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(54) **COMPOSITION FOR SINGLE-BASE PROPELLING POWDER FOR AMMUNITION AND AMMUNITION PROVIDED WITH SUCH COMPOSITION**

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COMPOSITION DESTINÉE À UNE POUDRE PROPULSIVE À BASE UNIQUE DESTINÉE À UNE MUNITION ET MUNITION COMPRENANT UNE TELLE COMPOSITION

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(73) Proprietor: **SIMMEL DIFESA S.p.A.**
00034 Colleferro (Roma) (IT)

(72) Inventors:
- **IUDICI, Nicola**
  00034 Colleferro, Roma (IT)
- **GIROTTI, Michela**
  00034 Colleferro, Roma (IT)
- **LEPORE, Laura**
  00034 Colleferro, Roma (IT)

(74) Representative: **Zanettin, Gianluigi**
Jacobacci & Partners S.p.A.
Piazza Mario Saggin, 2
35131 Padova (IT)

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Description

[0001] The present invention relates to a composition for single-base propelling powder for ammunition and an ammunition provided with such composition for propelling powder.

[0002] In particular, the composition for propelling powder according to the invention may be used in artillery ammunition, particularly in ammunition with a caliber comprised between 40mm and 155mm.

STATE OF THE ART

[0003] In general, an ammunition, both civil and military, consists of the assembly of a projectile and a propelling charge. In turn, the propelling charge consists of a so-called propelling powder and an ignition system.

[0004] The main element of the propelling charge is the propelling powder.

[0005] Propelling powders are classified according to the number of active components that constitute them, that is, in other words, the number of explosive bases. "Active component" or "explosive base" is intended to mean a compound capable of developing propulsion energy.

[0006] Depending on the number of explosive bases, conventional propelling powders are divided into four types:

- single-base, wherein the active component (single or main) is nitrocellulose;
- double-base, wherein, in addition to nitrocellulose, as an active component there is also a nitroester, typically nitroglycerine;
- triple-base, wherein the active components are nitrocellulose, a nitroester and a nitroamine (for example, nitroguanidine); and
- multi-base, wherein the active components are typically four: nitrocellulose, a nitroester and two nitroamines, generally nitroguanidine and cyclotrimethylentrinitroamine (RDX).

[0007] Generally, nitrocellulose with high nitrogen content (known as gun cotton) and nitrocellulose with a medium nitrogen content (known as collodion cotton), typically obtained from cotton flakes or from other plant forms, i.e. so-called arboreal nitrocellulose, are used in the production of propelling powders.

[0008] In the compositions of propelling powders, in addition to the active components, other components are present with a specific function, listed below: - plasticizers, which enable the workability of the nitrocellulose; - stabilizers, adapted to ensure the safety and stability over time of the propelling powder. In some cases, flash-reducer components may also be included directly in the propelling powder, so as to reduce the so-called muzzle flash at the mouth of the barrel of the weapon system.

[0009] The plasticizers used in single-base propelling powders are constituted by inert materials, while in the other families, the nitroester, in addition to acting as an active component, also acts as a nitrocellulose plasticizer.

[0010] Currently, the plasticizers used in single-base propelling powders are dinitrotoluene (DNT) and dibutyl phthalate (DBP).

[0011] Dinitrotoluene (DNT), classified as a carcinogenic compound, has been subjected, like all chemical compounds, to the screening of the European Chemicals Agency (ECHA) and has been banned in a mandatory way both in production and use from August 21, 2015, without possibility of derogation (Commission Regulation (EU) No. 125/2012).

[0012] Also, dibutyl phthalate (DBP) has been subjected to examinations and has been classified as harmful to fertility and the fetus (Commission Regulation (Eu) No. 143/2011 and the related Corrigenda). In this case, however, the date established for the end of its use, or February 21, 2015, has been postponed to February 21, 2027. The derogation is temporary and valid until the replacement/elimination of the DBP.

[0013] In the ammunition field, for reasons relating to occupational safety and the environmental impact of the chemical substances used, it has been made necessary to launch research programs aimed at eliminating or replacing the two substances, dinitrotoluene (DNT) and dibutyl phthalate (DBP), from propelling powders, without however affecting their workability and performance.

[0014] To date compositions of single-base propelling powder for ammunition that are devoid of dinitrotoluene (DNT) and dibutyl phthalate (DBP) and that at the same time guarantee workability and performance similar to those of propelling powders containing these two substances are not known. "Workability" is intended to mean both the capacity of the composition to be subject to a gelatinization process by which the nitrocellulose mass coagulates into a gelatinous state (gel) without separation of liquid, and the capacity of the materials used to mix themselves homogeneously and with stability over time. The performance is, however, tied to the energy of the final composition, represented, for the propelling powders, by the calorific value.

[0015] In addition to the composition, also the geometry of the grains into which the propelling powder is formed, contributes to the ballistic performance. Generally speaking, a grain of propelling powder is defined by typical dimensions (variable from case to case): the number of longitudinal through holes, the diameter of the holes, the outer diameter,

and the length. It is essential for proper ballistic behavior that the holes are symmetrical and reproducible.

[0016] The obtainment of propelling powder grains having a well-defined geometry is directly related to the workability of the composition. This confirms the importance of the workability of a propelling powder composition.

[0017] US3785888 discloses a gas-generating composition comprising 19 wt.% of nitrocellulose, 1 wt.% of ethyl centralite and 3 wt.% of dibutyl sebacate as a plasticizer.

[0018] US3690970 discloses a single base powder comprising 93.8% of nitrocellulose, 1.0% of diphenylamine as a stabilizer and 4.7% of dibutyl phthalate as a plasticizer.

[0019] US 2016/244382 discloses that dibutyl phthalate (used as a burn rate modifier/plasticizer in propellants) is toxic and dibutyl sebacate in a list of optional burn rate modifiers.

[0020] In the ammunition field, therefore, there is a strong need for a composition for a single-base propelling powder for ammunition which is devoid of dinitrotoluene (DNT) and dibutyl phthalate (DBP), while at the same time has workability and performance similar to the propelling powders containing these two substances.

PRESENTATION OF THE INVENTION

[0021] therefore, the object of the present invention is to eliminate in whole or in part the drawbacks of the aforementioned prior art by providing a composition for single-base propelling powder for ammunition which is devoid of dinitrotoluene (DNT) and dibutyl phthalate (DBP) and which at the same time ensures workability and performance comparable to conventional single-base propelling powders containing these two substances.

[0022] A further object of the present invention is to provide a composition for a single-base propelling powder for ammunition which is devoid of dinitrotoluene (DNT) and dibutyl phthalate (DBP) and which may be made with production costs comparable to conventional single-base propelling powders containing these two substances.

[0023] The technical features of the invention are clearly apparent from the content of the claims provided below, and the advantages thereof will become more apparent in the detailed description that follows, in particular with reference to one or more preferred and non-limiting embodiments.

DETAILED DESCRIPTION

[0024] The present invention relates to a composition for single-base propelling powder for ammunition and an ammunition provided with such composition for propelling powder.

[0025] In particular, the composition for propelling powder according to the invention may be used in artillery ammunition, particularly in ammunition with a caliber comprised between 40mm and 155mm.

[0026] According to a general embodiment of the invention, the composition for single-base propelling powder consists of:

- nitrocellulose as explosive base;
- an inert nitrocellulose plasticizer component;
- at least one nitrocellulose stabilizing component; and
- optionally, at least one flash-reducer component.

[0027] The composition for propelling powder may optionally also contain traces of one or more solvents and water.

[0028] According to the invention, the aforementioned inert plasticizing component is constitued by dibutyl sebacate (DBS). Dibutyl sebacate is present in the composition with a content comprised between 1% and 10% by weight based on the total amount by weight of nitrocellulose, nitrocellulose stabilizing component, inert plasticizer component and, if present, flash-reducer component.

[0029] Here and in the rest of the description, the percentages (%) by weight of the single components (included dibutyl sebacate as stated above) refer to the dry part of the composition, with 'dry part' meaning the composition's total components excluded any solvents and water. The content of any solvents and water is counted "out of a hundred", i.e. as the number of parts by weight per 100 parts by weight of the total of all other components (dry part of the composition).

[0030] It has been surprisingly found that in the compositions of single-base propelling powders, for the nitrocellulose plasticizer function, dibutyl sebacate, with a content comprised between 1% and 10% by weight, may completely replace the conventional plasticizers used in single-base propelling powders, i.e. dinitrotoluene (DNT) and dibutyl phthalate (DBP), without compromising the workability of the composition, nor the final performance or the stability of the propelling powder over time.

[0031] As already anticipated, "workability" is intended to mean both the ability of the composition to be subject to a gelatinization process, whereby the nitrocellulose mass coagulates into a gelatinous state (gel) without separation of liquid and the capacity of the materials used to mix themselves homogeneously and with stability over time. The material thus obtained may be drawn/extruded and subsequently subjected to a cutting process in order to give it a well-defined

shape. The obtainment of propelling powder grains having a well-defined geometry (essential as mentioned above to ensure ballistic performance) is directly related to the workability of the composition. Generally speaking, as already said previously, a grain of propelling powder is defined by typical dimensions (variable from case to case): the number of longitudinal through holes, the diameter of the holes, the outer diameter, the length. It is essential for proper ballistic behavior that the holes are symmetrical and reproducible. This can only be achieved if the propelling powder composition is workable in the sense specified above.

[0032] Moreover, the performance is tied to the energy of the final composition, represented, for the propelling powders, by the calorific value.

[0033] As can be seen from the comparative examples in the description, the content by weight of dibutyl sebacate in the composition of propelling powder according to the present invention is not higher than the content by weight of dinitrotoluene (DNT) and dibutyl phthalate (DBP) present in conventional single-base propelling powders. This means that replacement of these two compounds with dibutyl sebacate (according to the present invention) does not require a reduction in nitrocellulose content by weight in the composition and, consequently, a lowering of its calorific value (i.e., ultimately, its performance) with respect to conventional propelling powders.

[0034] International safety regulations do not indicate specific use restrictions for dibutyl sebacate in terms of safety for health. In particular, dibutyl sebacate is neither classified as a carcinogenic compound nor as a compound that is harmful to fertility and the fetus.

[0035] In the light of what is shown above, dibutyl sebacate is thus a compound particularly suitable for the complete replacement of dinitrotoluene (DNT) and dibutyl phthalate (DBP) as an inert plasticizer in single-base propelling powders.

[0036] In particular, it was established that, with a content of less than 1% by weight, the plasticizing action of dibutyl sebacate is not sufficient to ensure the workability of the propelling powder during the production phase, since it resulted to be excessively viscous. With a content of more than 10% by weight, the plasticizing action of dibutyl sebacate is still effective, although the calorific value is negatively affected, thus affecting the energy performance of the propelling powder. Additionally, for percentages of DBS higher than 10% by weight, swelling phenomena may occur after extrusion.

[0037] Preferably, the dibutyl sebacate is present in the composition with a content comprised between 2% and 7% by weight. Even more preferably, the dibutyl sebacate is present in the composition with a weight content between 3% and 5%. The different percentages of plasticizer affect the plasticity of the mixture during extrusion. It has been found that the preferred ranges indicated above allow to obtain more easily a correct extrusion of the composition and the subsequent size of the extrusion in grains of propelling powder, without causing deformation phenomena of the extrusion neither at the output of the extruder, nor after the cutting phase.

[0038] As already highlighted above, the composition for propelling powder according to the invention is single base, wherein the explosive base (or single active component) is constituted by **nitrocellulose.**

[0039] Preferably, nitrocellulose is selected from among nitrocelluloses with high nitrogen content (known as gun cotton) and nitrocelluloses with a medium nitrogen content (known as collodion cotton), typically obtained from cotton flakes or from other plant forms, i.e., so-called arboreal nitrocellulose.

[0040] Preferably, nitrocellulose is present with a content by weight comprised between 82.5% and 98%. Even more preferably, nitrocellulose is present with a content by weight comprised between 89% and 94.5%. The energy, i.e. the calorific value, of the propelling powder is directly linked to nitrocellulose content, in addition to the nitrogen content thereof.

[0041] As already noted above, the composition includes at least one nitrocellulose **stabilizing component.**

[0042] Advantageously, the aforementioned nitrocellulose stabilizer is selected from the group consisting of nitramines, nitrosamines, ureas, derivatives of such compounds or mixtures thereof.

[0043] Preferably, among the nitramines, the aforementioned nitrocellulose stabilizer may be selected from diphenylamine and n-nitrosodiphenylamine, while from their derivatives it may be selected from 2-nitrodiphenylamine, 4-nitrodiphenylamine, N-nitroso-2-nitrodiphenylamine, N-nitroso-4-nitrodiphenylamine, 2,2'-dinitrodiphenylamine, 2,4-dinitrodiphenylamine, 2,4'-dinitrodiphenylamine, 4,4'-dinitrodiphenylamine, N-nitroso-2,4'-dinitrodiphenylamine, N-nitroso-4,4'-dinitrodiphenylamine, N-nitroso-2-nitrodiphenylamine, 2,2'-dinitrodiphenylamine, 2,4-dinitrodiphenylamine, 2,4'-dinitrodiphenylamine, N-nitroso-4-nitrodiphenylamine, 2,4-dinitrodiphenylamine, 2,4'-dinitrodiphenylamine, 4,4'-dinitrodiphenylamine.

[0044] Preferably, among the nitrosamines the aforementioned nitrocellulose stabilizer may be selected from dimethylnitrosamine and n,n-diethylnitrosamine,

[0045] Preferably, among the ureas the aforementioned nitrocellulose stabilizer may be selected from ethyl-centralite (1,3-diethyl-1,3-diphenylurea) and acardite (Type I: 1,1-diphenylurea; Type II: 1-methyl -3,3-diphenylurea), while among their derivatives it may selected from 2-nitroethylcentralite, 4-nitroethylcentralite, 2,2'-dinitroethylcentralite, 2,4-dinitroethylcentralite, 2,4'- dinitroethylcentralite, 4,4'-dinitroethylcentralite, N-nitroso-N-ethylaniline, 2-nitro-N-ethylaniline, 4-nitro-N-ethylaniline, 4-nitro-N-nitroso-N-ethylaniline, 2,4-dinitro-N-ethylaniline.

[0046] Preferably, the aforementioned at least one stabilizing component of nitrocellulose is constituted by ethyl centralite (1,3-diethyl-1,3-diphenylurea). According to a particularly preferred embodiment of the invention, the composition includes a single nitrocellulose stabilizing component, constituted by ethyl centralite (1,3-diethyl-1,3-diphenylurea).

[0047] It has been verified experimentally that ethyl centralite (1,3-diethyl-1,3-diphenylurea / EC), in addition to the stabilizing effect, also provides a plasticizing effect, actively contributing to the workability of the final mixture. In this way, it is possible to reduce the content of dibutyl sebacate (DBS) by weight, enabling the content of this component in the composition to be more easily brought to the preferred range of 2%-7%, or the particularly preferred range of 3%-5%.

[0048] Preferably, said nitrocellulose stabilizing component is present with a content comprised between 1% and 5% by weight. Even more preferably, said stabilizing component is present with a content between 2.5% and 3.5% by weight. In the above weight percentages, it is possible to incorporate the stabilizer into the final composition in the proper amount so as to guarantee the desired stability of the final product over time.

[0049] Advantageously, the composition may optionally include at least one **flash-reducer component.** Preferably, if provided, the aforementioned at least one flash-reducer component is present with a content by weight comprised between 0.5% and 2.5%.

[0050] According to a preferred embodiment of the invention, the aforementioned at least one flash-reducer component is composed of potassium sulfate (K_2SO_4).

[0051] According to a preferred embodiment of the invention, the composition for single-base propelling powder has the following formulation:

- nitrocellulose: 82.5% - 98% by weight;
- dibutyl sebacate (DBS): 1% - 10% by weight;
- stabilizing component (preferably ethyl centralite): 1% - 5% by weight;
- flash-reducer component: 0% to 2.5% by weight.

[0052] According to a particularly preferred embodiment of the invention, the composition for single-base propelling powder has the following formulation:

- nitrocellulose: 89% - 94.5% by weight;
- dibutyl sebacate (DBS): 3% - 5% by weight;
- stabilizing component (preferably ethyl centralite): 2,5% - 3,5% by weight;
- flash-reducer component: 0% - 2.5% by weight.

[0053] As already anticipated, the composition for propelling powder may optionally also contain traces of one or more solvents and water. The content of any solvents and water is calculated as content in addition to the dry part of the composition, in terms of the number of parts solvent per 100 parts of the total of other components of the composition. In particular, the total content of solvents (including water) may reach up to 1.5 parts by weight per 100 parts of the dry part of the composition (nitrocellulose, plasticizer, stabilizer and, if present, flash-reducer).

EXAMPLES OF COMPOSITION ACCORDING TO THE INVENTION

[0054] Compositions of propelling powders have been produced for different types of ammunition.

[0055] In particular, the compositions of single-base propelling powder produced according to the invention are shown below for four different artillery ammunitions of which the caliber is reported.

[0056] For some examples of composition, a comparative example of a conventional composition of single-base propelling powder used for the same ammunition is provided.

EXAMPLE 1

[0057] A first example (example 1) relates to a composition of single-base propelling powder for 40mm L70 caliber ammunition. Composition values are provided in Table 1.

Table 1 - Example 1

Component	% by weight	Possible variant % by weight
Nitrocellulose	91.2	± 2.0
dibutyl sebacate	5.0	± 1.2
ethyl centralite	3.2	± 1.0
K_2SO_4	0.6	± 0.2

[0058] The following table 2 shows the data relating to a conventional composition of single-base propelling powder used for the same ammunition.

Table 2 - Comparative example propelling powder M1

Component	% by weight	Possible variant % by weight
Nitrocellulose	83.3	± 2.0
Dinitrotoluene	9.8	± 2.0
Dibutyl phthalate	4.9	± 1.0
Diphenylamine	1.0	+ 0.2 / -0.1
K_2SO_4	1.0	± 0.3

[0059] The composition of propelling powder according to the invention was produced using the same production line and the same production parameters as the conventional one (M1) without any alteration of the finished product. The composition according to the invention thus has a workability similar to the conventional one.

[0060] The calorific value of the composition according to the invention was found to be in line with the reference (M1), as well as the ballistic characteristics, in particular the velocity at the mouth and the pressure developed in the weapon by the ammunition of which the propulsion system provides for the use of the new propelling powder.

[0061] The composition of the propelling powder according to the invention has been subjected to chemical-physical and ballistic characterization with complete success. This has confirmed that the composition of the propelling powder according to the invention ensures performance similar to the conventional one.

EXAMPLE 2

[0062] A second example (example 2) relates to a composition of single-base propelling powder for 155mm caliber ammunition, in particular for bottom propelling charges. Composition values are provided in Table 3.

Table 3 - Example 2

Component	% by weight	Possible variant % by weight
Nitrocellulose	93.3	± 2.0
dibutyl sebacate	3.0	± 1.0
ethyl centralite	3.1	± 1.0
K_2SO_4	0.6	± 0.2

[0063] The composition of the propelling powder according to the invention was subjected to chemical-physical and ballistic characterization with complete success. This has confirmed that the composition according to the invention has adequate workability and ensures adequate performance.

EXAMPLE 3

[0064] A third example (example 3) relates to a composition of single-base propelling powder for 100mm caliber ammunition. Composition values are provided in Table 4.

Table 4 - Example 3

Component	% by weight	Possible variant % by weight
Nitrocellulose	91.0	± 2.0
dibutyl sebacate	4.9	± 1.2
ethyl centralite	3.0	± 0.8
K_2SO_4	1.1	± 0.2

[0065] Also in this case, the composition of the propelling powder according to the invention has been subjected to chemical-physical and ballistic characterization with complete success. This has confirmed that the composition according to the invention has adequate workability and ensures adequate performance.

EXAMPLE 4

[0066] A fourth example (example 4) relates to a composition of single-base propelling powder for 76mm L62 caliber ammunition. Composition values are provided in Table 5.

Table 5 - Example 4

Component	% by weight	Possible variant % by weight
Nitrocellulose	92.0	± 2.0
dibutyl sebacate	3.0	± 1.0
ethyl centralite	2.8	± 0.8
K_2SO_4	2.2	± 0.4

[0067] The following table 6 shows the data relating to a conventional composition of single-base propelling powder used for the same ammunition.

Table 6 - Comparative example propelling powder M6

Component	% by weight	Possible variant % by weight
Nitrocellulose	85.3	± 2.0
Dinitrotoluene	9.8	± 2.0
Dibutyl phthalate	2.9	± 1.0
Diphenylamine	1.0	+ 0.2 / -0.1
K_2SO_4	1.0	± 0.3

[0068] The composition of propelling powder according to the invention was produced using the same production line and the same production parameters as the conventional (M6) one without any alteration to the finished product. The composition according to the invention thus has a workability similar to the conventional one.

[0069] The calorific value of the composition according to the invention, as well as the ballistic characteristics, was found to be in line with the reference (M6) in particular the velocity at the mouth and the pressure developed in the weapon by the ammunition, the propulsion system of which provides for the use of propelling powder according to the invention.

[0070] The composition of the propelling powder according to the invention has been subjected to chemical-physical and ballistic characterization with complete success. This has confirmed that the composition of the propelling powder according to the invention ensures similar performance to the conventional one.

EXAMPLE 5

[0071] A fifth example (example 5) relates to a composition of single-base propelling powder for 155mm caliber ammunition, produced according to the invention. In this example, the composition is devoid of a flash-reducer component. Composition values are provided in Table 7.

Table 7 - Example 5

Component	% by weight	Possible variant % by weight
Nitrocellulose	91.8	± 2.0
dibutyl sebacate	5.0	± 1. 2
ethyl centralite	3.2	± 1.0

[0072] The following table 8 shows the data for a conventional composition of single-base propelling powder used for the same ammunition.

Table 8 - Compar. ex. propelling powder for 155mm cal.

Component	% by weight	Possible variant % by weight
Nitrocellulose	85.0	± 2.0
Dinitrotoluene	9.0	± 1.0
Dibutyl phthalate	5.0	± 1.0
Diphenylamine	1.0	+ 0.2 / -0.1

[0073] The composition of propelling powder according to the invention was produced using the same production line and the same production parameters as the conventional one without any alteration of the finished product. The composition according to the invention thus has a workability similar to the conventional one.

[0074] The calorific value of the composition according to the invention, as well as the ballistic characteristics, was found to be in line with the reference, in particular the velocity at the mouth and the pressure developed in the weapon by the ammunition, the propulsion system of which provides for the use of the new propelling powder.

[0075] The composition of the propelling powder according to the invention was subjected to chemical-physical and ballistic characterization with complete success. This has confirmed that the composition of the propelling powder according to the invention ensures similar performance to the conventional one.

[0076] Advantageously, the composition of single-base propelling powder for ammunition according to the invention is obtainable by the same production processes used to produce conventional compositions of single-base propelling powder.

[0077] In particular, a production process with solvents or without solvents may be used.

[0078] In particular, the specific compositions of propelling powder of the examples 1 to 5 above and their comparative examples were produced following a production process with solvents.

[0079] More in detail, such propelling powders were produced according to the following production scheme (which should be understood as a purely non-limiting example):

- Step 1: dehydration of nitrocellulose;
- Step 2: mixing nitrocellulose with the other components of the composition;
- Step 3: extrusion;
- Step 4: solvent removal;
- Step 5: drying;
- Step 6: homogenization.

[0080] Dehydration is necessary to make the nitrocellulose (NC) usable. In fact, in order to be transported, the NC has a water content of approximately 30%. In order for the mixing phase to be carried out efficiently, only the solvents capable of gelatinizing the NC must be present. In particular, for single-base powders, the gelatinization of NC takes place using ethyl ether and ethanol, in the ratio 65/35. Gelatinization is a process through which a partial solubilization of the nitrocellulose occurs, through which a macromolecular superstructure is generated that, when the evaporation is completed, leads to the final structure of the grain of the propelling powder.

[0081] The mixing of the nitrocellulose with the other components of the composition (step 1) was carried out in the presence of solvents (in particular water, alcohol and ether) so as to allow the gelatinization of the component mixture and consequently allow its workability. Gelatinization is an exothermic phenomenon, so it is necessary to control the temperature inside the mixer with a water chilling system.

[0082] The extrusion step (step 3) occurs using certain molds according to the application, i.e., the type of ammunition to which the propelling powder is destined. The die speed is able to influence the final structure of the grain of powder. The cutting speed must be correctly adjusted to obtain grains of powder with the desired length. The design of the mold for the die is very important, it must take into account the correct feeding, the stresses transmitted to the mold, and the shrinkage of the propelling powder after drying. At this stage, the action of the plasticizer (DBS) is decisive, which makes it possible to extrude through the die bushings the propelling mixture, so that the final grain maintains the geometric characteristics established in the design phase, to which is associated the ballistic performance in subsequent use.

The homogenization stage (stage 6)

[0083] Stages 4 and 5 relate to the reduction in the finished product of the content of all volatile substances used during the various stages of production. This has a dual object: to preserve the ballistic features of the final product and to make the product safer after the packaging phase.

[0084] If the composition of the propelling powder according to the invention is produced by a production process with solvents, it may contain traces of solvents and water used in the production process. The total content of solvents, i.e. solvents and water used in the production process, is such that it does not disturb chemical and performance stability over time. In particular, the total content of solvents (including water) may reach up to 1.5 parts by weight per 100 parts of the totality of the other components of the composition (nitrocellulose, plasticizer, stabilizer and, if present, flash-reducer).

[0085] The homogenization stage (stage 6) allows a batch of powder starting from a production batch. At this stage, the powder grains are mixed to ensure the homogeneity of the powder batch and are packed in suitable containers.

[0086] In particular, the composition of the propelling powder according to the invention is in the form of extruded grains having a prevalent longitudinal direction of development. Preferably, such grains are provided with a plurality of longitudinal through holes.

[0087] An object of the present invention is also an ammunition characterized by the fact that it is provided with a propelling powder having a composition according to the present invention and in particular as described previously.

[0088] Advantageously, the aforementioned ammunition has a caliber between 40 mm and 155 mm. Preferably, the ammunition has a caliber of 40 mm, 76 mm, 100 mm or 155 mm.

[0089] The invention provides many advantages already described in part.

[0090] The composition for a single-base propelling powder for ammunition according to the invention is devoid of dinitrotoluene (DNT) and dibutyl phthalate (DBP), and at the same time ensures workability and performance similar to conventional single-base propelling powders containing these two substances.

[0091] The composition for single-base propelling powder for ammunition is devoid of dinitrotoluene (DNT) and dibutyl phthalate (DBP) and may be achieved by processes similar to those used to obtain conventional single-base propelling powders. Production costs are therefore comparable to conventional single-base propelling powders containing dinitrotoluene (DNT) and dibutyl phthalate (DBP).

[0092] The invention thus conceived therefore achieves the foregoing purposes.

[0093] Obviously, in its practical implementation, it may also take forms and configurations other than those described above without, for this reason, departing from the present scope of protection as defined in the claims.

Claims

1. Composition for single-base propelling powder for ammunition, consisting of nitrocellulose as explosive base, an inert plasticizing component, at least one nitrocellulose stabilizing component and, optionally, a flash-reducer component and traces of one or more solvents and water, **characterized in that** said inert plasticizing component is constituted by dibutyl sebacate (DBS), wherein the dibutyl sebacate is present with a content comprised between 1% and 10% by weight.

2. Composition according to claim 1, wherein the dibutyl sebacate is present with a content comprised between 2% and 7% by weight.

3. Composition according to claim 2, wherein the dibutyl sebacate is present with a content comprised between 3% and 5% by weight.

4. Composition according to one or more of the preceding claims, wherein said at least one nitrocellulose stabilizing component is selected from the group consisting of nitramines, nitrosamines, ureas, derivatives of said compounds or mixtures thereof.

5. Composition according to one or more of the preceding claims, wherein said at least one stabilizing component of nitrocellulose is constituted by 1,3-diethyl-1,3-diphenylurea.

6. Composition according to one or more of the preceding claims, wherein said nitrocellulose stabilizing component is present with a content comprised between 1% and 5% by weight.

7. Composition according to claim 6, wherein said nitrocellulose stabilizing component is present with a content com-

prised between 2.5% and 3.5% by weight.

8. Composition according to one or more of the preceding claims, wherein the nitrocellulose is present with a content comprised between 82.5% and 98% by weight.

9. Composition according to claim 8, wherein the nitrocellulose is present with a content comprised between 89% and 94.5% by weight.

10. Composition according to one or more of the preceding claims, wherein said at least one flash-reducer component is present with a content comprised between 0.5% and 2.5% by weight.

11. Composition according to claim 10, wherein said at least one flash-reducer component is constituted by potassium sulfate.

12. Ammunition **characterized in that** it is provided with a propelling powder having a composition according to one or more of the preceding claims.

13. Ammunition according to claim 12, having a caliber between 40 mm and 155 mm, preferably a caliber of 40 mm, 76 mm, 100 mm or 155 mm.

Patentansprüche

1. Zusammensetzung für einbasiges Treibladungspulver für Munition, bestehend aus Nitrocellulose als Sprengstoffbasis, einer inerten plastifizierenden Komponente, mindestens einer Nitrocellulosestabilisierungskomponente und optional einer Flammreduzierkomponente und Spuren von einem oder mehreren Lösungsmitteln und Wasser, **dadurch gekennzeichnet, dass** die inerte plastifizierende Komponente durch Dibutylsebacat (DBS) gebildet ist, wobei das Dibutylsebacat mit einem Gehalt vorhanden ist, der zwischen 1 und 10 Gew.-% liegt.

2. Zusammensetzung nach Anspruch 1, wobei das Dibutylsebacat mit einem Gehalt vorhanden ist, der zwischen 2 und 7 Gew.-% liegt.

3. Zusammensetzung nach Anspruch 2, wobei das Dibutylsebacat mit einem Gehalt vorhanden ist, der zwischen 3 und 5 Gew.-% liegt.

4. Zusammensetzung nach einem oder mehreren der vorhergehenden Ansprüche, wobei die mindestens eine Nitrocellulosestabilisierungskomponente aus der Gruppe bestehend aus Nitraminen, Nitrosaminen, Harnstoffen, Derivaten dieser Verbindungen oder Gemischen davon ausgewählt ist.

5. Zusammensetzung nach einem oder mehreren der vorhergehenden Ansprüche, wobei die mindestens eine Stabilisierungskomponente der Nitrocellulose durch 1,3-Diethyl-1,3-diphenylharnstoff gebildet ist.

6. Zusammensetzung nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Nitrocellulosestabilisierungskomponente mit einem Gehalt vorhanden ist, der zwischen 1 und 5 Gew.-% liegt.

7. Zusammensetzung nach Anspruch 6, wobei die Nitrocellulosestabilisierungskomponente mit einem Gehalt vorhanden ist, der zwischen 2,5 und 3,5 Gew.-% liegt.

8. Zusammensetzung nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Nitrocellulose mit einem Gehalt vorhanden ist, der zwischen 82,5 und 98 Gew.-% liegt.

9. Zusammensetzung nach Anspruch 8, wobei die Nitrocellulose mit einem Gehalt vorhanden ist, der zwischen 89 und 94,5 Gew.-% liegt.

10. Zusammensetzung nach einem oder mehreren der vorhergehenden Ansprüche, wobei die mindestens eine Flammreduzierkomponente mit einem Gehalt vorhanden ist, der zwischen 0,5 und 2,5 Gew.-% liegt.

11. Zusammensetzung nach Anspruch 10, wobei die mindestens eine Flammreduzierkomponente durch Kaliumsulfat

gebildet ist.

12. Munition, **dadurch gekennzeichnet, dass** sie mit einem Treibladungspulver versehen ist, das eine Zusammensetzung nach einem oder mehreren der vorhergehenden Ansprüche aufweist.

13. Munition nach Anspruch 12, aufweisend ein Kaliber zwischen 40 mm und 155 mm, vorzugsweise ein Kaliber von 40 mm, 76 mm, 100 mm oder 155 mm.

Revendications

1. Composition pour poudre propulsive à base unique destinée à une munition, constituée de nitrocellulose en tant que base explosive, d'un composant plastifiant inerte, d'au moins un composant stabilisant de nitrocellulose et, éventuellement, d'un composant antilueur et de traces d'un ou plusieurs solvants et d'eau, **caractérisée en ce que** ledit composant plastifiant inerte est constitué par du sébacate de dibutyle (DBS), le sébacate de dibutyle étant présent selon une teneur comprise entre 1 % et 10 % en poids.

2. Composition selon la revendication 1, dans laquelle le sébacate de dibutyle est présent selon une teneur comprise entre 2 % et 7 % en poids.

3. Composition selon la revendication 2, dans laquelle le sébacate de dibutyle est présent selon une teneur comprise entre 3 % et 5 % en poids.

4. Composition selon une ou plusieurs des revendications précédentes, dans laquelle ledit composant stabilisant de nitrocellulose, au moins au nombre de un, est sélectionné dans le groupe composé des nitramines, des nitrosamines, des urées, des dérivés desdits composés ou des mélanges de ceux-ci.

5. Composition selon une ou plusieurs des revendications précédentes, dans laquelle ledit composant stabilisant de nitrocellulose, au moins au nombre de un, est constitué par de la 1,3-diéthyl-1,3-diphénylurée.

6. Composition selon une ou plusieurs des revendications précédentes, dans laquelle ledit composant stabilisant de nitrocellulose est présent selon une teneur comprise entre 1 % et 5 % en poids.

7. Composition selon la revendication 6, dans lequel ledit composant stabilisant de nitrocellulose est présent selon une teneur comprise entre 2,5 % et 3,5 % en poids.

8. Composition selon une ou plusieurs des revendications précédentes, dans laquelle la nitrocellulose est présente selon une teneur comprise entre 82,5 % et 98 % en poids.

9. Composition selon la revendication 8, dans laquelle la nitrocellulose est présente selon une teneur comprise entre 89 % et 94,5 % en poids.

10. Composition selon une ou plusieurs des revendications précédentes, dans laquelle ledit composant antilueur, au moins au nombre de un, est présent selon une teneur comprise entre 0,5 % et 2,5 % en poids.

11. Composition selon la revendication 10, dans lequel ledit composant antilueur, au moins au nombre de un, est constitué par du sulfate de potassium.

12. Munition, **caractérisée en ce qu'**elle est chargée d'une poudre propulsive présentant une composition selon une ou plusieurs des revendications précédentes.

13. Munition selon la revendication 12, présentant un calibre entre 40 mm et 155 mm, de préférence un calibre de 40 mm, 76 mm, 100 mm ou 155 mm.

REFERENCES CITED IN THE DESCRIPTION

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