July 24, 1956 A. H. HARTER, JR 2,755,735

EXPLOSIVE CARTRIDGE ASSEMBLY

Filed March 9, 1955

FIG.1.

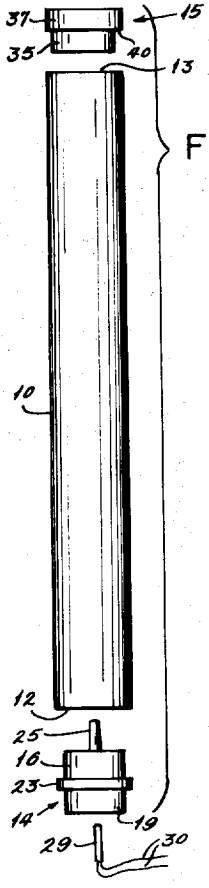


FIG.2.

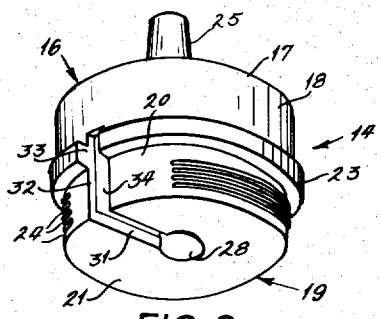


FIG.3.

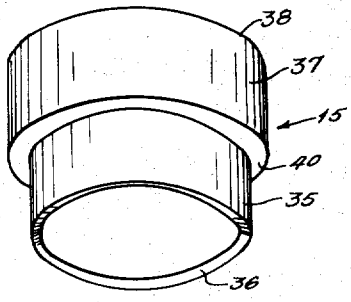


FIG.4.

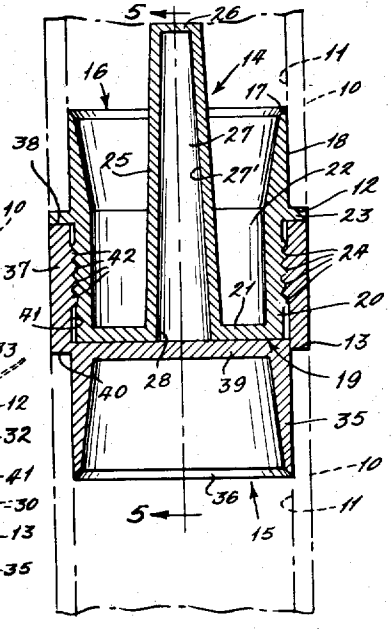


FIG.5.

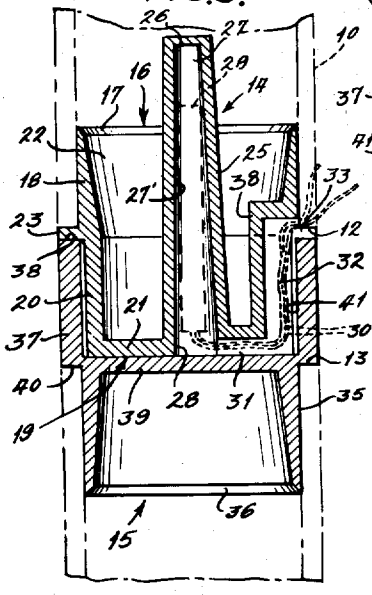
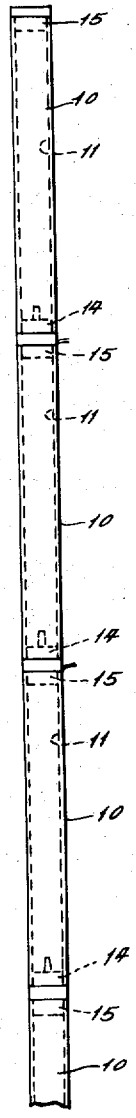


FIG.6.



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EXPLOSIVE CARTRIDGE ASSEMBLY

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10 Claims. (Cl. 102—24)

This invention relates to explosive cartridge assemblies of the kind used for geophysical prospecting, and particularly to seismograph prospecting for oil.

It is an object of the present invention to provide an explosive cartridge assembly especially adapted for seismic blasting operations.

Another object is to provide a means for quickly and efficiently securing together a plurality of cartridges in end to end relation to form a strong and rigid column which can be easily handled and lowered into the shot hole without separation of the cartridges.

Another object is to provide an explosive cartridge assembly in the form of a rigid column of cartridges having a smooth exterior surface so that the column can be inserted into a drill or shot hole without snagging and without exerting pressure upon the explosive.

Another object of the present invention is to provide a leakproof containing means for explosives so that mud or water in a shot hole will not contact the explosive and thereby diminish its efficiency.

Another object is to provide a cartridge assembly in the form of a column of explosive cartridges in which a blasting cap may be quickly and securely positioned at any level in the column in axial alignment with the cartridges.

Another object of this invention is to provide a containing means of sufficient strength and rigidity to eliminate the use of relatively insensitive explosives thereby obviating the need for a primer for efficient detonation, in addition to a blasting cap.

These and other objects and advantages will become apparent hereinafter.

This invention is embodied in an explosive cartridge having sealed ends adapted for threaded engagement with other explosive cartridges to form a rigid column, one end of the cartridge having a cap retaining means therein.

The invention also consists in the parts and in the combinations and arrangements of parts hereinafter described and claimed. In the accompanying drawings which form a part of this specification, and wherein like numerals refer to like parts wherever they occur:

Fig. 1 is an exploded view of a presently preferred cartridge assembly,

Fig. 2 is a perspective view of the plug member for one end of the cartridge,

Fig. 3 is a perspective view of the socket member for the other end of the cartridge,

Fig. 4 is a sectional elevational view showing the attachment of two cartridges,

Fig. 5 is a transverse sectional view taken along line 5—5 of Fig. 4 and showing a blasting cap in broken lines positioned in the cap retainer, and

Fig. 6 is a longitudinal view showing a series of cartridges joined together to form a column, Figs. 1 and 6 being on a smaller scale than the other views.

For the purposes of illustration, a cylindrical explosive cartridge or casing **10** having an inner wall **11** and ends **12** and **13** is provided as a container for explosives, such as may be used in seismograph prospecting for oil or the like. A plug member **14** is provided for sealing the end **12** of the casing **10** and a socket or sleeve member **15** is provided for sealing the other end **13** of the casing **10**. Preferably the casing **10** and the plug and socket members **14** and **15** are constructed of a plastic material, such as cellulose acetate butyrate or ethyl cellulose, from which a waterproof container can be made by bonding the plug and socket members **14** and **15** to their respective ends **12** and **13** of the casing **10** with a suitable bonding material, such as plastic glue or cement. The bonding material may be a solvent of the plastic material so that as the bonding material evaporates, the plug and socket members **14** and **15** will fuse into the casing **10** to form an integral unit.

As shown in Figs. 2, 4 and 5, the plug member **14** comprises a cup-shaped body having a lip or skirt portion **16** defined by an open end or rim **17** and an annular wall **18**, and a base portion **19** including an annular wall **20** enclosed by a circular plate **21**. The lip and base portions **16** and **19** are formed into an integral unit so that a central chamber **22** is defined by the inner surfaces of the lip and base walls **18** and **20** and the base plate or bottom wall **21**. An outwardly extending flange or abutment **23** is formed about the periphery of the plug member **14** intermediate the lip and base portions **16** and **19**, the flange **23** being adapted to engage the end **12** of the casing **10** so that the lip portion **16** extends into the casing **10** and the base portion **19** projects outwardly relative thereto. The base wall **20** is provided with fastening means, such as threads **24**, for locking engagement with the socket member **15**, as will be described hereinafter.

The plug member **14** also comprises a tubular cap well or hollow stem **25** positioned in the central chamber **22** in spaced relation with the inner surfaces of the lip and base walls **18** and **20** and having one end integrally connected to the inner surface of the bottom wall **21**. The other end of the cap well **25** is closed by an end piece **26** so that the cavity **27** defined by the inner surface **27'** of the cap well **25** will not be in communication with the chamber **22** when the plug member **14** is secured to the casing **10**. The bottom wall **21** is provided with a central opening **28**, which registers with the inner surface **27'** of the cap well **25** so that a conventional blasting cap **29** may be inserted through the opening **28** into the cavity **27**, Figs. 1 and 5. The cap **29** is provided with cap wires **30** and channel or conduit means are formed in the plug member **14** in which the wires **30** may be positioned when the explosive cartridges are being connected. The channel means in the plug member **14** include a radial groove **31** formed in the circular plate **21** from the central opening **28** to a point adjacent the base wall **20** and a longitudinal groove **32** formed in the base wall **20** in communication with the radial groove **31** and extending to a point adjacent the flange **23**, which is notched as at **33** to provide an outlet for the cap wires **30** as will be described hereinafter. The grooves **31** and **32** and the notch **33** are enclosed by a channel-shaped member **34**, which is integrally connected to the plug member **14** to form a leakproof unit.

It is now apparent that the annular lip wall **18** of the plug member **14** is adapted for engagement on the inner surface **11** of the casing **10** and may be bonded thereto in order to provide a leakproof seal at the end **12** of the casing. When the plug member **14** is secured to the end **12** of the casing **10**, the cap well **25** extends from the bottom wall **21** into the casing **10** and is concentrically aligned therewith so that explosive material packed in the casing **10** will be positioned in the chamber **22** of the plug member **14** about the cap well **25**. The socket member **15** may then be inserted and bonded to the end **13**

of the casing **10** to provide a leakproof cartridge for the explosives.

As shown in Figs. 3, 4 and 5, the socket member **15** comprises a small sleeve **35** having an open end or rim **36** and a larger sleeve **37** having an open end or rim **38**, the sleeves **35** and **37** having adjacent ends integrally connected by a radially extending diaphragm or web **39**. The socket member **15** is also provided with a radial abutment **40** extending between the adjacent ends of the smaller and larger sleeves **35** and **37**, the abutment **40** being adapted for engagement on the end **13** of the casing **10** so that the smaller sleeve **35** extends into the casing **10** and the larger sleeve **37** projects outwardly relative thereto. The larger sleeve **37** has an inner surface **41** provided with fastening means, such as threads **42**, for locking engagement with the threads **24** on the plug member **14**.

In assembling a single cartridge as shown in Fig. 1, the lip portion **16** of the plug member **14** is positioned in the casing **10** with the flange **23** abutting the end **12** of the casing. The lip wall **18** of the plug member **14** may then be bonded to the inner wall **11** of the casing **10** to render the connection watertight. Then the casing **10** is filled with explosive, which may either be packed directly in the casing or may be encased in a suitable light-weight paper container for insertion into the casing **10**. When the casing has been filled, the tubular cap well **25** will be circumscribed by the explosive in the chamber **22** of the plug member **14**. The smaller sleeve **35** of the socket member **15** is then positioned in the casing **10** with the radial abutment **40** engaged on the end **13** of the casing. The socket member **15** may also be bonded to the casing **10** thereby sealing the entire cartridge.

It is now apparent that a leak-proof explosive cartridge has been formed having the plug member **14** and the socket member **15** bonded to opposite ends of the casing **10**. Furthermore, the inner surface **41** of the larger sleeve **37** has a larger diameter than the outer diameter of the base wall **20** of the plug member **14** so that when it is desired to form a column of cartridges, Fig. 6, the plug member **14** of one cartridge may be easily inserted in the socket member **15** of another cartridge and the fastening means interlocked to effect a secure connection therebetween. When two cartridges have been joined together, the bottom wall **21** of the plug member **14** is engaged on the radial diaphragm **39** of the socket member **15** and the open end **38** of the large sleeve **37** will abut the flange **23** of the plug member **14**, Figs. 4 and 5.

As shown in Figs. 2, 4 and 5, the fastening means may comprise the threads **24** and **42**, which are formed on the outer periphery of the base wall **20** of the plug member **14** and on the inner surface **41** of the larger sleeve **37** of the socket member, respectively. The threads **24** and **42** are preferably of the interrupted type so that rotation of the plug member **14** on one cartridge a fraction of a turn relative to the socket member **15** on another cartridge will cause the threads **24** and **42** to become locked and the two cartridges rigidly secured in endwise abutting relationship. Additional cartridges are then joined in the same manner until a rigid column having a predetermined amount of explosive is formed. The blasting cap **29** is inserted into the cavity **27** in the cap well **25** of one of the plug members **14**, and the cap wires **30** positioned in the grooves **31** and **32**. The plug member **14** is then secured to the socket member **15** in the next cartridge thereby enclosing the cap **29** in the cap well **25** and the cap wires in the channel means. The notch **33** in the flange **23** permits the cap wires **30** to extend out of the channel so that they may be attached to electrical means (not shown) for detonating the cap **29** when the column has been positioned in a shot hole. It is apparent that the cap **29** may be located at any level in the column and cannot slip or be pulled from the cap well **25**. Furthermore, the cap **29** is aligned with the axis of the explosive contained in the casings **10** to assure maximum wave propagation when the column is detonated.

The rigid column of explosive cartridges may have a smooth outer surface by providing the flanges **23** of the plug members **14** and the large sleeves **37** of the socket members **15** with the same outside diameter as the casings **10**. The column may then be easily inserted into a shot hole without snagging on the sides thereof. In addition, the explosive column is of sufficient rigidity that considerable pressure may be exerted thereon when placing the column in the shot hole, and a relatively sensitive explosive may be used without endangering the life of the shooter. Furthermore, the waterproof cartridges can withstand considerable pressures from water in the shot hole without adverse effects, whereas paper-wrapped cartridges are frequently caused to collapse from water pressure and the efficiency of the explosive is greatly diminished.

This invention is intended to cover all changes and modifications of the example herein chosen for the purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention.

What I claim is:

1. Closure means for sealing the end of a tubular casing, comprising a first sealing member having a first side wall adapted to fit into one end of the casing and a base with an opening therein, cap retaining means on said base having a cavity in communication with the opening, and channel means extending from said opening to said first side wall; a second sealing member having a second side wall adapted to fit into another end of the casing and diaphragm means connected to the inner periphery of said second side wall, said first and second sealing members being adapted to interfit whereby casings having ends sealed by said members may be joined together.

2. Closure means for sealing the end of tubular casings, comprising a first sealing member having a first side wall adapted to be telescoped relative to the end of one casing, a base on one end of said first side wall having an opening therein, stem-like means on said base having a cavity in communication with said opening, and circuitous channel means extending from said opening to point intermediate the ends of said first side wall; a second sealing member having a second side wall adapted to be telescoped relative to the end of another casing and diaphragm means secured to the inner periphery of said second side wall; and fastening means adapted to secure said sealing members together.

3. Closure means adapted for sealing opposite ends of a tubular casing, comprising a plug member having a first side wall adapted to be positioned in overlapping relation with one end of the casing and a base on one end of said first side wall, tubular means attached to said base in spaced relation with said first side wall, conduit means extending from said tubular means to a point on the outer periphery of said first side wall; a socket member having a second side wall adapted to be positioned in overlapping relation with the other end of the casing and a diaphragm secured to the inner periphery thereof; and fastening means adapted to releasably secure said plug and socket members on one casing to socket and plug members respectively of similar casings.

4. Closure means for sealing the ends of a tubular casing, comprising a plug member having a cylindrical side wall adapted to be positioned in contacting relationship with one end of the casing, a circular bottom wall formed on one end of said side wall and having a central opening formed therethrough, a hollow stem positioned on said bottom wall in spaced relation with said side wall and having its inner periphery in communication with said opening, channel means in said bottom and side walls from said opening to a point on the outer periphery of said side wall, and threaded fastening means on the outer periphery of said side wall adjacent to said bottom wall; and a socket member having a first sleeve

adapted to be positioned in contacting relationship with another end of the casing in overlapping relationship, a second sleeve connected to one end of said first sleeve, a circular diaphragm on the inner periphery of said socket member intermediate said sleeves, and threaded fastening means on said second sleeve, said threaded fastening means of said plug member being adapted to coact with said threaded fastening means of said socket member whereby casings having said plug and socket members secured to their ends may be joined to form an explosive cartridge assembly.

5. Closure means for sealing the open ends of a cylindrical casing, comprising a cup-shaped plug member having a lip portion and a base portion with an outwardly extending abutment therebetween, said base portion including a side wall and a bottom wall having a central opening therein, a cap retaining means positioned on said bottom wall in spaced relation with the inner periphery of said plug member, said cap retaining means having a cavity defined by a peripheral wall conterminous with the periphery of said central opening, channel means in said plug member including a radial channel in said bottom wall extending from said central opening to a point adjacent the outer periphery of said side wall and a longitudinal channel in communication with said radial channel and extending to a point adjacent said abutment, and interrupted threads on the outer periphery of said side wall; and a socket member having a first sleeve and a second sleeve having adjacent ends, a circular diaphragm interconnecting said sleeves at the adjacent ends thereof, a radially-extending abutment formed between said sleeves, and interrupted threads on the inner periphery of one of said sleeves, said plug member being adapted to receive said socket member in threaded engagement therewith whereby casings carrying each of said members may be releasably secured to other casings carrying each of said members.

6. A tubular cartridge comprising a casing having open ends; a first member telescoped in one of said casing ends, said first member including a first side wall and a bottom wall with an opening therein, cap retaining means on said bottom wall in spaced relation with said first side wall and having a cavity in communication with said opening, channel means from said opening to a point on the outer periphery of said side wall; a second member telescoped in the other of said casing ends, said second member including a second side wall and a diaphragm; and fastening means on each of said members adapted to releasably engage other fastening means on similar cartridges.

7. A plurality of cartridges joined in end to end relationship to form an explosive cartridge assembly, each of said cartridges comprising a casing having open ends; a first member positioned in one of said open ends and including a side wall and a bottom wall defining a chamber in communication with the inner periphery of said casing, cap retaining means on said first member projecting into said chamber and having a cavity therein, passage means registering with said cavity and extending to the outer periphery of said first member; and a second member positioned in the other of said open ends and including a side wall and a diaphragm; and fastening means on each of said members whereby said cartridges are secured together.

8. A plurality of explosive cartridges secured in end to end relation to form an explosive cartridge assembly, each of said cartridges including a casing having an inner wall and open ends; a first sealing member sealably engaging one end of said casing and having first fastening means formed thereon; a second sealing member sealably engaging the other end of said casing and having second fastening means formed thereon for engagement with said first fastening means on first sealing members in other cartridges, said second sealing member having a side wall and a bottom wall with a central opening therein, channel means from said central opening to said side wall, and a tubular cap retaining means on said bottom wall in communication with said channel means for receiving a blasting cap therein.

9. A plurality of cylindrical explosive cartridges secured in end to end relation to form an explosive cartridge assembly, each of said cylindrical cartridges comprising a tubular casing having an inner wall and open ends; a first sealing member positioned in a first end of said casing and having small and large sleeves with a sealing diaphragm therebetween, a radially-extending abutment surface formed between said small and large sleeves for engagement on said first end of said casing, the larger sleeve extending conterminous with said casing and having threads on its inner surface; a second sealing member positioned in a second end of said casing and having an annular projecting portion with external threads circumferentially disposed thereon, said projecting portion being enclosed by a bottom wall having a central opening therein, a radial channel formed in said bottom wall from said central opening to a point adjacent the outer periphery of said projecting portion, a longitudinal channel in said projecting portion from said radial channel to a point adjacent the end of said casing, and a tubular member concentrically positioned relative to said casing and secured to said bottom wall in communication with said central opening for positioning a blasting cap therein.

10. An explosive cartridge assembly comprising a plurality of cylindrical explosive cartridges secured in end to end relation to form a column, each of said cartridges including a tubular casing having an inner wall and open ends; a socket member having a small sleeve positioned in one end of each of said cartridges, a large sleeve projecting outwardly relative to said cartridge end, a radial abutment extending between said small and said large sleeves engaged on the end of said cartridge, and a diaphragm sealing said small sleeve from said large sleeve, said large sleeve having an inner surface with interrupted threads formed thereon; a plug member having a cup-shaped body including an annular lip portion with an open end positioned in the other end of each of said cartridges and an annular base portion projecting outwardly relative thereto, said base portion being enclosed by a bottom wall and having interrupted threads adapted to coact with interrupted threads on the inner surface of one of said large sleeves, a radial flange formed integral with said lip and base portions in engagement with said other end of each of said cartridges, a tubular cap well formed on said bottom wall extending in concentric spaced relation to said lip and base portions, and channel means from said tubular cap well to said radial flange; and a blasting cap having cap wires operatively connected thereto, said cap being disposed in the cap well of at least one of said plug members with said cap wires positioned in said channel means.

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