United States Patent [19]

Remaly et al.

[11] **3,823,668**

[45] **July 16, 1974**

[54] **DUPLEX COMBUSTIBLE CARTRIDGE CASE**

[75] Inventors: **Robert F. Remaly**, Olympia Fields; **Milton S. Nusbaum**, Chicago; **Kenneth G. Johnson**, Aurora; **Seymour Levine**, Chicago, all of Ill.

[73] Assignee: **The United States of America as represented by the Secretary of the Air Force**, Washington, D.C.

[22] Filed: **Oct. 19, 1972**

[21] Appl. No.: **298,977**

[52] **U.S. Cl.** ..... **102/38 R**, 102/DIG. 1

[51] **Int. Cl.** **F42b 5/02**

[58] **Field of Search** ..... 102/38, 40, DIG. 1

[56] **References Cited**

UNITED STATES PATENTS

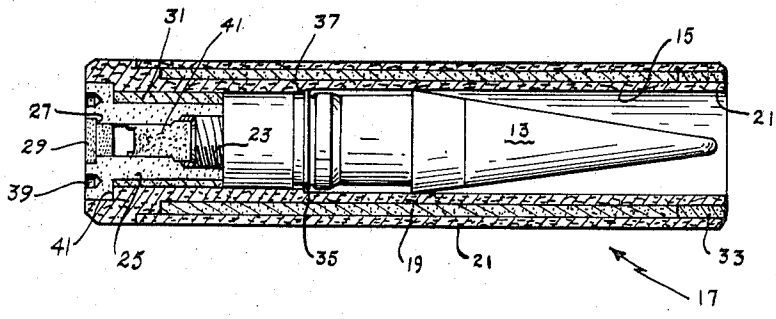
694,295	2/1902	Maxim	102/DIG. 1 X
3,048,849	8/1962	DeCaro et al.	102/38 X
3,288,066	11/1966	Stadler et al.	102/38
3,345,945	10/1967	Quinlan et al.	102/38
3,513,776	5/1970	Driscoll	102/DIG. 1 X
3,575,112	4/1971	Farmer	102/40 X
3,628,456	12/1971	Harrell	102/DIG. 1 X
3,645,206	2/1972	Quinlan et al.	102/40
3,645,207	2/1972	Daniels	102/40
3,687,077	8/1972	Goldin	102/40
3,688,698	9/1972	Quinlan	102/38
3,705,549	12/1972	Quinlan et al.	102/DIG. 1 X

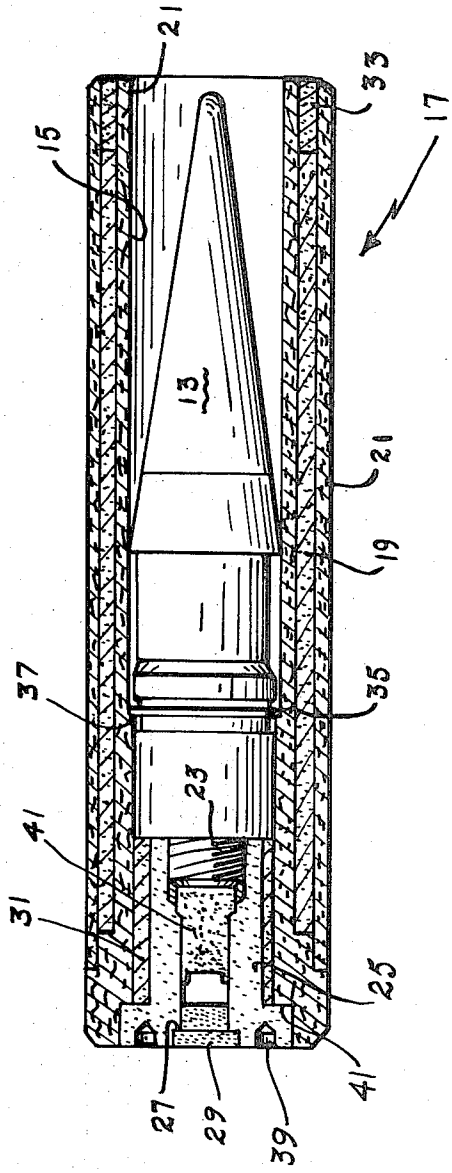
Primary Examiner—Benjamin A. Borchelt
Assistant Examiner—H. J. Tudor
Attorney, Agent, or Firm—Harry A. Herbert, Jr.; Arsen Tashjian

[57] **ABSTRACT**

A combustible cartridge case for use with a fully telescoped round of ammunition wherein the case is of a laminated type construction with a cylindrical molded grain propellant sandwiched between a double wall combustible case of felted nitrocellulose thereby adding considerable physical strength to the cartridge. A supplementary cylindrical charge of molded propellant is positioned in the rear portion of the case surrounding the outer wall of the igniter located aft of the projectile.

2 Claims, 1 Drawing Figure




21
33
17
15
13
21
19
37
35
23
41
31
25
27
29
39
41

DUPLEX COMBUSTIBLE CARTRIDGE CASE

BACKGROUND OF THE INVENTION

This invention relates to a duplex combustible cartridge case for use with a fully telescoped round of ammunition and, more particularly, the invention is concerned with providing a combustible cartridge case which is constructed of conventional gun propellant sandwiched between felted nitrocellulose. By varying the ratio of propellant to nitrocellulose, the cartridge can be designed to meet a broad range of performance requirements by taking advantage of the superior physical characteristics of the nitrocellulose material.

Caseless ammunition has long been recognized as the most advantageous means for improving the firepower and performance of high speed automatic weapons. The elimination of the need for extraction and ejection of spent cartridge cases makes the higher firing rates possible. Also, the caseless type ammunition is light in weight and easier to transport and the problem of disposing of spent cartridges is eliminated.

One of the major problems in the development of caseless ammunition has been the achievement of satisfactory muzzle velocity/maximum pressure requirements in weapons which use this type of ammunition. This is primarily the result of the more or less fixed ballistic characteristics of the cartridge propellant. The addition of more propellant only increases the peak pressure and adds nothing to the improvement of performance of the weapon. In certain instances the peak pressure will be increased to a point where the weapon is no longer capable of proper operation. Also, the conventional propellant used in the manufacture of combustible cartridge cases is inherently weak as far as its physical properties are concerned. Thus, it would be most desirable and a step forward in the art to provide a combustible cartridge case wherein the propellant could be modified to obtain a more efficient muzzle velocity/maximum pressure ratio without adding weight to the round or increasing the peak pressure. This would be particularly advantageous if it could be accomplished while at the same time adding to the physical strength of the caseless cartridge.

Accordingly, it is an object of the present invention to provide a telescoped round of caseless ammunition wherein the combustible case is constructed of two different materials which can be included in different relative amounts so as to effectively control the physical and ballistic properties of the round.

Another object of the invention is to provide a propellant for use as a combustible cartridge case wherein a cylindrical molded grain explosive is sandwiched between a double wall combustible case of felted nitrocellulose.

Still another object of the invention is to provide a duplex combustible cartridge case wherein a conventional propellant and felted nitrocellulose are combined to produce a caseless cartridge capable of meeting a broad range of performance requirements.

A further object of the invention is to provide a caseless cartridge wherein a conventional molded grain propellant is located between inner and outer layers of felted nitrocellulose. This arrangement permits the muzzle velocity to be increased without producing a corresponding increase in the peak pressure.

A still further object of the invention is to provide a telescoped round of caseless ammunition wherein the

combustible material making up the duplex cartridge case can be held at a constant weight while still allowing the ballistic properties to be varied by changing the ratio of propellant to felted nitrocellulose.

These and other objects, features and advantages will become more apparent after considering the following detailed description taken in conjunction with the annexed drawing and appended claims.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is a view in partial cross-section showing the duplex combustible cartridge case with the propellant sandwiched between the felted nitrocellulose according to the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawing, the hereinafter disclosed duplex combustible cartridge case for use with caseless ammunition includes a fully telescoped round of ammunition wherein a projectile **13** is positioned in the axial bore **15** of a duplex cartridge case **17.** A conventional molded propellant **19,** which can be made by bonding and molding granular propellants such as, for example, IMR–4996, is located in the wall of the cartridge case **17** between spaced layers of a felted material **21** such as nitrocellulose. The felted nitrocellulose **21** in combination with the propellant **19** can be varied to adjust interior ballistics and physical properties of the cartridge case **17** as well as allowing effective control of the peak pressures and muzzle velocity of the round by simply changing the composition and/or ratio of the two combustibles.

The projectile **13** is provided with a threaded axial recess (not shown) in the center of its base portion. A set screw **23** is threaded into the axial recess and extends aft beyond the base of the projectile **13** to form a threaded boss thereon. A tubular igniter **25** of felted nitrocellulose is positioned in the rearwardmost part of the axial bore **15** and includes an internally threaded forward section which engages the threads on the set screw **23.** Within the bore of the tubular igniter **25** at the base thereof, a shoulder **27** engages a primer **29,** preferably of the combustible type, such that the primer **29** is in a fixed position and the action of the firing pin (not shown) can effectively operate to crush it on impact. Most of the forward section of the igniter tube **25** is filled with a standoff igniter charge of 3FG black powder. Surrounding the outer surface of the igniter tube **25,** there is positioned a molded propellant supplementary charge **31** of the same material as the propellant charge **19.** The inner surface of the inner layer of felted nitrocellulose is in contact with the outer surface of the supplementary charge **31** at the rearward end of the case **17** in the igniter region. A ring of felted nitrocellulose **33** is in position between the inner and outer layers at the forward end of the case **17** forward of the propellant **19.**

When the telescoped round is assembled, the projectile **13** is inserted base downward into the axial bore **15** of the duplex cartridge case **17.** A diametral flange **35** which is the rear shoulder of the rotating band on the projectile **13** engages a shoulder **37** on the internal surface of the duplex cartridge case **17** and stops further downward movement. The igniter tube **25** is then threadably attached to the set screw **23** which had previously been fixedly positioned on the base of the pro-

jectile **13.** The igniter tube **25** is tightened in position by using a spanner-type wrench which fits into the openings **39** in the base of the igniter tube **25.** The operation of turning the igniter tube **25** causes the diametral flange **35** of the projectile **13** to be drawn against the shoulder **37** while the base portion of the igniter tube is pressed against the shoulder **41** locking all of the elements in position. This procedure effectively loads the central portion of the igniter **25** in tension and the forward section through the threads are loaded in shear to produce a stress pattern which is well able to withstand ramming. At the same time, quick opening effects are achieved by the internal pressurization of the igniter tube **25** very early in the ballistic cycle.

In accordance with the invention, the duplex cartridge case **17** can be prepared by boring out the inner diameter of a combustible cartridge case composed of a resin bonded fiber structure consisting principally of nitrocellulose and **4** percent silicone. A loose or molded grain of conventional propellant such as IMR–4996 is used to replace the bored out material. When the resulting duplex cartridge case is used in ammunition, it was found that the increase in the ratio of IMR propellant to the total combustible material produced a substantial increase in muzzle velocity. This benefit was achieved without any corresponding increase in peak pressure. Similarly, increasing the IMR charge and holding the combustible material weight constant increases the muzzle velocity. However, although peak pressure remains relatively stable, the exit pressure tends to increase with increasing IMR propellant charge weight.

The resin bonded nitrocellulose fiber parts are made by felting on a form from a water slurry of nitrocellulose fiber, acrylic fiber, resins and stabilizer to make a rough preform. This preform is subsequently molded under suitable conditions of temperature and pressure in suitable molds and may be finished, if necessary, by trimming and/or machining. A typical final composition would fall within the following:

	Parts by Weight	Range
Nitrocellulose (12.6% N_2)	70	55–85
Acrylic Fiber[a]	20	5–35
Resin[b]	10	
Stabilizer (N,N-diethylcarbamate)	1	
Silicone Resin[c]	4	

[a]American Cyanamid: Creslan T-98 Fibrillatable Fiber. Kraft fiber (cellulose) may be substituted for the acrylic in like amounts
[b]B. F. Goodrich, Avon Lake, Ohio: Hycar 2600X186
[c]Dow Corning, Medland, Mich.: Dow Corning B Silicone

The duplex combustible cartridge case **17** can also be fabricated by bonding molded grain propellant **19** to the combustible case **21** with nitrocellulose cement. However, this arrangement complicates assembly by making it necessary to fit each molded grain to both inner and outer case components with proper clearances allowed for the cement. It was found that equally satisfactory ballistic effects could be achieved by assembling the case **21** without any cement, thereby greatly simplifying the manufacture and assembly of the duplex cartridge case.

Although the invention has been illustrated in terms of a preferred embodiment thereof, the invention is not limited to this embodiment or to the preferred configuration mentioned. For example, it will be apparent to those skilled in the art that our invention can be practiced by including a standoff igniter charge **41,** preferably 3FG black powder, disposed in the forward section of the igniter tube **25** to further enhance the ballistic properties of the ammunition round. Also, it should be understood that various changes, alterations, modifications and substitutions, particularly with respect to the construction details can be made in the arrangement of the several elements without departing from the true spirit and scope of the appended claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent of the United States is:

1. A duplex combustible cartridge case for a fully telescoped round of ammunition comprising,

a laminated propellant charge of substantially cylindrical configuration composed of dissimilar materials and having an axial bore therethrough,

the laminations in said propellant charge being comprised of a conventional propellant sandwiched between layers of felted nitrocellulose,

a projectile positioned in the forward portion of the bore of said propellant charge,

a tubular igniter positioned in the rearward portion of said propellant charge immediately aft of said projectile,

a molded propellant supplementary charge positioned around the igniter tube, the inner surface of the inner layer of felted nitrocellulose being in contact with the outer surface of said supplementary charge,

means for threadably connecting said tubular igniter to the base of said projectile, and

a primer disposed within the rearwardmost portion of said igniter,

the peak pressure of said propellant charges remaining substantially constant while the muzzle velocity of the ammunition is increased by varying the ratio by weight of propellant to nitrocellulose.

2. The duplex combustible cartridge case defined in claim **1** wherein a ring of felted nitrocellulose is positioned between the inner and outer layers at the forward end of said case.

* * * * *