March 20, 1945. F. F. CHAPMAN ET AL 2,371,874

EXPLOSIVE CARTRIDGE

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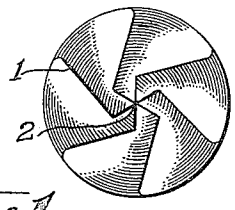


Fig. 1

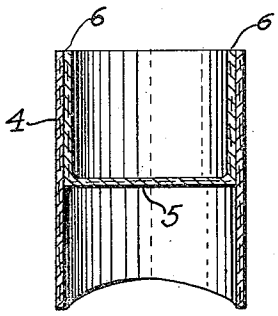


Fig. 4

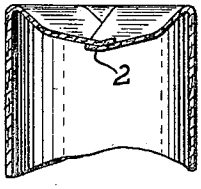


Fig. 2

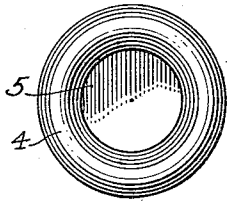


Fig. 6

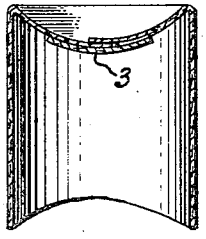


Fig. 3

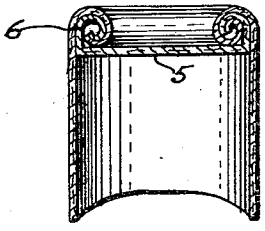


Fig. 5

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EXPLOSIVE CARTRIDGE

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Application June 6, 1940, Serial No. 339,062

1 Claim. (Cl. 102—24)

This invention relates to an improved explosive cartridge.

Containers or shells employed for the enclosure of explosive charges should, in general, provide adequate moisture protection, prevent leakage of explosive liquid nitric esters or their equivalent, be adapted to loading of the explosive charge therein, and be economical to produce. Moreover, in certain applications, such as in seismograph exploring, the container should be rigid and of great mechanical strength, and possess sufficient resistance to tear so that it is capable of being forced through sharp rocks and dirt to an exact position and yet maintain the explosive charge in complete confinement.

The object of the present invention is an explosive cartridge having high resistance to tear and possessing an enhanced mechanical strength in general. Another object is an explosive cartridge having a novel end closure conducive to the production of a cartridge which is entirely waterproof. A further object is an explosive cartridge of such design that it fails to open and expose the explosive charge even though it be subjected to severe tamping. Further objects will become apparent as the invention is disclosed hereinafter.

We have found that the foregoing objects are accomplished by the adoption of a cartridge having a particular design involving a shell wall which is in effect a convolute tube having a plurality of overlapping plies. Thus, a sheet of predetermined dimensions is rolled upon itself, and the "free" ends of the sheet are fixed by means of an adhesive applied along substantially the entire length of said free ends. One end of the tube thus formed is then sealed by inserting a cup disc into the end of the tube, following which the tube wall is curled over and about the edges of said disc, which are likewise curled inwardly while being maintained in substantially fixed relationship with the tube wall. This operation may be effected by subjecting the edges of the tube and disc to the spinning action of a die of suitable dimensions. A closure of this type not only protects the explosive charge against moisture but imparts great mechanical strength to the finished cartridge.

Various methods may be employed for the production of the container having such closure. However, we prefer to supply an excess of adhesive on the surfaces of the "free" ends of the sheet which is rolled to form the convolute tube, being particularly careful to have an excess of the glue or other adhesive adjacent to the top and bottom of said "free" ends. After formation of the convolute tube, but before the glue is dry, the cup disc is positioned and the edges of the disc and of the shell wall are rolled or crimped inwardly. When the edges of the tube and disc are rolled inwardly, there is an exudation of the glue from said edges, thereby providing sufficient adhesive to insure maintenance of the rolled closure. Adhesive may be added to the surface of the edges of the disc or the shell or both.

After the explosive charge has been loaded inside an open cartridge of this type, the top closure may be made in a number of ways. Thus, the top closure may be of the type employed for closure of the bottom of the shell, which is described immediately above. Likewise, the top of the shell may be closed by means of the closure described by C. R. Johnson et al. in a copending application having Serial Number 260,694, filed March 9, 1939, wherein an end closure comprising a plurality of interlocking folds in the wrapper material and having a depression in the central portion thereof is disclosed. Due to the distinctive pattern characterizing this closure, we refer to it as a "rosette," and this term is used in this sense throughout the remainder of the description. The rosette closure, due to its particular design, can be forced open only with great difficulty.

Alternatively, one end may be sealed by any conventional closure, for instance, by the well-known star or fluted crimp formed on conventional dynamite cartridges without the twisting action necessary for the overlapping, interlocking rosette crimp described above.

An absolutely waterproof cartridge can be formed by closing both the top and bottom with the rolled closure described above, wherein the tube wall is curled over and about the edges of a cup disc.

The designs of the various end closures are illustrated in the accompanying drawing. Figure 1 illustrates a plan view of the rosette closure, and Figure 2 refers to a cross-sectional view in elevation of the same type closure. Figure 3 represents the same view as Figure 2 with respect to a modification of the rosette closure. Figures 4, 5, and 6 represent views of closures involving the use of a cup disc. Similar numerals refer to similar parts throughout the several views.

Referring more specifically to Figures 1, 2, and 3, the numeral 1 shows folds of the cartridge material, whereas 2 denotes the central portion of the interlocking folds. The use of a flat disc in conjunction with an end closure of this type

denoted by the numeral 3, this modified closure being particularly adapted for those applications requiring a maximum protection of the explosive charge against water. One embodiment involving the use of the cup disc is disclosed in Figure 4, the base of said disc being denoted by the numeral 5, whereas the edges are denoted by the numeral 6. In this particular embodiment, the cup which fits snugly inside the tube is merely maintained in place by the application of a suitable adhesive to the outer surface of the edges 6. Figure 5 illustrates the closure which we prefer to employ for the bottom of the cartridge. This type of closure, as stated in the foregoing, is produced by inserting the cup disc inside the tube and maintaining it in position while the edges of the disc as well as those of the tube are rolled inwardly upon themselves, while maintaining the edges of the disc in substantially fixed relationship with respect to the edges of the tube. Figure 6 shows a plan view of the disc having its edges turned over together with the edges of the tube.

In the mass production of this convolute type of paper shell, we prefer to form each successive tube from paper severed from a paper supply in the form of a large continuous supply roll. In other words, paper comes off the large roll, is severed and re-rolled into the small convolute tube, being re-rolled at right angles to its former curvature on the large supply roll. Thus, one edge of the continuous sheet on the supply roll is also employed as the outer edge of the paper forming the finished convolute tube while the other edge of the continuous length of paper on the supply roll is employed as the inner edge of the paper forming the finished convolute tube and will be disposed inside the finished shell after it is rolled. Difficulty was encountered with the aforementioned outer edge of the paper for the reason that upon the application of glue to the one side thereof to fasten this edge to the rolled tube, it was found that upon contact with the glue the edge of the paper tended to curl outward away from the tube to which the edge was to be attached. We have found that this disadvantage can be overcome quite readily by a very convenient expedient. We have determined that by wetting one side of the paper of the edge for two or three inches with water or other aqueous media before the application of glue thereto, we can either cause the paper to curl inward naturally in the direction desired to complete the rolled shell, or at least "break the back" of the paper so that there will be no outward curl upon application of the glue. This pre-wetting step may be carried out advantageously in connection with the continuous supply roll described above. This may be done by wetting continuously a strip of two or three or more inches of that edge of the paper coming off the supply roll which is to form the outer edge of the rolled convolute shell. Although water alone is satisfactory for this pre-wetting step, any conventional wetting agent or wetting means may also be employed.

Thus, our convolute tube will be closed at one end by means of a closure which is characterized by a curling or crimping of the edges of the tube together with the edges of the cup. The other end of the tube may be closed by any of the closures disclosed in the drawing, that is, by a closure of the type employed for the bottom of the tube, or by the rosette with or without a flat disc underneath it, or by means of the upright disc merely maintained in position by means of a suitable adhesive. In certain instances it is conceivable that it may be desirable to reverse the position of the cup when it is merely maintained in place by means of an adhesive, that is to say, instead of having it in what may be considered an upright position, it may be reversed so that it forms a closure having a flat surface at the extreme end of the cartridge.

Cartridges made in accordance with this invention possess an unusually high mechanical strength, so that they can withstand the impact and shock characterizing vigorous tamping of the explosives which are loaded in such shells. Unlike spirally wound shells, they do not tend to open upon impact, nor do they become distorted unless the tamping conditions are unusually extreme. Moreover, because of the fact that the shell wall is free from irregular surfaces, they do not permit leakage of nitroglycerin to the outside of the shell in those cases where the explosive charge is apt to be characterized by the exudation of nitroglycerin. Due to their smooth surface and rigidity, shells of this type lend themselves very readily to the loading of explosive charges therein. In addition, particularly in those cases where high mechanical strength is not essential, it is possible to decrease the number of plies making up the wall of the tube, thereby reducing the quantity of paper per unit of explosive charge to a minimum. Such reduction is an important factor in overcoming the evolution of noxious fumes, since the paper acts as a fuel in the explosive reaction. Thus, there is provided a shell which is moistureproof, containing a minimum of paper without necessitating the use of large quantities of paraffin or other moistureproofing material, so that it is possible to control more readily the oxygen balance and thereby obviate to a large extent the development of undesirable fumes. The stiffness and strength of the cartridge eliminate completely any chance that it may unfold or mushroom under ordinary conditions of application, and consequently these shells are particularly advantageous for use in those instances where it is essential that the explosive charge be positioned exactly, as in siesmograph work, for example.

It will be understood that various adhesives may be employed for fixing the free ends of the sheet which is rolled into the form of a convolute tube. Thus, glue, paste, asphalt, rubber hydrochloride, homogeneous films of mixtures of rubber and wax, and the like, may be employed as the adhesive. It merely is essential that the particular adhesive possess the requite stability, and form a union which is sufficiently strong. Likewise, our invention is not limited to the use of a single sheet of paper, but instead contemplates the employment of several sheets in conjunction with each other. Moreover, the sheets of paper may be joined to each other by means of a lamina of waterproofing material such as asphalt, paraffin, rubber hydrochlorides, or known mixtures of the same.

Variations from the foregoing description can be made by those skilled in the art without departing from the spirit of the invention. We intend, therefore, to be limited only in accordance with the following claim.

We claim:

A method of cartridging explosive charges which comprises supplying sheet material from a continuous supply roll, continuously wetting one side of one edge of said material as it leaves said

supply roll, severing a predetermined length of said material from said supply roll, rolling the severed sheet at right angles to the line of severance to form a convolute tube, the outside of the outer edge of which is the wet edge of the sheet material, supplying adhesive on the inner side of said edge, and sealing the material against itself to complete the tube, closing one end of said convolute tube by positioning a cup-like disc inside of said end before the adhesive has dried between the plies and turning inwardly the edges of said disc and the ends of said tube while maintaining them in substantially fixed relationship so that the adhesive exudes from between the ends of the plies to seal a waterproof bond between the disc and the tube, thereby closing one end of the cartridge, charging said cartridge with explosive and closing the other end thereof.

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