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CASELESS PROPELLANT CHARGE CONTAINING NITROCELLULOSE IN A SYNTHETIC RESIN

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U.S. Cl. 149—19 4 Claims

ABSTRACT OF THE DISCLOSURE

A compact propellant charge of any configuration made from propellant powders without a casing or shell.

STATE OF THE ART

The burning of loose powder or other forms of propellant powders in a munition casing to fire a projectile is well known. But for certain types of propellant powders, rapid combustion with a high combustion velocity is needed and the greater the demand for a high initial velocity of the projectile as it leaves the barrel, the higher the developed gas pressure must be. To fulfill this need, two and three component propellant powders in a perforated or porous body form have been introduced. However, these powdered body forms have the disadvantage of a reduced density charge and these forms make the use of a cartridge or casing even more important.

OBJECTS OF THE INVENTION

It is an object of the invention to provide a propellant charge which does not require a casing.

It is another object of the invention to provide compact propellant charges which have a superior combustion velocity.

These and other objects and advantages of the invention will become obvious from the following detailed description.

THE INVENTION

The compact propellant charges of the invention are comprised of at least one propellant powder homogenously admixed with an organic binder which mixture is then subjected to a rapid hardening by known casting or molding techniques to obtain a molded explosive body which upon impact of a conventional type detonator the body disintegrates into its original powder form. Customary hardening agents and catalysts may be present in the mixture for molding.

The organic binders are preferably brittle synthetic resins. Examples of suitable resins are short-chain Duroplast which can be highly cross-linked in amounts from 1 to 15%, preferably 3 to 7% (heat-hardenable resins of phenol-cresol-epoxide, polyether, polyester or polyurethane basis; nitrated Duroplasts such as nitrated methacrylic acid esters or acrylic acid esters in amount from 1 to 20%, preferably 5 to 1%. The homogeneous mixing of the binder with the propellant powder and rapid hardening provide a high degree of cross-linking.

The compact propellant charge of the invention has the advantage that the combustion velocity of the propellant powder can be varied depending upon the use desired. The propellant charge is an element which is resistant to mechanical stresses occuring during shipping and during loading of the weapon. The propellant charge can be secured directly to the projectile or can be loaded directly adjacent to the projectile base. The propellant surface exposed by the disintegration of the shaped body at the moment of ignition effects such a short burning time that the entire powdered propellant is completely burned in the gun barrel.

The sudden or immediate decomposition of the propellant charges of the invention and complete burning of the propellant before the projectile leaves the barrel will occur even at temperatures below 0° C. Moreover, the propellant charge of the invention results in an increased charge density and allows the control of a progressive or regressive combustion characteristic depending upon the powdered propellant used.

Examples of suitable propellant powders which may be used are monobasic (nitrocellulose) or dibasic (nitrocellulos and nitroglycerin or diglycoldinitrate) and tribasic (nitrocellulose and nitroglycerine and nitroguanidine).

In the following examples there are described several preferred embodiments to illustrate the invention. However, it should be understood that the invention is not intended to be limited to the specific embodiments.

EXAMPLE I

100 gm. of propellant powder type A 502 having an explosion heat of 825 cal, per gm. were admixed with 7 gm. of an unsaturated polyester resin containing 50 to 70 mole percent of maleic acid dissolved in divinyl benzene. Fumaric acid could be used in place of maleic acid. The said propellant powder is comprised of 98.4% nitrocellulose having a nitrogen content of 13.15%, 1.0% diphenylamine and 0.6% sodium oxalate which has on its surface 4.9% of dibutylphthalate, symmetrical diethyldiphenylurea(Centralite I) and 0.3% graphite. A peroxide hardener and a catalyst were added thereto and mixture was poured into a mold and hardened at 50–80° C. The resulting cast body, upon an impact equivalent to a detonation impact, disintegrates. The course of combustion velocity of the above propelltant powder is as follows:

Percent:	Cm.²/kp.–S
20	18.4
30	24.0
40	26.9
50	28.4
60	28.2
70	27.0
80	24.0

EXAMPLE II

90 gm. of the propellant powder of Example I was admixed with 10 gm. of a mixture of 1 part by weight of a polyether containing hydroxyl groups and having an OH number of 10.5 to 12 and 2 parts by weight of an isocyanate having an NCO— content of 30–32%. The mixture was poured into a mold and compressed and allowed to stand for several hours. The resulting molded body decomposed upon a detonation impact.

EXAMPLE III

A mixture of 10 gm. of dinitropopylacrylate containing 4% by weight of methyl ethyl ketone peroxide and 1% by weight of a cobalt catalyst was admixed with 90 gm. of the propellant powder of Example I. The mixture was hardened and cast in molds at elevated temperatures.

EXAMPLE IV

A tribasic propellant powder consisting of 28% by weight of nitrocellulose having a nitrogen content of 12.6%, 22.5% by weight of nitroglycerin and 47.7% by weight of nitroguanidine, 1.5% by weight of Centralite I and 0.3% of Kryolith and having an explosion heat of 1050 cal. per gm. was processed in the same way as the powder in Example I to obtain a cast body which disin-

tegrated upon impact. The said propellant powder had a regressive combustion velocity as follows:

Percent:	Cm.²/kp.–S
20	33.8
30	30.7
40	28.3
50	27.5
60	26.5
70	23.9
80	23.1

Various modifications of the compositions of the invention may be made without departing from the spirit or scope thereof. The invention is intended to be limited only as defined in the appended claims.

We claim:

1. A compact propellant charge useful as an ammunition element without a casing comprising a molded mixture of a nitrocellulose containing propellant powder and 1 to 20% by weight of a brittle heat hardenable synthetic resin binder selected from the group consisting of phenol-cresol epoxide resins, polyether resins, polyester resins and polyurethane resins which may be high cross-linked and resins of nitrated methacrylic acid and nitrated acrylic acid esters of alkanols of 1 to 7 carbon atoms which molded mixture will disintegrate into its original powdered elements when subjected to a detonation impact.

2. The charge of claim 1 containing to 15% by weight of a short chain resin selected from the group consisting of phenol-cresol epoxide resins, polyether resins, polyester resins and polyurethane resins which may be highly cross-linked.

3. The charge of claim 2 containing 3 to 7% of said resin.

4. The charge of claim 1 containing 5 to 10% by weight of a resin binder selected from the group consisting of nitrated methacrylic acid and nitrated acrylic acid esters of alkanols of 1 to 7 carbon atoms.

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BENJAMIN R. PADGETT, Primary Examiner

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CERTIFICATE OF CORRECTION

Patent No. 3,676,233 Dated July 11, 1972

Inventor(s) Theodor Netzer and Hans-Jurgen Block

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

IN THE PATENT		APPLICATION		
Col.	Line	Page	Line	
1	59	2	16	Please insert --)-- after the word "polyurethane basis"
1	61	2	18	"5 to 1%" should be --5 to 10%--
2	14	3	14	"nitrocellulos" should be --nitrocellulose--
Claim	Line			
2	1	6	1	"containing to 15%" should be --containing 1 to 15%--

Signed and sealed this 13th day of March 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

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