April 19, 1966 R. A. MEREDITH ETAL 3,246,602

EXPLOSIVE CARTRIDGE WITH RIGID CLOSURE MEANS

Filed July 9, 1964 2 Sheets-Sheet 1

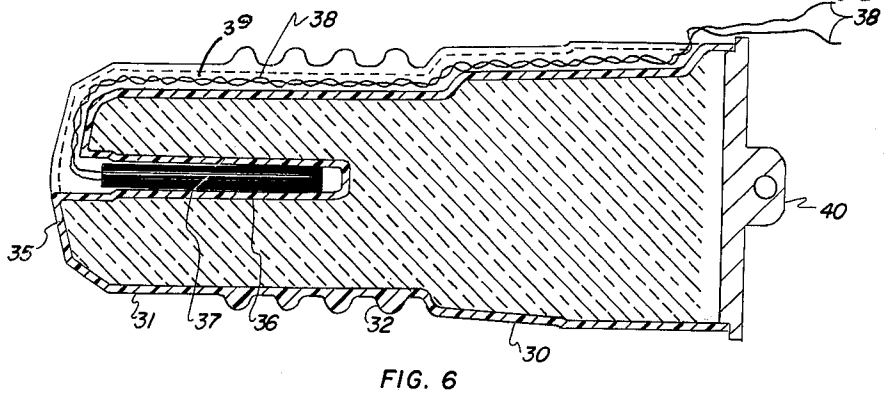


FIG. 6

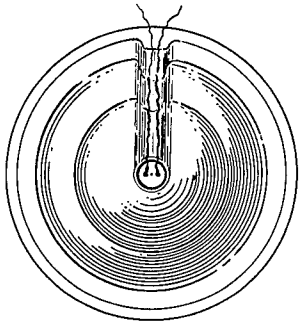


FIG. 7

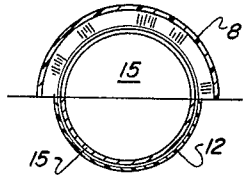


FIG. 2

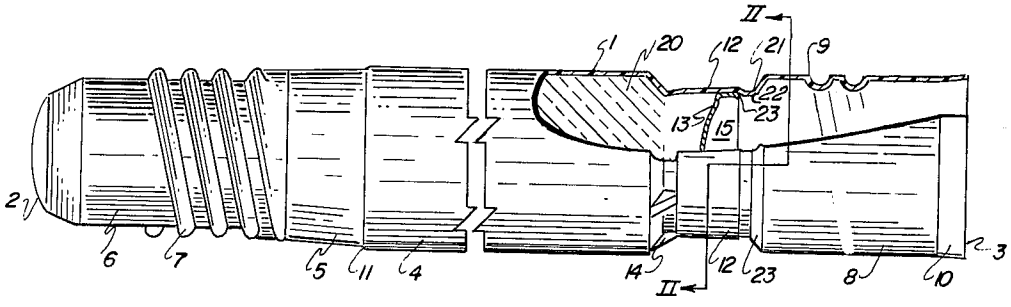


FIG. 1

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EXPLOSIVE CARTRIDGE WITH RIGID CLOSURE MEANS

Filed July 9, 1964 2 Sheets-Sheet 2

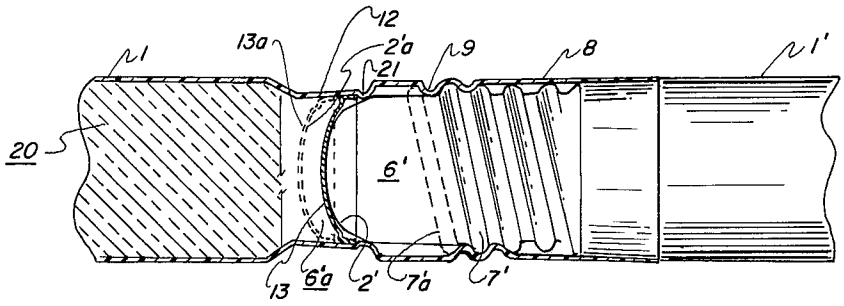


FIG. 4

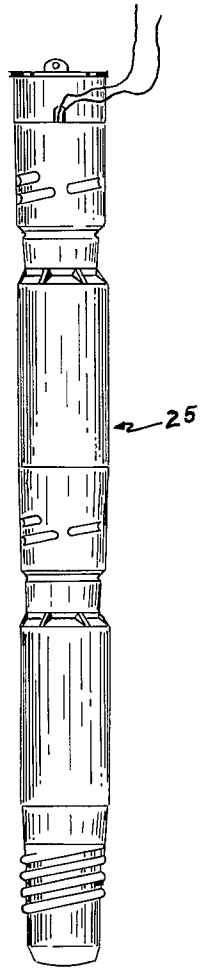


FIG. 5

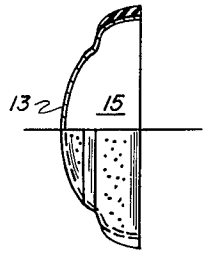


FIG. 3

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3,246,602

EXPLOSIVE CARTRIDGE WITH RIGID CLOSURE MEANS

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23 Claims. (Cl. 102—24)

This invention relates to explosive cartridges, and more particularly to explosive cartridges adapted for forming an exposive column train by end-to-end coupling.

The use of a train of explosive cartridges in columnar assemblies for application such as seismic exploration, coal mining, quarry and metal mining, well-shooting, and various constructional functions is a common practice, with typical assemblies shown and described in U.S. Patents No. 2,238,938 and No. 3,013,492. In general, a plurality of like cartridges are formed by fabricating, as by drawing, a seamless closed-end cylindrical container of steel, providing suitable male coupling means, as screw threads, at the closed end of the container, filling the container with explosives, including various blasting agents, and securing a closure member to the closed end. Normally the closure member is a recessed or dished disk provided with female coupling means, as screw threads, and which is suitably secured to the container. Normally the securement of the closure disk is effected by means of crimping or roll-seaming the adjacent edges of the container and the closure means. To facilitate the coupling of such cartridges or sub-sections, the female and male couplings are normally complementary to each other, thus permitting the cartridges to be joined in end-to-end relationship into a string or column of the cartridge units desired for a specific application. The train or column is then inserted into a boring or an existing well-hole to the required depth, and the explosive initiated in any appropriate manner.

Since water, oil, quicksand, muck and the like are commonly found in borings and well-holes, these cartridges or subassemblies are normally hermetically sealed to prevent contamination of the explosive by the environment in which they are placed. This is particularly true where the explosive is water sensitive or hygroscopic in nature such as the nitrocarbonitrate or ammonium nitrate type explosives. Heretofore the complete fabrication of an explosive cartridge or subassembly has been accomplished in a single location, wherein the cartridge is formed of a drawn metal container, filled with explosive material and a closure member secured to the container by crimping or roll-seaming the adjacent edges of the closure and container into a fluid tight seal. However, since such securement of the closure member to the container by crimping and roll-seaming involves relative heavy equipment, which together with the safety precaution necessary in such practice, adds to the cost of the cartridge. Further, since these prior art cartridges generally must be preformed prior to transportation to on-site application, it prevents on-site loading of the cartridge with the type and quantity of explosive required for a desired application.

In contrast to such prior art blasting cartridges, a novel blasting assembly has been discovered which permits on-site loading of the cartridge and simple water-tight closure thereof by mere manipulation of the cartridge components. Broadly speaking, the closure comprises a reduced throat or neck section formed in the cartridge at an intermediate portion thereof spaced from both ends, with the reduced throat portion having a tapered configuration in the form of a truncated cone in which is seated a closure member having tapered sidewalls conforming to the inner walls of the throat section. The

closure member is adapted to be driven and forced into welding engagement in the throat section upon the abutment or engagement of the closure member by the nose portion or closed end of a like cartridge when it is coupled with the first said cartridge. Accordingly, the invention comprehends a hollow tubular cartridge having male coupling means, such as external screw threads, on one end of the cartridge and female coupling means, such as internal screw threads, at the opposite open end of the cartridge which adapts the cartridge to be coupled to like cartridges in the explosive train. The novel closure means comprises a reduced throat section which is adjacent to and spaced from the open end which is provided with the female coupling means. The throat section defines a truncated cone which tapers inwardly towards the closed end of the cartridge provided with the male coupling means, with the open section, of the cartridge, adapted to receive a closed end of a like cartridge when it is coupled to the cartridge. A closure means which is seated in the throat section by insertion therein, is adapted to be driven in wedging engagement in the throat section upon projection of the closed end of a like cartridge into the throat section upon coupling thereof. The necessary degree of sealing of the cartridge can be effected by the degree in which the closure member is wedged into the neck section during the coupling of like cartridges together.

Accordingly, it is an object of this invention to provide a novel blasting assembly. A further object of this invention is to provide an explosive cartridge of novel construction which can be easily and simply manufactured, and which is adapted for on-site loading with subsequent simple closure thereof in fluid-tight condition. Another object of this invention is to provide an explosive cartridge of novel construction adapted to be filled with an explosive which can be sealed therein from external environment by simple manipulation of a closure means. Another object of this invention is to provide a novel explosive cartridge having a novel closure means which can be sealed to the cartridge by mere coupling of the cartridge to a like cartridge. Other objects and advantages of this invention will become more apparent from the following descriptions and drawings in which:

FIGURE 1 is a side view, partly in section, illustrating one embodiment of this invention;

FIGURE 2 is a cross-sectional view taken along lines II—II of FIGURE 1;

FIGURE 3 is a side view, partly in section, illustrating one embodiment of the closure means of this invention;

FIGURE 4 is a side view, partly in section, illustrating the cooperation of like cartridges of this invention during coupling thereof into end-to-end relationship;

FIGURE 5 is a longitudinal view illustrating a columnar assembly or a train of the explosive cartridges of this invention coupled in end-to-end relationship;

FIGURE 6 is a cross-sectional view of an explosive booster unit adapted for coupling to the cartridge of this invention; and

FIGURE 7 is an end view of the explosive booster unit of FIGURE 6.

Referring to the drawing, the novel cartridge of this invention as shown in FIGURE 1 comprises a tubular container 1 which is preferably of seamless construction, and normally provided with a closed end 2 and an open end 3. The container may be fabricated of any material which is self-sustaining and rigid enough to provide a necessary strength for insertion into borings or well-holes for the application desired. In this regard the container can be formed of metal such as steel or various water-inert polymeric materials such as phenol-formaldehyde resins, polyethylene, polystyrene, cellulose acetate, polyvinyl chloride, and the like. In the particular form contemplated, the container shown is formed of linear poly-

ethylene formed in any suitable manner, for example by blow-molding.

The cartridge container **1** is normally of cylindrical configuration so as to conform it to the cross-sectional configuration normally encountered in borings and well-holes. As shown in the drawings, the cartridge container **1** is provided with a main body portion **4** integrally connected through a tapered transitional section **5** to a nose portion **6** on which are provided suitable male coupling means, such as external male screw threads **7** which as shown are of the double thread type. As will be noted, the closed end, or end wall, of the container is of general convex configuration which will adapt it for cooperative engagement with a particular closure means to be described below in conjunction with this embodiment. However, it is to be noted that this end wall may be of any configuration desired, for example it may be planar and of reduced cross-section which is joined to the container through a beveled transitional portion of the container.

As indicated above the opposite end of the container **1** is open with the end portion **8** adjacent thereto provided with female coupling means such as internal female screw threads **9** formed on the inner wall of the end section **8**. If desired and as shown, female threads **9** will also be double threads, and will also be complementary to the male threads **7** provided on the nose portion **6** to thus adapt the cartridge for coupling to like cartridges in end-to-end relationship. If desired, and as also shown, the open end of the container is provided with a flared portion **10** having the internal wall thereof complementary to the taper of transition section **5** so as to form a smooth continuation of one coupled cartridge to the other. In this respect it will also be noted that the transition portion **5** is slightly stepped to provide a shoulder **11** having a width substantially that of the thickness of the container at the endmost section **3** so as to facilitate the attainment of the smooth continuation from cartridge to cartridge, which are coupled together. The cartridge of this invention is adapted for closure, in accordance with this invention, by means of a reduced neck section or constriction **12** having a diameter substantially smaller than that of the container main body portion **4** and integral end portion **8**. As shown in the drawing, the necked or throat section **12** defines, in substance, a truncated cone tapering inwardly of the container toward the closed end **2** thereof. The specific angle of the taper is not critical in this respect and it being only necessary that it be sufficient to permit a wedging action of a closure member **13** sealed therein (and described below) to obtain a fluid-tight seal desired, when the closure member is forced into the neck section **12** toward the interior of the container or cartridge.

If desired, the container **1** can be reinforced at the juncture of the neck section **12** with the main body portion **4** by means of reinforcing gussets **14** which may be formed in the container during fabrication thereof.

The closure member **13** will normally be a cylindrical member having slightly conical or tapered walls having an angle complementary to the angle provided in the throat section **12**. In the form shown, particularly FIGURES 1 and 3, the closure member will comprise a cupped or dished member which is seated in the neck section **12** so that the concavity **15** thereof is disposed adjacent the open-end **3** of the container. The closure's concavity **15** is preferably complementary to the convexity provided on the end-wall of the nose section **6** to permit the seating of a nose section (of a coupled like cartridge) therein in order to facilitate the driving of the closure member **13** into reduced throat section **12**. In order to assist the attainment of the seal between closure member **13** and throat section **12**, the sidewalls or the entire outer surfaces of the closure member may be coated, as by spraying, with rubber compositions conventionally employed in facilitating the attainment of a seal between two members. However it is to be understood that such rubber coating is not necessary since an effective seal can be obtained by simple wedgement of the closure member **13** within the throat section **12**. In this respect it is noted that the provision of the tapered throat section **12** provides a secondary important function in eliminating disadvantages inherent in blow-molding of plastic materials. As is known, inherent in the process of blow-molding is the inability for internal surface finishing of molded articles obtained thereby. Accordingly, a wide variation in tolerance is found to occur in dimensional variation of the inner walls of the article. As will be appreciated, such dimensional variation, of the herein described blow-molded cartridge, can be obviated by the simple expedient of wedging the closure member **13** in the throat section **12**, by only a distance necessary to compensate for variation in internal dimension of the throat section **12**. It is also noted that the reduced neck section **12** provides a further supplemental advantage in the handling of the cartridges. As will be appreciated, a continuously smooth container involves difficulty in the handling thereof, as by grasping or by the use of tools, without denting or damage thereof. In contrast, the reduced throat section **12** forms a substantial indentation or depression in the exterior of the cartridge to permit easier grasping and holding thereof during manipulation necessary in coupling the units together and/or insertion into the boring or well-hole. This is particularly significant when the cartridge is handled under a wet environment, which makes the cartridge more slippery than usual when, as commonly happens, the cartridge is handled by grease-stained gloves or hands, or particularly when the container is formed of polyethylene as herein contemplated.

In operation, the container **1** is filled, on-site if desired, with a main charge **20** of an explosive, preferably cap-insensitive, in an amount desired for the specific application. The container is then closed by the insertion of a closure member **13** through the open-end **3** of the container, into the reduced throat section **12** to seat the closure member therein. If desired, and preferably, as shown in the drawings, the desired orientation of the closure member **13** in throat section **12** may be facilitated by and the closure member locked therein by means of a detent section **21** formed of a portion of the throat section **12**, and having a still further reduced diameter which forms a circumferentially extending projection **22** which, in turn, defines an inner shoulder **23** of a width sufficient to radially overhang the closure member **13** but insufficient to interfere with the insertion of the closure member **13** into the throat section **12**. Although the projection **23**, for locking the closure member in the throat section, has been described as continuous, it is to be understood that the projection may be segmented, or formed as a plurality of circumferentially spaced lugs, in any number to effect the desired orientation of and locking of the closure member into the throat section. Further, although the detent section **21** has been described as being a reduced diameter, it is to be understood that such reference is made only to internal diameter thereof with the external diameter thereof permissably having the same external diameter as the throat section **12**.

Any cap sensitive explosive can be employed as the main charge of the cartridge, typical of which are the nitrocarbonitrate or ammonium nitrate type explosives, with or without sensitizers. The nitrocarbonitrate explosive may be comprised mainly of ammonium nitrate and some carbonaceous material which is combustible, examples of which are carbon (either carbon black or in the form of coal dust), paraffins, and various liquid hydrocarbons (such as diesel oil and fuel oils), each of which may be used either in whole or in part as the carbonaceous material. The ammonium nitrate need not be of high purity and can actually be of fertilizer grade, coated or uncoated with sensitizers or other additives, and granular and free

flowing. A particularly useful composition may be the prilled ammonium nitrate processed and compounded in accordance with the teachings of U.S. Patent No. 2,975,046. However, it is to be understood that although any cap-insensitive main explosive charge is preferred as the main charge of the cartridge, the invention is not limited thereby, since any type of main explosive charge can be employed.

The cartridge or subunits of this invention can be assembled into an explosive column **25** (see FIGURES 4 and 5) by coupling two like cartridges together in end-to-end relationship This assembly can be effected by the insertion of a nose portion **6'** of a like cartridge **1'** into the open end of cartridge **1**, and then screwing the units together by engagement of the male threads **7'** of cartridge **1'** with the female threads **9** of cartridge **1**. As can be more clearly seen in FIGURE 4, as the nose portion **6'**, of cartridge **1'**, advances within the end portion **8** of cartridge **1**, it engages closure member **13** by seating in the concavity thereof. With further advancement of the nose portion **6'**, it forces or drives the closure member **13** into more severe wedgement within the reduced throat section **12** to provide the desired sealing of the main charge **20** from an external environment. The new position of the elements is shown in phantom in FIGURE 4 wherein the new position of closure member **13** is shown as **13***a*, and that of closed end **2'** of nose portion **6'** are shown, respectively, as **2'***a* and **6'***a*. Coupling of the cartridge units may be continued to the number desired in the column, a booster unit **30** may then be coupled to an endmost cartridge, and the axial alignment of cartridges and boosting unit may then be inserted in the boring or well-hole for subsequent initiation of the booster and main charges.

A particularly effective explosive booster unit, also comprehened within this invention, is illustrated in FIGURE 6. This booster unit may comprise an elongated tubular container formed of the same material as the novel cartridges described above. For example, the container may be formed of linear polyethylene by injection molding and the like. In the form shown the booster unit is provided with an integral end nose portion **31** provided thereon with a male coupling means, such as male screw threads **32** having a configuration complementary to the female threads **9** of cartridge **1**. However it is noted that since the booster unit forms the terminal unit of an explosive train, there is no necessity for further additional coupling means in order to accommodate for further coupling of additional units, and accordingly the open end of the booster unit is therefore not provided with coupling means or screw threads. The closed end **35** of the booster unit is formed with an inwardly extending axial recess **36** so as to form a detonator well for receiving a detonator **37**. The facilitate the threading of the lead wires **38**, extending from detonator **37**, the booster unit is provided with a longitudinal groove **39** which communicates with detonator well **36** and the exterior of the explosive train **25**. In practice the boster unit is filled with a suitable explosive booster composition and a closure member or cap **40**, which also may be fabricated from polyethylene, is secured to the open end of the booster unit, by spin-welding and the like. A detonator **37** may then be inserted itno the detonator well **36** with the lead wires **38** threaded along groove **39**, and the booster unit is then coupled, as by screwing, to the female coupling of an endmost cartridge unit of the explosive train. It is noted that since the end portion **31** of the booster unit is complementary to the female coupling on an adjacent coupling cartridge, the end of the booster unit will project into the nose portion of the adjacent coupled cartridge so as to abut and force and further wedge the closure member seated therein further into the throat section.

Although not absolutely required, the retention of the detonator in its well **36** can be effectively accomplished by a modification in the configuration of the well. As shown in the drawings, the detonator well **36** can be formed in a conical form tapering inwardly of the booster unit so that the end-wall of the well is of smaller cross-section than the entrance or mouth of the well. The cross-sectional dimensions of the well can be sized so that it will snugly receive a variety of commercially available detonators when they are partially inserted in the well, and so that the detonator can be and will be firmly wedged in the well upon full insertion therein under nominal force such as may be applied bodily.

Any suitable cap-sensitive composition may be employed in the booster unit, typical of which are gelatin dynamite, trinitrotoluene, tetryl, pentaerythritol tetranitrate, picric acid and the like. The size of the booster unit is normally small as compared with the size of the main charge in the cartridge units. For example, by way of comparison, a typical cartridge unit of this invention was approximately 27¾ inches long whereas, in contrast, the booster unit of substantially the same corresponding cross-sectional dimensions was fabricated in a length of 6¾ inches. Any suitable method of detonating the booster charges can be employed such as blasting caps or detonating fuses. For example, the blasting cap may be a commercially available unit containing standard charges of mercury fulmanate.

Although the invention has been described with references to specific materials, embodiments and details, various modifications and changes within the scope of the invention will be apparent to one skilled in the art and are contemplated to be embraced within the invention.

What is claimed is:

1. In a hollow cylindrical cartridge having one closed end male coupling means on the one closed end thereof and female coupling means on the opposite end thereof for coupling to like cartridges into an explosive train, the improvement comprising, a reduced throat section defining a truncated cone tapering inwardly of said cartridge toward said closed end having said male coupling means with said throat section being reduced relative to adjacent portions of said cartridge and spaced from, both, said closed end and said opposite end, said throat section being spaced from said opposite end a distance such that said throat section receives the closed end of a coupled like cartridge in projecting relationship therein; and a rigid closure means slidably seated in said throat section for longitudinal movement therein with said closure means being adapted to be abutted by the closed end of a like cartridge upon projection into said throat section so that said closure means is wedged in said throat section in fluid-tight engagement therewith as coupling is being effected between said cartridge and said like cartridge.

2. The cartridge of claim 1 including detent means for locking said closure means in said throat section comprising an inwardly extending rib circumferentially disposed on the inner wall of said throat section on the upper portion thereof adjacent to said opposite end of said cartridge.

3. The cartridge of claim 2 wherein said cartridge is filled with an explosive.

4. An explosive cartridge for end-to-end coupling with like cartridges into an explosive column comprising a self-sustaining elongated tubular container having an integral closed end nose portion and an opposite open end, male screw thread means on said nose portion, female screw thread means on said open end with said female and said male thread means being complementary to each other to adapt said cartridge for said coupling to a like cartridge, a reduced throat section defining a truncated cone tapering inwardly of said cartridge toward said closed end with said throat section being reduced relative to adjacent portions of said cartridge and spaced from, both, said closed end and said open end, said throat section being spaced from said open end a distance such that when said female screw thread means and said open end receive the nose section of a like cartridge the closed end of the nose portion thereof projects into said throat section; and a rigid clo-

sure means slidably seated in said throat section for longitudinal movement therein, said closure means being adapted to be abutted by the closed end of said like cartridge upon projection into said throat section so that said closure means is wedged in said throat section in fluid-tight engagement therewith as coupling is being effected between said cartridge and said like cartridge.

5. The cartridge of claim 4 wherein said closure means comprises a cup-shaped member having outwardly tapered side walls with the concavity thereof disposed adjacent said open end.

6. The cartridge of claim 5 including detent means for locking said closure means in said throat section comprising a circumferentially extending rib on the inner wall of said throat section at the upper end thereof adjacent said open end.

7. The cartridge of claim 6 wherein said cartridge comprises a container formed of water-inert polymeric material.

8. An explosive cartridge for end-to-end coupling with like cartridges into an explosive column comprising a self-sustaining cylindrical container of polymeric material and having an integral closed end and an opposite open end, male coupling means on the outer wall of said container adjacent said closed end, female coupling means on the inner wall of said container adjacent said open end with said female coupling means being complementary to said male coupling means to adapt said cartridge for coupling to a like cartridge, a reduced throat section defining a truncated cone tapering inwardly of said cartridge toward said closed end having said male coupling means, said throat section being reduced relative to adjacent portions of said cartridge and spaced from, both, said closed end and said open end; said throat section being spaced from said open end a distance such that the said throat section receives the distal portion of the closed end of said like cartridge when coupled to said cartridge so that the said distal end projects into said throat section; and a rigid closure means slidably seated in said throat section for longitudinal wedging movement therein, said closure means being adapted to be abutted by said distal end of said like cartridge upon projection into said throat section so that the said closure means is forceably driven thereby into wedged sealing engagement with said throat section as coupling is being effected between said cartridge and said like cartridge.

9. The cartridge of claim 8 including detent means for locking said closure means in said throat section comprising an inwardly extending rib circumferentially disposed on the inner wall of said throat section at the end portion thereof adjacent the open end of said cartridge.

10. The cartridge of claim 9 wherein said closure means comprises a rigid cup-shaped member having outwardly tapered sidewalls conforming to the inner wall of said throat section with the concavity of said member being disposed adjacent said open end of said cartridge.

11. The cartridge of claim 10 wherein said container is filled with a nitrocarbonitrate explosive composition.

12. The cartridge of claim 10 wherein said container is filled with an explosive comprising ammonium nitrate.

13. The cartridge of claim 9 wherein said container is filled with an explosive.

14. The cartridge of claim 13 wherein said explosive is a nitrocarbonitrate composition.

15. The cartridge of claim 13 wherein said explosive comprises ammonium nitrate.

16. The cartridge of claim 8 including a lower nose portion formed of said container and defining its said closed end and wherein said male coupling means are external male screw threads formed of said container and disposed externally on said nose portion, and an upper portion formed of said container and defining its said open end and wherein said female coupling means are internal female screw threads disposed on the inner wall of said upper portion, said upper portion having its said inner wall complementary to the outer wall of said nose portion whereby said upper portion is adapted to be coupled to a nose portion of a like cartridge so that its nose portion projects into said throat section.

17. The cartridge of claim 16 including external radial gussets formed of said container and extending between the external walls of said throat section and said container with said gussets disposed at the junction of said throat section with the adjacent portion of said container disposed between said throat section and said nose portion.

18. The cartridge of claim 17 including detent means for locking said closure means in said throat section comprising an inwardly extending rib circumferentially disposed on the inner wall of said throat section at the end portion thereof adjacent the open end of said cartridge.

19. The cartridge of claim 18 wherein said closure means comprises a rigid cup-shaped member having outwardly tapered side walls conforming to the inner wall of said throat section with the concavity of said member being disposed adjacent the said open end of said cartridge.

20. The cartridge of claim 19 wherein said container is filled with a nitrocarbonitrate explosive composition.

21. The cartridge of claim 19 wherein said container is filled with an explosive composition comprising ammonium nitrate.

22. The cartridge of claim 19 wherein said cartridge comprises a container formed of polymeric material and said container is filled with an explosive, and including a booster primer unit coupled to the upper portion of said container, said unit comprising a self-sustaining cylindrical container of polymeric material having a lower closed end and an upper open end, an integral lower portion formed of said unit and defining its said closed end, external male screw threads disposed on the external wall of said unit's lower portion and adapted to be coupled into and with the female screw threads in the said upper portion of said cartridge to project the closed end of said unit into said throat section in driving engagement with said closure member, a detonator well comprising a portion of said closed end of said unit recessed inwardly thereof, a longitudinal groove in the external wall of said unit communicating with said well, an explosive booster charge in said unit, closure means secured to the said open end of said unit, a detonator disposed in said well, and an electric lead wire extending in said groove to said detonator.

23. A blasting column comprising a plurality of cartridges coupled in end-to-end relationship with said cartridges filled with an explosive, and a blasting unit coupled to an endmost cartridge each of said cartridges comprising a cartridge formed of

(a) a self-sustaining cylindrical container of polymeric material and
  (i) having an integral closed end and
  (ii) an opposite open end,
(b) a lower nose portion formed of said cartridge and defining its said closed end,
(c) male coupling means defining external male screw threads with
  (i) said male coupling means formed of said cartridge and
  (ii) disposed externally on said nose portion,
(d) an upper portion formed of said cartridge and
  (i) defining its said opposite open end,
(e) female coupling means defining internal female screw threads
  (i) disposed on the inner wall of said upper portion, with
  (ii) said upper portion having its said inner wall complementary to the outer wall of said nose portion whereby
  (iii) said upper portion is adapted to be coupled to a nose portion of a like cartridge,
(f) a reduced throat section defining a truncated cone

tapering inwardly of said cartridge toward said closed end having said male coupling means,

(i) said throat section being reduced relative to adjacent portions of said cartridge and

(ii) spaced from, both, said closed end and said open end, with

(iii) said throat section spaced from said open end a distance such that said throat section receives the distal portion of the closed end of said like cartridge when coupled to said cartridge so that the distal end projects into said throat section,

(g) a rigid closure means slidably seated in said throat section for longitudinal wedging movement therein, said closure means comprising

(i) a rigid cup-shaped member having outwardly tapered side walls conforming to the inner wall of said throat section with the concavity of said member being disposed adjacent the said open end of said cartridge, and

(ii) said closure means being adapted to be abutted by the said distal portion of said like cartridge upon projection into said throat section so that said closure means is forceably driven thereby into wedged sealing engagement with said throat section as coupling is being effected between said cartridge and said like cartridge,

(h) external radial gussets formed of said cartridge extending between the external walls of said throat section and said cartridge with

(i) said gussets disposed at the junction of said throat section with the adjacent portion of said cartridge disposed between said throat section and said nose portion, and

(i) detent means for locking said closure means in said throat section comprising

(i) an inwardly extending rib circumferentially disposed on the inner wall of said throat section at the end portion thereof adjacent the open end of said cartridge; and

(j) said blasting unit comprising a self-sustaining container of polymeric material having

(i) a lower closed end and

(ii) an upper open end,

(k) an integral lower portion formed of said unit and

(i) defining its said closed end,

(l) external male screw threads disposed on the external wall of said unit's lower portion and

(i) adapted to be coupled into and with the female screw threads in the said upper portion of said cartridge to project the closed end of said unit into said throat section in driving engagement with said closure means,

(m) a detonator well comprising a portion of said closed end of said unit recessed inwardly thereof,

(n) a longitudinal groove in the external wall of said unit communicating with said well,

(o) an explosive booster charge in said unit,

(p) a closure means secured to said open end of said unit,

(q) a detonator disposed in said well, and

(r) an electric lead wire extending in said groove to said detonator.

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