June 12, 1945. J. B. JOHNSON 2,378,223

EXPLOSIVE CARTRIDGE

Filed Nov. 8, 1941

FIG. 1

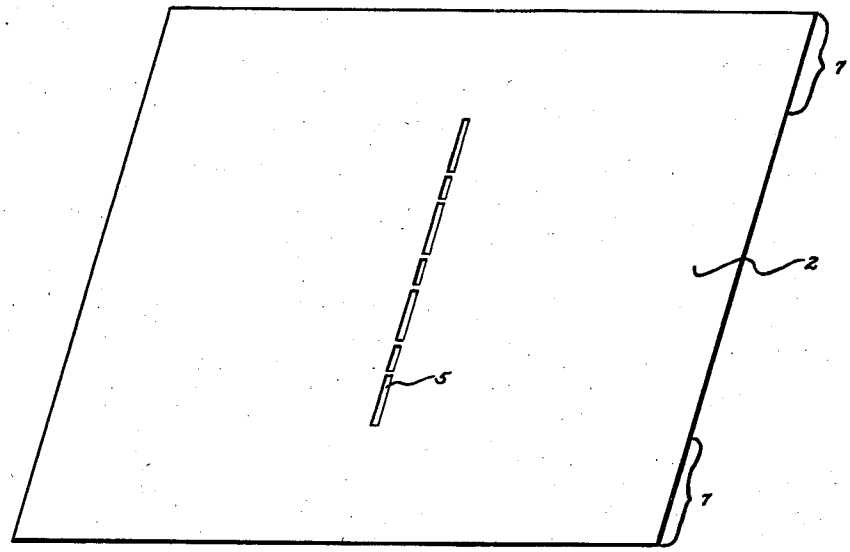


FIG. 2

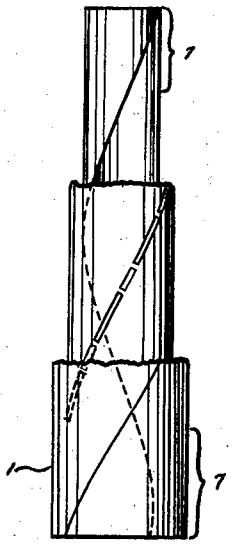
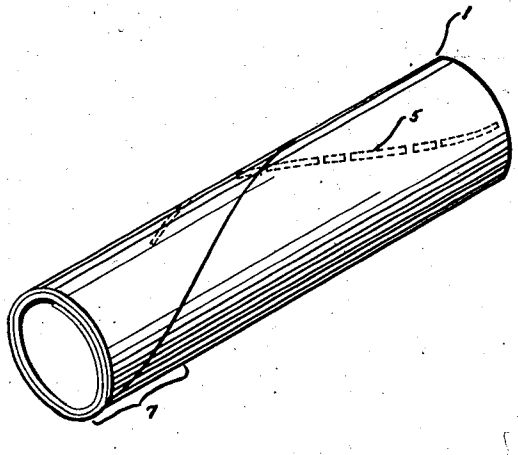


FIG. 3



John B. Johnson
INVENTOR.

BY Cleveland B. Hollabaugh
ATTORNEY

Patented June 12, 1945

2,378,223

UNITED STATES PATENT OFFICE

2,378,223

EXPLOSIVE CARTRIDGE

John B. Johnson, Wilmington, Del., assignor to Hercules Powder Company, Wilmington, Del., a corporation of Delaware

Application November 8, 1941, Serial No. 418,296

8 Claims. (Cl. 102—24)

This invention relates to an improved blasting cartridge and more particularly to a blasting cartridge which is weakened along its length in a manner which allows expansion of the cartridge when pressure is exerted on an end thereof.

In blasting operations, it is normally required that the explosive operators after loading explosive cartridges into boreholes tamp the explosives in order to eliminate air spaces, thus increasing the loading density of the explosives and insuring more efficient blasting operations. In loading boreholes, the explosive cartridges used are somewhat smaller in diameter than the diameter of the boreholes in order that the cartridges may be inserted without undue friction. After insertion of the cartridges, it has been customary to tamp or ram the cartridges into the borehole with sufficient force to burst the cartridges and allow complete filling of the hole, or, in order to reduce the force necessary to burst the cartridges, they may have been slit lengthwise before introduction into the borehole.

The use of slit cartridges to assist in tamping, or the use of normal cartridges with heavier tamping is objectionable because with slit cartridges explosive material is often spilled prior to the loading of the borehole, and with unslit cartridges, the tamping force required is excessive when considered in the light of safety.

Another tamping operation, which is most important in metal mining, is the tamping of explosives into boreholes which slant upwardly. In this type hole, it is difficult to avoid spillage of the explosive when placing it in position if the cartridge is slit prior to insertion or tamped sufficiently strongly to cause rupture of the cartridge.

It is the object of this invention to overcome the various difficulties encountered in loading boreholes by providing a novel cartridge which is easily expandable but which does not expand in such a manner as to spill the explosive content thereof.

A further object of this invention is to provide a cartridge which may be manufactured in the normal manner but which has a wrapper designed to allow easy expansion.

A still further object of this invention is to provide a cartridge cover having a line of weakness which allows easy expansion of the cartridge but which line of weakness is located so that it is not exposed to the inner surface of the cartridge, nor to the outer surface thereof.

A still further object of this invention is to provide a cartridge having a perforation which winds spirally down a central layer of paper and provides a line of weakness which tends to cause the cartridge to expand cylindrically instead of rupturing and/or bulging it if and when pressure is exerted on either end thereof.

Another object of this invention is to provide an improved blasting explosive cartridge which when tamped will expand in diameter and fill the borehole while still maintaining a substantial cylindrical form to a marked degree.

Other and further objects of the invention will appear hereinafter.

The objects of this invention have been accomplished, in general, by providing a cartridge wound from a suitable sheet of paper by wrapping the sheet upon itself at least two and a fraction times.

The section of the cartridge which contains more than two layers of paper contains a line of weakness, perforations, or the like, in the central layer thereof. Further, the perforations are so aligned on the sheet of paper that they wind spirally or helically along the longitudinal axis of the cartridge. The cartridge produced from the sheet may be similar to the cartridges described in U. S. Patents 1,575,894 and 1,665,834 to William T. Ayer. These cartridges described by Ayer are specifically formed from rhomboidal sections of paper which are cut into blanks having a length and breadth of coordinating dimensions such that the proper diameter cartridge is produced when the sheet is wrapped so that all of its circumference contains at least 2 layers of sheet material, and so that at least part of the circumference contains 3 layers of sheet material. The three layers of sheet material generally constitute only about ¼ to ½ of the circumference but may constitute as much thereof as desirable.

The present invention, in particular, improves the Ayer cartridges by supplying perforations or a series of slits which extend substantially parallel to and preferably approximately centrally of the edges of the rhomoidal sheet which form along the length of the cartridge, as by such expedient an easily expandable cartridge is obtained. The perforations or series of slits, when the rhomboidal sheet is wrapped into a tubular cartridge, position themselves approximately centrally of the section of the cartridge which is composed of 3 layers of sheet material. These slits or perforations follow along the cartridge substantially parallel to the edges of the rhomboidal sheet and are therefore spirally or helically disposed along the length of the cartridge.

The Ayer cartridges are made from rhomboidal sheets, but the cartridges of the present inven-

tion may be formed from any shaped sheet which allows the formation of a cylindrical cartridge having a portion of its circumference composed of more than two layers of the sheet and having between these two layers a layer of material containing a line of weakness. The cartridges are formed so that the line of weakness winds helically or spirally along its longitudinal axis. Thus, the cartridges may be formed from trapezoidal sheets or from various polygonical shaped sheets which have a line of weakness so disposed in the surface that it will form in a helical line when the sheet is formed into the cylinder.

Although the preferred embodiments of the invention contain a single line of weakness, and no more than three layers of material, in some instances it is desirable that the line of weakness comprise a plurality of lines of slits or perforations, but each line is disposed helically and is positioned in a layer formed between the inner and outer layer of the cartridge. The plurality of lines of weakness are normally not used, but if cartridges are formed by more than three layers, i. e., four or five layers, this plurality of lines gives more positive action.

Having now described in general the material and purpose of this invention, there now follows a more detailed description of preferred embodiments thereof with reference to the drawing in which:

Fig. 1 represents a rhomboidal blank of material suitable for forming a cartridge.

Fig. 2 represents the rhomboidal sheet of Fig. 1 formed into a cartridge, and cut away in sections to show the relationship between edges and perforations.

Fig. 3 represents a completed cartridge formed from the rhomboidal sheet of Fig. 1 and ready for loading with explosives.

The cylindrical open end cartridge 1 (Fig. 3) is formed from a rhomboidal sheet 2 (Fig. 1) of material which may be any suitable stock, e. g., a manilla paper of 60 to 150 pounds. The stock may be sized, waxed or both, or may be plain paper, but if desirable, the plain paper may be waxed or otherwise treated after formation into the cartridge. Other stock of a weight and strength which is adaptable for the formation of a tubular cartridge of proper diameter and length may also be used. The sheet 2 is rhomboidal in structure, has acute angles which are between 60 and 80 degrees and has a line of perforations or slits 5 extending approximately centrally between the sides of the sheet 2 which form along the long axis of the completed cartridge. The perforations 5 may be of any desirable type, such as for example, a series of very small, closely spaced holes, or a series of slits of the same or different lengths having small joints therebetween, or in some instances, a continuous slit. However, the preferable means of forming the line of weakness 5 is to provide a series of substantial perforations connected with very easily ruptured joints.

It will be noted in the drawing that line 5 does not extend through to the top and bottom of the rhomboidal sheet. However, these perforations may be so extended, if desirable, but the design of Fig. 1 is the preferable embodiment because the top and the bottom segments, denoted by 7, of the sheet are used to form a crimp across the top and bottom of the cartridges in order to secure the explosive therein. The perforations 5, if extended to the edge of the sheet, would reduce the strength of the cartridge and might hinder proper crimping. Likewise, the extension of the perforations 5 may cause operating difficulties in some instances.

Reference to Fig. 2 shows that when the rhomboidal sheet 2 is rolled into a cartridge, the line of perforations 5 position themselves between the overlapping edges of the sheet. By this positioning of the line of perforations 5, a cartridge is formed, which from outside appearances and from inside appearances, does not contain a line of perforations. This is highly desirable because the cartridges must be packed by tamps, such as those of the Hall or Kimber packing machines, and if the perforations are exposed to the inside of the cartridge, may effect the operations. In addition, it will be noted that there are other advantages in cartridges which do not present a perforated surface to the outside element as they are much safer to handle since no explosive can be spilled and their most efficient performance is obtained when the cartridge presents a solid surface to the interior of a borehole as it gives protection from elements, such as water which might be present therein. Further, there is no tendency for any of the liquid explosive ingredients to migrate or leak through the split.

It has been found that the cartridges of this invention, having a line of perforations or slits between two layers of paper, are the substantial equal of normal cartridges in water resistance, appearance, and other physical properties and that they are considerably superior to any of the slit or expandible cartridges known to the prior art. All pre-slit cartridges known to the prior art have a tendency to spill powder when they are being used in explosive operations and even during that period when they are being shipped or are in storage in magazines. To overcome these disadvantages, expanding enclosing members have been used to encase explosives. However, these enclosing members are bulky and do not meet with favor because of inefficient operation, the necessity of using larger boreholes and because they alter the oxygen balance to such an extent that there is a fume problem presented.

The present cartridge having the line of perforations or slits which allow expansion cannot be distinguished visually from normal cartridges and may be employed in all operations where cartridges are used and also may be employed with greater efficiency and ease of operation in operations where slit cartridges are demanded. These cartridges have exactly the same oxygen balance as normal cartridges, and thus there is no fume problem created.

A practical adaptation of this invention consists of an explosive cartridge formed by wrapping a rhomboidal sheet of paper upon itself 2⅓ times, thereby forming a cartridge having ⅔ of its circumference made up of 2 layers of paper and ⅓ of its circumference made up of 3 layers of paper. The formed cartridge has located centrally of and in the middle layer of the paper forming said ⅓ of its circumference comprising 3 layers of paper, a line of weakness consisting of perforations or slits. This cartridge, prior to filling with explosives, is closed at one end and then whether pre-waxed or plain paper was used, if desirable, it may be treated with molten wax such as paraffin in order to coat the paper and render the cartridge more waterproof and nitroglycerine proof. After cooling to harden the wax, the cartridge is filled with an explosive through its open end and closed by folding and crimping after which, if desired, the loaded car-

tridge may again be dipped into wax or a sealing compound. The finished cartridge, when tamped into a borehole, easily expands into contact with the walls thereof. The type of explosive which is placed in the cartridge does not effect the expanding characteristics thereof, and it will be understood that cartridges in accordance with this invention may contain explosives which are straight dynamites, extra dynamites, gelatins, extra gelatins, semi-gelatins, safety explosives, and the like.

The cartridges of the invention may be of any size normally used for explosive operations, e. g., they may be cartridges having a diameter of between ¾" and 8" and a length between 4" and 30". However, the normal cartridges most suitable for use in the present invention are 1 to 2 inches in diameter and 6 to 8 inches in length.

Hereinbefore it has been noted that the rhomboidal sheet of paper is crimped to form the ends of the cartridges. However, in some instances, it may be desirable to form the end of the cartridges by insertion of paper cups in the ends thereof, and if such is desirable, the line of perforations will preferably extend to the edge of the rhomboidal sheet or may extend any suitable distance along the rhomboidal sheet.

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

1. A tubular cartridge for blasting explosives comprising a substantially cylindrical container formed from a rhomboidal sheet wrapped upon itself at least two and a fraction turns, whereby a portion of the container has more than two layers, a line of perforations disposed helically along an interposed layer of that portion of the said container having more than two layers, said line of perforations adapted to tear and thereby enable the cartridge to radially expand when longitudinally compressed.

2. A tubular cartridge formed from a rhomboidal sheet having a line of perforations extending centrally of and parallel to the edges of the sheet which lie along the long axis of the cartridge, said cartridge formed of two layers of material for approximately ⅔ of its circumference and of three layers of material for approximately ⅓ of its circumference, and the said line of perforations being in the section of the sheet which forms the intermediate layer of the ⅓ of the circumference formed by said three layers, said line of perforations adapted to tear and thereby enable the cartridge to radially expand when longitudinally compressed.

3. A dynamite cartridge comprising dynamite enclosed in a substantially cylindrical paper shell made by rolling a polygonical sheet of paper into the form of a cylinder having at least part of its circumference formed of three layers of paper, said sheet having a line of perforations approximately centrally and helically located in the intermediate layer of paper formed by the circumference sections having three layers of paper, whereby said shell tends to expand radially and retain its cylindrical shape when pressure is applied simultaneously to both ends of said cartridge.

4. A tubular cartridge formed by approximately 2⅓ turns of a rhomboidal sheet having a line of perforations extending centrally of and parallel to the edges of the said sheet which lies along the long axis of the cartridge, said line of perforations being contained in the intermediate layer of the ⅓ section of the cartridge made up of three layers of material, said line of perforations adapted to rupture and thereby enable the cartridge to radially expand when longitudinally compressed.

5. The tubular cartridge according to claim 1 wherein said rhomboidal sheet has its acute angles between about 60 and 80 degrees and said line of perforations extends centrally of and parallel to the edges of the sheet which lie along the long axis of the cartridge.

6. The tubular cartridge according to claim 2 wherein said rhomboidal sheet has its acute angles between about 60 and 80 degrees.

7. A tubular cartridge for blasting explosives comprising a substantially cylindrical container formed from a sheet wrapped upon itself at least two and a fraction turns, whereby a portion of the container has more than two layers, a line of perforations disposed helically along an interposed layer of that portion of the said container having more than two layers, said line of perforations adapted to tear and thereby enable the cartridge to radially expand when longitudinally compressed.

8. A tubular cartridge for blasting explosives comprising a substantially cylindrical container formed from a sheet wrapped upon itself at least two and a fraction turns, whereby a portion of the container has more than two layers, a line of slits disposed helically along an interposed layer of that portion of the said container having more than two layers, said line of slits adapted to tear and thereby enable the cartridge to radially expand when longitudinally compressed.

JOHN B. JOHNSON.