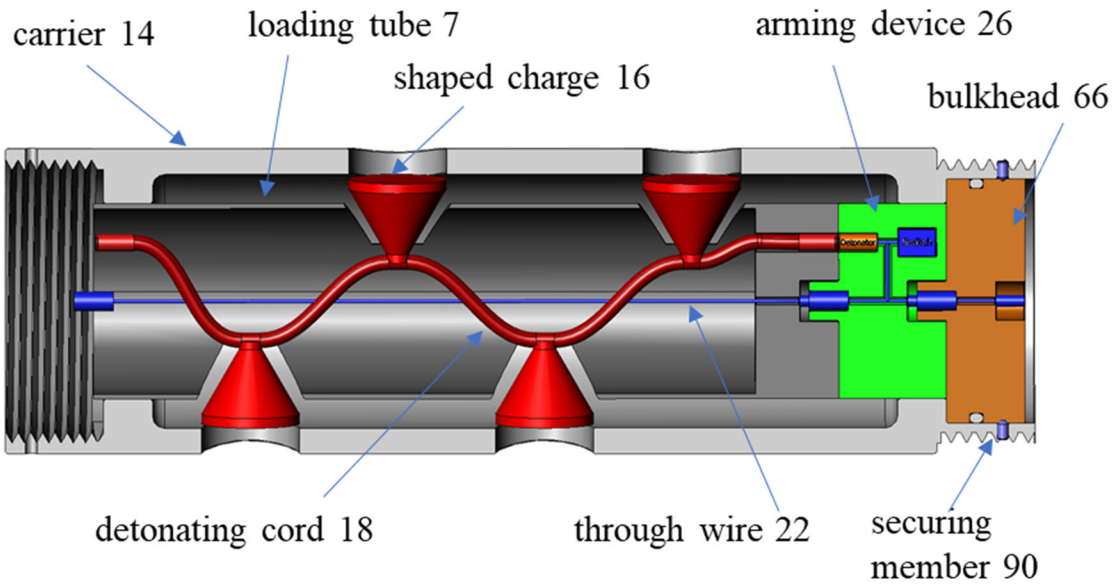
123. However, as seen above, the pin extending from the bulkhead would be received by the pin connect, and thus the wireless ground contact connector never contacts the TSA itself, much less "is in wireless electrical contact with" as claimed in '938 Patent. Thus, EWAPS does not show a wireless ground contact connector in wireless electrical contact with the tandem seal adapter, as claimed in Claims 1 and 9.

5. Black Does Not Anticipate the Challenged Claims (Ground 6)

124. Petitioner alleges that Black anticipates Claims 1-2, 4-5, 7-9, and 11-20 of the '938 Patent. Black generally describes a perforating gun 10 with a conventional charge tube ("loading tube" 12) disposed inside of a gun carrier 14 (Fig. 10 (below)), and an EBBA assembly (arming device 26) according to well-known EBBA safety standards within the oil and gas perforating industry. Ex. 1002 ¶¶[0006], [0023], Figs. 2, 4, 8-10.



125. A CAD model representation was also made of Black's Fig. 10 to provide better clarity on the system is illustrated below in cross section. For this representation, because of the lack of disclosure in Black, an assumption was made that the end of the loading tube had to be solid in order to provide a means for positioning the end of the detonation cord for alignment with the arming device.

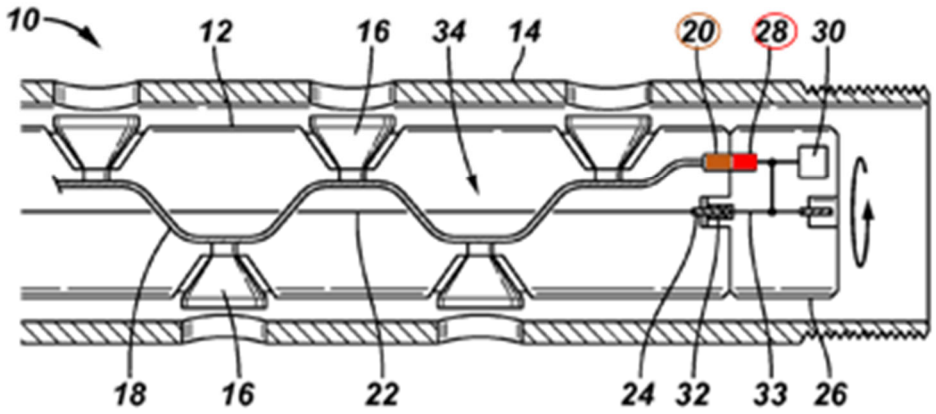


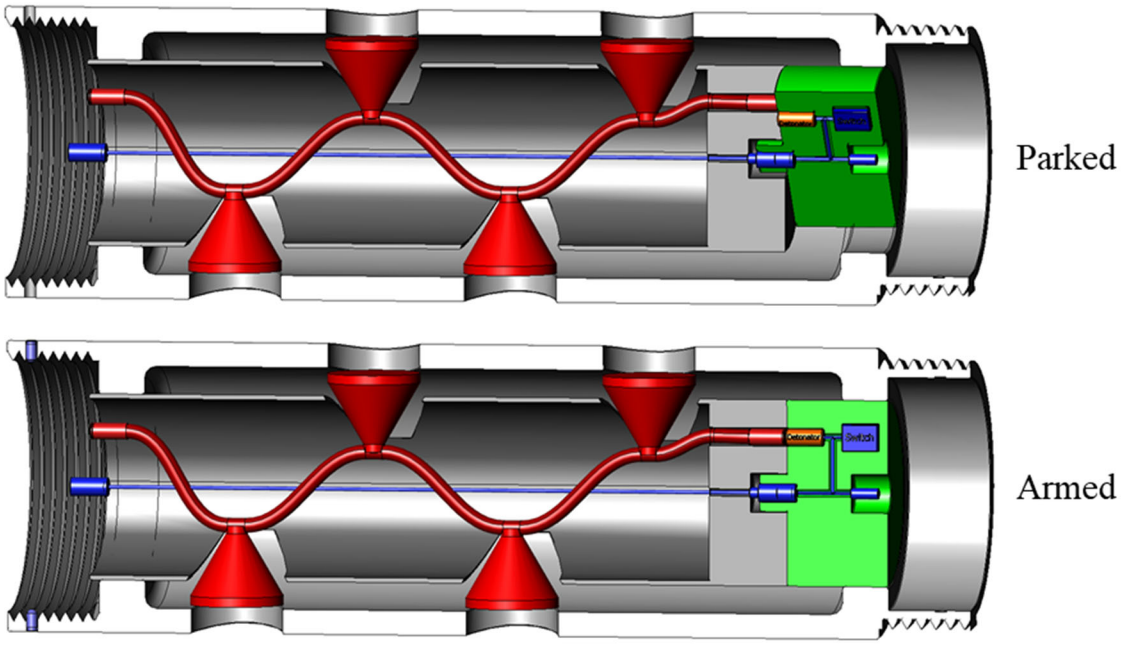
126. For example, Black (as shown above) very generally discloses an EBBA system in which, first, an electronic connection between perforating gun carriers 14a, 14b is made by an "electrical connector 23 of the loading tube 12 . . . connected to [a] . . . bulkhead 66 *and rotated along its longitudinal axis to the desired orientation*." *Id.* ¶[0038] (emphasis added), Fig. 10. The conventional loading tube

12 that Black discloses must be rotated/oriented to properly align the shaped charges 16 with the scallops, before locking the loading tube 12 and arming device 26 in the desired orientation by connecting the top bulkhead 66 (as labeled in annotated Fig. 10, above) and locking the top bulkhead 66 with securing member 90, e.g., a set screw. *Id.* ¶¶[0038], [0040], Fig. 10.

127. The EBBA arming device 26 that Black discloses connects initially to the loading tube 12 in a "park" position, in which the arming device 26 and the loading tube 12 are electrically connected between electrical connectors 24, 32. *Id.* ¶¶[0025], Fig. 10. The arming device 26 is rotated to an "armed" position in which a detonator 28 within the arming device 26 is aligned with an end 20 of a detonating cord 18 in the loading tube 12. *Id.* ¶¶ [0027]-[0028], Fig. 4 (below). The two positions are also illustrated in the second figure below for the CAD model.

FIG. 4

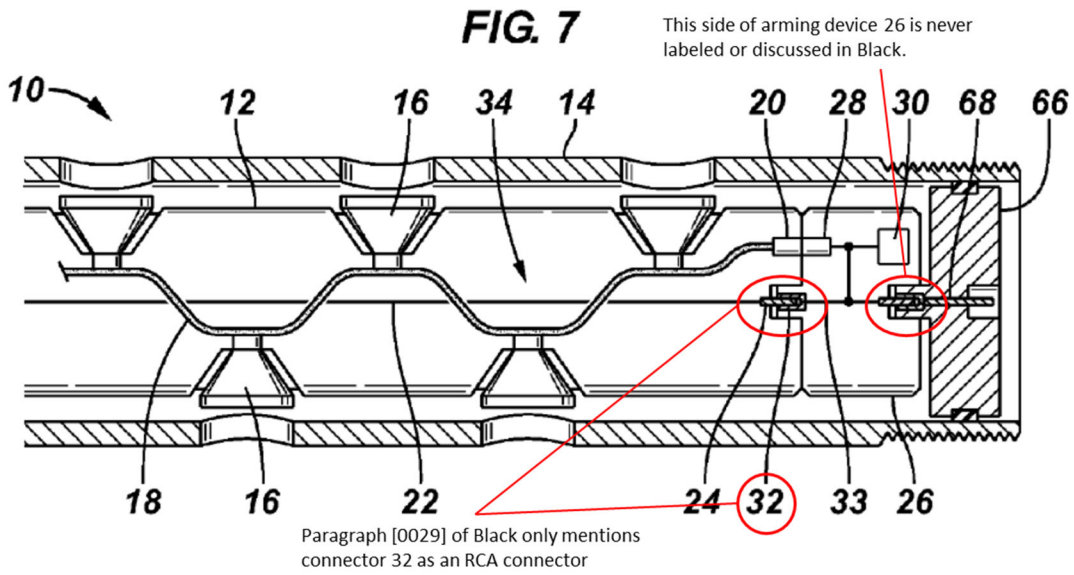




128. Black is overwhelmingly directed to the arming procedure—i.e., moving the detonator 28 into ballistic alignment with the end 20 the of the detonating cord 18, and securing the loading tube 12 and the arming device 26 in the required orientation by locking the top bulkhead 66 with the set screw 90. Black does not disclose any further details regarding the detonating cord 18 and/or loading tube 12 with respect to the other. In fact, description(s) of either of those conventional components are largely absent from Black. For example, Black does not describe at all how the detonating cord 18 is held oriented in place for ballistically aligning with the detonator 28 or how the loading tube 12 and/or detonating cord 18 are arranged at the end of the loading tube 12 opposite the arming device 26.

a) Black fails to disclose a detonator including . . . a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in Claims 1, 9, and 13.

129. The Petition never states what specific structures of Black correspond to the wireless signal-in connector, the wireless through wire connector, and the wireless ground contact. Instead, the Petition states that arming device 26 corresponds to a detonator and that "Black teaches that electrical connectors of arming device 26 can be two conductor RCA connectors." Pet at 34-35. First, this characterization of Black is misleading. Black makes only a single mention of RCA connectors, found in paragraph [0029]: "Electrical connector 24 of loading tube 12 and electrical connector 32 of arming device 26 are depicted as male and female devices, for example RCA connectors." Ex. 1002 ¶[0029]. Crucially, paragraph [0029] of Black only refers to a single connector 32 of arming device 26, as summarized in the following annotated Figure 7 of Black; the connector on the opposite end of arming device 26 is never even labelled or discussed in Black.



130. Based on the above, arguing that Black discloses plural connectors of arming device 26 as RCA connectors is misleading and goes beyond the explicit teachings of the reference. At best, Black only discloses that connector 32 may be an RCA connector, and Black further provides no information whatsoever regarding any connectors on the opposite side of arming device 26. Accordingly, this only accounts for at most two of the three claimed wireless connectors, and Petitioner does not an attempt to identify which of the claimed wireless connectors are disclosed by the purported RCA connector.

131. Further, Black makes no mention of a ground connection, much less a wireless ground contact connector as claimed, anywhere in its entire disclosure. It is possible that such a ground connection could be provided by a wired connection

that is not shown; it is impossible to conclude that Black discloses a wireless ground contact connector because Black simply does not discuss electrical ground at all.

132. Thus, Black does not disclose a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in Claims 1 and 9.

b) Black fails to disclose a wireless ground contact connector in wireless electrical contact with the TSA as claimed in Claims 1 and 9.

133. The Petition never clearly identifies any structure in Black that corresponds to a wireless ground contact connector.

134. Petitioner further argues that "[t]he electrical contacts on the arming device 26, provide for . . . a ground connection." Pet at 35. However, Black does not mention anything about electrical ground even once; there is no mention whatsoever about how the circuits are grounded. It is not clear if the electrical connectors shown provide a second conductor for a ground or if Black relies on contact through the carrier and metallic components for a ground path.

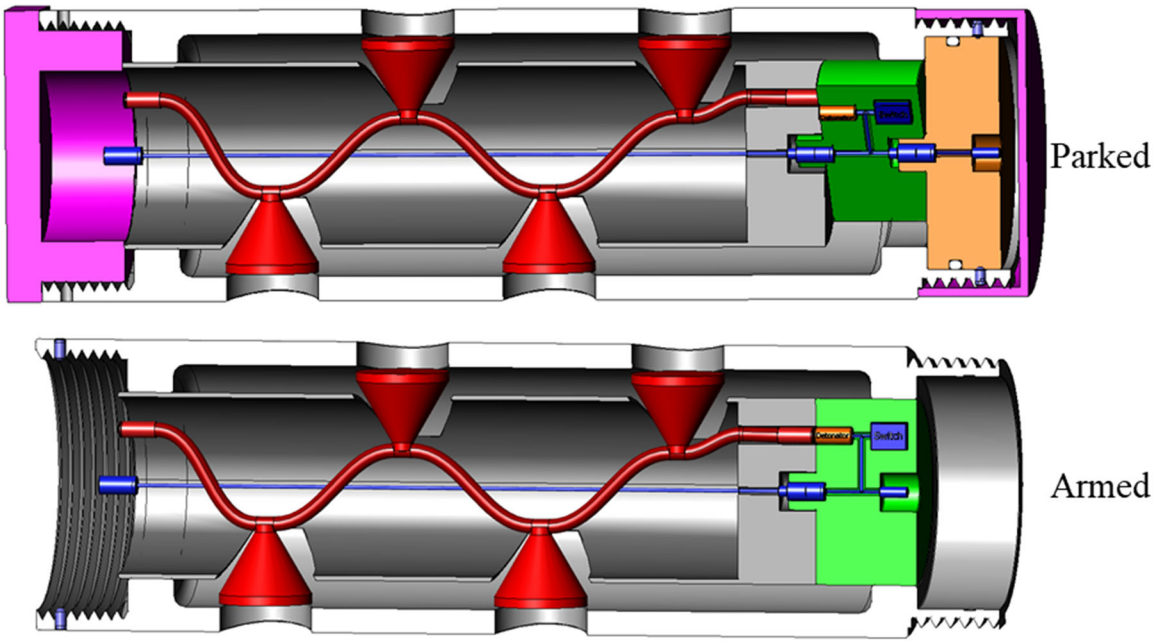
135. Mr. Parrott attempts to overcome this deficiency by arguing that a ground would be required for the electronics of Black to function properly. Ex. 1007 ¶304. However, the general requirement for a ground by no means establishes the specifically claimed limitation of a wireless ground contact connector in wireless

electrical contact with a TSA. This goes beyond the explicit disclosure of Black, which does not mention or discuss a ground connection even once. Thus, Black does not show a wireless ground contact connector in wireless electrical contact with the TSA as claimed in Claims 1 and 9.

c) Black does not disclose the steps recited in Claim 13.

136. Claim 13 recites a specific set of method steps to be performed with the claimed structures. Black is silent as to where parts of the perforating gun are assembled or any transportation of parts. A POSITA might infer that the arming-device feature would enable the gun to be assembled at a remote location, with the arming device in the park position (unarmed). The gun could then be armed at the wellsite by rotating the arming device to the armed position. The detonator would already be installed in the arming device and would simply need to be rotated into alignment, with no insertion step required. As illustrated in the CAD figure below, the gun could be transported fully-assembled, in the parked position (shown with protective endcaps added) and then reconfigured to the armed position at the wellsite. Thus, the entire gun is pre-assembled prior to shipment. The Petition seems to acknowledge this where it states: "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." Pet. at 148.



137. Paragraphs [0026]-[0027] of Black cited by Petitioner make no mention of assembly sites for different parts of the perforating gun, and the paragraph 566 of the Parrott declaration cited by Petitioner merely copies verbatim the argument from the Petition (Pet. at 148 (citing Ex. 1002 ¶¶[0026]-[0027]; Ex. 1007 ¶566) without explanation or citation of the common industry practices or safety requirements.

138. If Black is preassembled as suggested above, in the parked position, and then shipped to the well site, then the claimed feature of inserting a detonator …at the wellbore site would not be disclosed by Black since it would be pre-installed before shipment.

139. Thus, Black does not disclose transporting the perforation gun system to a wellbore site, wherein at least one of inserting a charge holder into an outer gun carrier, inserting a top connector into the outer gun carrier adjacent the charge holder, and connecting a through wire to the wireless through wire connector is performed before transporting the perforation gun system, while inserting a detonator into the hollow channel of the top connector is performed at the wellbore site, as claimed in Claim 13.

6. Lanclos Does Not Anticipate the Challenged Claims (Ground 8)

140. Petitioner alleges that Lanclos anticipates Claims 1-2, 4-5, and 7-20 of the ’938 Patent.

141. Much like Schacherer, Lanclos is generally directed to providing a detonator in a sub positioned between adjacent guns. As shown in Figure 3 of Lanclos below, the detonator 88 is positioned in a cartridge sub 68, and subsequently connecting the cartridge sub 68 between perforating gun 62_1 and perforating gun 62_2:

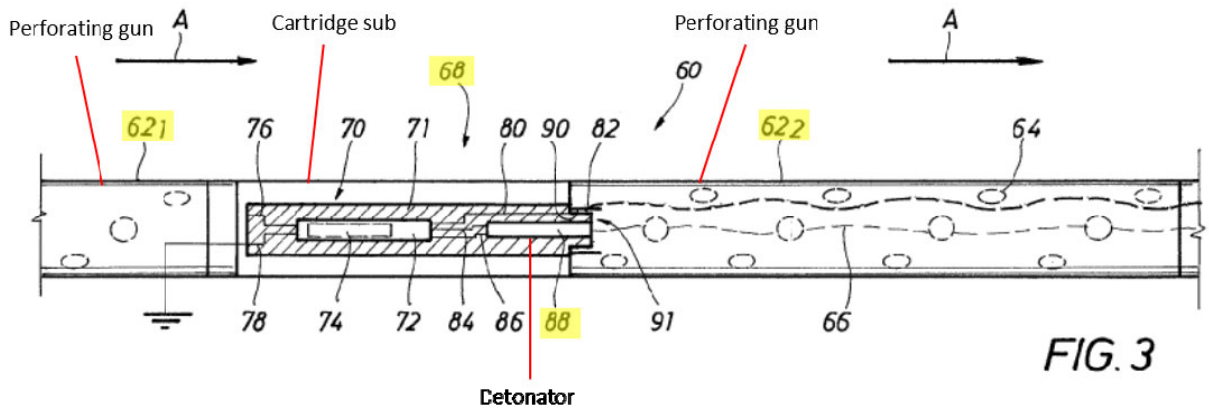


FIG. 3

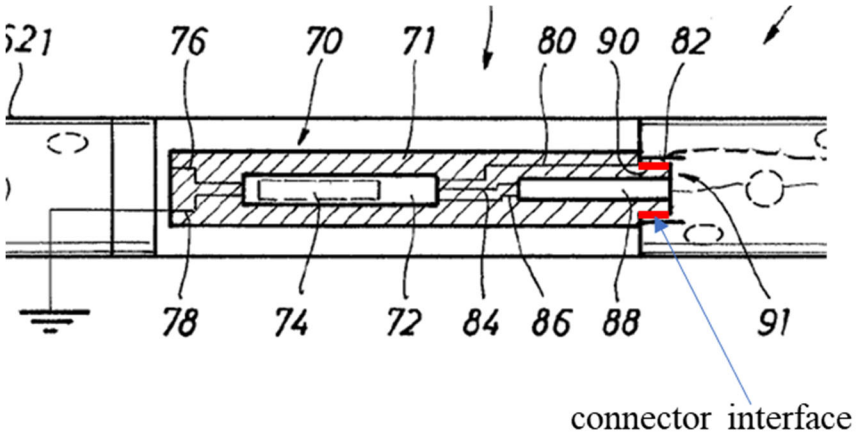
142. In this way, the detonator 88 of Lanclos is provided in a completely different structure (cartridge sub 68) from the perforating gun 62_2 that includes the shaped charges. While Lanclos provides for a wireless connection via connector 90 on the downstream side of the sub 88, Lanclos shows a wired connection on the upstream side.

a) Lanclos fails to disclose a detonator including... a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in claims 1, 9, and 13.

143. Petitioner never identifies structures of Lanclos as particularly corresponding to a wireless signal-in connector, a wireless through wire connector, or a wireless ground contact connector. Instead, Petitioner suggests that Lanclos discloses "a cartridge sub 68 with electrical connector 90" connecting the cartridge sub to a perforating gun, and posits that such "connectors" are provided "on the

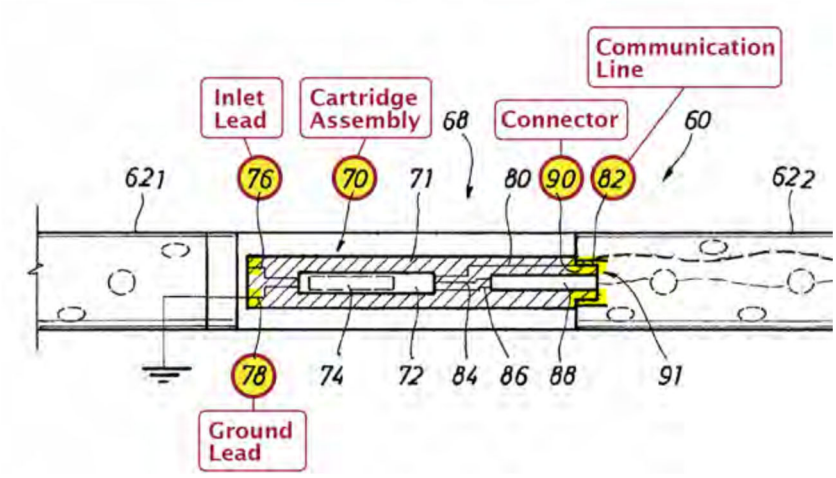
upstream and downstream sides of the cartridge sub 68," without any specific reference to such a teaching in Lanclos (because it does not exist). Pet. at 36.

144. Petitioner alleges that the connector 90 provided at the downstream side of the cartridge sub 68 is at least one of the separate and distinct claimed wireless signal-in connector, wireless through wire connector, and wireless ground contact connector, and then leaves the rest unexplained. Lanclos discloses a single wireless connector 90 on the downstream side of the cartridge sub 68 as illustrated by the connector interface highlighted in red from the section of Figure 3 below; this only accounts for one connector, whereas independent Claims 1, 9, and 13 require three separate and distinct connectors. The detonation cord or a ballistic coupling must occur on the centerline, so no second connector can be located there.

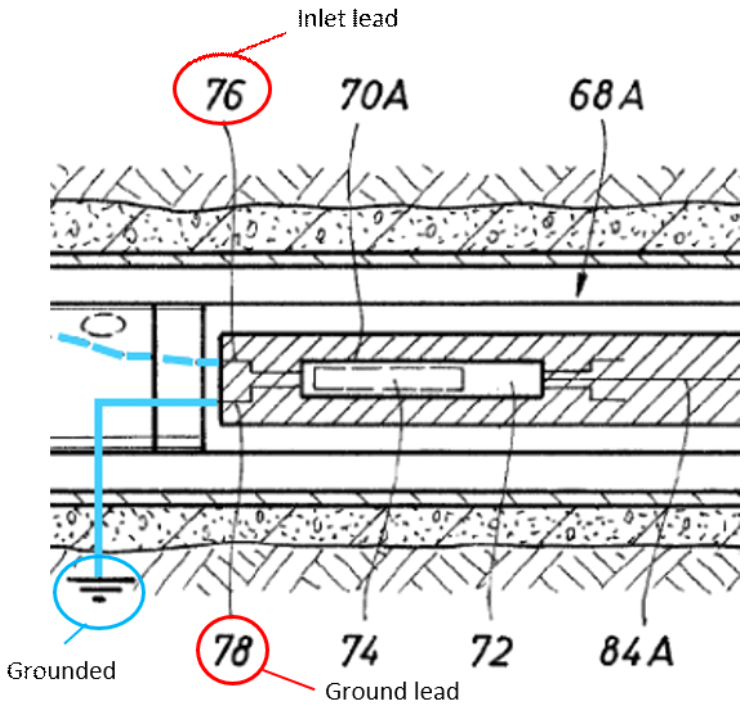


145. The Petition further argues that "the connectors lead to 'an inlet lead 76, a ground lead 78 and a supply lead 80."[6] Pet. at 36. Petitioner appears to suggest that the inlet lead wire 76 and the ground lead wire 78 are connected to a wireless connector at the upstream side. The closest Lanclos comes to describing such a wireless connection on the upstream end is between the upper carrier 62_1 and the cartridge sub 68 with "spring connectors" on the "upstream and downstream sides of the cartridge sub 68." Ex. 1015, 6:38-39; Ex. 1007 ¶. In the figure, the spring connectors on the upstream end do not couple directly to the detonator but rather couple the cartridge sub to the upper carrier.

[6] It will be understood that the inlet lead 76, the ground lead 78, and the supply lead 80 cannot be the claimed wireless connectors themselves, nor does Petitioner argue as such. For example, the inlet lead 76, the ground lead 78, and the supply lead 80 are all depicted in the Figures of Lanclos as wired.



146. Lanclos clearly depicts that both the inlet lead 76 and the ground lead 78 are wires extending from the upstream gun to the cartridge sub 68, passing directly through as wires to the identified detonator, i.e. the cartridge assembly 70 as shown in annotated excerpted Fig. 3.



147. Lanclos simply does not provide any detail at all about how the ground lead wire 78 is ultimately connected to ground, with the exception of Fig. 3. Ground lead wire 78 is shown in rough schematic form as being grounded through the upstream gun and wired to the cartridge sub 68.

148. Lanclos merely describes the inlet lead 76 and the ground lead 78 as they relate to the switch assembly; there is no discussion at all in this passage describing any sort of wireless connection between the switch assembly and the inlet lead 76 and ground lead 78, much less that there is some sort of wireless connector between either the bulkhead and the detonator or between the wireless ground contact connector and the TSA as claimed in the '938 Patent.[7]

---

[7] Column 5, lines 1-11 reads:

> In one example of operation, the switch assembly **72** regulates transmission therethrough of electrical signals through the switch assembly **72** that are received by an inlet lead **76** in the cartridge sub **68** from the upstream perforating gun **62** $_1$. The switch assembly **72** also includes a ground lead **78** on the side with the inlet lead **76**; the ground lead **78** is selectively in electrical communication with the switch assembly **72** such as by the switching action provided by the circuit board **74**. Exiting the switch assembly **72**, on a side opposite the inlet lead **76**, is a supply lead **80** that is in electrical communication with a communication line **82** shown extending within the downstream perforating gun **62**$_2$.

149. Thus, Lanclos does not disclose each of the wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in Claims 1, 9, and 13.

b) Lanclos fails to disclose that the wireless ground contact connector is in wireless electrical contact with the TSA, as claimed in Claims 1 and 9.

150. As noted above, the Petition does not explain what particular structure in Lanclos corresponds to the claimed wireless ground contact connector, and Lanclos itself does not readily present any such structure.

151. Regarding the TSA, the Petition asserts in the header for Section IV.D.2.h.: "Lanclos teaches a tandem." Pet. at 81-82. Petitioner appears to argue that the connector sub 116 corresponds to the claimed TSA, and further argues that the connector sub 116 "is in electrical contact with the ground contact connecter (sic) of the detonator." *Id.* at 82. There is simply no disclosure that the connector sub 116 is in wireless electric contact with anything. In fact, the only mention of connector sub 116 is found in Lanclos provides that "[T]the connector sub 116 may optionally be provided for coupling upstream ends of the cartridge subs 68 with an upstream perforating gun." Ex. 1015, 7:17-19. With reference to Figure 5 of Lanclos, the connector sub 116 is shown without any detail, and the arrangement

shows gun 62_2 connected to the cartridge sub 68, which is connected to the connector sub 116, which is connected to gun 62_n. Connector sub 116 is a blank box.

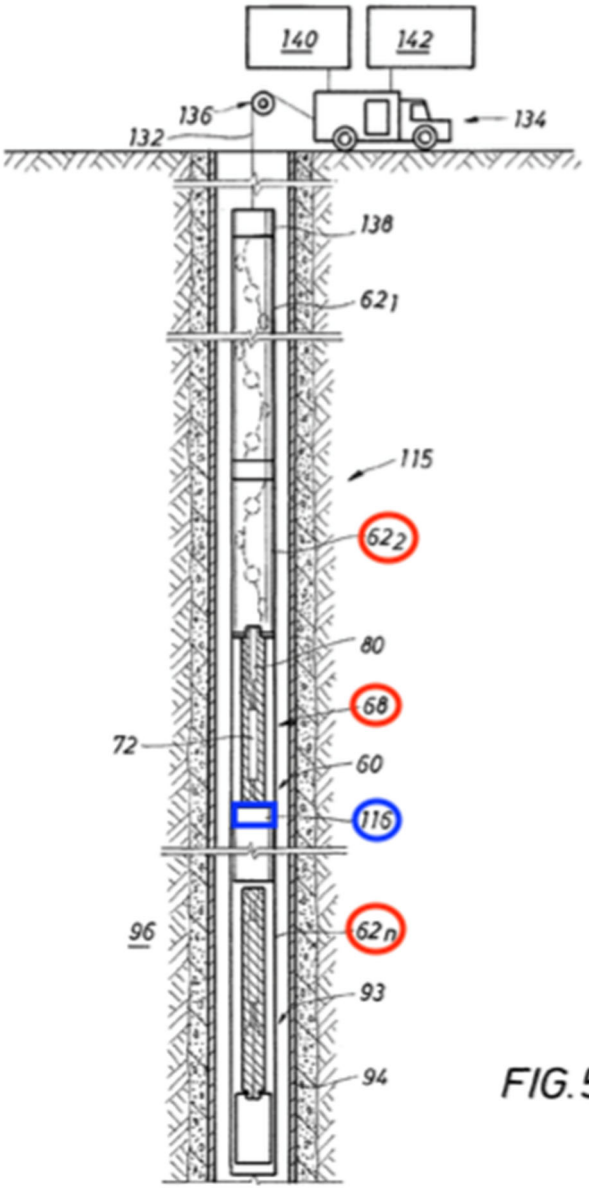


FIG. 5

152. In any event, the Petition misstates claim limitations and omits key words. Claims 1 and 9 do not merely claim a "ground contact connector," they claim

a "wireless" ground contact connector. Further, Claims 1 and 9 do not merely claim that the TSA is "in electrical contact" with the wireless contact ground connector, the claim requires that the TSA is in "wireless" electrical contact with the wireless contact ground connector.

153. Petitioner cites column 6, lines 48-50 of Lanclos as supporting its position (Pet. at 82), but this portion of Lanclos only discusses the signal wire and makes no mention whatsoever about ground lead 78. The Parrott Declaration is of no help on this point either, as the cited paragraph 481 of Parrott merely states, without any supporting reasoning, that "[a] POSITA would understand Lanclos to teach that the connector sub 116 is in electrical contact with the ground contact connecter (sic) of the detonator." Ex. 1007 ¶481. While Figure 3 of Lanclos shows ground lead 78 (shown as a wire) passing through an adjacent gun, there is simply no indication that there is any kind of wireless electrical contact with connector sub 116. To the contrary, the figure specifically shows the wire originating as a grounded wire in the adjacent gun and passing to the connector sub 116. A POSITA at the time of the '938 Patent would understand this to be a wired ground lead passing through to the connector sub 116.

154. Thus, for at least the above reasons, Lanclos does not disclose each of the wireless ground contact connector is in wireless electrical contact with the tandem seal adapter, as claimed in Claims 1 and 9.

c) Lanclos fails to disclose a detonator contained entirely within the outer gun carrier, as claimed in Claim 1.

155. Independent Claim 1 claims in relevant part, "a detonator contained entirely within the outer gun carrier."

156. Petitioner argues that "Lanclos teaches an elongated body 71 holding a detonator 88 which has its own body" and "Lanclos' detonator 88 and elongated body 71 each teach the claimed detonator body." Pet. at 18. Petitioner further argues that the cartridge sub 68, which includes the elongated body 71, is part of the outer gun carrier. *Id.* at 129.

157. However, a POSITA would understand that an outer gun carrier is a structure that includes a shaped charge. A POSITA would understand that cartridge sub 68 is either a tandem sub or similar gun connector sub. In other words, once the carrier including the shaped charge transitions to a separate housing or sub within the tool string, that second structure is not part of the first outer gun housing. The cartridge sub is clearly separate from the gun carriers on either side, illustrated with scallops (identified as shaped charges 64) and detonation cord in Figure 3. The cartridge sub will have a threaded interface with both carriers as well as o-ring seals,

making it a separate structure and downhole tool. As seen from the annotated Figure 3 of Lanclos below, the cartridge sub 68 is a separate structure from the perforating gun 62 that actually includes the shaped charges.

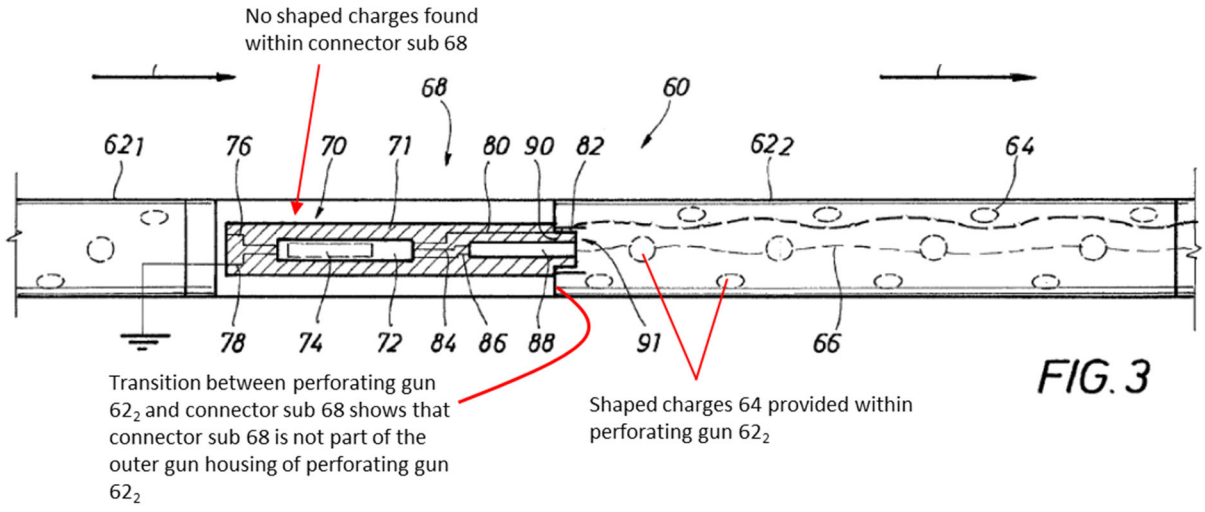


FIG. 3

158. Without any shaped charges being provided in cartridge sub 68, it is clear that a POSITA would not consider cartridge sub 68 of Lanclos to be an outer gun housing, and therefore elongated body 71 (i.e., the purported detonator) is not contained entirely within an outer gun housing. A POSITA would be quite familiar with the typical alternating pattern of perforating guns and connector subs that make up a perforating gun string as depicted in Lanclos.

159. Thus, Lanclos does not disclose a detonator contained entirely within the outer gun carrier, as claimed in Claim 1.

d) Lanclos does not disclose the steps of Claim 13.

160. First, Lanclos does not disclose the step of "(b) inserting a top connector into the outer gun carrier adjacent to the charge holder, the top connector comprising a hollow channel." Petitioner argues that Lanclos teaches this feature but it does not. "Lanclos' cartridge assembly 70 inside a cartridge sub 68, each of which hold a detonator and are in a carrier adjacent to a charge holder, teaching the claimed top connector." Pet. at 122-23. Petitioner appears to argue that cartridge assembly 70 is a top connector. First, as established above, cartridge sub 68 is separate from the perforating gun 62_2 and thus is not an outer gun carrier. Accordingly, cartridge assembly 70 is clearly never inserted into an outer gun carrier, as required by Claim 13.

161. Further, Lanclos never discloses that cartridge assembly 70 is adjacent to a charge holder. The charge holder is never shown in Figure 3 of Lanclos; all that is shown is dotted-lined circles, presumably designating scallops or recesses 64 in the gun carrier that would be aligned with the shaped charges within, illustrated in a rough schematic form:

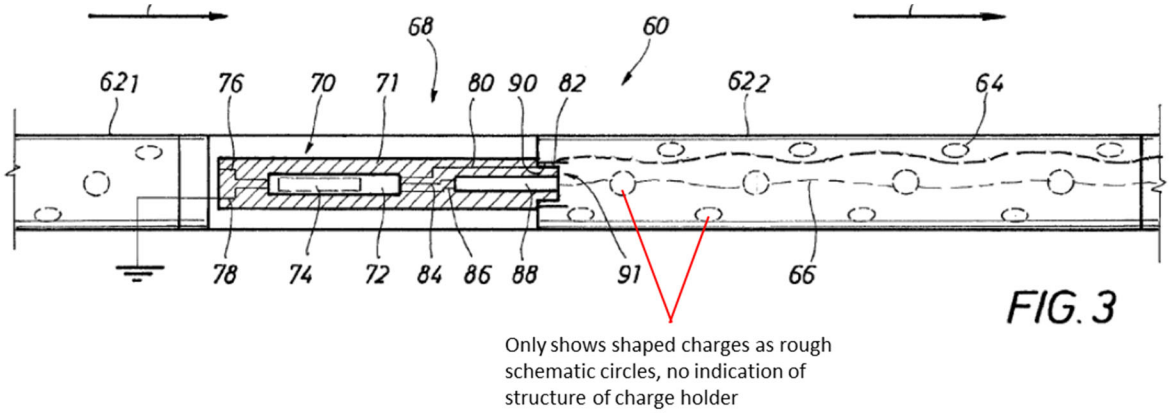


FIG. 3

162. Without any information about the structure of the charge holder, it is impossible to determine whether the cartridge assembly 70 is adjacent to a charge holder. Further, connector 90 is provided at the downstream end 91 of cartridge sub 68, which would necessarily be positioned between the cartridge assembly 70 and any charge holder within perforating gun 622. Lanclos does not disclose that cartridge assembly 70 is inserted into an outer gun housing adjacent to a charge holder, and therefore cartridge assembly 70 cannot be the top connector of Claim 13.

163. Lanclos also does not disclose the step of "(c) inserting a detonator into the hollow channel of the top connector . . . wherein . . . step (c) is performed at the wellbore site."

164. The Petition simply points to the background section of Lanclos, which notes that "detonators are connected to the detonating cords in the field," and argues that this discloses the limitations of Claim 13. Pet. at 148. Merely connecting a

detonator to a detonator cord in the field does not satisfy the limitation of inserting a detonator into a hollow channel of a top connector (not to mention satisfy the remaining structural limitations relating to the wireless detonator). For example, Petitioner states that cartridge assembly 70 is the top connector. *Id.* at 122-23. It is entirely possible for the detonator 88 to be inserted into the cartridge assembly 70 at a factory, yet there is no teaching in Lanclos that the detonator 88 is connected to a detonator cord and is energetically coupled to the detonating cord until the connector sub 68 is connected to the perforating gun 62_2 in the field. In fact, Lanclos strongly suggests that connection of the detonating cord to the connector sub 68 does not occur until the assembly is shipped to the field: "[t]hus they are shipped to the field with the electrical portions and high explosive [the detonators] coupled together in a single unit." Ex. 1015, 2:23-25. In other words, detonator 88 and related electronics are inserted into the cartridge assembly 70 (i.e., the purported top connector) and then shipped to the field, rather than being inserted into the cartridge assembly 70 at the wellbore site.

7. Goodman Does Not Anticipate the Challenged Claims (Ground 18)

165. Petitioner alleges that Goodman anticipates Claims 1-17 and 19-20 of the '938 Patent, but Goodman does not disclose all of the limitations of independent Claims 1, 9, and 13.

166. Similar to Harrigan, Rogman and EWAPS, Goodman is generally directed to a pre-assembled perforating gun that includes assembling "[a]t a first location, e.g., a shop, which is not the location at which perforating operations will be conducted, the loading tube is completely assembled." Ex. 1018, Abstract. A wired, RF-safe initiator is also pre-installed prior to shipment. *Id.* ¶[0025].

a) Goodman fails to disclose a detonator including…a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in Claims 1, 9, and 13.

167. Petitioner argues that structures 15, 45, and 47 of Goodman each correspond to a detonator. Pet. at 130. However, Petitioner does not point to any structure that purportedly corresponds to a wireless signal-in connector, a wireless through wire connector, or a wireless ground contact connector. Instead, Petitioner merely argues in very general terms that an addressable detonator would require three connections, and that electrical connectors 11, 12, 43, and 44 of Goodman could "be used with RCA connectors." *Id.* at 37-38. What Petitioner does not address is that the cited connectors 11, 12, 43, and 44 are not part of any detonator. The detonator is illustrated as a simplistic structure within the loading tube, separate from the connectors. As seen in the annotated Figures 2 and 4 of Goodman provided below, each of connectors 11, 12, 43, and 44 are provided on a loading tube 10, and not a detonator:

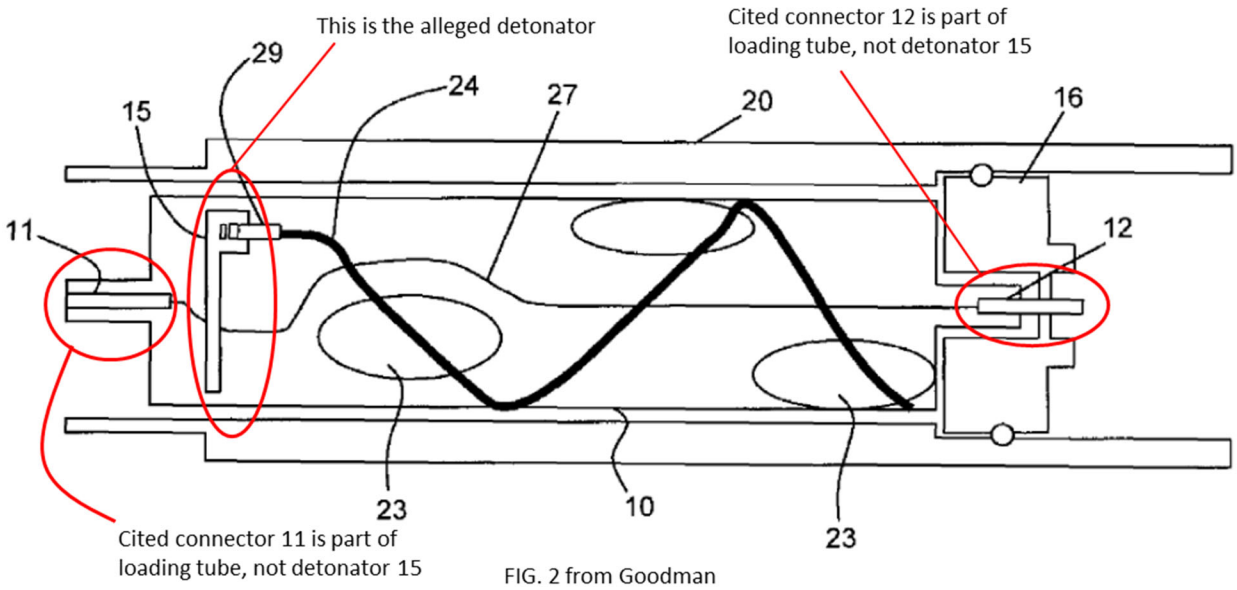


FIG. 2 from Goodman

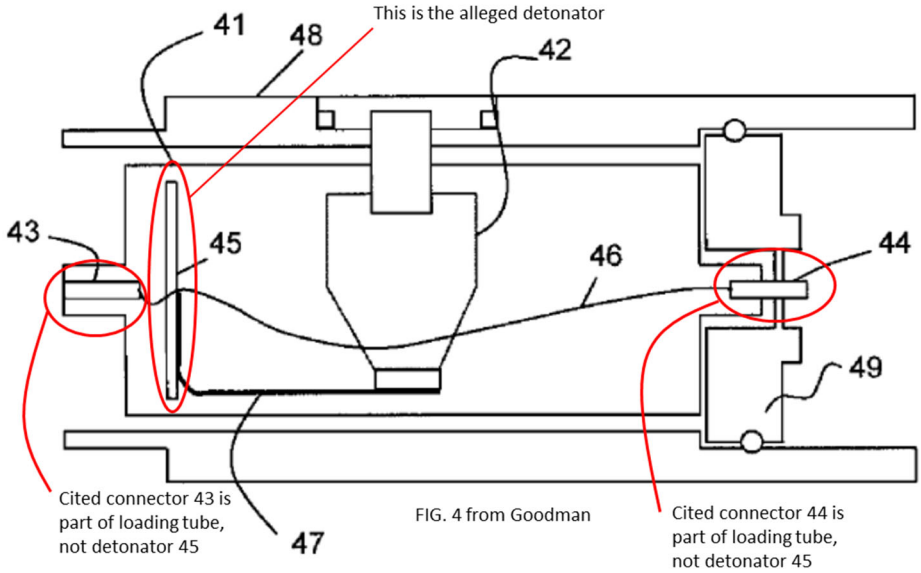


FIG. 4 from Goodman

168. From the above, it is clear that connectors 11, 12, 43, and 44 are not part of the alleged detonators 15, 45; instead, these connectors are provided on the loading tubes. The wiring between these connectors is illustrated as a single through-wire (wiring 27, 46) from one end of the loading tube to the other with no

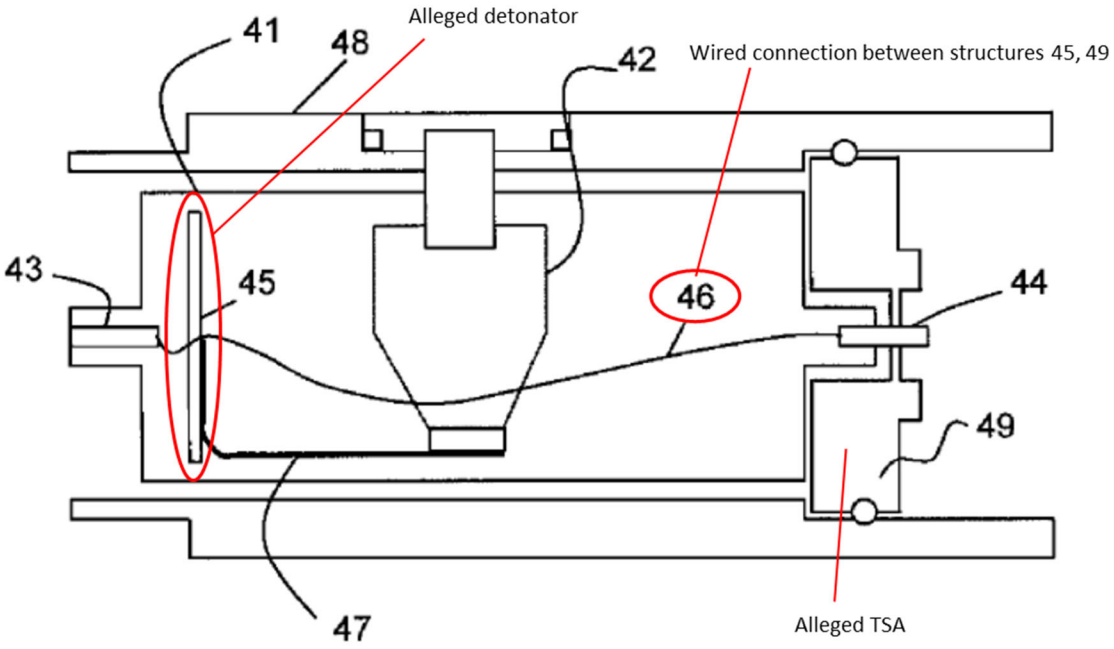
interface shown with the detonators. Further, Goodman itself indicates that the electrical connections to the detonators 15, 45 are in fact wires; paragraph [0020] of Goodman clearly indicates that "wiring" 27 is used to connect to alleged detonator 15, whereas paragraph [0024] clearly states that "wiring" 46 connects to alleged detonator 45. Ex. 1018 ¶¶[0020], [0024]. In other words, not only does Petitioner cite connectors 11, 12, 43, and 44 that are not even part of the alleged detonators 15, 45, even the briefest reading of Goodman clearly indicates that any electrical connections to detonators 15, 45 are in fact wired, not wireless. Clearly, Goodman does not disclose a detonator with wireless connectors.

169. Thus, Goodman does not disclose a detonator including a wireless signal-in connector, a wireless through wire connector, and a wireless ground contact connector, as claimed in Claims 1, 9, and 13.

b) Goodman fails to disclose a wireless ground contact connector in wireless electrical contact with the TSA, as claimed in Claims 1 and 9.

170. As mentioned above, Petitioner does not point to any structure that purportedly corresponds to a detonator including a wireless ground contact connector. Petitioner further argues that bulkheads 16, 49 are TSAs that engage connectors 11, 12. Pet. 83-86. Assuming that these bulkheads are TSAs, there is no disclosure that the (nonexistent) wireless ground contact connecter is in wireless

electrical contact with the TSA. Rather, since the RF-safe initiator is always described as wired in Goodman, a POSITA would understand that the connectors 11, 12 are pre-wired during gun assembly. However, as noted above, connectors 11, 12 are not part of the detonator 15 and cannot be the claimed wireless ground contact connector. Further, to any extent that structures 16, 49 are TSAs, electrical connection between the detonators 15, 45 and alleged TSAs 16, 49 is made by wirings 27, 46. Fig. 4 of Goodman is excerpted and annotated below showing the wired connections:



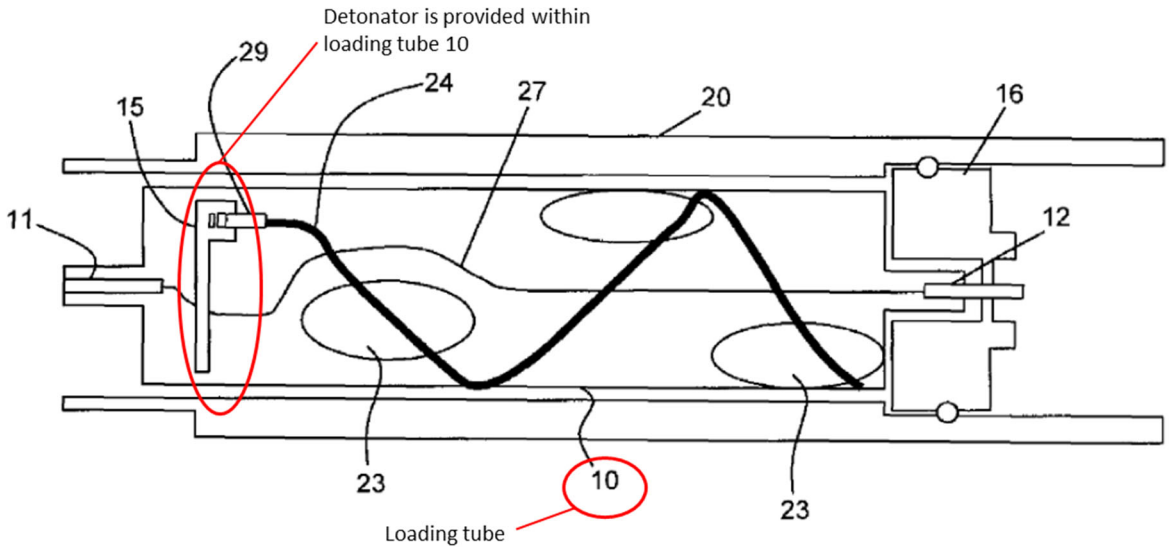
171. From the above, there is clearly no wireless electrical contact between a wireless ground contact connector of the alleged detonators 15, 45 and alleged TSAs 16, 49, as required by Claims 1 and 9.

172. Thus, Goodman does not disclose "a wireless ground contact connector in wireless electrical contact with the tandem seal adapter," as claimed in Claims 1 and 9 of the '938 Patent.

c) Goodman fails to disclose all of the steps of Claim 13.

173. Goodman does not disclose multiple recited steps of Claim 13, which is not surprising, since it is not at all concerned with a pre-wired gun and modular detonator like the '938 Patent.

174. First, Goodman does not disclose the step of "(b) inserting a top connector into the outer gun carrier adjacent to the charge holder, the top connector comprising a hollow channel." Petitioner argues that the device in Goodman must "inherently" include a component to hold the detonator 15, 45. Pet. at 123-124 Instead, Figure 2 of Goodman clearly shows that the detonator 15 is provided within loading tube 10 (i.e., the charge holder) itself and not "adjacent to the charge holder" as claimed:



175. There is no structure corresponding to a top connector in Goodman and Petitioner completely fails to demonstrate such. The major structural components within the gun are limited to the loading tube and the bulkhead (or TSA) on the end. Accordingly, to any extent that there is inherently a component to hold the detonator, such a component would be found within the loading tube 10 itself and not adjacent to the loading tube.

176. Next, Goodman does not disclose the step of "(c) inserting a detonator into the hollow channel of the top connector." As noted above, Goodman does not disclose a top connector, and therefore it is not possible for Goodman to disclose inserting a detonator into a hollow channel of the top connector.

177. Finally, Goodman does not disclose the step of "wherein . . . step (c) is performed at the wellbore site." Petitioner cites paragraph [0005] of Goodman as

purportedly disclosing inserting a detonator into the hollow channel of a top connector at the wellbore site. Pet. at 148. This passage of Goodman merely relates to how conventional wired detonators (not the claimed detonators including three separate and distinct wireless connectors) are connected to perforating guns, and makes no mention whatsoever regarding inserting a detonator into a hollow channel of a top connector at a wellbore site. In the prior art method, a detonator was installed into a firing sub at the wellsite by making up multiple wired connections to a detonator and ballistically coupling to an extended length of detonation cord from the gun (*see supra* ¶¶31-35 for further description). To the contrary, Goodman's wired RF-safe initiator (i.e., the detonator) is pre-installed at the shop prior to shipment to the field location (i.e., wellbore site). Ex. 1018 ¶¶[0017], [0025]. Thus, Goodman does not disclose "wherein . . . step (c) is performed at the wellbore site," as claimed in Claim 13.

B. Obviousness Grounds

178. First, I note that it is difficult to understand exactly what obviousness positions the Petition is advancing. There are so many references "combined" with "and/or" connectors that it makes parsing it all out very difficult. As I have said above, every reference is missing multiple claim limitations, including the limitation of a wireless signal-in/through wire/ground contact connector and a wireless ground

contact connector in wireless electrical contact with the TSA, so none of the proposed "combinations" could possibly teach every element either. The secondary references fail to overcome these deficiencies in the primary references. As an example, Petitioner only cites Lendermon as teaching injection molding (Pet. at 169), and never makes any allegation whatsoever that Lendermon teaches anything related to wireless connectors or wireless electrical contact with a tandem seal adapter. Similarly, Petitioner only cites the SLB Catalog as purportedly teaching sealed bulkheads (*id.* at 54, 73) and purported industry standard safety practices (*id.* at 8, 149) and never makes any allegation whatsoever that the SLB Catalog teaches anything remotely related to wireless connectors or wireless electrical contact with a TSA.

179. Also, the Petition does not explain any motivation to combine the references with each other. Instead, there are many reasons a POSITA would not do so. I explain a non-exhaustive list of them here.

180. Petitioner merely asserts that "[a]ll of the cited references are in the field of oilfield perforating and discuss perforating," and proceeds to argue that any of the references could be combined based on five generic rationales. *See, e.g.*, *id.* at 8-9.

181. Petitioner's generic statements on motivation to combine further ignores specific details of the individual references that clearly shows a POSITA would not combine the references as proposed. The cited references propose differing solutions to issues encountered in oilfield perforation; combining the references would present significant technical obstacles and require substantial redesign of the underlying structures.

182. For example, while many in the industry have desired to eliminate the excessive time and safety risks of using wired detonators that have to be installed at the wellbore site, the prior art took very different approaches to achieve those goals. Schacherer keeps the detonator in a separate sub, but adds ballistic and electrical connections to mate the sub to the gun. Harrigan, Rogman, and EWAPS use addressable switches and a ballistic interrupt shutter that enables the detonator to be incorporated into the loading tube. Black uses an arming device that incorporates the detonator into the gun in a parked position, thus presumably to ship as such, and then to move the detonator to the armed position before deployment into the well. And Lanclos also uses a separate sub to house a detonator and maintains a wired connection on one end.

183. None of these references attacked the industry problem in the way that DynaEnergetics did. And the prior art attempted solutions provided features that

could be used by others to make improvements, but again those improvements would be different in kind and features from the solution DynaEnergetics invented.

184. However, these very different approaches would not be combined with each other or with other prior art teachings to arrive at the claimed invention of the '938 Patent. There would be no motivation, for instance, for a POSITA looking at Schacherer to integrate the detonator into the gun. The system is pre-wired in the shop away from the wellsite where costs are low. The physical separation between the detonator sub and the gun allows for the required safety measures, and one can rely on the addressable switch for safe transport.

185. In the system of Harrigan, Rogman, and EWAPS, there is no reason to exclude the detonator during off-site assembly due to the ballistic shutter. In fact, it would be disadvantageous for a POSITA to make such a modification, due to additional safety considerations and increased costs at the wellsite. There is also no motivation whatsoever for a POSITA to modify the system of Harrigan, Rogman, and EWAPS to make the detonator modular and insertable into a hollow chamber, as it is already integrated into the initiator module. The Black and Lanclos references are simply too conceptual for a POSITA to credibly take and modify to arrive at the claimed invention of the '938 Patent.

186. Additionally, there is no motivation for a POSITA to modify Schacherer to add a hollow channel for a detonator in a gun since the detonator is not needed in the gun. There is no motivation for a POSITA to modify the systems of Harrigan, Rogman, and EWAPS to add a hollow channel to the initiator module, which could be considered a top connector, since the detonator is pre-wired at the shop. If the initiator module is construed as a top connector, it cannot also be a detonator body. There is no motivation for a POSITA to modify any of the cited prior art to insert a detonator into a top connector in a carrier at the wellsite.

187. In short, a POSITA would not be motivated to combine or modify any of the references cited in the Petition to arrive at the claimed invention of the '938 Patent, and the Petition does not explain any reasoning that a POSITA would do so. As a result, it is my opinion that the challenged claims of the '938 Patent are not obvious.

C. Grounds Based on 35 U.S.C. § 112

188. I understand that to satisfy the definiteness requirement, a claim must "particularly point[ ] out and distinctly claim the subject matter which the inventor ... regards as the invention." 35 U.S.C. § 112(b). "[A] patent is invalid for indefiniteness if its claims, read in light of the specification ... and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the

scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). I understand that in describing the invention, "[e]xact precision is not required." *Telebrands Corp. v. Tinnus Enters., LLC*, PGR2017-00024, 2017 WL 6209221, at *8 (PTAB Nov. 30, 2017).

189. I understand that to satisfy the written description requirement, the specification must "reasonably convey[ ] to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc) (citations omitted).

1. The "detonator body" limitations in Claims 1, 9, and 13 are definite and have adequate written description support

190. Petitioner argues that the "detonator body" limitations of Claims 1, 9, and 13 lack written description because the '938 Patent "never describes any detonator components in a detonator body, or any detonator components at all" (Pet. at 10-11), but this ignores the clear disclosure of the '938 Patent specification of a detonator body with components. Specifically, the specification describes that the detonator assembly 26 includes "a detonator head 100, a detonator body 102 and a plurality of detonator wires 104, including a through wire 106, a signal-in wire 108 and a ground wire 110." Ex. 1001, 8:7-10. Figure 27, for example, shows the plurality of detonator wires 104, including through wire 106, signal-in wire 108, and

ground wire 110 as being contained within the detonator body 102. *Id.*, Fig. 27; *see also* Figs. 28-32.

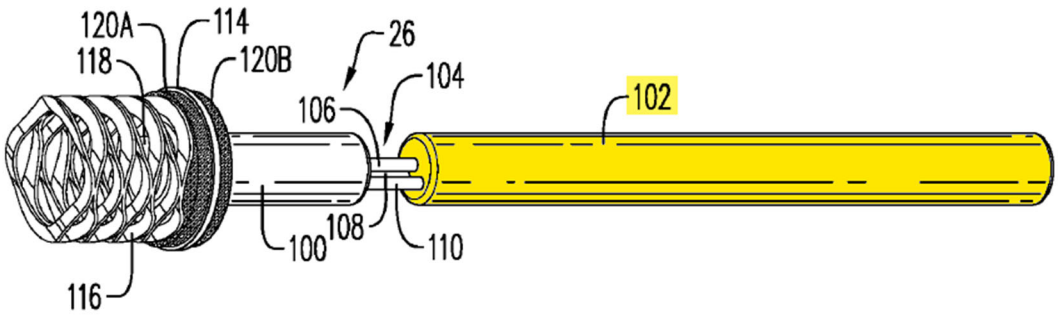


FIG. 27

191. A POSITA reading the specification and viewing the figures would understand that the '938 Patent describes a detonator that has parts, i.e., components, within a housing or body and therefore provides adequate written description support for a detonator body containing detonator components, which is confirmed by Petitioner's statement about what a POSITA's "best guess" for the meaning of the limitation would be. Pet. at 11 ("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.").

192. Petitioner also states that the "modular detonator" of Claim 9 is indefinite because "[t]here are no references within the specification of the Patent teaching a 'modular detonator.'" The '938 Patent describes the detonator as a "basic

component" of the claimed gun system which can be built in multiple configurations. Ex. 1001, 5:59-6:11. A POSITA would understand that the "modular detonator" from Claim 9 has components or parts that can be put together in different ways to be part of the claimed perforation gun assembly.

2. The "wireless connector" limitations in Claims 1, 8, 9, 12, and 13 are definite and have adequate written description support

193. Petitioner makes several arguments regarding the alleged indefiniteness and lack of written description support for the "wireless connector" limitations of Claims 1, 8, 9, 12, and 13, which Petitioner defines as including a "wireless signal-in connector," "wireless through wire connector," "wireless ground contact connector," "through wire connector," "signal-in connector," and "ground contact connector" but none of Petitioner's arguments are clear or make sense. Pet. at 21. To the extent Petitioner's arguments are even understandable, Petitioner essentially claims that the "wireless connector" elements are allegedly indefinite and lack written description support because "the Patent does not provide a definition or explanation of the wor[d] 'wireless'" and, as a result, "it could mean anything from wifi to a terminal on a wire." Pet. at 23-24. The '938 Patent specification also generally describes that a basic component of the claimed perforation gun system is "a push-in detonator *that does not use wires to make necessary connections*. The

push in-detonator may use[] spring-loaded connectors, *thus replacing any required wires and crimping*." Ex. 1001, 6:8-11 (emphasis added). A POSITA would clearly understand, based on these disclosures, that the '938 Patent does not have anything to do with radio communications or wifi. Pet. at 21, 23. Rather, a POSITA would understand that a "wireless connector" claimed as an element of the detonator in the '938 Patent is capable of being electrically connected within a perforating gun without connecting wires directly to the detonator. Pet. at 26. Petitioner itself states that the "wireless connectors" mean "three electrical contacts," just as described in the '938 Patent. *Id.* at 25.

194. The '938 Patent specification teaches that the detonator head 100 includes "a bulkhead connector element 118 for connecting the signal-in wire 108 to the bulkhead assembly 58," as shown in Figures 19, 27, 28, 33, and 35A. Ex. 1001, 8:17-19 (emphasis added). Figure 32, excerpted and annotated below, shows that the bulkhead connector element 118 is in wireless contact with contact pin 126A of the bulkhead 124.

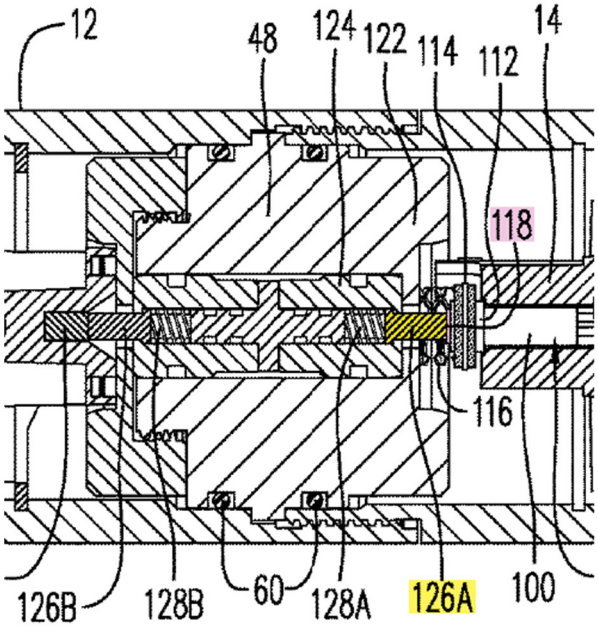


FIG. 32

195. The specification also defines the "wireless through wire connector." Specifically, the specification teaches that the "through wire [] goes from the top connector 14 to the bottom connector 22, whose ends are connectors." Ex. 1001, 6:26-28. Detonator head 100 of the detonator assembly 26 includes "a through wire connector element 112 connected to the through wire 106." *Id.*, 8:7-14 (emphasis added); Figs. 27, 28 and 35B.

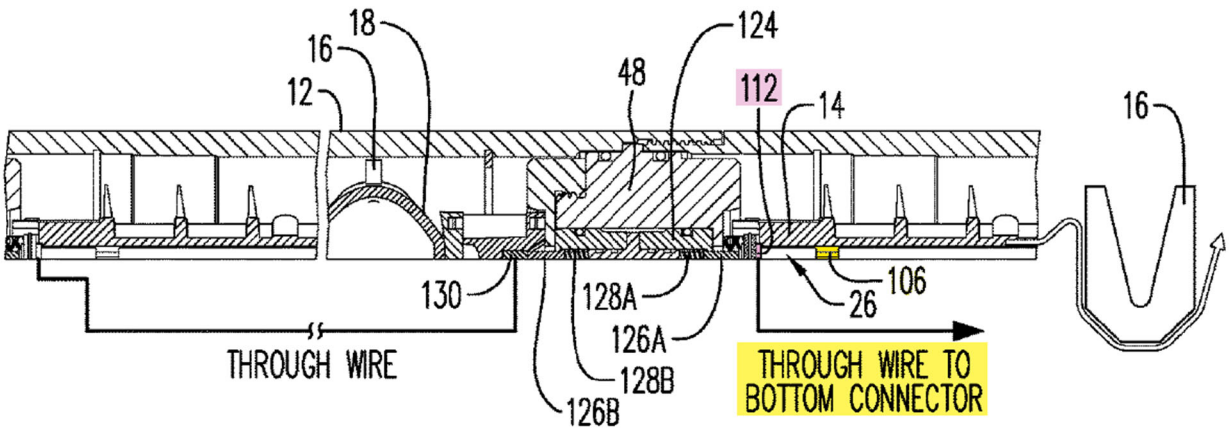


FIG. 35B

196. Putting these teachings together, a POSITA would understand that the through wire connector element 112 is the wireless through wire connector

197. The specification also defines "a wireless ground contact connector." Figure 32 shows and the '938 Patent discloses that the detonator head 100 of the detonator assembly 26 includes "a ground contact element 114 for connecting the ground wire 110 to the tandem seal adapter (also not shown), through ground springs 116. Ex. 1001, 8:12-17 (emphasis added); Figs. 27-32. Figure 32, excerpted and enlarged below, shows ground springs 116 in contact with TSA 48.

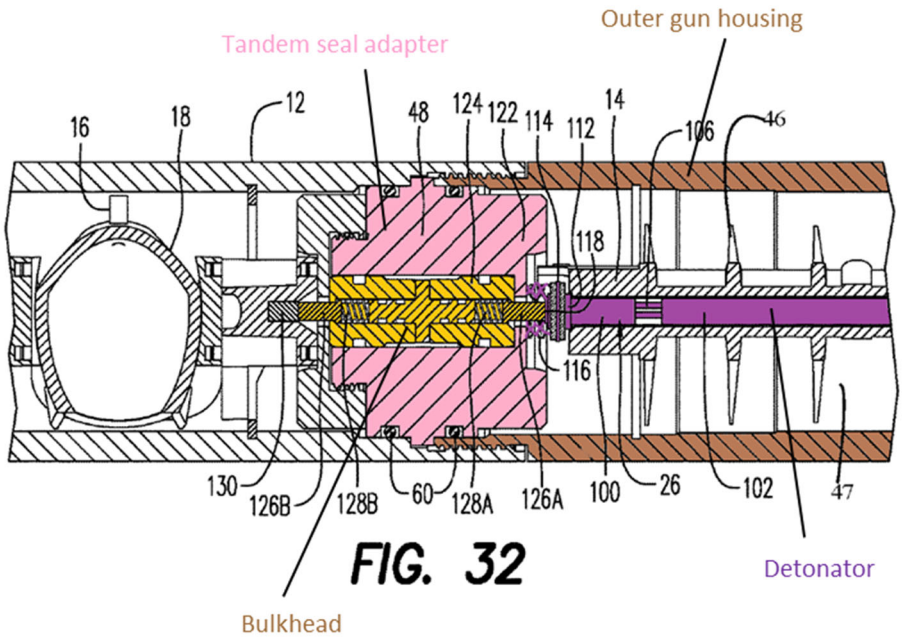
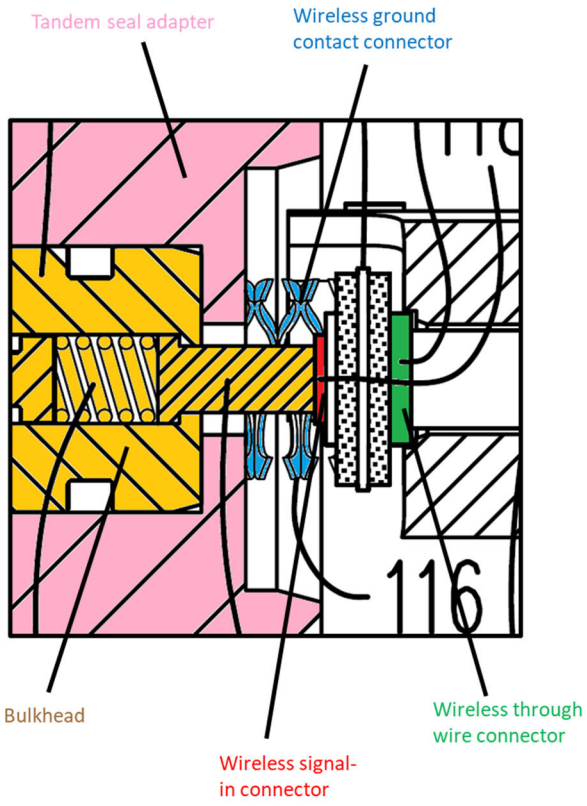

Outer gun housing
Tandem seal adapter
16
18
12
48
124
122
114
112
14
106
46
118
116
130
126B
128B
60
128A
126A
100
26
102
47
Detonator
Bulkhead

FIG. 32


Tandem seal adapter
Wireless ground contact connector
116
Bulkhead
Wireless signal-in connector
Wireless through wire connector

3. The "insulator" limitations in Claims 1, 9, and 13 have adequate written description support

198. Petitioner argues that the "insulator" limitations lack written description support because the '938 Patent "never describes 'an insulator electrically isolating the wireless signal-in connector from the wireless through wire connector.'" Pet. at 38. But Petitioner also states that "insulators" are "common knowledge." *Id.* at 40. To the contrary, the '938 Patent explicitly describes that "[d]ifferent insulating elements 120A, 120B are also provided in the detonator head 100 for the purpose of insulating the detonator head 100 and the detonator wires 104 from surrounding components." Ex. 1001, 8:19-22. Figure 35A shows that the insulating elements 120A and 120B (highlighted below) physically separate, and therefore electrically isolate, the wireless signal-in connector 118 from the wireless through wire connector 112. *Id.*, Fig. 35A.

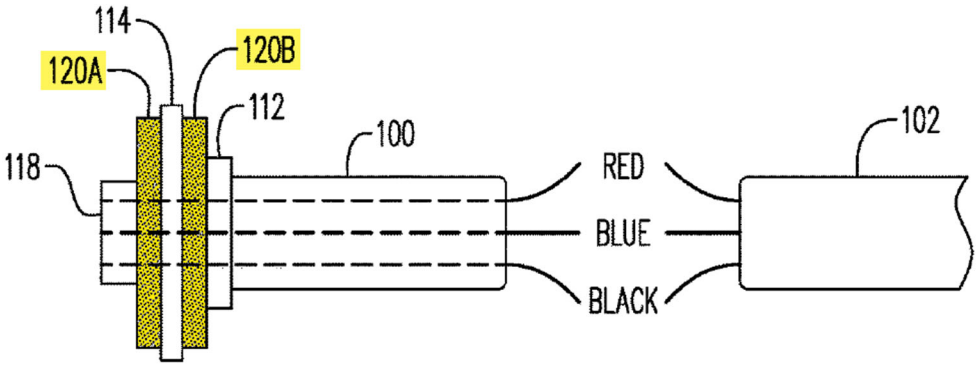


FIG. 35A

199. A POSITA reading the specification and viewing the figures would readily understand that the inventor of the '938 Patent was in possession of an insulator (i.e., insulating elements 120A and 120B) positioned between—and therefore electrically isolating—two electrical contacts (i.e., the wireless signal-in connector 118 and the wireless through wire connector 112) of a detonator. Pet. at 40.

4. The "bulkhead" limitations of Claims 1, 4, 8, and 16 are definite and have adequate written description support

200. Petitioner states that "bulkheads" are "common knowledge" but also says that the bulkhead limitations are indefinite, which does not make sense.

201. Regardless, the '938 Patent provides adequate written description support for a bulkhead in wireless electrical contact with the wireless signal in connector and it is therefore not indefinite. The '938 Patent describes a "connection of the above-described detonator assembly 26 to the tandem seal adapter 48 and a pressure bulkhead 124" where the "bulkhead 124 includes spring connector end interfaces comprising contact pins 126A, 126B, linked to coil springs 128A, 128B." Ex. 1001, 8:28-33. The dual spring pin connector assembly of the bulkhead 124 "is positioned within the tandem seal adapter 48 extending from a conductor slug 130 to the bulkhead connector element." *Id.*, 8:33-37. Figure 32 below shows the

contact pin 126A of the bulkhead 124 in wireless electrical contact with the wireless signal-in connector 118. *Id.*, Fig. 33.

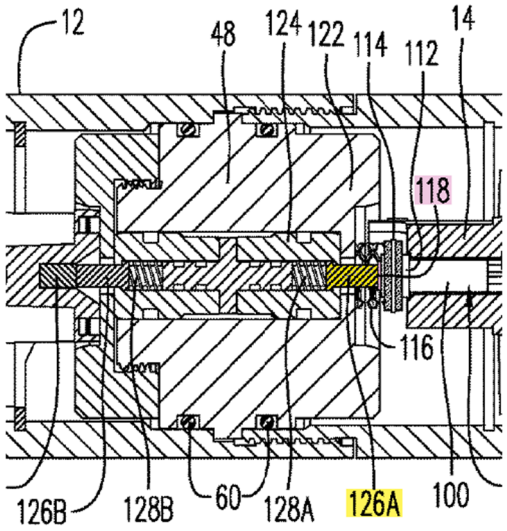


FIG. 32

202. A "bulkhead" is a common industry term and is clearly described in the '938 Patent.

5. The "transferring a signal" limitation of Claim 4 is not indefinite

203. Petitioner states that "[i]t is not clear what is meant by a 'previous wellbore tool'" but later Petitioner acknowledges that a POSITA would understand that the "previous wellbore tool" recited by Claim 4 is simply "another wellbore tool." Pet. at 53-54. Petitioner also states that the '938 Patent "neither describes nor teaches the contact pin transferring an electrical signal as claimed." *Id.* at 54. But

the ’938 Patent specification describes the dual spring pin connector assembly, which includes contact pins 126A and 126B, is “connected to the through wire 106 of the detonator assembly 26” (Ex. 1001, 8:37-39), where the through wire 106 “traverses from the top to the bottom of the perforating gun system 10, making a connection at each charge holder 16” (*id.*, 8:10-12). A POSITA would therefore understand that the contact pin is capable of transferring an electrical signal from a previous wellbore tool to the wireless signal-in connector.

6. The “tandem limitations” of Claims 1 and 9 are definite and have adequate written description support

204. Petitioner make several confusing arguments for the “tandem limitations” of Claims 1 and 9 but none of Petitioner’s arguments are clear or understandable.

205. To the extent Petitioner’s arguments are understandable, Petitioner’s statement of a POSITA’s “best guess” for the meaning of the claims demonstrates that the Claims are not indefinite and/or lack written description. *Id.* at 71-72 (providing “[a] POSITA’s best guess for the meaning of this limitation of Claim 1”); *id.* at 72 (providing “[a] POSITA’s best guess as to the meaning of this limitation of Claim 9”).

7. The “charge holder” limitations of Claims 1 and 13 have adequate written description support

206. Petitioner states that the "written description indicates that the applicant did not have possession of a charge holder with multiple charges" because the '938 Patent specification only describes a "single charge holder . . . holding a single shaped charge." Pet. at 100. First, there is no claim of the '938 Patent that requires "a charge holder with multiple charges." The '938 Patent claims a charge holder with at least one shaped charge. A POSITA would understand that a charge holder with a single shaped charge is supported by the '938 Patent specification. Ex. 1001, 5:40-42, 5:47-49.

207. Petitioner also states that there is allegedly inadequate written description support for a charge holder that "includes a detonating cord" but does not provide any supporting argument or evidence. Regardless, a POSITA would understand that the '938 Patent specification clearly discloses that a "detonation cord 20 is connected to the top connector 14 and to each stackable charge holder 16." Ex. 1001, 5:42-44.

8. The "perforating gun" limitations of Claims 1, 9, and 13 are definite

208. Petitioner states that the "gun assembly" limitation of Claim 9 is indefinite because "[t]he specification provides a circular definition of 'gun assembly.'" Pet. at 87. The '938 specification discloses that "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, 7:63-67 (emphasis added); *see also id.*, 6:60-63 ("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."). A POSITA would understand that the '938 Patent specification refers to subsequent gun assemblies or gun assembly units (i.e., a first gun assembly and a second gun assembly), not the same gun assembly, which Petitioner's "best guess" interpretation confirms. Pet. at 87 (citing Ex. 1001, 2:59-60, 7:63-67, 9:47-48).

9. The "top connector" limitations in Claims 5 and 13 are definite

209. Petitioner claims that the "top connector" of Claims 5 and 13 is indefinite because it is "unclear as to whether a top connector must be a separate component or whether the limitation can be met by other claimed components." Pet. at 111. A POSITA would understand with reasonable certainty that the top connector is a separate component and cannot be satisfied by other claimed components based on the '938 Patent specification, which describes the top connector, charge holder, and detonator as separate and distinct components. *See, e.g.*, Ex. 1001, 5:59-67 ("Hence, a user can build multiple configurations of gun systems using various combinations of basic components. A first of these basic

components includes a top connector. Another basic component is a single charge holder . . . Another basic component is a bottom connector . . .") (emphasis added);. Petitioner's own "best guess" as to the meaning of Claim 5 supports this understanding of the top connector a separate component. Pet. at 112.

210. Petitioner also states that Claim 13 is indefinite "[b]ecause the Patent does not describe a channel in the top connector." Pet. at 112. To the contrary, the '938 Patent clearly describes that the top connector includes an "elongated opening 247 [that] extends from the second end 244, adjacent the coupler 246, towards the first end 242. 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, 7:32-42. A POSITA would understand that the elongated opening 247 highlighted in yellow in Figure 11 below is the hollow channel that receives the detonator 26. *Id.*, Fig. 11 (annotated).

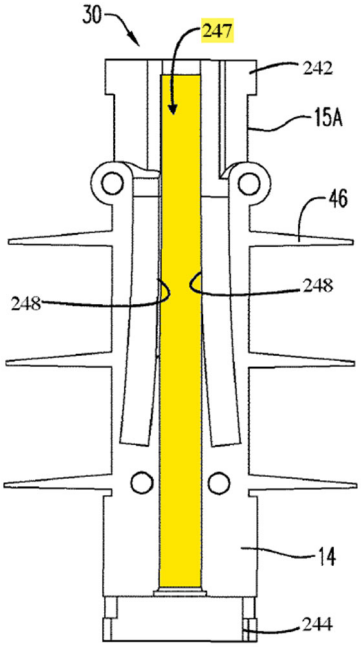


FIG. 11

211. A POSITA would have no trouble understanding the scope of the with reasonable certainty the scope of Claim 13. Pet. at 112.

10. The "detonator within the carrier" limitations in Claims 1 and 14 are definite and have adequate written description

212. Petitioner states that Claim 14 is indefinite because "Claim 13 does not include inserting a detonator into the outer gun carrier for Claim 14 to modify." Pet. at 125. Claim 13 recites the steps of (b) "inserting a top connector into the outer gun carrier . . . the top connector comprising a hollow channel" and (c) "inserting a detonator into the hollow channel of the top connector." A POSITA would understand, based on the claim language, that the detonator is inserted into the outer

gun carrier when it is inserted into the hollow channel of the top connector in step (c) because the top connector has already been inserted into the outer gun carrier in step (b). . A POSITA would also understand that Claim 14 further limits the "inserting a detonator into the top connector" limitation of Claim 13, requiring that step (b) of Claim 13 be performed before step (c) because "inserting a detonator into an outer gun carrier necessarily requires pushing the detonator into the gun carrier." ; Pet. at 125. In other words, there is no dispute that a POSITA would understand the scope of Claim 14.

11. The "transporting elements" of Claims 13 and 17 are definite and have adequate written description support

213. Petitioner states that Claim 13 is indefinite because it is unclear "[w]hat constitutes 'the perforation gun system' that is being transported." Pet. at 145. ("Claim 13 defines the perforation gun system as the thing that is made by following steps a-f, but then 'the perforation gun system' cannot be transported before step (c) happens because it would not yet exist."). The plain language of Claim 13 does not require that each of steps (a), (b), *and* (d) be performed before transporting the perforation gun system to the wellbore site. Claim 13 instead provides that *any one* of the products of steps (a), (b), **or** (d) are transported to the wellbore site. In other words, the perforation gun system being transported to the wellbore site is the

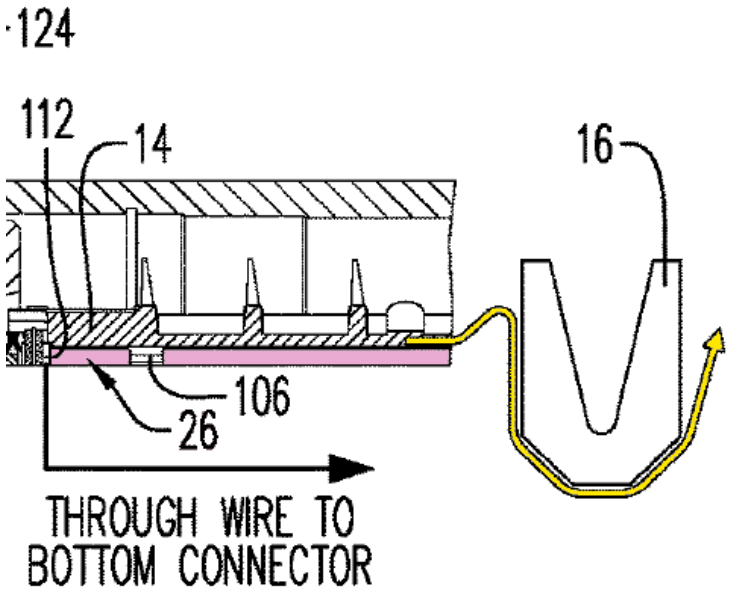
product of steps (a), (b), *or* (d)—not the completed, fully assembled perforation gun system.

214. Petitioner also states that Claim 17 is indefinite because "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), (d), ***or (e)*** happen away from 'a wellbore site.'" Pet. at 145 (emphasis in original). It's unclear whether Petitioner believes that Claim 17 is indefinite based on the number and ordering of claimed steps or the location of assembly. Regardless, Claim 13 requires that *at least one* of steps (a), (b), and (d) is performed before transporting to a wellbore site (i.e., at a site that is not the wellbore site); Claim 17 further limits Claim 17 by providing that *one or more* of steps (a), (b), (d), or (e) are performed at a factory or a facility (i.e., at a site that is not the wellbore site). A POSITA would understand the scope of Claims 13 and 17 based on the plain language of the claims.

12. The "energetically coupling" limitations of Claims 10 and 13 have adequate written description support

215. Petitioner states that Claim 13 lacks written description support because the only structure for providing energetic coupling between the detonator and the detonating cord in the specification is "side walls 248" and the detonating cord is on an opposite side of the electrical connections from the detonator. Pet. at 135. The '938 Patent specification describes that it is the top connector 14—not the side walls

248—that provide the energetic coupling between the detonating cord and the detonator. Specifically, the specification describes that the "top connector 14 may be configured for providing energetic coupling between the detonator 26 and a detonation cord [20]." Ex. 1001, 7:34-36 (emphasis added). As shown in Figure 35B below, the detonator 26 (highlighted in pink), is inserted into the central bore of top connector 14 and the detonation cord (unlabeled, highlighted in yellow) is energetically coupled to the detonator.



216. As illustrated in Figure 11 below, the detonator is inserted into the end of top connector 14 (specifically the elongated opening 247) as shown in pink. Upon insertion, the detonator 26 is "energetically coupled" to—i.e., capable of energetically and ballistically initiating—the detonation cord 20 which is pushed

into either channel beside the central bore and aligned on either side of the detonator (shown in yellow) in the top connector 14. A POSITA would understand that the detonation cord would be inserted into one or other of the channels marked in yellow. Thus, the detonator is positioned in a side-by-side arrangement with (i.e., proximate to) the detonation cord such that when the detonator is initiated, it will also initiate the detonation cord.

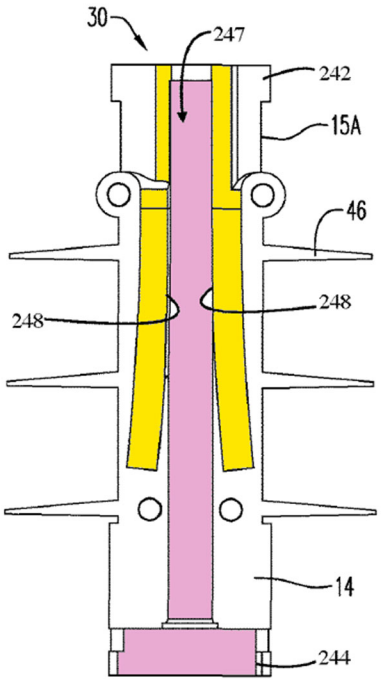


FIG. 11

217. Petitioner also states that Claim 10 is indefinite and lacks written description support because the '938 Patent "provides no discussion of a detonator with a detonating cord connecting portion, but rather describes only detonators that

do not have any way to retain a detonating cord." Pet. at 136. The '938 Patent specification describes that the "top connector 14 may be configured for providing energetic coupling between the detonator 26 and a detonation cord." Ex. 1001, 7:34-36. The top connector has "an elongated opening 247" that "extends from the second end 244, adjacent the coupler 246, towards the first end 242" and "is flanked by side walls 248 that provide the energetic coupling between the detonator 26 and the detonation cord 20." *Id.*, 7:37-42. A POSITA would understand that the top connector 14 is designed to retain the detonating cord 20 which is pushed into either channel beside the central bore and aligned on either side of the detonator (shown in yellow in Figure 11 above) in the top connector 14 to energetically couple the detonating cord to the detonator, as explained above.

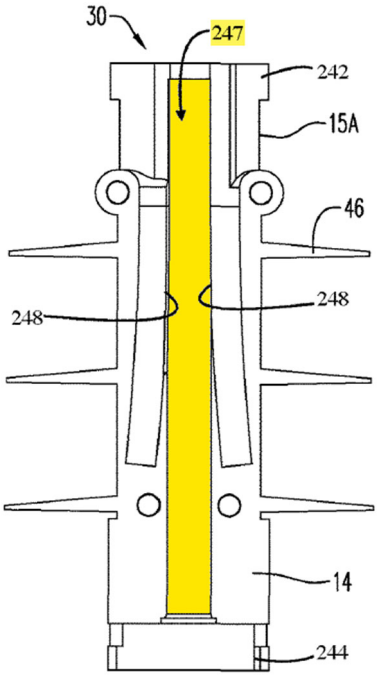


FIG. 11

I hereby declare that all statements of my knowledge made in this declaration are true and that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: 11/18/2020

John Rodgers

APPENDIX A

JOHN P. RODGERS, Ph.D., P.E.

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RIDGEFIELD, CT 06877

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EDUCATION

Massachusetts Institute of Technology
Cambridge, Massachusetts
Department of Aeronautics and Astronautics

-Ph.D. received October 1998.
Major in Structures Technology and Minor in Estimation and Control.
Thesis Title: *Development of an Integral Twist-Actuated Rotor Blade for Individual Blade Control.*

-Master of Science received May 1995.
Thesis Title: *Modeling and Manufacturing of Adaptive Composite Plates Incorporating Piezoelectric Fiber Composite Plies.*

Duke University
Durham, North Carolina
Department of Mechanical Engineering and Material Science

-Bachelor of Science in Engineering received December 1992.
Graduation with Departmental Distinction
Scholarship Recipient, National Academy for the Advancement of Nuclear Power
-Second major in Mathematics.

AREAS OF EXPERTISE

Knowledgeable in a variety of fields related to mechanical, materials, and aerospace, and downhole engineering, including:

- Structural design and analysis
- Actuation and sensing
- Vibration and noise
- Smart materials
- Manufacturing and QC
- Fluid mechanics and dynamics
- Downhole tool design and test
- Forensic engineering
- Electromagnetics
- Aerodynamics and aeroelasticity
- Structural dynamics
- Active control systems
- Polymer-matrix composites
- Crash/shock survival
- Heat transfer
- Testing and characterization of materials, devices, systems
- Machine design
- Intellectual property
- Instrumentation and sensing

EXPERIENCE

Starboard Innovations, LLC, *President, Founder*
Ridgefield, CT
March 2000-present
Engineering consulting company specializing in concept development, new technology research, design, analysis, prototyping, and testing. Recent projects include:

- Development of multiple downhole oilfield tools and integration of new technologies including sensing, autonomous positioning, explosives safety, acoustic telemetry, remote power generation, vibration mitigation; multi-disciplinary FEA, electromagnetic design; support for field testing and operations; qualification testing for thermal, pressure, shock, explosive operations; strength analysis, damage prediction, and troubleshooting of mechanical systems.
- Development of shock simulation software package and shock sensing downhole tool for predicting, measuring, and optimizing perforating gun string and wellbore dynamics. Prediction of tool string failure under operational loading.
- Led multiple failure investigation teams that included extensive simulations and tests to demonstrate causation; successful in reducing client liability in negotiations. Rapid redesign of deficient design elements to enable a return to reliable service.
- Development and implementation of food production engineering systems for major snack food manufacturer.
- Support for large-scale power grid energy storage system design and installation.
- Litigation support and expert witness for plaintiff and defense involving trade secret, product liability, personal injury, and patent IPRs
- Intellectual property development and research, competitive patent analysis.
- Rotorcraft vibration reduction using active material treatments and integrated on-blade actuation technology for Bell Helicopter (Variable Geometry Advanced Rotor Technology program)
- Crashworthy aircraft seat design using shape memory materials and rotorcraft occupant restraint systems for NASA and Air Force

More information at http://www.starboardinnovations.com

Midé Technology Corporation, ***Senior Engineer***
Cambridge, Massachusetts
November 1998-February 2000
Active in technology, product, and business development.
- Co-developer, PowerAct™, a novel piezoceramic actuator/sensor
- Principal Investigator for Air Force-funded research program to develop advanced rotor concepts and team lead for Bell Helicopter Dynamically-Tailored Airframe Structures program

The MIT Active Materials and Structures Laboratory, ***Research Assistant***
Cambridge, Massachusetts
May 1995-October 1998
- Project leader for design, manufacture, and hover testing of a Mach-scale active helicopter rotor blade for individual blade control of vibrations and noise
- Developed manufacturing process for and characterized active fiber composite piezoelectric actuators
- Teamed with Boeing as part of Smart Structures for Rotorcraft Consortium
- Aided in design and led implementation of Mach-scaled rotor test stand facility

The MIT Space Engineering Research Center, ***Research Assistant***
Cambridge, Massachusetts
January 1993-May 1995
- Developed a Rayleigh-Ritz model of a composite plate with embedded, anisotropic active materials and acoustic radiation

- Designed, manufactured, and tested adaptive composite plates with active plies

Duke University Department of Mechanical Engineering, *Laboratory Assistant*
Durham, North Carolina
May 1992-December 1992
- Fabricated and tested a fiberglass wind-tunnel model for measuring airfoil pressure distribution with LabView data acquisition system virtual instrument shell

NASA Langley Research Center, Configuration Aeroelasticity Branch, *Intern*
Hampton, Virginia
June 1991-August 1991
- Performed aerothermoelastic analysis of a NASP vertical tail using a finite element model

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PROFESSIONAL ACTIVITIES

Licensed Professional Engineer (PE) in mechanical engineering in TX, ND, CT

American Society of Mechanical Engineers (ASME), Associate Member, PE Review Instructor

Society of Petroleum Engineers (SPE), Member

American Institute of Aeronautics and Astronautics (AIAA), Member

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PUBLICATIONS

Rodgers, J., Glenn, T.S., Serra, M., "Prediction of Gun String Dynamic Failure Risks during Perforating", presented at the North American Perforating Symposium, 2019 NAPS 6.3, Arlington, TX, Aug. 2019.

Anderson, M., Rios, F., Rodgers, J. et al, "The Dynamic Loading Effects of Non-linear Gun Connectors During and After Detonation", presented at the 2018 Latin American Perforating Symposium, Bogota, Columbia, Oct. 2018.

Rodgers, J., Glenn, T.S., Serra, M., Craddock, G.G., "High-Fidelity Finite Element Analysis of Deepwater Gun-Parting Failures", presented at the North American Perforating Symposium, NAPS-46-18, July 2018.

Glenn, T.S., Serra, M., Rodgers, J. et al, "Validation of a Finite Element Simulation of a Downhole Perforating Gun String through Comparison with Data from a New Datalogging Sensor Sub", presented at ASME 2015 Verification and Validation Symposium, May 2015.

Wight et al, "New Shock Sensing Sub Permits Greater Understanding of the Dynamic Response of Perforating Gun Strings", IPS-14-03, presented at the 2014 International Perforating Symposium, May 2014.

Glenn, T.S., Serra, M., Rodgers, J., Wight, J., Zhang, W., Craddock, G.G., Harive, K. "Investigating the Dynamic Three-Dimensional Loading Effects on Perforating Guns Imposed by Shaped Charges – Downhole Evaluation". OTC 24891. Presented at Offshore Technology Conference – Asia, Malaysia, March, 2014.

Craddock, G.G., Zhang, W., Wight, J., Rodgers, J., Glenn, T.S., Serra, M., and Bettenmann, T. "Investigating the Dynamic Three-Dimensional Loading Effects on Perforating Guns Imposed by

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10151152 – Perforating gun connectors

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9909408 - Protection of electronic devices used with perforating guns

9909384 - Multi-actuating plugging device

9598940 - Perforation gun string energy propagation management system and methods

9447678 - Protection of electronic devices used with perforating guns (8978817*)

9091152 - Perforating gun with internal shock mitigation

9051812 - Through tubing bridge plug and installation method for same

9019798 - Acoustic reception

8985200 - Sensing shock during well perforating

8978817 - Protection of electronic devices used with perforating guns

8978749 - Perforation gun string energy propagation management with tuned mass damper

8893801 - Method and apparatus for pressure-actuated tool connection and disconnection

8881816 - Shock load mitigation in a downhole perforating tool assem. 8714252*,8714251*)

8714270 - Anchor assembly and method for anchoring a downhole tool

8555959 - Compression assembly and method for actuating downhole packing elements

8490686 - Coupler compliance tuning for mitigating shock produced by well per. (8393393*)

8408286 - Perforating string with longitudinal shock de-coupler (8397800*)

8397814 - Perforating string with bending shock de-coupler

7781939 - Thermal expansion matching for acoustic telemetry system (7557492*)

7594434 - Downhole tool system and method for use of same

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7363967 - Downhole tool with navigation system

7325605 - Flexible piezoelectric for downhole sensing, actuation and health mon (7234519*)

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