April 6, 1965 D. A. BRAFFORD 3,176,617

SEPARATE LOADING OF ARTILLERY PROPELLANT CHARGES

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Fig. 1

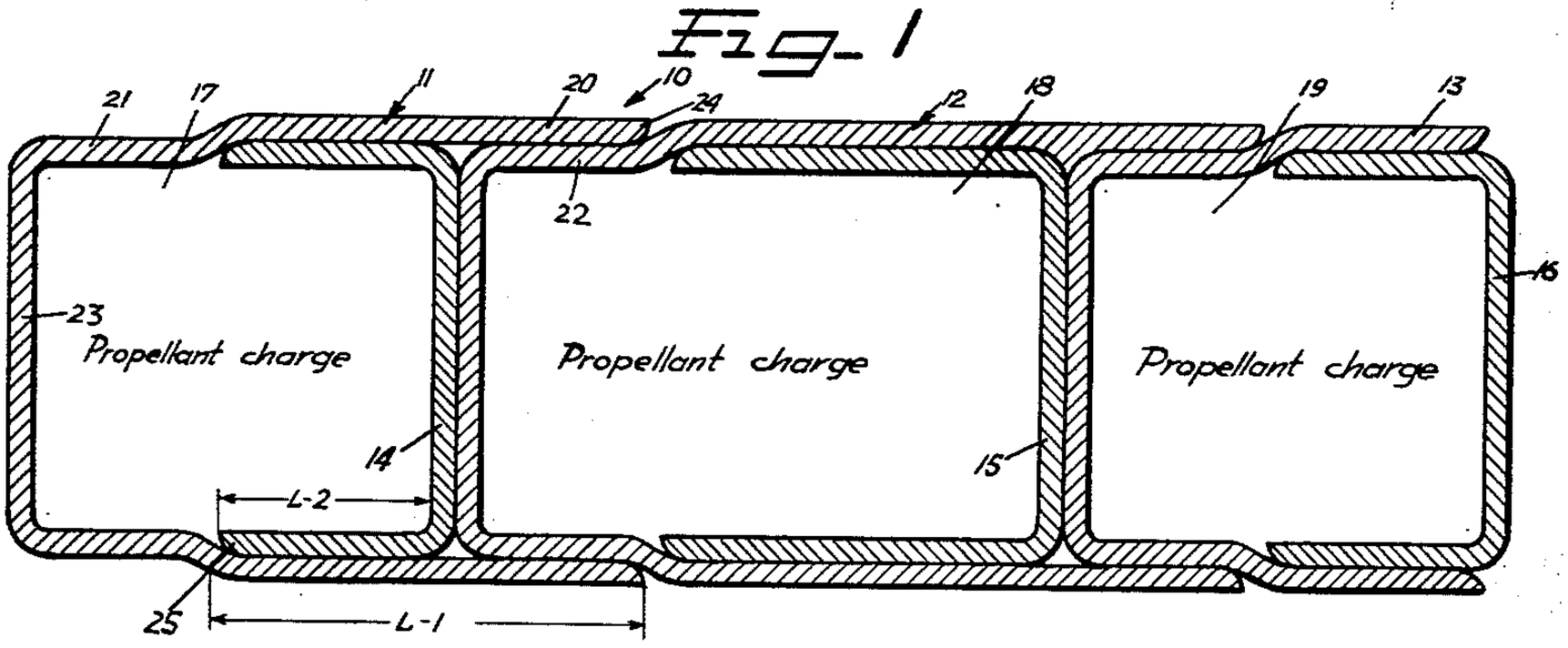
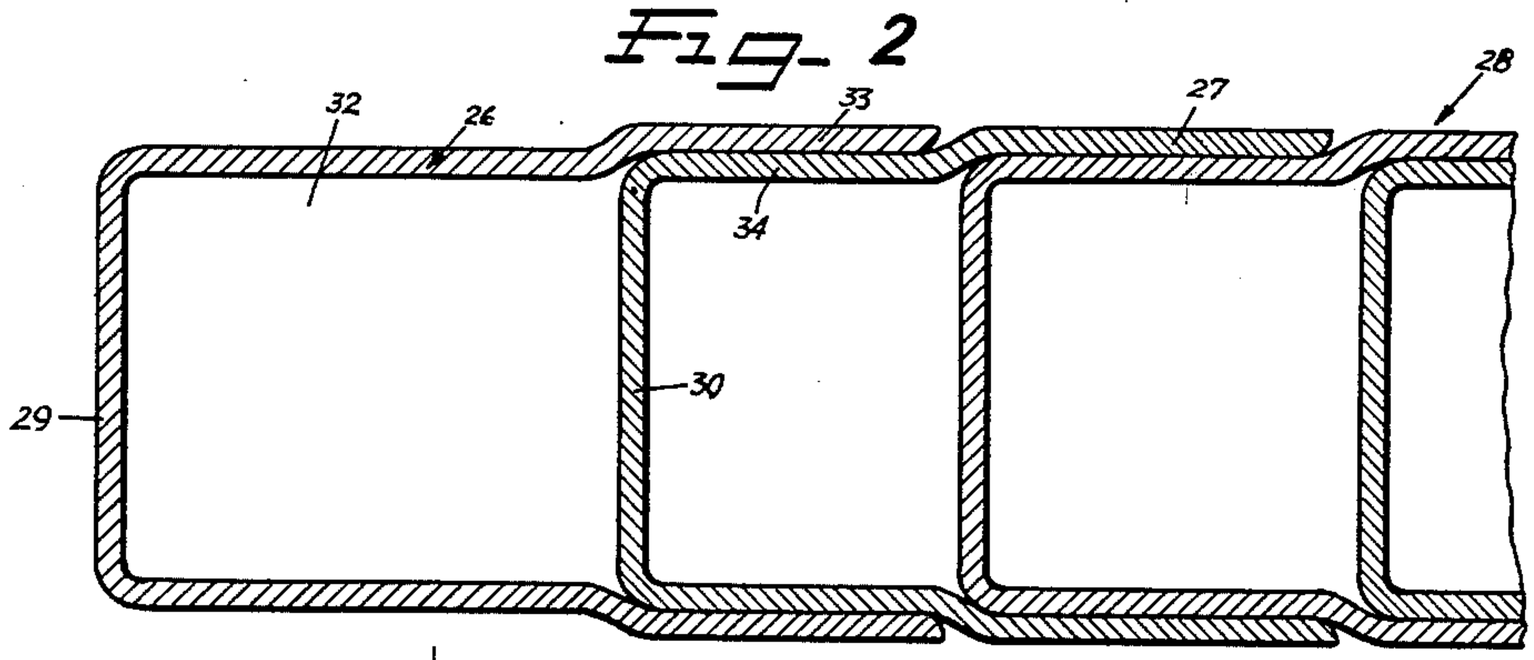


Fig. 2



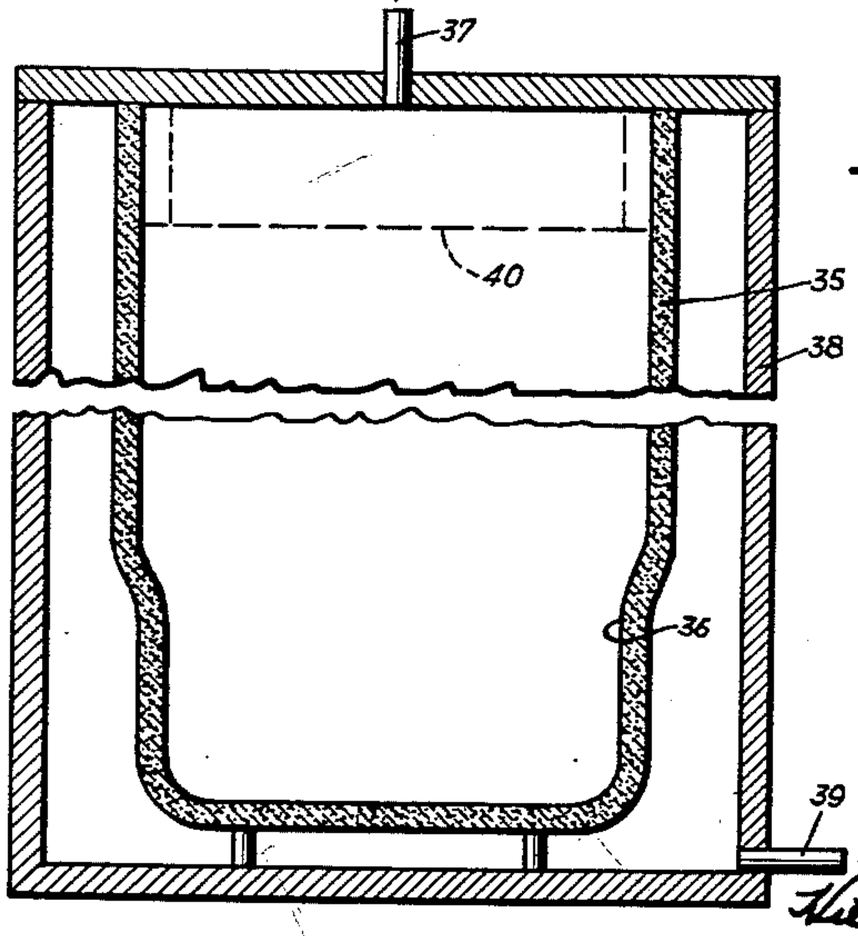


Fig. 3

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SEPARATE LOADING OF ARTILLERY PROPELLANT CHARGES

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This invention relates to improvements in propellant units for use in guns and particularly to a unit package or container and a mechanism for making the container, for a propellant charge of the type used in guns where the propellant is loaded separately from the projectile.

In large guns used for artillery or on shipboard the projectile is first inserted into the breech end of the gun barrel and the propellant charge is loaded separately. The propellant charge is usually contained in sewn cloth bags formed of material such as silk which are stored in waterproof containers until the time of use. The bags are then removed from their containers and individually loaded into the breech end of the gun barrel and the number of bags loaded is primarily determined by the firing range. The propellant contained in the bags is generally in pellet form usually being of an extruded or formed nitrocellulose and nitroglycerine material of decompounding, and frequently material known as cordite is used. When combustion of the propellant occurs in the gun barrel, the cloth bags are not highly combustible but will usually be destroyed due to the high temperatures present.

With the use of cloth bags it is essential to use separate containers for storing and handling in order to protect the charges against moisture and weather, and against deformation and tearing. This requires extra space for the storage of containers and requires handling in order to dispose of the containers and of course involves the additional expense of container manufacture. The disadvantage of the requirement of container space and the additional time needed for handling the containers is also unavoidable with the use of cloth bags.

It is accordingly an object of the present invention to provide an improved container for gun propellant charges wherein disadvantages of cloth bag type of containers are eliminated, and a more rugged package is provided for field handling which eliminates the necessity for extra containers such as are required with the cloth bags.

A further object of the invention is to provide a container unit for propellant charges wherein separate containers such as bags need not be handled and wherein a unit charge of a predetermined size can be handled and loaded in one operation.

A still further object of the invention is to provide an improved propellant container formed of a molded pulp material which is rigid in nature to avoid deformation and damage and provide for easier handling, and wherein the container is capable of absorbing a substantial amount of moisture avoiding damage to the propellant charge in adverse weather conditions.

A still further object of the invention is to provide an improved container for a propellant charge which takes the place of cloth bags, and which provides insulative protection against rapid ambient temperature changes and also which is relatively inexpensive.

A still further object of the invention is to provide an improved propellant container of a combustible material which is consumed with a propellant more readily than cloth bags, and which avoids steps such as stitching, gluing and so forth which are necessary with cloth bag containers.

Yet another object of the invention is to provide an

improved propellant container which eliminates the need for protective extra packaging material, and which affords additional advantages such as making possible the compounding of flash hiding chemicals into the container itself.

Other objects, advantages and features will become more apparent with the teaching of the principles of the invention in connection with the disclosure of the preferred embodiments thereof in the specification, claims and drawings, in which:

FIGURE 1 is a sectional view shown in somewhat schematic form of a propellant unit for use in guns embodying the principles of the present invention;

FIGURE 2 is a sectional view shown in somewhat schematic form of another arrangement of propellant unit; and

FIGURE 3 is a sectional view shown in somewhat schematic form of a mechanism for making components of the propellant container and illustrating a method for varying the container length.

As shown on the drawings:

FIGURE 1 illustrates a propellant unit **10** formed of a plurality of joined sections. Each of the sections is substantially identical in construction, and therefore only one need be described in detail.

The sections are suitably attached to each other so as to form a unit, and as illustrated the sections have one end tapered so as to telescopically fit into adjacent sections.

Each of the sections **11, 12** and **13** contains a chamber **17, 18** and **19**, and each of the chambers contains a propellant charge so that each chamber may be selected to be of a size to be the equivalent in capacity of a silk bag of the type heretofore commonly used or may be selected to be of any predetermined size and different sizes may be employed for different sections. The propellant charges are of suitable material such as cordite.

Each of the sections, as illustrated by the section **11** has an outer rigid wall or shell **20** of a combustible material and the shell has an outer cylindrical surface of a diameter to fit into the breech end of the barrel of a gun. The shells will of course be manufactured in accordance with the size of the guns in which they are to be used. One end of the shell is tapered such as illustrated at **21** for the section **11** and as illustrated at **22** for the section **12**, and the other end **24** for the section **11** provides a cylindrical axially extending skirt for receiving the tapered section **22**. The tapered end **21** is closed by an end wall **23** to close the chamber **17**.

The other end of the chamber **17** is closed by a cup-shaped shell **14** which slides telescopically into the skirt **24**. The cup-shaped shell **14** is slid sufficiently far into the end of the shell **20** to engage a shoulder **25** formed by the reduced portion **21**. This provides an end of the skirt **24** for surrounding the reduced portion **22** of the next adjacent shell. The outer diameters of the reduced portions, the inner diameters of the skirts can be made so that a snug fit results whereby the sections will tightly fit together and provide a rigid unit that can readily be handled by personnel or by loading machinery. The unit can thus be slid into the breech end of a gun loading the entire propellant charge in one operation. Each of the chambers is closed by a cup-shaped member, the chamber **18** is closed by the cup-shaped member **15** and the chamber **19** by the cup-shaped member **16**, and the end shell may be formed somewhat shorter so that the cup-shaped member **16** is flush across the end. However, various arrangements may be employed in sizing and shaping for the end section. It is also easily possible to vary the chambers for the propellant charge by changing the lengths of the skirts on the cup-shaped member **14** and on the shell **20**. To reduce the size of the chamber **17**, the length L–2 of the

skirt for the cup-shaped member **14** will be shortened, and the length L–1 of the skirt for the shell **20** will be shortened. This can be readily accomplished at the time of manufacture as will be described in connection with FIGURE 3.

FIGURE 2 illustrates another arrangement wherein the cup-shaped members or shells are omitted. In FIGURE 2 a series of shells **26, 27** and **28** are shown telescopically interconnected. The shells are constructed somewhat similar to the shells of FIGURE 1, except that the skirts **33** are as long as the coacting tapered portions **34**. Thus the chamber **32** within the first shell **26** is bounded at its ends by the end wall **30** of the shell **27**, and by the end wall **29** of the shell **26**. The shells are again formed of combustible material as are the shells and cup-shaped members of the structure of FIGURE 1.

FIGURE 3 illustrates somewhat schematically a mechanism for forming shells, and a shell forming mold of a porous material isp rovided having a substantially cylindrical shaped inner forming surface **36**. The forming surface **36** has the same shape as the outer surface of the finished shell.

A fluid stock containing shell fibers in suspension will be forced into the mold and through the porous mold wall so that the stock fibers will deposit on the forming surface **36**. Stock is supplied through an inlet line **37**, and the mold is surrounded by a housing **38** for collecting the fluid which is drained off through an outlet line **39**.

For controlling the length of shell to be formed a sleeve **40** may be inserted into the end of the mold **35** to block a portion of its length and thereby change the length of the shell which will be formed. It will be observed that sleeves of different lengths may be employed, and the construction of the mold will be such that a sleeve can be inserted or removed.

The mold is of a porous material and may be formed of a material such as individual glass beads coated with an epoxy resin to bind the beads together in the mold shape. A description of a type of mold may be found in the copending patent application Modersohn and Hornbostel Jr. entitled "Mold," U.S. Serial No. 89,451, filed February 15, 1961.

The shell is made of fibers which may be formed by being in suspension and the nature of the stock used in formation may be of the general nature of stock used in the formation of paper. More particularly, the stock is preferably water with particles or fibers in suspension at a consistency of 0.01% to 2.0%, and a preferred consistency of 0.05% is employed. Particles or fibers suitable for the formation of the desired shell are in suspension in the water, and a preferred arrangement employs a kraft pulp comprising 40% kraft fibers and 60% cotton linters. This obtains a strong shell wall and provides features well suited for the physical structures above described wherein the shell is combustible, will absorb moisture, and has a low coefficient of heat transfer.

The stock may also contain additional material such as a compatible resinous impregnate and/or binder, e.g. urea-formaldehyde or melamine-formaldehyde resins, cellulose esters and esters, polyvinyl alcohols, etc. The stock may also contain flash hiding materials so that these are integral with the shell, and separate flash hiding charges do not have to be loaded or handled as has heretofore been necessary.

The shell may be subjected to additional steps of preparation after being formed such as by being subjected to a pressing and sizing operation to insure that the outer diameter will be the proper size to fit within the breech end of the gun bore. The shell may also be subjected to an impregnation operation wherein an impregnant is applied to the pulp to penetrate through the material of the shell. An impregnating solution such as a compatible resinous impregnant and/or binder, e.g. urea-formaldehyde or melamine-formaldehyde resins,

cellulose esters and esters, polyvinyl alcohols, etc. may be employed. The resin may be in a 1% to 10% organic solvent solution or aqueous emulsion.

Suitable sizing and drying operations may then further be applied to the shell, and the cup-shaped member or inner shell is formed in the same manner. The shells are then loaded with propellant and assembled by being forced together in a telescopic relationship to provide the units illustrated in FIGURE 1 or 2.

Positive identification features may be employed marking the outer surface of the shell or penetrating the surface, and marking arrangements may be employed which are impossible with a cloth bag container. A rigid outer shell is thus provided eliminating any extra protective packaging material. The number of propellant charges that are stacked together is determined by the capability of the individuals or equipment that will handle the charges in the field. The charges are, of course, made up in accordance with the loads that are to be placed in the gun as determined by the firing ranges.

Thus it will be seen that there has been provided an improved combustible propellant charge container having the advantages and features above described. The containers are constructed so as to be nested and improve the ability to handle the propellant charges. A container has been provided which affords better protection against moisture, shock, and temperature, and which avoids the requirement of an additional carton type container as is now used with fabric type bags.

The drawings and specification present a detailed disclosure of the preferred embodiments of the invention, and it is to be understood that the invention is not limited to the specific forms disclosed, but covers all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by the invention.

I claim as my invention:

1. A container for a charge of propellant for a gun comprising

an elongated shell having a rigid cylindrical wall the outer surface of which is sized to fit into the breech end of the gun and defining a propellant-containing chamber therein,

said wall having a closed axially elongated reduced diameter portion at one end thereof to be telescopically received in an enlarged portion of a shell adjacent said closed end and having an open ended axially elongated enlarged diameter portion at the other end thereof having a given axial dimension, and

an axially elongated inverted cup-shaped member telescopically received in the enlarged diameter portion of the wall through the open end thereof,

said cup-shaped member having an axial dimension less than said given axial dimension and positioned inwardly from said open end to enable a reduced diameter portion of a shell adjacent said open end to be received in said enlarged diameter portion of said wall outwardly of said cup-shaped member for combining a plurality of shells into a unit,

said container being constituted completely of a combustible molded fiber pulp to be consumed with the propellant.

2. The container as defined in claim 1 wherein said pulp comprises a kraft pulp having 40 percent kraft fibers and 60 percent cotton linters.

References Cited by the Examiner

UNITED STATES PATENTS

115,548	5/71	Wells	102—43
923,922	6/09	Wratzke	102—97
1,315,081	9/19	Bradley	102—97

(Other references on following page)

5

UNITED STATES PATENTS

2,050,871	8/36	Woodbridge	102—97
2,397,370	3/46	Raven et al.	29—1.3
2,405,104	7/46	Mydans	102—97
2,764,939	10/56	Phemister	102—97
2,887,953	5/59	Mager	102—24
2,940,390	6/60	Bergstrom et al.	102—8
3,027,621	4/62	Clark	29—1.3

6

FOREIGN PATENTS

917,369	11/45	France.
693,795	7/53	Great Britain.
1,082,834	6/60	Germany.

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