Feb. 1, 1944. J. E. ROTHROCK 2,340,695

EXPLOSIVE CARTRIDGE

Filed Jan. 31, 1940 2 Sheets-Sheet 1

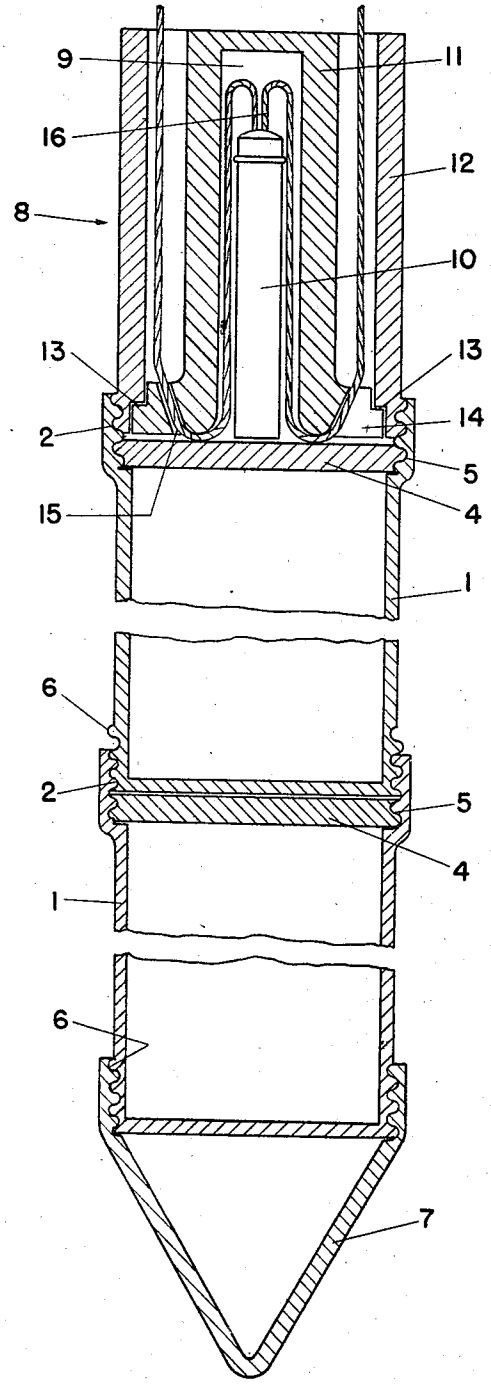


FIG.-1

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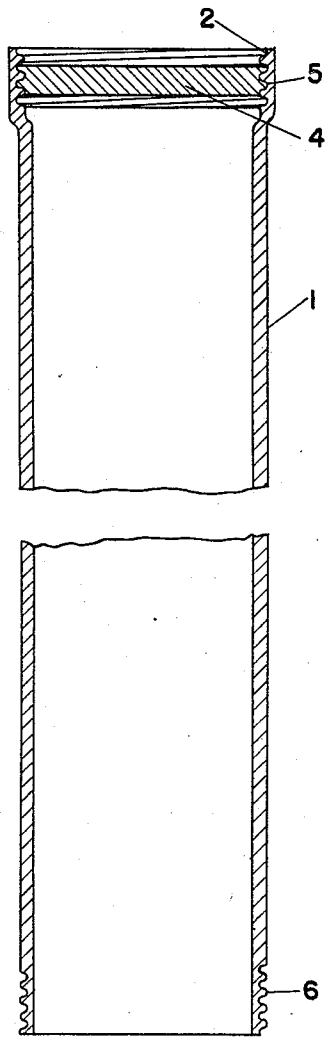


FIG.-2

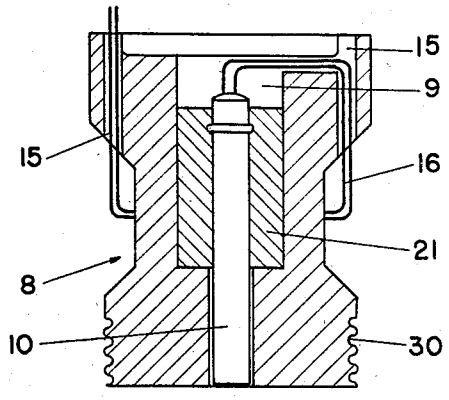


FIG.-3

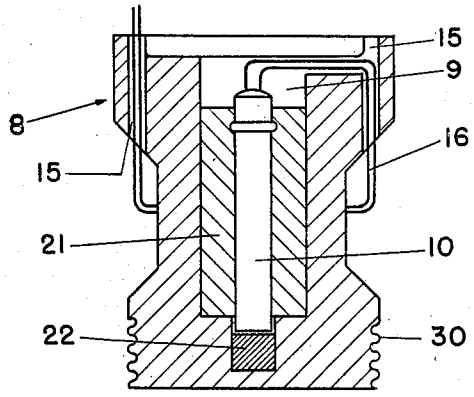


FIG.-4

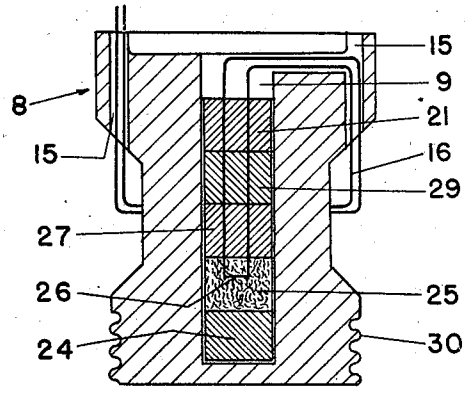


FIG.-5

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UNITED STATES PATENT OFFICE

2,340,695

EXPLOSIVE CARTRIDGE

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Application January 31, 1940, Serial No. 316,477

1 Claim. (Cl. 102—22)

This invention relates to containers for explosives and means for initiating the explosives therein. The invention more particularly relates to a rigid plastic container for explosives and to plastic detonating charge containers for obtaining effective priming contact with and effective detonation of the explosive in the containers.

The explosive industry has for many years packaged explosives in paper cartridges or paper bags and has supplied blasting caps which are inserted into the explosive to effect priming contact and provide a means of detonating the charge. The use of paper cartridges and blasting caps presents certain problems which are definite disadvantages. Whenever paper containers of nitroglycerin explosives are handled, the operators in most instances develop severe headaches which are most uncomfortable and reduce their efficiency. The priming or inserting of blasting caps into the explosive cartridges is a dangerous job at best and one which requires skill to insure proper priming contact between the blasting cap and the explosive. Priming also must be correctly carried out to prevent separation of the cap and explosive charge when the primed cartridge is lowered into a bore hole. A further disadvantage of the paper cartridge is their lack of complete waterproofness. The increasing use of ammonium nitrate explosives makes packaging in waterproof containers essential to successful operation of present day explosives. A still further drawback to paper cartridge explosives is the poor appearance caused by their non-rigid character which is aggravated by the shipping and handling necessary before use, and, further, the waterproofness of paper is usually destroyed due to creasing during handling or rough treatment in the bore hole.

To overcome the various disadvantages of paper containers, the explosive industry has packaged some of the less sensitive explosives in metal cans which are completely sealed to insure waterproofness. By designing metal containers, the dangers of headaches were overcome since the operator does not contact the explosive. The waterproofing problem was also overcome as the containers could be sealed. The waterproofing advantage was not complete, however, as the light containers may collapse under the high water pressure and leak or they may quickly rust through under conditions encountered in the bore holes.

The metal container while overcoming the headache problem presents a more serious problem in that the container itself is made of a sparking metal. The introduction of sparking metal into explosive operations creates a very hazardous condition as during the priming, loading, and tamping procedures there is always the danger of a spark struck from the container causing a premature blast with possible damage and loss of life. In addition to sparking, the metal containers may be dangerous since they do not completely shatter or disintegrate at the time of the explosion, but may remain in large pieces and create a hazard as flying particles. The metal containers remaining after the blast, in a great many operations, have to be removed from the material as their presence may cause serious damage in subsequent operations, this removal is expensive and time consuming.

It is an object of this invention to provide a waterproof container for explosives.

An object of this invention is to provide a plastic container for explosives, adapted to be closed in a waterproof manner.

A further object of this invention is to provide a waterproof casing containing a blasting explosive.

A further object of this invention is to provide a plastic primer device.

A further object of this invention is to provide a plastic primer which contains a centrally located detonating explosive.

A further object of this invention is to provide a guiding nose for attaching to the plastic explosive containers.

A further object of this invention is to provide a container for explosives having a priming device connected thereto.

A further object of this invention is to provide a container for explosives having a priming device attached to one end and having a guiding nose attached to the other end.

A further object of this invention is to provide a primer in combination with a guiding nose.

A further object of this invention is to provide a primer having detonating charge therein and a guiding nose attached thereto.

A further object of this invention is to provide a waterproof container for explosives which will prevent the development of headaches from the nitroglycerin explosive contained therein.

A further object of this invention is to provide a rigid cartridge which will be easy to prime.

A further object of this invention is to provide a rigid cartridge which will completely disintegrate during the explosion.

A still further object of this invention is to provide an explosive container and a priming

device which may be joined together without affecting the waterproofness of the explosive container.

A still further object of this invention is to provide a primed cartridge that has means whereby it may be safely and efficiently lowered into a bore hole.

Other objects of this invention will be apparent hereinafter.

In accordance with this invention, these objects have been accomplished by providing a blasting explosive container prepared from a molded plastic. This molded plastic container is provided with a closure which may be sealed thereto in a completely waterproof manner. The need of priming the explosive container has been accomplished by providing a molded plastic device in which may be positioned an initiating explosive either directly or in the form of a blasting cap. The priming device and the explosive container in accordance with this invention are designed so that they may be joined together in priming contact. In addition, a conical guiding nose is provided which may be attached to the leading container to aid in following the bore hole during loading operations.

The explosive containers and priming devices of this invention will be described hereinafter without specifically stating that they contain explosives. However, it is to be understood that the containers described may be filled with any of the various type blasting explosives. Thus, the containers may have packed therein dynamites, extra dynamites, gelatins, extra gelatins, permissibles, or safety explosives or any other of the various explosives which are used in blasting operations. The priming devices may either contain a detonating charge in the form of a commercial blasting cap or a detonating explosive charge positioned directly in the priming device itself. The commercial blasting caps which I may use contain initial explosives such as diazodinitrophenol, lead azide, mercury fulminate, either alone or with an oxygen carrying salt such as, for example, potassium chlorate. These commercial blasting caps may also contain in conjunction with the initial explosives, secondary explosives such as tetryl, T. N. T., nitrostarch, P. E. T. N. or the like.

It is to be understood, therefore, I contemplate filling my explosive containers with any desirable blasting explosive and contemplate using in the priming devices either a commercial blasting cap or a detonating charge similar to the charges of any of the commercial blasting caps, or other desirable detonating charges.

Described generally, my invention comprises a tubular plastic container of blasting explosives which may be sealed to effect waterproofness and which need not be punctured for priming and which has means at one end for joining thereto a detonating device and means at the other end for, if desirable, joining a guiding nose. The detonating device comprises a container in which is positioned an initiating explosive and has means of joining to the explosive container in order to effect priming contact with the explosive in the explosive container when the two devices are joined together. The explosive container also has means whereby it may be joined to another similar explosive container, or to a guiding nose.

Having now indicated in a general way the nature and purpose of this invention, there follows a more detailed description of preferred embodiments thereof with reference to the accompanying drawings in which

Fig. 1 is a cross-sectional view of an assembly comprising a series of explosive containers having a priming device connected thereto to effect detonation of the explosive and a nose positioned thereon to guide the assembly into the bore hole.

Fig. 2 is a sectional view of an individual explosive container.

Fig. 3 is a cross-sectional view of an alternative priming device for use with the explosive containers of this invention with a blasting cap located therein, and the wires thereof fastened about the priming device.

Fig. 4 is a cross-sectional view of a priming device similar to Fig. 3, but containing an additional booster charge below the blasting cap.

Fig. 5 is a cross-sectional view of a priming device similar to Fig. 3, but in which the detonating explosive is positioned directly within the priming device.

Referring now to the drawings and more particularly to Figs. 1 and 2, there is shown an explosive container comprising a tubular casing 1 made from a non-sparking molding material. The casing 1 is open at one end and this opening contains interior threads 2 designed to receive a closure 4. The closure 4 may be cemented into position at 5 to provide a waterproof seal.

The casing 1 also is provided with threads 6 at the closed end for joining similar casings thereto, or for joining a substantially conical guiding nose 7 (Fig. 1) thereto. While I have shown the cartridges or casings threaded to effect joining, I may provide other telescoping or joining means such as by wedging, clamping or the like. It will be noted that Figs. 1 and 2 show the open end of the casing 1 slightly enlarged in order to obtain the proper joint, but while I have found this design preferable, I may prepare casings which have their open end the same diameter as the casing but which have the threaded closed end decreased in diameter to cause proper joining. Also, I may provide a tapered container to effect decrease in diameter. The threads 2 extend beyond the closure 4 in order that an additional casing may be inserted therein, Fig. 1, or so that a priming device 8, shown in Fig. 1 and also in Figs. 3, 4, and 5, may be easily joined to the casing 1.

The joining together of the casings 1 with additional casings or with priming devices or with a guiding nose or with each is illustrated in Fig. 1. It will be noted that I have left the closure 4 in place as shown between the two casings of Fig. 1, but, if desirable, I may remove the closure between the casing and/or between the casing and the priming device. This closure 4 is designed in a manner which insures priming and propagation of the explosive if it remains in place.

The priming devices 8 shown in Figs. 1, 3, 4, and 5 are molded plastic devices which have a central bore 9 in which may be positioned a blasting cap 10.

In Fig. 1 the priming device 8 comprises two parts, a holder 11 having a central bore 9 for the cap 10 and a cylindrical body 12 adapted to fit in locking relation by, for example, a step cut 13. Both the holder 11 and body 12 when joined are attached to a casing 1 by threads 2. The holder 11 contains either slots 14 or holes 15 to provide means whereby the leg wires 16

of the cap 10 may be extended from the holder 11. Although, I have shown both a slot 14 and a hole 15, I prefer to use slots since it is then unnecessary to thread the leg wires through holes. Threading the leg wire is rather difficult and time consuming.

In order to insure positive priming contact of the blasting cap 10 with the explosive container's closure 4, I may insert a plug (not shown) of rubber or other compressible material into the central bore 9. The plug may be of any desired dimensions depending on the length and type of blasting cap used.

While I have found the use of a holder and body most preferable as the body prevents abrasion of the leg wires along the walls of the bore hole, I have found that I may form the holder of a diameter and with attaching means which join directly into the casings. This use of a holder by itself gives the same results as a holder and a body but there is a slight danger of abrasion of the wires along the walls of the bore hole.

The design of the central bore 9 of this device provides an air seal for the top of the blasting cap 10 and thus there is obtained a waterproof initiating device without the need of excess waterproofing material. Many deep hole blasting operations are carried out under as high as 900 to 1000 feet of water but the central bore of my device is designed to provide an air pocket sufficient to prevent the water from contacting the top of the blasting cap.

Fig. 3 shows an alternative priming device 8 in which the bottom of the cap 10 is substantially flush with the bottom of the device 8. This blasting cap 10 may be securely positioned by any sealing compound 21 such as sulfur, asphalt, resin, plastics, or mixtures thereof. The leg wires 16 of the blasting cap extend from the cap and may be, if desired, passed through the hole 15 then around the central part of the priming device 8 and through a similar hole 15 and upward from the device. This means of threading the wire 16 through the holes 15 provides a means whereby an assembled explosive casing 1 and priming device 8 may be safely lowered into a bore hole. Thus, the wires are also positioned in a manner which prevents their possible contact with the walls of the bore hole. I have found that it is also desirable in this embodiment to use slots instead of holes as stated hereinbefore. These methods I find preferable, but I may, if desirable, merely wind the wires securely about the priming device to effect lowering of the charge.

An alternative means of positioning the initiating charge in the priming device 8 is shown in Fig. 4. The central bore 9 of this device does not extend completely through the device, but leaves a closure across the bottom so that a booster charge 22 may be placed therein. The blasting cap 10 is then positioned in contact with this booster charge 22 and held in place by a method similar to that described above. The wires 16 of this blasting cap may be threaded through holes or slots to provide safe means of lowering the device into a bore hole.

Another alternative means of positioning the initiating charge in the base of the priming device 8 is shown in Fig. 5. The central bore 9 of this device is reduced to a diameter comparable to the diameter of a blasting cap and then a base charge 24 is positioned in the bottom of the central bore 9, a priming charge 25 is superimposed on the base charge 24 and a firing assembly, comprising a bridge wire 26 across the leg wires 16, positioned in contact therewith. The leg wire 16 is held in position by a plug 27, waterproofing material 29 and a sealing compound 21. The wires 16 may be threaded through slots or holes in a manner similar to that described for the priming devices of Figs. 1, 3 and 4.

Each of the priming devices 8, Figs. 3, 4, and 5, are similar to and act in the same way as the device 8 of Fig. 1. These devices also have threads 30 about the bottom end thereof to provide a means of joining the priming devices 8 to the explosive casing 1.

Wherever I have used threads, it will be noted that they are rounded as this is the normal type thread used in molding articles, but I may use other type threads if desirable.

In manufacturing the explosive casings of this invention, I have found that I may produce casing in any of the various sizes which are used in the explosive industry. Thus, I may prepare casings which are from one-half inch to seven and, a half inches in diameter and from four inches to twenty-four inches long. While the above sizes are normal for the explosive industry, I have also found that it may be desirable to prepare casings of any of the above diameters but of quite short lengths, say about one or two inches, and fill these short lengths with sensitive explosives. These short lengths have been found to be useful as inserts in a column of explosives to aid in propagation, especially of the very insensitive explosives of the "safety type." The explosives which I have used in the short lengths are, for example, high nitroglycerin powders or explosives such as tetryl, T. N. T. or the like.

In the shipping of my explosive containers, the priming device and the explosive container must, of course, be shipped separately, due to I. C. C. regulations. In packing the explosive cartridges in the cases, they may be packed individually or joined together, depending entirely upon the length of the cartridges, the shape and size of the case and upon the use to which the cartridges are to be put. In shipping the priming device, I have found that it is preferable to either join a priming device and a guiding nose together and ship these as a unit or to nest the guiding nose and priming device. While this is not necessary since the priming devices may be shipped alone if the customer does not require guiding noses, the combination is the normal manner of shipping. Thus, when a priming device and a guiding nose are shipped together, the operators have both units at hand for immediate and efficient use. Further, the joining of a guiding nose and a priming device is advantageous in shipping since the guiding nose tends to protect the end of the priming device which contains the detonating explosive.

The materials which I have found suitable for manufacturing my casing, primer devices and guiding nose are those plastic materials which are moldable and when so molded to form such articles, produce articles which have suitable water resistance, strength, and rigidity. The various materials which are suitable are, for example, the moldable plastics such as phenol-aldehyde, urea-aldehyde, wood flour phenolics and ureas, and the lignin fiber plastics, a fibrous base bound with thermoplastic lignin resins. The lig-

nin fiber has been found to be the most desirable as it is economical, waterproof, and has the necessary rigidity to withstand the usage to which it will be exposed.

A representative sample of lignin fiber plastic which I have found very desirable has the following properties:

Table

Specific gravity	1.36–1.40
Specific volume—cu. in. per lb	19.8–20.5
Tensile strength—lbs. per sq. in.	8,000–15,000
Modulus of elasticity, lbs. per sq. in. × 10 to 5th power	8–15
Compressive strength lbs. per sq. in.	25,000–35,000
Flexural strength—lbs. per sq. in.	11,000–25,000
Impact strength—ft. lbs. C. N.	1.5–2.0
Molding temperatures—up to 392° F—°C	200
Molding pressures—lbs. per sq. in.	1,000–2,000
Water absorption per cent in 24 hours	0.5–3.0

I have packed, in the casing of my invention, explosives of various types thus, for example, gelatins, dynamites, permissibles, safety explosives and variations of these types, each of which have been found to give perfect results. Although I have found those explosives which are effected by water as the type most improved by my new casing, I have also found that a great improvement exists by packing water resistant explosives. The blasting gelatins which are water resistant are much easier to handle in my new casing especially since operators never contract headaches when handling this high nitroglycerin explosive in plastic casing. Further gelatins so packed do not decrease in sensitiveness due to high pressures thus by using my casings an improved blasting gelatin is possible.

The means of packing explosives in my new casing may, if desirable, be directly into the casing or into a light paper tube which is then inserted into the casing. Either of the two methods give excellent results and the preferable method depends entirely upon the type machinery to be used and the type explosive being packed. In packing of high nitroglycerin explosives, I prefer to use a paper liner in the casing to aid in preventing segregation of the nitroglycerin, while in safety and permissible explosives I prefer to pack the explosive directly into the casing. I have found that packing in the casing to a predetermined density is facilitated by the rigid character of my casing and that bulging which is often encountered in paper cartridges is never experienced.

The closures which I use for the casing of this invention are usually made from the same type plastic as the casing and are threaded. Upon screwing the closure into place, a suitable waterproofing material is used to make a waterproof joint.

The advantages of my plastic casings and primer devices, are that explosives may be packed in entirely waterproof packages which may be primed without the need of puncturing the container. The explosive is packed in a rigid container which is neat, easy to handle, and which prevents operators from contracting headaches. There is altering of sensitiveness due to water or high pressures encountered in bore holes. The use of the primer device insures positive priming and due to the arrangement of the wires provides a method of lowering explosives into the bore hole which prevents the danger of separating the primer from the explosive encountered in the prior art.

Where in the specification and claims, I have used the term "plastic" as, for example, "a plastic casing," it is to be understood that I have used the term in the sense it is used in the molding art. Thus, the term "plastic" refers to organic moldable or molded materials which may be, for example, of the thermosetting or thermoplastic type.

It will be understood that the details and examples hereinbefore set forth are illustrative only, and that the invention as broadly described and claimed is in no way limited thereby.

What I claim and desire to protect by Letters Patent is:

In combination a primed blasting assembly including a priming device and an explosive cartridge, said cartridge being made of a synthetic plastic molding material, attaching means adjacent one end of said cartridge, means closing said cartridge against the entrance of moisture, said priming device being secured to said attaching means and comprising a detonator receiving chamber having an open end adjacent the cartridge closure means and having a closed end whereby air may be trapped in said chamber to prevent the entrance of water thereto, a detonator-leg-wire-opening in said device, said opening extending into the chamber adjacent the open end of said device.

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