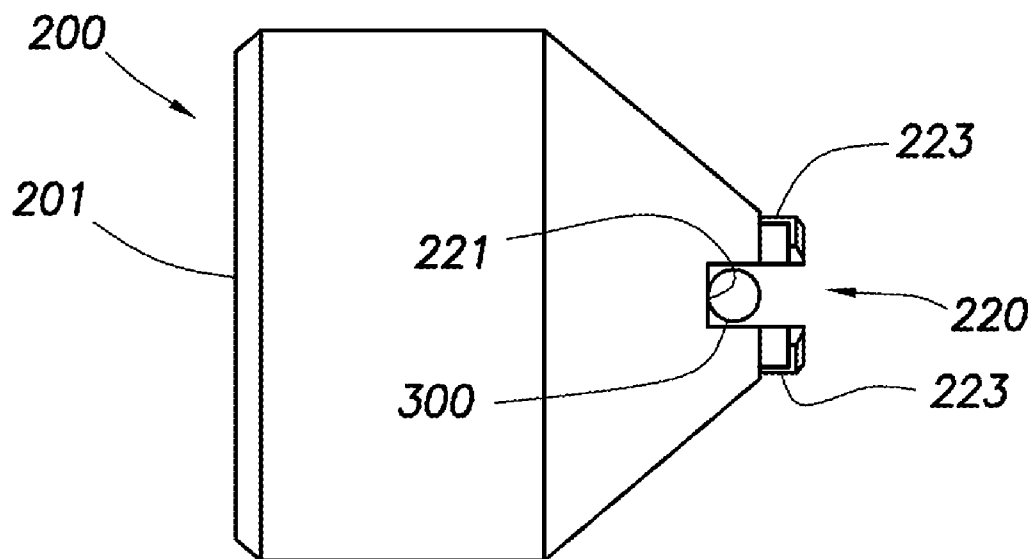


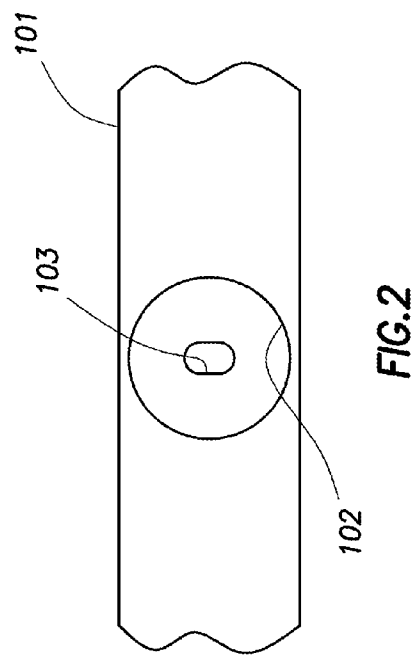
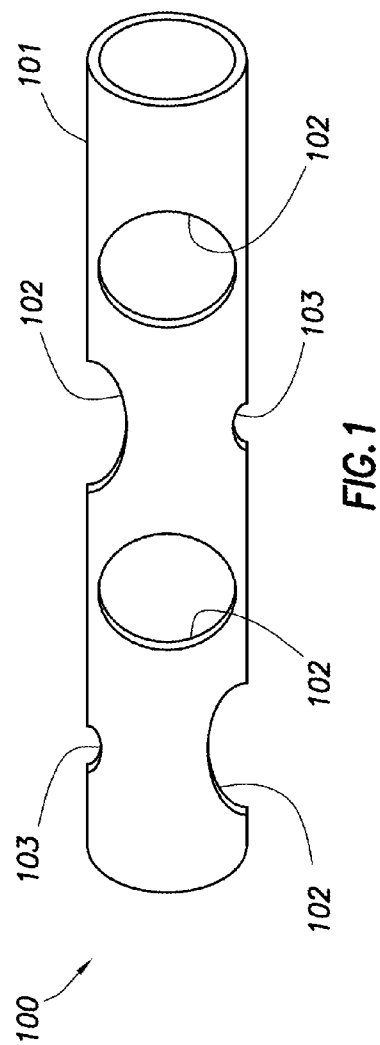


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(19) **United States**(12) **Patent Application Publication**
WALKER(10) **Pub. No.: US 2013/0019770 A1**(43) **Pub. Date: Jan. 24, 2013**(54) **DEVICE FOR PERFORATING A MATERIAL
COMPRISING A TAIL-LOCKING CHARGE
CASE**(75) Inventor: **Jerry L. WALKER**, Azle, TX (US)(73) Assignee: **HALLIBURTON ENERGY
SERVICES, INC.**, Houston, TX (US)(21) Appl. No.: **13/188,542**(22) Filed: **Jul. 22, 2011****Publication Classification**(51) **Int. Cl.**
F42B 3/26 (2006.01)
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F42D 1/00 (2006.01)(52) **U.S. Cl.** **102/322; 102/314; 166/297**(57) **ABSTRACT**

According to an embodiment, a charge holder assembly comprising: a charge holder, wherein the charge holder is a hollow cylinder, and wherein the charge holder comprises: (a) at least one hole disposed through a wall of the charge holder; and (b) at least one slot disposed through the wall of the charge holder, wherein the at least one slot is located diametrically opposite from the at least one hole; and a charge comprising a charge case, wherein the charge case comprises: (a) a tail end portion, wherein the tail end portion comprises: (i) a cord retaining groove; and (ii) two legs, wherein each of the two legs comprises at least one slot engaging groove, wherein the slot engaging grooves are at an angle offset from the cord retaining groove. According to another embodiment, a method of perforating a material using a charge comprising: positioning a perforation gun adjacent to the material to be perforated, wherein the perforation gun comprises: the charge holder assembly; and causing the charge of the charge holder assembly to detonate.





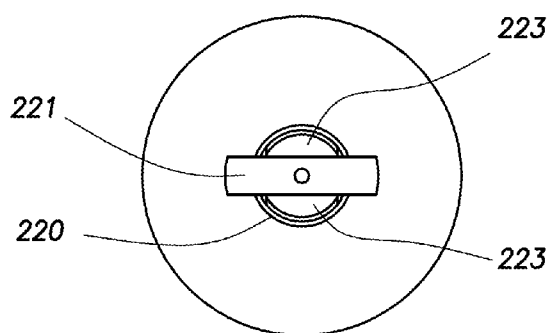
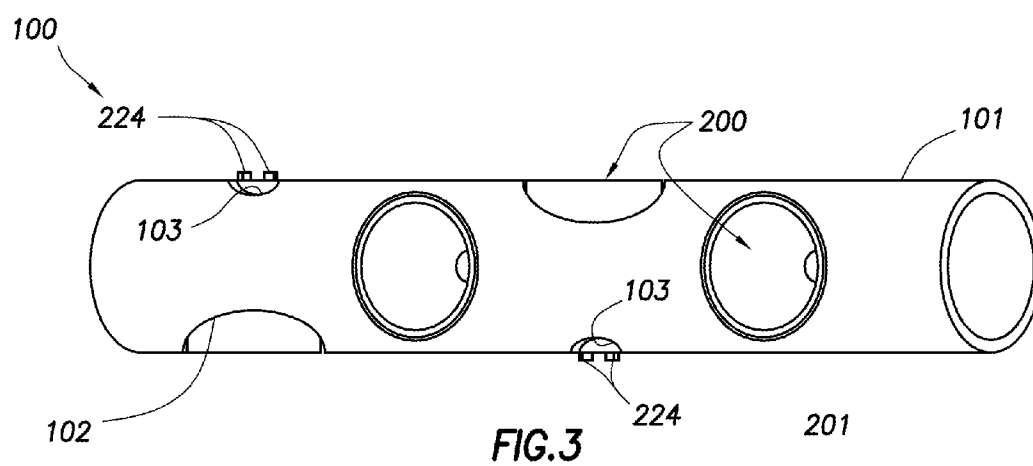


FIG. 4

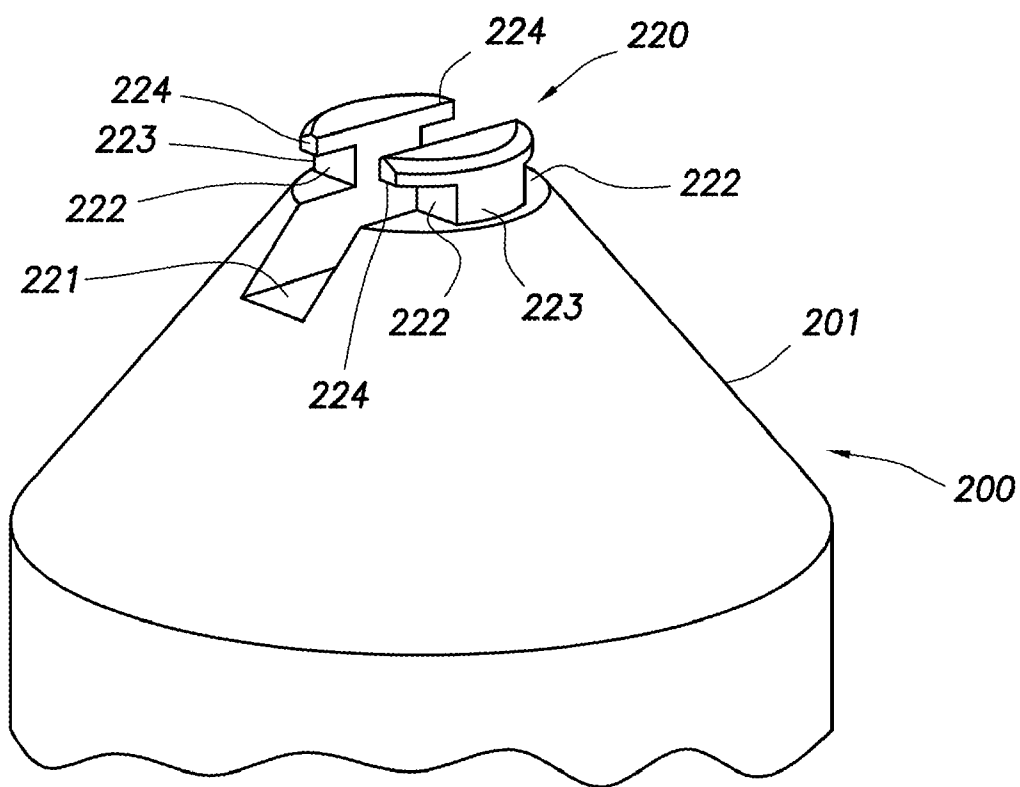


FIG.5

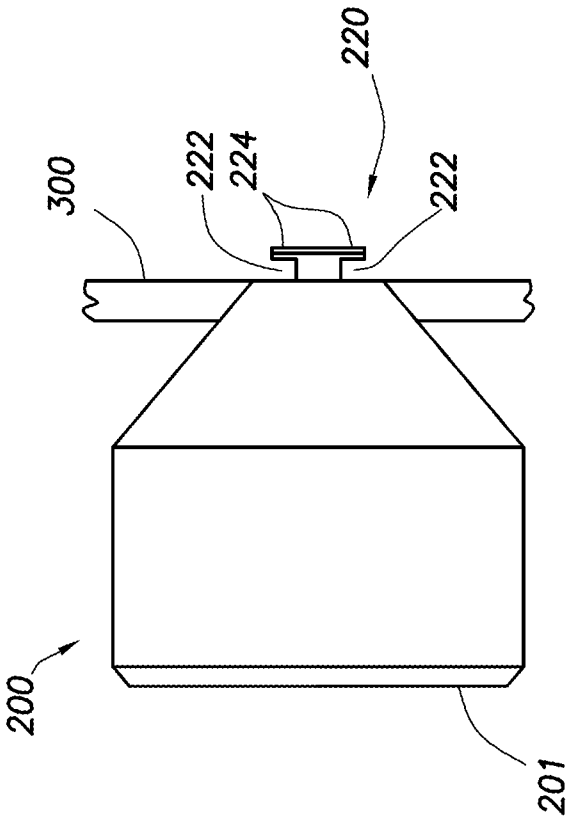


FIG. 6

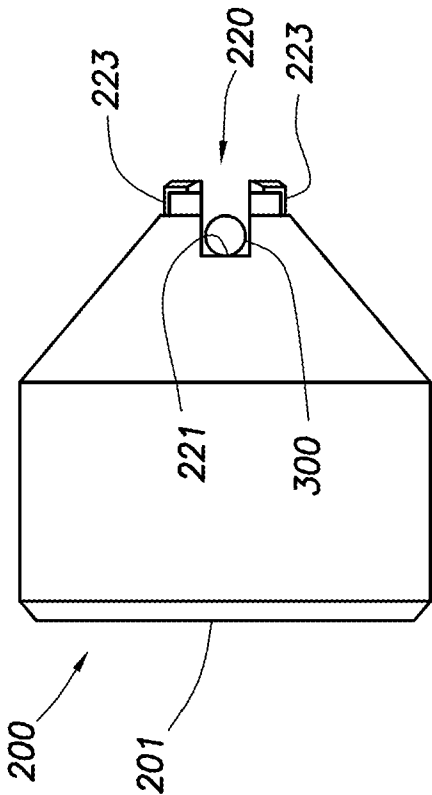


FIG. 7

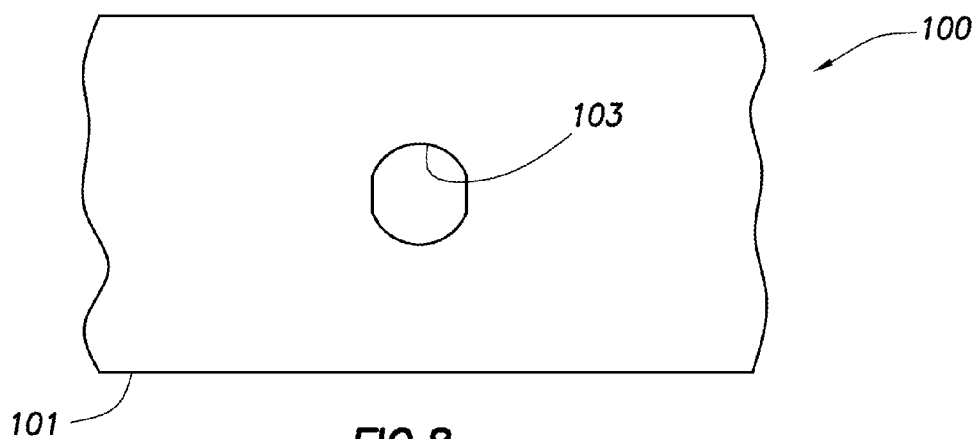


FIG. 8

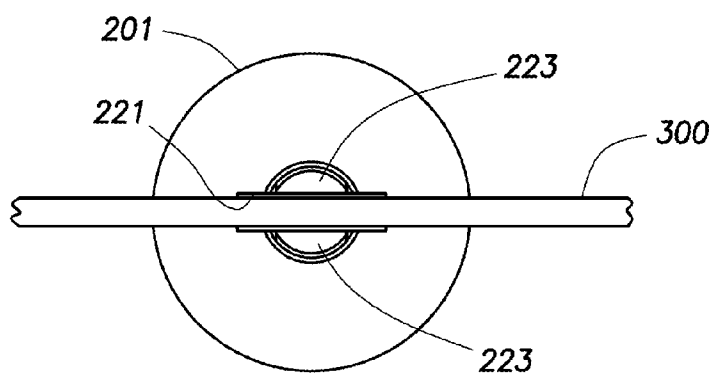


FIG. 9

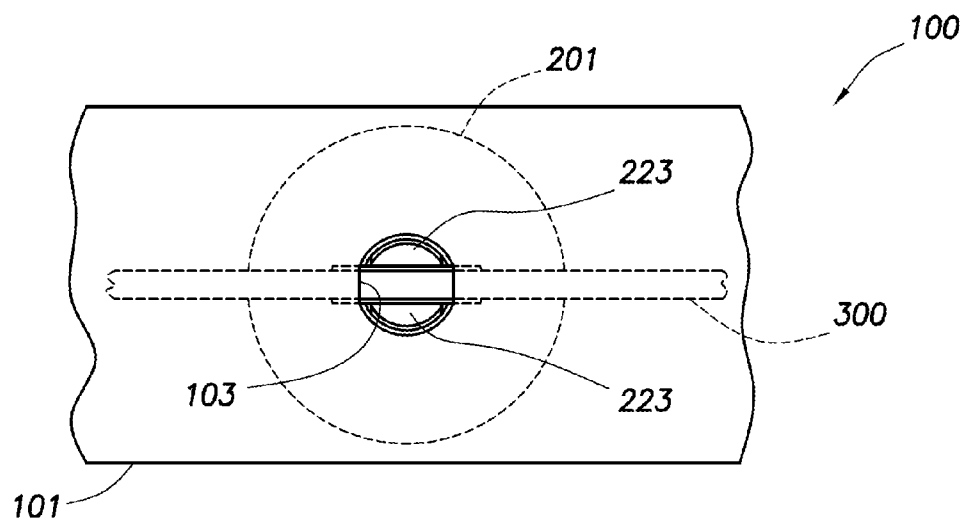


FIG. 10

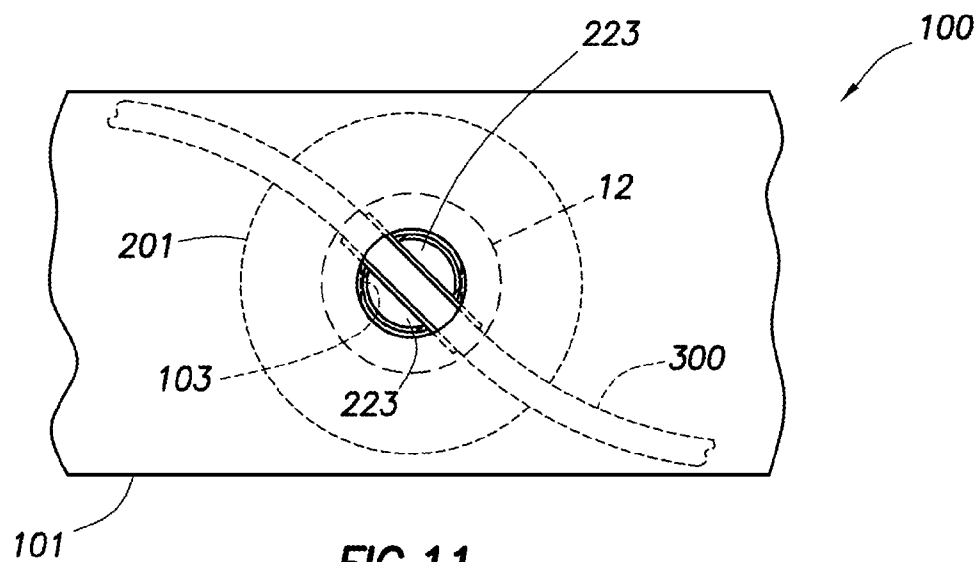


FIG. 11

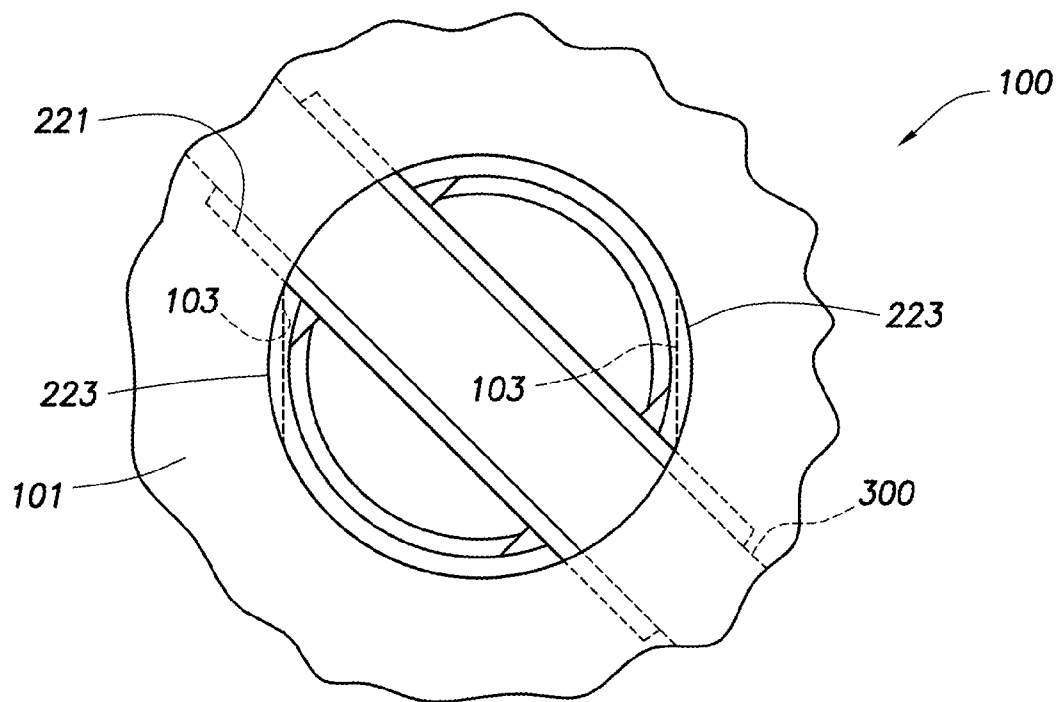


FIG. 12

DEVICE FOR PERFORATING A MATERIAL COMPRISING A TAIL-LOCKING CHARGE CASE

TECHNICAL FIELD

[0001] A charge holder assembly and methods of use are provided. The charge holder assembly comprises a charge positioned in a charge holder. According to certain embodiments, the charge includes a charge case that includes a detonation cord retaining groove and a slot retaining groove located at the tail-end portion of the charge case. The slot retaining groove can lock the charge into the charge holder via engagement with a slot on a wall of the charge holder. According to other embodiments, the charge holder assembly is used to perforate a material. In an embodiment, the material is a well.

SUMMARY

[0002] According to an embodiment, a charge holder assembly comprising: a charge holder, wherein the charge holder is a hollow cylinder, and wherein the charge holder comprises: (a) at least one hole disposed through a wall of the charge holder; and (b) at least one slot disposed through the wall of the charge holder, wherein the at least one slot is located diametrically opposite from the at least one hole; and a charge comprising a charge case, wherein the charge case comprises: (a) a tail end portion, wherein the tail end portion comprises: (i) a cord retaining groove; and (ii) two legs, wherein each of the two legs comprises at least one slot engaging groove, wherein the slot engaging grooves are at an angle offset from the cord retaining groove.

[0003] According to another embodiment, a method of perforating a material using a charge comprising: positioning a perforation gun adjacent to the material to be perforated, wherein the perforation gun comprises: the charge holder assembly; and causing the charge of the charge holder assembly to detonate.

BRIEF DESCRIPTION OF THE FIGURES

[0004] The features and advantages of certain embodiments will be more readily appreciated when considered in conjunction with the accompanying figures. The figures are not to be construed as limiting any of the preferred embodiments.

[0005] FIG. 1 is a schematic perspective of the charge holder.

[0006] FIG. 2 is an elevation view of the charge holder showing a hole and a slot.

[0007] FIG. 3 is a schematic perspective of the charge holder shown in FIG. 1 with charges inserted into the charge holder.

[0008] FIG. 4 is an elevation view of the back of one of the charges.

[0009] FIG. 5 is a partial perspective view detailing the tail end of one of the charges.

[0010] FIG. 6 is an elevation view of the side of one of the charges.

[0011] FIG. 7 is an elevation view of charge of FIG. 6 rotated 90°.

[0012] FIG. 8 is an elevation view of the back of the charge holder detailing one of the slots.

[0013] FIG. 9 is an elevation view of the back of one of the charges with the detonation cord inserted.

[0014] FIG. 10 is an elevation view of the back of the charge holder with one of the charges placed into the holder.

[0015] FIG. 11 is the system of FIG. 10 with the charge rotated in order to lock it into position.

[0016] FIG. 12 is an enlarged view of circle 12 of FIG. 11 detailing the locking mechanism.

DETAILED DESCRIPTION

[0017] As used herein, the words “comprise,” “have,” “include,” and all grammatical variations thereof are each intended to have an open, non-limiting meaning that does not exclude additional elements or steps.

[0018] It should be understood that, as used herein, “first,” “second,” “third,” etc., are arbitrarily assigned and are merely intended to differentiate between two or more grooves, charge cases, etc., as the case may be, and does not indicate any sequence. Furthermore, it is to be understood that the mere use of the term “first” does not require that there be any “second,” and the mere use of the term “second” does not require that there be any “third,” etc.

[0019] Oil and gas hydrocarbons are naturally occurring in some subterranean formations. A subterranean formation containing oil or gas is sometimes referred to as a reservoir. A reservoir may be located under land or off shore. Reservoirs are typically located in the range of a few hundred feet (shallow reservoirs) to a few tens of thousands of feet (ultra-deep reservoirs). In order to produce oil or gas, a wellbore is drilled into a reservoir or adjacent to a reservoir.

[0020] A well can include, without limitation, an oil, gas, water, or injection well. A well used to produce oil or gas is generally referred to as a production well. As used herein, a “well” includes at least one wellbore. A wellbore can include vertical, inclined, and horizontal portions, and it can be straight, curved, or branched. As used herein, the term “wellbore” includes any cased, and any uncased, open-hole portion of the wellbore. A near-wellbore region is the subterranean material and rock of the subterranean formation surrounding the wellbore. As used herein, a “well” also includes the near-wellbore region. The near-wellbore region is generally considered to be the region within about 100 feet of the wellbore. As used herein, “into a well” means and includes into any portion of the well, including into the wellbore or into the near-wellbore region via the wellbore.

[0021] A portion of a wellbore may be an open hole or cased hole. In an open-hole wellbore portion, a tubing string may be placed into the wellbore. The tubing string allows fluids to be introduced into or flowed from a remote portion of the wellbore. In a cased-hole wellbore portion, a casing is placed into the wellbore, which can also contain a tubing string.

[0022] Some subterranean formations can include low permeability areas. Permeability refers to how easily fluids can flow through a material. For example, if the permeability is high, then fluids will flow more easily and more quickly through the material. If the permeability is low, then fluids will flow less easily and more slowly through the material. Conversely, if the permeability of a formation is low, it can be more difficult to produce oil or gas because it is more difficult for the oil or gas to flow from the formation and into the production tubing.

[0023] There are several techniques that can be used to increase the permeability of low permeable regions of a formation. For example, fracturing or perforating a portion of a formation can be used to increase the permeability of a for-

mation. In fracturing techniques, a fracturing fluid is pumped at a sufficiently high flow rate and high pressure into the wellbore and into the subterranean formation to create or enhance a fracture in the subterranean formation. A fracture is a highly-permeable void in an area of the formation material that allows fluids to flow more easily through the fracture.

[0024] Perforating is another technique that can be used to increase the permeability of a formation. Well perforation operations can involve the controlled detonation of shape charges within the well. The shape charges perforate the casing, if any, and the surrounding formation, thereby improving the flow of liquids into or from the wellbore. A perforation gun is used to hold the shape charges. The perforation gun is lowered into the well on either tubing or a wire line until it is at the depth of the formation of interest. The gun assembly includes a charge holder that holds the shape charges and a carrier that protects the shape charges from the environment. A detonation cord links each charge located in the charge holder.

[0025] A shaped charge is inserted into a hole in the charge holder, and a charge retention apparatus holds the charge firmly within the hole. The charge retention apparatus normally includes retaining rings, charge retention jackets, clips, or bending tabs, all of which are designed to secure the shaped charge in the charge holder. Normally when a bending tab is used, a device, such as a flat-head screwdriver, must be inserted into the holder via a specially-cut slot in the holder to connect with the tab, and then the tab must be bent into a holding position via the device. The extra costs associated with machining the specially-cut slot and the time spent manually bending each tab makes the use of bending tabs more expensive and time consuming. Other means of securing a shaped charge inside the charge holder include grooves located at the outside of the hole in the holder and a tab located at the periphery of the charge case. After the charge is inserted into the hole in the holder, the charge case can be rotated to engage the tab with the groove. In this manner, the charge case is locked in the hole of the holder. However, it may not be convenient to manually rotate the charge case into a locked position.

[0026] Thus, it is desirable to provide an apparatus for securing a shaped charge to a charge holder of a perforating gun without using bending tabs or the like, and/or without having to manually lock the charge case in the holder.

[0027] A novel apparatus and method of use for locking a shaped charge into a holder of a perforation gun, includes at least one pair of feet positioned at the tail end of the charge case that engage the outside of the holder via a slot in the holder. The charge case can be self locking, partially self locking, or be manually locked into position.

[0028] According to an embodiment, a charge holder assembly comprising: a charge holder, wherein the charge holder is a hollow cylinder, and wherein the charge holder comprises: (a) at least one hole disposed through a wall of the charge holder; and (b) at least one slot disposed through the wall of the charge holder, wherein the at least one slot is located diametrically opposite from the at least one hole; and a charge comprising a charge case, wherein the charge case comprises: (a) a tail end portion, wherein the tail end portion comprises: (i) a cord retaining groove; and (ii) two legs, wherein each of the two legs comprises at least one slot engaging groove, wherein the slot engaging grooves are at an angle offset from the cord retaining groove.

[0029] According to another embodiment, a method of perforating a material using a charge comprising: positioning a perforation gun adjacent to the material to be perforated, wherein the perforation gun comprises: the charge holder assembly; and causing the charge of the charge holder assembly to detonate.

[0030] Any discussion of a particular component of the charge holder assembly **100** (e.g., a hole **102**) is meant to include the singular form of the component and also the plural form of the component, without the need to continually refer to the component in both the singular and plural form throughout. For example, if a discussion involves “the hole **102**,” it is to be understood that the discussion pertains to one hole (singular) and two or more holes (plural). It is also to be understood that any discussion of a particular component or particular embodiment regarding a component is meant to apply to the apparatus embodiments and the method embodiments, without the need to re-state all of the particulars for both the apparatus and method embodiments.

[0031] Turning to the Figures, FIGS. **1** and **2** depict the charge holder assembly **100** including the charge holder **101**. The charge holder assembly **100** includes a charge holder **101**. The charge holder **101** is a hollow cylinder. An example of a hollow cylinder is a tube or pipe. The charge holder **101** can be made from a variety of materials, including, but not limited to, steel, aluminum, fiberglass, or a polymeric material. The charge holder **101** can be a variety of lengths. One of skill in the art will be able to determine the length needed depending on the particulars for each perforation job. The charge holder **101** has a wall with a certain thickness. The charge holder **101** can have an inner diameter (I.D.) and an outer diameter (O.D.), wherein the difference between the O.D. and the I.D. equals the wall thickness. The charge holder **101** includes at least one hole **102** disposed through the wall of the holder and at least one slot **103** disposed through the wall of the holder. According to an embodiment, the charge holder **101** comprises a plurality of holes **102** and a plurality of slots **103**.

[0032] The slot **103** is diametrically opposite of the hole **102**. For a plurality of holes **102** and slots **103**, each slot **103** is diametrically opposite of a unique hole **102**. The holes **102** and the slots **103** can be arranged in a variety of ways along the wall of the charge holder **101**. For example, the holes **102** can be aligned in a straight line along the wall. In this embodiment, the slots **103** will be aligned in a straight line along the diametrically opposite wall from the holes **102**. By way of another example, and as shown in FIGS. **1-3**, the holes **102** can be arranged in a spiral pattern along the wall of the charge holder **101**. If the holes **102** are spirally arranged, then the slots **103** will also be arranged in a spiral pattern, so long as each slot **103** is diametrically opposite of its corresponding hole **102**. For a spiral arrangement, the actual spacing and/or tightness of the spiral pattern of the holes **102** can be adjusted such that there is sufficient room for each slot **103** to be positioned diametrically opposite of its corresponding hole **102**. The arrangement of the holes **102** can also be adjusted based on the desired perforation pattern and perforation density for the well. A common perforation density is between four to six charges per foot of carrier. Moreover, a charge **200** does not have to be placed in every hole **102** of the charge holder **101**. The actual placement of the charges **200** can be determined based on the desired perforation pattern and perforation density for the well.

[0033] The charge holder assembly 100 includes at least one charge 200. The charge 200 is formed by a charge case 201 and can include an explosive charge. The charge case 201 comprises a head end that tapers to a region called the tail end 220. The head end of the charge case can be a variety of shapes including, but not limited to, square, rectangular, or cylindrical. The tail end 220 can be generally conical in shape. The charge case 201 can be made from a variety of materials, including, but not limited to, steel, aluminum, fiberglass, or a polymeric material.

[0034] As can be seen in the Figures, the tail end 220 comprises a cord retaining groove 221. The cord retaining groove 221 is preferably capable of receiving a detonation cord 300. The detonation cord 300 can be positioned in the cord retaining groove 221 in a manner such that the detonation cord 300 ignites an explosive charge within the charge case 201.

[0035] The tail end 220 also comprises two legs 223. The legs 223 can be aligned parallel to the cord retaining groove 221. Each of the two legs 223 comprises at least one slot engaging groove 222. The slot engaging groove 222 can span at least a portion, alternatively the majority, of the leg 223. According to another embodiment, each of the two legs 223 comprises two slot engaging grooves 222. Each of the slot engaging grooves 222 are at an angle offset from the cord retaining groove 221. According to another embodiment, the slot engaging groove 222 is oriented perpendicular to the cord retaining groove 221. In yet another embodiment, the slot engaging groove is cut on a radius around the leg 223. Each slot engaging groove 222 forms a foot 224 on the leg 223. According to an embodiment, each of the two legs 223 includes two feet 224, shown in detail in FIG. 5. The feet 224 can be a variety of sizes and shapes. Some of the edges of the feet 224 can be straight, while other edges can be rounded.

[0036] The charge case 201 can be inserted tail end 220 first into the charge holder 101 via a hole 102. As seen in FIG. 10, the charge case 201 can be inserted such that the detonation cord 300 is oriented within the cord retaining groove 221. The slot 103 can be used as a visual means by which to guide the charge case 201 into the charge holder 101 such that the legs 223 straddle the detonation cord 300, thus causing the detonation cord 300 to become positioned within the cord retaining groove 221. Once inserted, the head end of the charge case 201 can at least mostly fill the hole 102. Once the charges 200 are installed into the charge holder 101, a carrier (not shown) may be placed over the charge holder 101 to protect the integrity of the charges 200.

[0037] According to an embodiment, at least a portion of the tail end 220 is capable of being pushed through the slot 103. In an embodiment, the distance from the outermost end of the head end to the outermost end of the tail end 220 of the charge case 201 is at least a sufficient distance such that after insertion, at least a portion of the tail end 220 is capable of protruding through the slot 103. The distance between the outermost ends of the case may have to be adjusted based at least in part on the O.D. of the charge holder 101. In this manner, the charge case 201 can be inserted into the charge holder 101 and at least a portion of the tail end 220 emerges through the slot 103, shown in FIG. 3. The size and shape of the slot 103 can be selected such that the feet 224 are capable of protruding through the slot 103. For example, once inserted, the feet 224 of the tail end 220 of the charge case 201 can pass through the wall of the charge holder 101 and are positioned on the outside of the charge holder 101. According

to another embodiment, the size and shape of the legs 223 and the feet 224 are selected such that the feet 224 are capable of protruding through the slot 103. The height and depth of the slot engaging groove 222 is preferably selected such that upon rotation of the legs 223, the feet 224 slidably engage the O.D. of the charge holder 101. The actual angle that the slot engaging grooves 222 are offset from the cord retaining groove 221 can be selected such that upon rotation of the legs 223, the feet 224 slidably engage the O.D. of the charge holder 101. According to this embodiment, each leg 223 can include only one, or more than one, slot engaging groove 222 and the angle of offset of each slot engaging groove 222 can be selected to allow at least one foot 224 to engage the O.D. of the charge holder 101. It is to be understood that the angle of offset for each slot engaging groove 222 can be the same or different. As can be seen in FIGS. 8, 11, and 12, the size and shape of the slot 103 can be selected such that the feet 224 engage the outside of the charge holder 101. By way of example, the height of the slot engaging groove 222 can be slightly greater than the thickness of the wall of the charge holder 101. The depth can also be selected such that upon rotation, a sufficient area of each foot 224 is capable of covering at least a portion of the outside of the charge holder 101. In this manner, as the charge case 201 is rotated, the feet 224 engage the outside of the charge holder 101 and lock the charge case 201 in place. This can help prevent rotational movement and vertical or lateral movement of the charge case 201. It may be sufficient for the charge case 201 to be rotated only a small amount in order to engage the outside of the charge holder 101. The charge case 201 can also be rotated a $\frac{1}{4}$ turn. One of skill in the art will be able to determine the exact amount of rotation necessary to ensure that the charge 200 is locked in place.

[0038] The charge case 201 can be self-locking, partially self-locking, or manually locked into place. Regardless of the method of locking, the detonation cord 300 can be positioned on the inside of the charge holder 101 in a variety of configurations. For example, as shown in FIG. 11, the detonation cord 300 can be positioned in a spiral position inside the charge holder 101. For a self-locking charge case, the charge case 201 can be inserted into the charge holder 101 such that the legs 223 disrupt the natural orientation of the detonation cord 300. This disruption of the natural orientation can create tension on the detonation cord 300. When the charge case 201 has been manually inserted and the grip on the head end of the case is released, the detonation cord 300 can snap back into its natural orientation, thus causing rotation to the charge case 201. This rotation of the charge case 201 turns the feet 224 such that they lock the charge 200 in place, shown in FIG. 12.

[0039] In the event that the tension on the detonation cord 300 is not sufficient to fully rotate the charge case 201 into a locked position, then the charge case 201 can be manually rotated to lock the charge 200 in the charge holder 101. The charge 200 can also be entirely locked in place manually. For manual locking, the charge 200 can further include an optional ring 202 attached to the head end of the charge case 201. The ring 202 can have a depth such that at least a portion of the ring protrudes from the hole 102 in the charge holder 101. In this manner, one can simply grab a hold of the portion of the ring 202 and twist the ring. This twisting action can rotate the charge case 201 and the feet 224, thus locking the charge 200 in place. The charge case 201 can also be designed for use in conjunction with a rotating tool. For example, the charge case 201 can be manufactured such that it is capable of

receiving and coupling with the rotating tool. In this manner, one can simply couple the rotating tool to the charge case **201** to rotate the charge case **201** into a locked position.

[0040] The methods include the step of positioning a perforation gun adjacent to the material to be perforated. The perforation gun comprises the charge holder assembly **100**. The material to be perforated can be a variety of substances. According to an embodiment, the material is a portion of a subterranean formation. The subterranean formation can be penetrated by a well. The material to be perforated can also be a portion of the well. The step of positioning can include inserting the perforation gun into the well.

[0041] The methods include the step of causing the charge **200** of the charge holder assembly **100** to detonate. The step of causing can be any means by which the charge is detonated. By way of example, the step of causing can be igniting the detonation cord **300**. The step of causing can also be manually activating a switch that causes the charge to detonate.

[0042] The methods can further include the step of inserting the charge **200** into the charge holder **101** prior to the step of positioning. The step of inserting can include inserting a plurality of charges into the charge holder. The step of inserting can further include the step of allowing the charge case **201** to lock in the charge holder **101** or causing the charge case to lock in the charge holder.

[0043] Some of the advantages of the charge case include: the charge case is easy to install into the charge holder; and the retention method does not create any extra debris from the charge holder that can be left in the well during the detonation process or the trip out of the well. The lack of debris created from the charge case is different from other devices that utilize clips or bend tabs, which tend to break off during the detonation process and create debris that can be left in the well. Another advantage to the charge case is that it is easy to unload. For example, it is often desirable to have a back-up perforation gun on a job site in the event that some or all of the charges in another perforation gun fail to explode. If a back-up gun contains charges and the back-up gun is not needed, then the charges can be easily removed from the back-up perforation gun.

[0044] Therefore, the present invention is well adapted to attain the ends and advantages mentioned as well as those that are inherent therein. The particular embodiments disclosed above are illustrative only, as the present invention may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below. It is, therefore, evident that the particular illustrative embodiments disclosed above may be altered or modified and all such variations are considered within the scope and spirit of the present invention. While compositions and methods are described in terms of “comprising,” “containing,” or “including” various components or steps, the compositions and methods also can “consist essentially of” or “consist of” the various components and steps. Whenever a numerical range with a lower limit and an upper limit is disclosed, any number and any included range falling within the range is specifically disclosed. In particular, every range of values (of the form, “from about a to about b,” or, equivalently, “from approximately a to b,” or, equivalently, “from approximately a to b”) disclosed herein is to be understood to set forth every number and range encompassed within the broader range of values. Also, the terms in the

claims have their plain, ordinary meaning unless otherwise explicitly and clearly defined by the patentee. Moreover, the indefinite articles “a” or “an”, as used in the claims, are defined herein to mean one or more than one of the element that it introduces. If there is any conflict in the usages of a word or term in this specification and one or more patent(s) or other documents that may be incorporated herein by reference, the definitions that are consistent with this specification should be adopted.

What is claimed is:

1. A charge holder assembly comprising:

a charge holder, wherein the charge holder is a hollow cylinder, and wherein the charge holder comprises:

(a) at least one hole disposed through a wall of the charge holder; and

(b) at least one slot disposed through the wall of the charge holder, wherein the at least one slot is located diametrically opposite from the at least one hole; and

a charge comprising a charge case, wherein the charge case comprises:

(a) a tail end portion, wherein the tail end portion comprises:

(i) a cord retaining groove; and

(ii) two legs, wherein each of the two legs comprises at least one slot engaging groove, wherein the slot engaging grooves are at an angle offset from the cord retaining groove.

2. The charge holder assembly according to claim 1, wherein the charge holder comprises a plurality of holes and a plurality of slots, wherein each slot is located diametrically opposite of a unique hole.

3. The charge holder assembly according to claim 2, wherein the holes and the slots are arranged in a spiral pattern along the wall of the charge holder.

4. The charge holder assembly according to claim 1, wherein the cord retaining groove is capable of receiving a detonation cord.

5. The charge holder assembly according to claim 1, wherein at least a portion of the tail end is capable of protruding through the slot.

6. The charge holder assembly according to claim 5, wherein the size and shape of the slot is selected such that the at least a portion of the tail end is capable of protruding through the slot.

7. The charge holder assembly according to claim 5, wherein each slot engaging groove forms a foot on the leg.

8. The charge holder assembly according to claim 7, wherein the at least a portion of the tail end is the feet.

9. The charge holder assembly according to claim 8, wherein the size and shape of the feet are selected such that the feet are capable of protruding through the slot.

10. The charge holder assembly according to claim 9, wherein the height and depth of the slot engaging groove is selected such that upon rotation of the legs, the feet slidingly engage the outer diameter of the charge holder.

11. The charge holder assembly according to claim 10, wherein the engagement of the feet locks the charge case into the charge holder.

12. The charge holder assembly according to claim 11, wherein each of the two legs comprises two slot engaging grooves.

13. A method of perforating a material using a charge comprising:

positioning a perforation gun adjacent to the material to be perforated, wherein the perforation gun comprises:

a charge holder, wherein the charge holder is a hollow cylinder, and wherein the charge holder comprises:

(a) at least one hole disposed through a wall of the charge holder; and

(b) at least one slot disposed through the wall of the charge holder, wherein the at least one slot is located diametrically opposite from the at least one hole; and

a charge comprising a charge case, wherein the charge case comprises:

(a) a tail end portion, wherein the tail end portion comprises:

(i) a cord retaining groove; and

(ii) two legs, wherein each of the two legs comprises at least one slot engaging groove, wherein

the slot engaging grooves are at an angle offset from the cord retaining groove; and

causing the charge to detonate.

14. The method according to claim **13**, wherein the material to be perforated is a portion of a well.

15. The method according to claim **13**, wherein a detonation cord is positioned in the cord retaining groove in a manner such that the detonation cord can ignite an explosive charge within the charge case.

16. The method according to claim **13**, further comprising the step of inserting the charge into the charge holder prior to the step of positioning.

17. The method according to claim **16**, wherein the step of inserting comprises inserting the charge into the charge holder such that at least a portion of the tail end of the charge case protrudes through the slot.

18. The method according to claim **17**, further comprising the step of allowing the charge case to lock in the charge holder or causing the charge case to lock in the charge holder after the step of inserting.

* * * * *