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(54) **MODIFIER FOR EXPLOSIVES**

(57) Universal modifiers from the class of organic and inorganic acids and their salts of new power systems of driving force on the basis of complex complete or/and incomplete nitrates (nitroesters) monoatomic (alcohols, alkanes), diatomic (diols, glycols, alkanediols), triatomic (triols, glycerin), multinuclear (of absolute valence) alcohols, cellulose, as well as nitroamines (nitramines),

azides (azoimides), nitro compounds and compositions (substances) with mixed groups and their mixes purposefully modifying their thermodynamic (thermochemical) parameters (characteristics), mechanical, physical, chemical, biochemical properties.

EP 2 128 117 A2

Description

[0001] The proposed invention relates to modifiers from the range of organic and inorganic compositions, capable to modify their thermodynamic parameters, physical, chemical, biochemical properties for explosives, including gas generating compositions, rocket fuels and gunpowders based thereon.

[0002] It is known, that when interacting (etherification) with a mix of nitric and sulphuric acids the monoatomic (alkanols, alcohols), diatomic (alkanediols, glycols, diols), triatomic (triols, glycerin), multinuclear (absolute valence) alcohols and their possible isomers easily form corresponding complex, complete or/and incomplete ethers of nitric acid (nitrate ethers, nitric ethers, nitrates) [1-5] which are to some extent explosive, where the nitrates of monoatomic alcohols are less explosive, than nitrates of multinuclear alcohols [3], that defines their application as brisant substances [3], that is rapidly decaying substances with releasing great volume of strongly heated gases [2, 5], that is they are shattering explosives [1] used in blasting operations [1-5], but inapplicable in small arms [1-5] as there would be not a shot, but a shattering explosion with break of a gun tube, and the projectile would not have time to leave the gun tube[1].

[0003] One of such representatives for explosives is the complex complete ether of triatomic alcohol (glycerin) and nitric acid, the glycerine trinitrate incorrectly named nitroglycerine [1, 3-5]. Glycerine trinitrate blows up from a push [1], heating [5], impact, shock, under influence of detonation, for example explosion of a fuse of mercuric fulminate, as a result of self-decomposition [2], and simple touch [3], however the simplicity of process of synthesising the glycerine trinitrate, its low-stage and low-waste, as well as availability and cheapness of initial substances (semi-products) for producing glycerine trinitrate makes its manufacturing economic, while the constancy of structure as a target product which is the glycerine trinitrate itself, and insignificant quantity of impurity, that is very important when making compositions (structures, compoundings) based thereon, makes it a rather promising composition (substance) as compared to other substances of similar application (purpose, use) [1-5].

[0004] There is known application (use) of glycerine trinitrate in structure of bibasic gunpowders [1-5], various kinds (embodiments) of dynamite [1-5].

[0005] Glycerine trinitrate in the pure state is not applied because of its extreme instability, and, during its decomposition not only enormous quantity of energy is liberated as heat and huge volume of the heated gases: nitrogen, water, carbon dioxide, but also oxygen in free condition [1, 2] which may be used for amplification for explosive action of glycerine trinitrate in its mix with combustible materials including ethers of nitric acid of monoatomic, diatomic, triatomic and multinuclear alcohols, as well as cellulose [1-5], thus it is possible to obtain dynamites with active and inactive weight [1], for example, with fossil meal, a special kind of silica (porous SiO₂,

kieselguhr) [1-5].

[0006] Now alongside with glycerine trinitrate other nitrates of alcohols became important as explosives, that is complex complete or/and incomplete ethers of alcohols and nitric acid, for example, methyl nitrate, ethyl nitrate [4], ethylene glycol dinitrate [2,4], propylene glycol dinitrate [2], mannitol hexanitrate, pentaerythritol tetranitrate [1] and so on [6, 7, 8]. They are safer to operate as compared to glycerine trinitrate, but as well as the latter they are also unsuitable for use when shooting with fire-arms.

[0007] It is known, that in a molecule of cellulose formed from a molecule of glucose, the alcohol hydroxyl groups of glucose persist, that puts cellulose to the class of alcohols and defines its properties of alcohols [1-5], and a molecule of cellulose contains three hydroxyl groups, therefore during its interaction (etherification) with a mix of nitric and sulphuric acids the complex complete, and incomplete nitrate ethers of cellulose are formed, i.e. depending on conditions of reaction of etherification the residues of nitric acid can replace one, two or all the three hydroxyls thus forming accordingly mononitrate, dinitrate and trinitrate of cellulose [or mononitro, dinitro and trinitro cellulose] [5].

[0008] It is known, that trinitro cellulose or pyroxylin where all the three hydroxyls are replaced by the residues of nitric acid [1-5], as well as glycerine trinitrate, is a detonating explosive featuring high energy and it is applied as shattering explosive in blasting works, but it is not applied when shooting from gun and rocket weapon as the shattering explosion would break the installation before the projectile would come to movement [1-5]. For using the trinitro cellulose in gun systems it is necessary to slow down the speed of its combustion so as to gradually accrue the pressure of formed gases to set a projectile in motion (to push it out) [1-5]. For reducing the speed of its combustion the trinitro cellulose is being gelled using various solvents, for example such as acetone, vinegar amyl ether and others [1], i.e. trinitrate of cellulose swells and forms dense jellylike mass; such a mass is used for pressing tapes of various thickness and sizes which after drying may be applied as a smokeless gunpowder. They are burning down more slowly than trinitrate of cellulose that enables to use them for shooting from gun and rocket installations. For obtaining a weapon smokeless gunpowder they are being cut to fine slices. It is known, that trinitrate of cellulose is also being gelled by using glycerine trinitrate thus the formed mass represents a special kind of dynamite also used in blasting works under the name "blasting gelatin" [1]. As the properties of trinitrate of cellulose are similar to those of similar complete or incomplete ethers formed during interaction (etherification) of our proposed corresponding alcohols with a mix of nitric and sulfuric acids the principles of the approach to the decision of tasks for purposeful modification of thermodynamic (thermochemical) parameters and stability influences negatively influencing the properties and quality of trinitrate of cellulose are authentic, as well as the substances (compositions) applied (used)

as universal modifiers of new composite structures of compoundings of power systems of driving force based thereon. And some grades of smokeless gunpowders consist of a mix containing at the same time trinitrate of cellulose and ~30% of glycerine trinitrate [4], thus the use (application) of the only and the same universal modifier allows not only to improve the compatibility of components in a somewhat componental system, but also to exclude or reduce the general contents of each of its components as the use (application) of the universal modifier allows to reject the use of many other components necessary for obtaining required properties, and also to provide additional improvement of other properties, including, bio-, radio-, light, thermal, chemical and antioxidizing stability which the system gets when use only one of our proposed universal modifiers.

[0009] Further to our study of materials of periodic and patent literature concerning the use (application) of explosives and compositions based thereon, intended for the various purposes, we defined the main drawback, namely, the constant and limited set of additives which are not featuring sufficient efficiency and versatility, and, the compositions created on their basis (structures, compoundings) do not solve many problems related to sensitivity, temperature, pressure, volume of formed substances, to their structures and ecological compatibility, speed of burning and its transition to detonation.

[0010] Till now there are intensive works for creating new composite compounds of explosives having universal properties.

[0011] It is known, that smokeless gunpowders are produced on the basis of nitrates of cellulose in structure with various softeners. There are smokeless gunpowders on the basis of glycerine trinitrate (ballistites) and pyroxylin [the Soviet encyclopaedic dictionary.-M.: Soviet encyclopedia, 1983, p.119]. Smokeless gunpowders, both artillery ballistite and pyroxylin, and ballistite rocket firm fuel differ the big variety on рабарѣTHO-mass parameters (characteristics), structure, sensitivity a various sort to mechanical influences, power parameters, speed of burning, sensitivity a detonation pulse. Now the explosives most used in the industry are the hexogen and an octogen, however they possess high sensitivity a different sort to mechanical influences and cannot be applied without input in their structure of retarders [Patent RU N $\text{\textcircled{0}}$ 2226522, Cl. C 06 B 25/00,21/00,25/24,31/32, C 06 D 5/06, publ. 10.04.2004, Bul. N $\text{\textcircled{0}}$ 10],

[0012] There are known powder explosive compositions (structures, compoundings) on the basis of smokeless pyroxylin, artillery ballistite gunpowders, ballistite solid rocket fuels, their mixes [Patents RU N $\text{\textcircled{0}}$ 1810321; 2021239; 2026274; 2026275; 2046117; 2074160; 2092473; 2099396; 2130446, 2176632; 2086524 C1 10.08.1997; 2122990 C1, 10.12.1998; 2096396 C1, 20.11.1997; GB 1265718, 08.03.1992; GB 1307967, 21.02.1973; Patents US N $\text{\textcircled{0}}$ 3235425; 3186882, 01.06.1965; 3713917, 30.01.1973; 4555276; 5445690; Kuk M.A. Industrial explosives science - M.:

Nedra, 1980, p.28.], in materials of these works, as a rule, structures of explosives, possess significant sensitivity a different sort to mechanical and other influences, thus the required result is not always reached.

[0013] It is known that till now hexogen, octogen are applied (are used) as brisant explosives which possess high sensitivity and consequently cannot be applied (used) in the pure state. For lowering their sensitivity and maintaining safe handling they are used (applied) only in a combination with various unexplosive additives (retarders), as additives (retarders) are used unsaturated and saturated solid hydrocarbons, such as wax, paraffin, ceresin and other chemical substances (compositions) similar to such compositions as stearin, and also various rubbers and polymers plasticized by inactive and active (explosive) softeners. Powerful explosives usually contain in their structure retarders from 2,5 up to 10 mas. % [Patent RU 2252925 CL. C 06 B 25/34, 45/22, 28.10.2003, publ. 27.05.2006. Bul. N $\text{\textcircled{0}}$ 15]. In this work [LLNL Explosive Handbook. Properties of Chemical Explosive and Explosive Simlants/Dobratz B.M., Livermore, California, 1981.] explosive structures containing hexogen (95-93,5 %) and a retarder (5-6,5 %), consisting of a mix of synthetic ceresin (45 %), natural ceresin (15 %), stearin (38,8 %) and orange fat-soluble dye (1,2 %) are cited; octogen (97,5 %) and a retarder (2,5 %), consisting of polymethyl methacrylate (1,2 %), graphite (0,5 %), and oxysin (0,8 %), and other widely used mix explosive compounds.

[0014] There is known a more powerful explosive (composition) from the class of cyclic nitramines 2,4,6,8,10,12-hexa-nitro-2,4,6,8,10,12-hexa-azo-tetracyclo (5,5,0,0^{3,11}, 0^{5,9}) dodecane as compared to hexogen and octogen, and as to chemical stability and sensitivity it is similar to octogen, it features high sensitivity to different sort of mechanical influences and low chemical stability. [Patent RU N $\text{\textcircled{0}}$ 2199540 from 26.04.2001. Method for obtaining the 2,4,6,8,10,12-hexa-nitro-2,4,6,8,10,12-hexaazo-tetracyclo (5,5,0,0^{3,11}, 0^{5,9}) dodecanes. Sysoliatin S.V., Lobanova A.A., Chernikova J.T.].

[0015] In the work [Patent US N $\text{\textcircled{0}}$ 5587533, High performanse pressable explosive compositions/Braithwaite P. C., Lund O. K., Wardle R. B.] explosive compositions based on 2,4,6,8,10,12-hexa-nitro-2,4,6,8,10,12-hexa-azo-tetracyclo (5,5,0,0,1¹¹, 0^{5,9}) dodecane and a retarder (an active binding additive) in quantity of 5-10 mas.%, consisting of polyglycidil nitrate, polyglycidil azide and others are offered.

[0016] In the work [Simpson R.L., Urtiew P.A., Ornellas D.L., et al. CL-20 performance exceeds that of HMX and its sensitivity is moderate // Propellants, Explosives - 1997 - N $\text{\textcircled{0}}$ 22 - Pp. 249-255.] a composition consisting of a basis of 2,4,6,8,10,12-hexa-nitro-2,4,6,8,10,12-hexa-azo-tetracyclo (5,5,0,0,1¹¹, 0^{5,9}) dodecane (CL-20) retarded by polyurethane polymer Estane-5703-P, is offered, and this composition features higher sensitivity than the composition of octogen with the same poly-

urethane polymer.

[0017] In the work [Patent RU 2252925, Cl. C06 B 25/34, 45/22, 28.10.2003, publ. 27.05.2006. Bul. № 15] a composition based on 2,4,6,8,10,12-hexa-nitro-2,4,6,8,10,12-hexa-azo-tetracyclo (5,5,0,0,^{3,11,0^{5,9}}) dodecanes (98,5-97 mas.%) and a retarder (1,5-3 mas.%) is offered, it consists of stearin acid and-or paraffin and-or ceresin or their mixes though works for improving the properties of explosive compositions on the basis of these compounds (substances) are still in progress and there is some success, however it is rather difficult to reach the results allowing to apply (to use) them safely according to their intended purpose because of their instability.

[0018] It is known, that application (use) of liquid explosive compositions (substances) and their composite structures of compoundings is one of important and promising directions for solving certain tasks of various special-purpose designations, and the consistent solutions on their basis being liquid or heterogeneous, under usual conditions are easier to produce as compared to solid explosives (compositions). [Patent RU 2063944, Cl. C 06 B 25/10, 1996, publ. in Bul. № 20 from 20.07.96].

[0019] However, the use (application) of liquid explosives such as glycerine trinitrate or compositions (structures, compoundings) based thereon is seriously limited because of their very high sensitivity to various mechanical influences, however high-energy substances (compositions), in particular glycerine trinitrate, are constant objects for creating on the basis thereon explosive compositions for various purpose. For reducing (decreasing) their sensitivity to various influences some retarding additives are used (applied). Using such additives a lot of so-called, tri-nitro-glycerin explosive compositions (substances, compoundings) for various special-purpose designations, including industrial (commercial) explosives, such as pobedits, detonites and similar compounds are created. Though these compositions (compounds) feature rather low sensitivity to mechanical influences due to low contents (approximately 10 %) of glycerine trinitrate and at the same time, and for the same reason they feature low energy characteristic (response).

[0020] There is known a number of compositions (substances, compoundings) on the basis of glycerine trinitrate [Patent US 3108916, Cl. C 06 B 19/02, 1963. Patent US 2988436, Cl. C 06 D 5/04 1961. Patent US 4011114, Cl. C 06 B 45/10, 1976]. These compositions (compoundings) feature rather high sensitivity to mechanical influences and low energy properties because of low (small) oxygen factor. There is known use (application) of trimethylolethane trinitrate as a retarder for glycerine trinitrate. [Patent US 3423256, Cl. C 06 B 3/001969.] However an essential decrease in sensitivity of liquid explosive composition is reached only in case of introducing a lot of retarder in glycerine trinitrate, thus its explosive characteristics (parameters) go down sharply. On the basis of the above-stated it follows, that the problem of creating a high-energy explosive heterogeneous bodies (so-

lutions) featuring enough low sensitivity to various mechanical influences is rather urgent till now and it is not yet solved because the common drawback of the described explosive compositions is the high sensitivity to various mechanical influences. Therefore creating new explosive compositions using our offered modifiers that were unknown earlier for the given purpose, with mechanical and other properties set depending on the object in view, is a novelty.

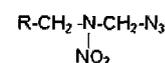
[0021] The common drawback of explosive compositions described in these patents materials is their high sensitivity to various mechanical influences.

[0022] Till now the task of creating explosives designed for manufacturing extended and sheet charges, detonating tape and other similar materials (products) for special explosive works is rather urgent and promising. There are known plastic explosive substances hexoplasts HP-74; HP -87; HP -87K [« The list of recommended industrial explosive materials. » M: Nedra, 1977, page 28.] and elastic explosives [Patent US 3723204, Cl. 149-19 C 06B 3/00, C 06C 1/100, 1973; Patent UK № 1297706, Cl. C 06B 15/01, 1970], such explosives belong to mix of efficient crystal explosives, as a rule it is hexogen in a combination with various binding substances, for example, rubbers which content in composite materials ranges from 13 to 30%. These compositions are used (applied) for special explosive works. However they feature high sensitivity to various mechanical influences, thus the frequency of explosions during phasic test makes 70% and the transition of burning of these compositions to their explosions is quick and fast.

[0023] There is a known explosive composition containing colloxylin as a basis, plasticized by liquid nitroesters of multinuclear alcohols, for example, glycerine trinitrate, as well as the stabilizer for chemical stability. [Svetlov B.Ya. and Yaremenko N.E. The theory and properties of industrial explosives. M.: Nedra, 1973, p.185.]. This explosive composition features high explosibility.

[0024] There is a known explosive composition also containing colloxylin as a basis, and plasticized by liquid nitroesters of multinuclear alcohols, for example, by glycerine trinitrate; stabilizer for chemical stability and finelydispersated particles of high density substance. The stabilizer for chemical stability is centralite. [Patent RU 2105746, Cl. C 06 B 25/18. Publ. 27.02.1998 in Bul. № 6].

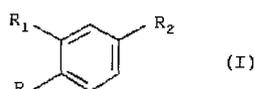
[0025] Till now creating the gas generating compositions, including those for fire extinguishers, safety bags and other pneumatic devices is rather urgent and promising. There is a known gas generating composition for fire extinguishers on the basis of ether of cellulose which contains 30 to 40 % of softener substance (composition) with the formula



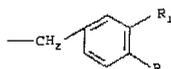
[Patent US 3873579, Cl. C 06 D 5/06, 1975]. The tem-

perature of burning of this composition makes 2000 to 2500°K. Another gas generating composition for fire extinguishers contains in mass.% dibutyl phthalate (17), acetate of cellulose (7,6), N-methyl-p-nitroaniline (1), nitrate of cellulose (30,4), trinitrate of pentaeritrit (37), ethyl centralite (2), tin oxides (5) while the temperature of its burning makes 1700°K. [Patent US 3639183, Cl. C 06 D 5/06, 1972]. The purpose of improvement of such compositions is lowering the sensitivity to various mechanical influences and lowering the temperature of burning; and the main components of such compositions remain almost without qualitative and quantitative changes. Thus there is known a gas generating composition consisting in mass.% of ratio of nitrate of cellulose (59-69) bases, 1,6-diazido-2-acetoxy-4-oxa-hexane (30-40) as softener, while the other additives are dimethyl diphenyl urea (0,5-0,6) and vaseline (0,4-0,5), and the temperature of burning of this composition makes 1450°K [Copyright certificate RU № 918289, M Cl. C 06 D 5/06. UDC 662.16 (088.8), publ. 07.04.82. Bul. №13. date of publication of the description 10.04.82], however all these compositions feature higher sensitivity to mechanical influences, high temperature and high speed of burning.

[0026] Earlier it was considered, that acids promote decomposition of many explosives (compositions) [L.A.Smirnov «The equipment for manufacturing ballistite gunpowders using auger technology and charges made of them», edited by L.V.Zabelina. M.: 1997]. However, there is known a stabilizer of chemical stability of gunpowder, solid rocket fuel and gas generating composition on the basis of nitrocellulose, a boric or phosphorous acid, or an organic acid or its salt having the formula (I)

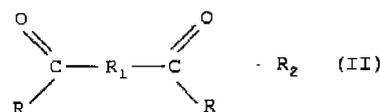


where R=H, -OH, -COOH, -COONa
 $R_1 = -H, -OH, -COOH, -COONH_4, -COONa,$
 $R_2 = -H, -OH, -COOH, -COONa,$ the residue of composition having the formula



where R_1 or R have above-stated values, or having the formula (II):

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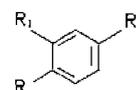
where R= -OH, -OK, -ONH₄, -ONa,
 $R_1 = -\text{bond or } -C_2H_4,$

R_2 is absent or means H₂O or 2H₂O [Patent RU 2244703, Cl. C06 B 25/18, 21/00, 25/28 C06 D 5/00, 02.12.2003, publ. 20.01.2005 Bul. № 2].

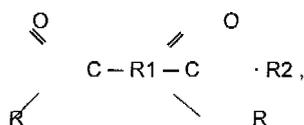
[0027] The engineering problem of the invention consists in creating a universal modifier for explosives from a range of composite complete or incomplete nitrates of monoatomic, diatomic, triatomic or multinuclear alcohols, nitrocelluloses, nitroamines, azides, nitrobenzenes or nitroalkanes; introducing such a modifier in these explosives allows to modify their thermodynamic parameters, physical, chemical, biochemical properties and to create on the basis of these explosives, with the introduced modifiers, explosive and unexplosive composite compounds having liquid (consistent), heterogeneous or solid aggregate state depending on objects in view (tasks) with required properties that may vary, by varying the ratio of components included in the composition.

[0028] The technical result of the invention is the inhibition of premature decomposition of explosives (compounds) at all the initial stages of development of this process, with its subsequent initiation (activation) as a result of smooth and fast growth (increase) of temperature thus leading to explosive decomposition or burning depending on sufficiency surplus of oxygen in the system, both due to oxygen-containing compounds (substances), and as a result of emission of oxygen in a pure state when decomposing the substances (compounds) included in explosive composition, i.e. controlling the rate of their decomposition, as well as decrease in sensitivity of explosives to various mechanical influences, improvement of the degree of compression.

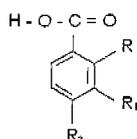
[0029] The technical result is reached by using known, cheap and accessible compositions (substances) belonging to inorganic, organic acids and their salts as a universal modifier for explosives from the range of complex complete or incomplete nitrates of monoatomic, diatomic, triatomic or multinuclear alcohols, nitrocellulose, nitroamines, nitroanilines, azides, nitrobenzenes, nitroalkanes and their mix, where the compositions belonging to inorganic or organic acids or their salts, are chosen from the following group: orthoboric acid, phosphorous acid or orthophosphoric acid, or composition having the formula (1):



where R = - H, - OH, - COOH, COONa,
 R₁ = - H, - OH, - COOH, - COONH₄, - COONa,
 R₂ = - H, - OH, - COOH, - COONa, and R₁ and R have
 the above-stated values, or formula (2):



where R = - OH, - OK, - ONH₄, - ONa,
 R₁ = - single bond or - C₂H₄,
 R₂ is absent or H₂O or 2H₂O,
 Or formula (3):



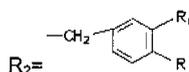
if R = -NO₂; R₁ = R₂ = -H, it is a 2-nitrobenzoic acid (o-nitrobenzoic acid),

if R₁ = -NO₂; R = R₂ = -H, it is a 3-nitrobenzoic acid (m-nitrobenzoic acid),

if R₂ = -NO₂; R = R₁ = -H, it is a 4-nitrobenzoic acid (p-nitrobenzoic acid).

The preferable acids and salts of the above mentioned formulas are the following compositions:

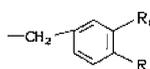
[0030] The composition having the formula (1) at R = OH, R₁ = -COOH,



is the 5,5'-methylenedisalicylic acid.

[0031] The composition having the formula (1) at R = OH, R₁ = -COONH₄,

R₂ =



is the diammonium salt of 5,5'-methylenedisalicylic acid.

[0032] The composition having the formula (1) at R = H, R₁ = -COOH, R₂ = -H is the orthophthalic acid.

[0033] The composition having the formula (1) at R = H, R₁ = -COOH, R₂ = -COOH is the isophthalic acid.

[0034] The composition having the formula (1) at R = COOH, R₁ = H, R₂ = -COOH is the terephthalic acid.

[0035] The composition having the formula (1) at R = COONa, R₁ = H, R₂ = -COONa is the disodium salt of

terephthalic acid.

[0036] The composition having the formula (1) at R = H, R₁ = -COONa, R₂ = -COONa is the disodium salt of metaphthalic acid.

5 **[0037]** The composition having the formula (1) at R = COOH, R₁ = -OH, R₂ = -H is the salicylic acid.

[0038] The composition having the formula (1) at R = OH, R₁ = -COONa, R₂ = -H is the sodium salt of salicylic acid.

10 **[0039]** The composition having the formula (1) at R = COOH, R₁ = -H, R₂ = -H is the benzoic acid.

[0040] The composition having the formula (1) at R = COONa, R₁ = -H, R₂ = -H is the sodium salt of benzoic acid.

15 **[0041]** The composition having the formula (1) at R = COOH, R₁ = -H, R₂ = -OH is the para-oxybenzoic acid.

[0042] The composition having the formula (1) at R = -H, R₁ = -COOH, R₂ = -OH is the meta-oxybenzoic acid.

20 **[0043]** The composition having the formula (2) at R = OH, R₁ = single bond, R₂ = absent, is the oxalic acid is.

[0044] The composition having the formula (2) at R = -OH, R₁ = single bond, R₂ = 2H₂O is the 2-water oxalic acid.

25 **[0045]** The composition having the formula (2) at R = -OK, R₁ = single bond, R₂ = absent, is the lemon salt.

[0046] The composition having the formula (2) at R = -ONa, R₁ = single bond, R₂ = absent, is the sodium oxalate.

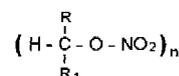
30 **[0047]** The composition having the formula (2) at R = -ONH₄, R₁ = single bond, R₂ = absent, is the ammonium oxalate.

[0048] The composition having the formula (2) at R = -OH, R₁ = -C₂H₄, R₂ = absent, is the succinic acid.

35 **[0049]** The listed compositions have, basically, rather low temperature of decomposition and rather high temperature of ignition, thus, a part of thermal energy will be spent for decomposing these substances when introducing them into the specified explosives, thus there will be a decrease of general (total) temperature of formed gases with simultaneous increase in their volumes and there will be a proportional development of pressure due to gases formed as a result of decomposition and-or burning of these compositions.

40 **[0050]** The explosives from the range of complex complete or incomplete nitrates of monoatomic, diatomic, triatomic or multinuclear alcohols, nitrocelluloses, nitroamines, nitroanilines, azides, nitrobenzenes or nitroalkanes, where it is offered to introduce the above modifiers, may be the following explosives:

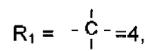
- Explosives having the formula:



where R or/and R₁ = -CH₃, -H,



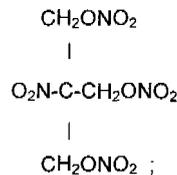
- CH₂-O-NO₂, n=1-4; 5
 if R=R₁ = -CH₂O-NO₂; n=1, is a glycerol trinitrate (nitroglycerine);
 if R=R₁ = -H; n=1, is a methyl nitrate;
 if R=-CH₃; R₁ =-H; n=1, is an ethyl nitrate
 if R=-CH₂-O-NO₂; R₁ = -H; n=1, is an ethylene glycol dinitrate; 10
 if R=-CH₃; R₁ = -CH₂-O-NO₂; n=1, is a propylene glycol dinitrate;
 if R=R₁ = -CH₂-O-NO₂; n=4, is a mannitol hexanitrate (nitromannit); 15
 if R = -CH₂CL; R₁ = -CH₂-O-NO₂; n=1, is a monochlorhydrin dinitrate;
 if R=-H;



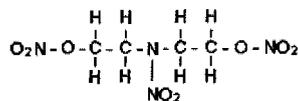
it is pentaerythritol tetranitrate (penthrite);

- Explosives having the formula: 25

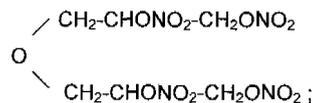
Nitroisobutyl glycerinetrinitrate having the formula



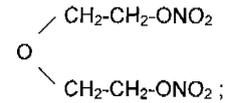
- Diethanol-N-nitroamine dinitrate(DINA) having the formula 40



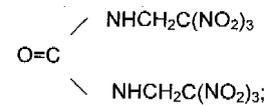
- Diglycerin tetranitrate having the formula 45



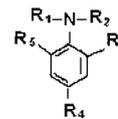
- Diethyleneglycol dinitrate (diglycol dinitrate, dinitrodiglycol) having the formula 50



- Trinitrate of cellulose (trinitro cellulose, trinitrate of cellulose, trinitrate) - [C₆H₇O₂(O-NO₂)₃]_n;
- Ethylene-N, N -dinitramine (EDNA) NO₂NH-(CH₂)₂-NHNO₂;
- Nitroguanidine (NH₂)₂C=NNO₂
- NitroureaNH₂CONHNO₂;
- N, N'-bis(□,□,□,-trinitroethyl) carbamide, or N, N'-bis(□,□,□ - trinitroethyl) urea(BTNEM)



- Explosive having the formula: 25



if R₁ = -NO₂; R₂=R₃=R₄=R₅ = -H, it is an N-nitroaniline;

if R₁=R₄ = -NO₂; R₂ = -CH₃; R₃=R₅ = -H, it is a 4-nitrophenyl-N-methylnitroamine (N-nitro - N-methyl 4-nitroamine);

if R₁=R₅ = -H; R₂= -CH₃, R₃=R₄ = -NO₂, it is a 2,4-dinitro-N-methylaniline;

if R₁= R₃=R₄ = -NO₂; R₂ = -CH₃; R₅ = -H, it is a 2,4-di-nitrophenil-N-methylnitroamine (N-nitro - N-methyl - 2,4-dinitro - aniline);

if R₁ -H; R₂ = -CH₃; R₃=R₄=R₅ -NO₂, it is N-methyl - 2,4,6-trinitroaniline;

if R₁=R₃=R₄= R₅ = -NO₂; R₂ = -CH₃, it is N-methyl - N, 2,4,6-tetranitroaniline (N-methyl - N-nitro - 2,4,6-trinitroaniline);

if R₁ = -H; R₂ =-CH₃; R₃=R₄=R₅- NO₂ it is N-methyl - 2,4,6-trinitroaniline;

if R₁=R₃=R₄ = R₅ = - NO₂; R₂ = - CH₃, it is N-methyl - N, 2,4,6-tetranitroaniline (N-methyl - N-nitro - 2,4,6-trinitroaniline or 2,4,6-trinitroaniline - N-methylnitroamine, tetryl);

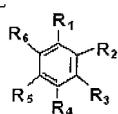
if R₁= -H; R₂ = -CH₃; R₃=R₄=R₅ -NO₂, it is N-methyl - 2,4,6-trinitroaniline;

R₁=R₃=R₄= R₅ = - NO₂; R₂ = -CH₃, it is N-methyl - N, 2,4,6-tetranitroaniline (N-methyl - N-nitro - 2,4,6-trinitroaniline or 2,4,6-trinitroaniline - N-methylnitroamine, tetryl);

If R₁=R₂= -H; R₃=R₄= R₅ = - NO₂, - it is a

2,4,6-trinitroaniline;

Explosive having the formula:



if $R_1 = -OH$; $R_2=R_4=R_6 = -NO_2$; $R_3=R_5 = -H$, it is 2,4,6-trinitrophenol (picric acid);

if $R_1 = -Cl$; $R_2=R_4=R_6 = -NO_2$; $R_3=R_5 = -H$, it is 2,4,6-trinitrochlorobenzene;

if $R_1 = R_3 = -OH$; $R_2=R_4=R_6 = -NO_2$; $R_5 = -H$, it is 2,4,6-trinitroresorcin (TNR, stiftine acid);

if $R_1 = -OCH_3$; $R_2=R_4=R_6 = -NO_2$; $R_5 = -H$, it is 2,4,6-trinitroanisol (2,4,6-trinitro methoxybenzene);

if $R_1 = R_3 = -NH_2$; $R_2=R_4=R_6 = -NO_2$; $R_5 = -H$, it is 1,3-diamino-2,4,6-trinitrobenzene (2,4,6-trinitrophenylenediamine);

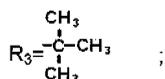
if $R_1 = R_3 = R_5 = -NH_2$; $R_2=R_4=R_6 = -NO_2$, it is 1,3,5-triamino-2,4,6-trinitrobenzene;

if $R_1 = -CH_3$; $R_2=R_4=R_6 = -NO_2$; $R_3=R_5 = -H$, it is 2,4,6-trinitrotoluene (trotyl, a TNT);

if $R_1 = -CH_3$; $R_2=R_4=R_6 = -NO_2$; $R_3 = -OH$; $R_5 = -H$, it is trinitrocreosol;

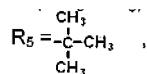
if $R_1=R_3=R_6 = -NO_2$; $R_2=R_4=R_6 = -H$, it is 1,3,5-trinitrobenzene;

if $R_1 = -CH_3$; $R_2=R_4=R_6 = -NO_2$;



$R_5 = -H$, is 1-methyl - 3-tert - butyl - 2,4,6-trinitrobenzene;

if $R_1 = R_3 = -CH_3$; $R_2=R_4=R_6 = -NO_2$;

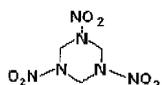


is 1,3-dimethyl - 5-tert-butyl - 2,4,6-trinitrobenzene;

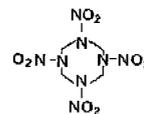
if $R_1 = R_3 = R_5 = -CH_3$; $R_2=R_4=R_6 = -NO_2$; $R_5 = -H$, it is 2,4,6-trinitro meta-xylene (1,3-dimethyl - 2,4,6-trinitrobenzene);

Isomers of tetranitrobenzene;

. 1,3,5-trinitro- 1,3,5-triazacyclo-hexane (hexogen)



. 1,3,5,7-tetranitro-1,3,5,7-tetraazocyclooctane (cyclotetramethylene - tetranitroamine, octogen)



. 2,2',4,4',6,6' - hexanitrodiphenyl;

. 2,2',4,4',6,6' - hexanitrodiphenylsulfide (hexyd);

. 2,2',4,4',6,6' - hexanitrodiphenylsulfone;

. 2,2',4,4',6,6' - hexanitrostyrene;

. 3,3'-diamino-2,2',4,4',6,6' - hexanitrodiphenyl;

. 2,4,6,-hexanitrodiphenylamin;

Isomers of trinitronaphthalene;

. Isomers of tetranitronaphthalene;

. Nitroalkanes:

$C(NO_2)_4$ -tetranitromethane;

$CH_2(NO_2)CH_2NO_2$ - 1,2-dinitroethane;

$CH_3CH(NO_2)_2$ - 1,1-dinitroethane;

$CH_3CH(NO_2)_2$ - 1,1,1-trinitroethane;

$C_2(NO_2)_6$ - hexanitroethane;

. $C_6(NO_2)_3(N_3)_3$ - trinitrotriazidobenzene;

. $C_3N_3(N_3)_3$ - cyanurtriazide,

30 **[0051]** The above cited (designated) explosives (compositions) and their mixes do not limit the possible assortment of various other explosives (compositions) that in combination (mix) with our proposed compositions (substances) from between organic, inorganic acids and their salts or other of substances (compositions), featuring similar properties and used as universal modifiers, may also similarly (purposefully) influence various parameters and properties of new energy systems of driving force created on their basis with characteristics required for any specific purpose, where, the same explosive composition may feature different speed of decomposition depending on the way (method) of its activation, and may also show the properties of simple burning not passing to detonation or brisances, i.e. to carry out the possibility of application (use) of two-component explosive composition on basis of the cited obtained explosives in a combination (mix) with our offered modifiers in an individual kind of each of them, as an active principle of a new composite structure of compoundings of monobasic gunpowders, gas generating compositions with or without using (application) pyroxylin (pyroxylin-free gunpowders) in their composition.

55 **[0052]** As the operating principle of our offered modifiers in various composite structures of compounds for the specified classes of explosives (compositions) is essentially the same, and it consists in that these modifiers and substances (compositions) having similar properties under certain conditions may decay with emitting gase-

ous products, and in presence of enough of oxygen in the system may occur not only their decomposition, but also burning or a combination of these processes, thus there may be a thermodynamic (thermochemical) effect of significant decrease in temperature and increase in volume of the formed gases, and incidental proportional development of certain pressure [and the effect of decrease in temperature of gases is most pronounced in case when the compositions (substances) having the temperature of decomposition that is lower or coincides with the temperature of ignition are used (are applied) as modifiers], our approach to creating explosive and unexplosive energy systems of driving force with the properties set depending on the object in view is general and universal for all such systems. Using such an effect is rather urgent when creating low erosion, low-kindle or «cold gunpowders». When the properties of substances do not satisfy these conditions there may be an increase in total temperature effect. The modifier for our offered explosives may be used in case of the ratio modifier/explosive equal to (0,1-99,9 : (99,9-0,1)).

[0053] For increasing (raising) the energy characteristics (properties) of our offered composite structures (compositions) it is possible to introduce in them metallic power additives (substances).

[0054] For giving various consistent properties including the plasticity to such explosive and unexplosive composite structures it is possible to use binding, gelatinizing (swelling) and polymeric compositions (substances).

Examples, illustrating the invention.

[0055] Researches of mixes of each of modifiers and each of explosives regarding the compatibility and influence of modifiers on heat-resistant characteristics of explosives. It is marked, that introduction of modifiers not only does not reduce the heat-resistant parameters of explosives, but also makes an inhibitory effect on their autocatalytic decomposition. Researches were carried out using an installation for defining the temperature of the beginning of intensive decomposition (T_{bid}) and phase transformations of polymeric materials using the DTC method (differential thermocouple) according to OST B-84-615-72.

Example 1

[0056] A thematic example of influence of the offered acids is the influence of oxalic acid (crystalline hydrate) on glycerine trinitrate. In Fig. 1 and Fig. 2 there are the diagrams of decomposition of mixes of oxalic acids (crystalline hydrate) with glycerine trinitrate in mass ratio 1:2 and 1:5 accordingly; it was been found that introducing oxalic acids (crystalline hydrate) does not worsen the heat-resistant characteristics of glycerine trinitrate. It is also determined, that the composition is not susceptible to transition of burning to explosion or detonation.

[0057] Mixes of glycerine trinitrate (OST B 84-2386)

and oxalic acids (crystalline hydrate) Ty standard 2642-001-07500602-97 were prepared from their solutions in ethyl alcohol GOST 18300-87 by mixing at a room temperature and further removal of ethyl alcohol by keeping in exhaust case until a film is formed. The mixing did not cause changes of temperature, color and sedimentation. The compositions have been investigated using a microscope and a significant decrease in heterogeneity was marked with increase of the oxalic acids (crystalline hydrate) content. The density of structures made $\rho = 1,7-1,75 \text{ g/cm}^3$ (high density compositions).

Example 2

[0058] A thematic example of influence of the proposed salts of organic acids is the influence of ammonium oxalate (crystalline hydrate) on glycerine trinitrate. In Fig. 3 there is a diagram of decomposition of a mix of ammonium oxalate (crystalline hydrate) with glycerine trinitrate in mass ratio 1:1 accordingly, it was been found that introducing ammonium oxalate (crystalline hydrate) does not worsen the heat-resistant characteristics of glycerine trinitrate, but also renders inhibitory action on its autocatalytic decomposition. It is also determined, that the composition is not susceptible to transition of burning to explosion or detonation. The mixes were prepared similarly to those of Example 1.

Example 3

[0059] Thematic examples are mixes of oxalic acids (crystalline hydrate) with glycerine trinitrate, thus the mixes prepared in mass ratio: composition N $\text{O}1$ - 1:5, composition N $\text{O}2$ - 1:2, composition N $\text{O}3$ - 1:1, composition N $\text{O}4$ - 2:1 accordingly, have been tested for explosive characteristics using a Kast's impact machine OST B 84-892-74 (Sensitivity impact using an impact machine at the bottom limit with instr. N $\text{O}1$ and instr. N $\text{O}2$) and the following results are received:

Composition N $\text{O}1$ with a load of 2 kg. and height $H_0=250 \text{ mm}$. (instr. N $\text{O}2$). The percent of explosions made 80 %,

Structure N $\text{O}2$ with a load of 2 kg. and height $H_0=250 \text{ mm}$. (instr. N $\text{O}2$). The percent of explosions made 55 %,

Composition N $\text{O}3$ with a load of 10 kg. and height $H_0=250 \text{ mm}$. (instr. N $\text{O}2$). The percent of explosions made 68 %,

Composition N $\text{O}4$ with a load of 10 kg. and height $H_0=250 \text{ mm}$. (instr. N $\text{O}2$). The percent of explosions made 0 %.

The detonation of glycerine trinitrate is caused when dropping a 2 kg. load from a height of $H_0=40 \text{ mm}$ [9]. Composition N $\text{O}3$ with a load of 10 kg. $H_0 > 500 \text{ mm}$. (instr. N $\text{O}1$)

Composition N $\text{O}4$ with a load of 10 kg. $H_0 > 500 \text{ mm}$. (instr. N $\text{O}1$),

[0060] The compositions have been tested for sensitivity to shock-free friction at the bottom limit (OST B 84-894-74) at a speed of disk rotation (friction) of 520 rev/min. Thus the sensitivity to shock-free friction at the bottom limit of composition N03 makes $P_o > 3000$ kilogram-force/cm² and of composition N04 - $P_o = > 3000$ kilogram-force/cm². The tests were carried out at a temperature of 18°C.

[0061] The compositions have been tested for sensitivity to friction at a shock shift at the bottom limit (OST B 84-895-83). Thus the sensitivity to friction at a shock shift at the bottom limit of composition N03 was equal to $P_o = 750$ kilogram-force/cm² and of composition N04 $P_o = 1750$ kilogram-force/cm².

[0062] As a result of tests of samples with various percentage of glycerine trinitrate and oxalic acid (crystalline hydrate), it is possible to reckon the mix of 50%-60% of glycerine trinitrate and 50%-40% oxalic acid (crystalline hydrate) accordingly, among substances featuring low sensitivity to mechanical influences thus it is possible to operate with them while observing conventional security measures.

[0063] The compositions have been tested for speed of explosive transformation (detonation) OST B 84-90074, susceptibility to transition of burning to explosion or detonation - the character of destruction of a pipe with indicating its dimensions and estimating the explosive process according to OST B 84-90074, thus the composition with the content of oxalic acid (crystalline hydrate) with glycerine trinitrate of 40%-60 % accordingly, has shown the following characteristics: the density $\rho = 1,75$ g/cm³, the speed of detonation $D = 6370$ m/s, the composition is not susceptible to transition of burning to explosion or detonation; the composition with the content of oxalic acids (crystalline hydrate) with glycerine trinitrate of 60%-40 % accordingly, has shown the following characteristics: the density $\rho = 1,7$ g/cm³, the speed of detonation $D = 880-2230$ m/s, the composition is not susceptible to transition of burning to explosion or detonation.

[0064] For giving various consistent properties including plasticity to such explosive and unexplosive compositions, gelatinating (swelling) and polymeric compositions (substances) were used, such as pyroxylin, colloxylin and other compositions in monobasic and bibasic composite materials with our offered modifiers. Thematic examples are the obtained structures: oxalic acid (crystalline hydrate) 72 %, ДТ-30 21 %, glycerine trinitrate 7 % with speed of burning 0,5 mm/s and temperature of burning ~800°K (at $P=40$ and temperature 20°C) - the product is plastic, it is susceptible to molding; and oxalic acid (crystalline hydrate) 42 %, glycerine trinitrate 42 %, PVR (polyvinyl butyral resin) 16 % with speed of burning 5 mm/s and temperature of burning ~1500°K (at $P=40$ and temperature 20°C).

[0065] The product is plastic, it is susceptible to molding, there is also an expressed influence of the modifier on the speed of burning and temperature of the obtained

gases.

Example 4

[0066] The thematic example are also the obtained compositions of pyroxylin with salt of methylenedisalicylic acid. Thus when introducing it up to 0,5 % of mass., the stability of gunpowders made 3,5 to 4,5 kPa, at a norm of 8 kPa. When introducing the diammonium salt of methylenedisalicylic acid up to 20% of mass. essential decrease in temperature of the formed gases down by 700-800 °K was marked, while maintaining acceptable power of gunpowders.

Example 5

[0067] The obtained compositions of pyroxylin with lemon salt may also serve a thematic example, because when introducing it up to 0,5 % mass., the stability of gunpowders made 3,5-4,5 kPa, at a norm of 8 kPa. When introducing the lemon salt up to 20 % mass., the obtained compositions had the power of gunpowder comparable to the normal one at a level of 1030 to 1060 kJ/kg.

[0068] The obtained data as to characteristics of compositions in the Examples 1 and 2 allow to assume the possibility of their application for modifying the properties of gunpowders, including control of temperature, of the structure of obtained gases.

[0069] Alongside with experimental data we have also obtained thermodynamic calculated values of obtained compositions which had good convergence of results and completely confirmed the experimental data and the Claims.

[0070] On the basis of that the principle of action of our first proposed modifiers for new power systems of driving force for all classes of explosives (compositions) though essentially the same, however each individual explosive, as well as any other composition (substance) possesses certain unique inherent properties (physical, chemical, mechanical and others), that is each new power system of driving force on their basis has its own "know-how" having certain information value, but not influencing on essence of the invention as a whole and that are sometimes inexpedient to open with a view of the further preservation of priority of the trend itself and of the time of research process, therefore our obtained data and some results, having certain dependence and convergence in application conditions of our proposed modifiers in a combination (mix) with the cited explosive compositions (substances) are not always outlined in the description of materials in the text or being restricted.

LITERATURE

[0071] (The list of documents quoted and taken into account during examination)

1. E.S. Hotinsky. The course of organic chemistry. -

Kharkov.: Publishing house of the Kharkov Red Labour Banner Award A.M.Gorky National University, 1959.-724 pp.

2. B.A.Pavlov and A.P.Terentyev. The course of organic chemistry. - Moscow.: National scientific and technical publishing house of chemical literature, 1961. - 592 pp.

3. A.E. Chichibabin. Principles of organic chemistry. Volume I. - Moscow.: National scientific and technical publishing house of chemical literature, 1963. - 912 pp.

4. A.N. Nesmeyanov, N.A. Nesmeyanov. Principles of organic chemistry. Book one.-Moscow.: Publishing house "Khimiya", 1974.-624 pp.

5. B.N. Stepanenko. The course of organic chemistry Part I. Aliphatic compositions. - Moscow.: Publishing house "Vysshaya shkola", 1976. - 448 pp.

6. E.Ju. Orlova. Chemistry and technology of brisant substances. - Moscow.: Scientific and technical publishing house OBORONGIZ, 1960 - 396 pp.

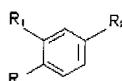
7. E.Ju. Orlova. Chemistry and technology of brisant substances. - Leningrad.: Publishing house "Khimiya", 1973. - 688 pp.

8. Ju.A. Lebedev, E.A.Miroshnichenko, Ju.K. Knobel. Thermochemistry of nitro compounds. Publishing house "Nauka". Moscow. 1970. - 168 pp.

9. Orlova E.Ju.Chemistry and technology of brisant substances: Textbook for high schools - Ed., - 3rd ed., rev. - L.: Khimiya, 1981.-312 pp.

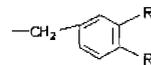
Claims

1. Modifier for explosives from a range of complex complete or incomplete nitrates of monoatomic, diatomic, triatomic or multinuclear alcohols, nitrocelluloses, nitroamines, azides, nitrobenzenes, nitroanilines, nitroalkanes and their mixes being an inorganic acid chosen from the following group: orthoboric acid, phosphorous acid, orthophosphoric acid or organic acid chosen from the following group: 2-nitrobenzoic acid, 3-nitrobenzoic acid, 4-nitrobenzoic acid, or composition having the formula (1)

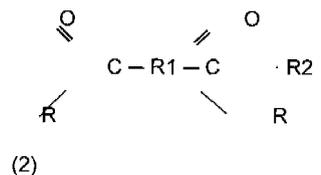


(1)

Where R = - H, - OH, - COOH, - COONa,
R1 = - H, - OH, - COOH, - COONH4, - COONa,
R2 = - H, - OH, - COOH, - COONa,

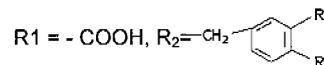


and R₁ and R have the above-stated values,
Or formula (2):



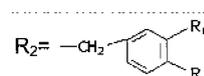
where R = - OH, - OK, - ONH4, - ONa,
R₁ = a single bond or - C2H4,
R₂ = is absent or H₂O or 2H₂O

2. Modifier as claimed in Claim 1 whereas the composition having the formula (1) at R = - OH, R1 = - COOH,



is 5,5'-methylenedisalicylic acid.

3. Modifier as claimed in Claim 1 whereas the composition having the formula (1) at R = - OH, R1 = - COONH4,



is diammonium salt of 5,5'-methylenedisalicylic acids.

4. Modifier as claimed in Claim 1 whereas the composition having the formula (1) at R = - COOH, R1 = - COOH, R2 = - H is orthophthalic acid.

5. Modifier as claimed in Claim 1 whereas the composition having the formula (1) at R = H, R1 = - COOH, R2 = - COOH is isophthalic acid.

6. Modifier as claimed in Claim 1 whereas the composition having the formula (1) at R = - COOH, R1 = H, R2 = - COOH is terephthalic acid.

7. Modifier as claimed in Claim 1 whereas the com-

position having the formula (1) at R= - COONa, R1= H, R2= - COONa is disodium salt of terephthalic acid.

8. Modifier as claimed in Claim 1 whereas the composition having the formula (1) at R= H, R1= - COONa, R2= - COONa is disodium salt of metaphthalic acid. 5

9. Modifier as claimed in Claim 1 whereas the composition having the formula (1) at R= - COOH, R1= - OH, R2= -H is salicylic acid. 10

10. Modifier as claimed in Claim 1 whereas the composition having the formula (1) at R= - OH, R1= - COONa, R2= -H is sodium salt of salicylic acid. 15

11. Modifier as claimed in Claim 1 whereas the composition having the formula (1) at R= - COOH, R1= - H, R2= -H is benzoic acid. 20

12. Modifier as claimed in Claim 1 whereas the composition having the formula (1) at R= - COONa, R1= - H, R2= -H is sodium salt of benzoic acid.

13. Modifier as claimed in Claim 1 whereas the composition having the formula (1) at R= - COOH, R1= - H, R2= - OH is para-oxybenzoic acid. 25

14. Modifier as claimed in Claim 1 whereas the composition having the formula (1) at R= - H, R1= - COOH, R2= - OH is meta-oxybenzoic acid. 30

15. Modifier as claimed in Claim 1 whereas the composition having the formula (2) at R= -OH, R1= single bond, R₂= absent, is oxalic acid. 35

16. Modifier as claimed in Claim 1 whereas the composition having the formula (2) at R= - OH, R1= single bond, R₂= 2H₂O is oxalic acid dihydrate. 40

17. Modifier as claimed in Claim 1 whereas the composition having the formula (2) at R= - OK, R1= single bond, R₂ - absent, is lemon salt.

18. Modifier as claimed in Claim 1 whereas the composition having the formula (2) at R= - ONa, R1= single bond, R₂ - absent, is sodium oxalate. 45

19. Modifier as claimed in Claim 1 whereas the composition having the formula (2) at R= - ONH₄, R1= single bond, R₂ - absent, is ammonium oxalate. 50

20. Modifier as claimed in Claim 1 whereas the composition having the formula (2) at R= - OH, R1= - C₂H₄, R₂ - absent, is succinic acid. 55

21. Modifier as claimed in Claim 1 whereas it is a modifier for explosive from the range: glycerol trini-

trate, methyl nitrate, ethyl nitrate, ethylene glycol dinitrate, propylene glycol dinitrate, mannitol hexanitrate, monochlorhydrin dinitrate, pentaerythritol tetranitrate.

23. Modifier as claimed in Claim 1 whereas it is a modifier for explosive from the range: nitroisobutyl glycerinetrinitrate or diethanol-N-nitroamine dinitrate, either diglycerin tetranitrate, or diethyleneglycol dinitrate.

24. Modifier as claimed in Claim 1 whereas it is a modifier of trinitrate of cellulose.

25. Modifier as claimed in Claim 1 whereas it is a modifier for explosive from the range: ethylene - N, N'-dinitramine or nitroguanidine, or nitrourea, or N, N'-bis (b, b, b trinitroethyl) carbamide, or N, N'-bis (b, b, b trinitroethyl) urea, or N-nitroaniline, or 4-nitrophenyl-N-methylnitroamine, or 2,4-di-nitro - N-methylaniline, or 2,4-dinitrophenyl - N-methylnitroamine, or N-methyl-2,4,6-trinitroaniline, or N-methyl-N, 2,4,6-tetranitroaniline, or N-methyl-N, 2,4,6-tetranitroaniline, or 2,4,6-trinitroaniline.

26. Modifier as claimed in Claim 1 whereas it is a modifier for explosive from the range: 2,4,6-trinitrophenol, or 2,4,6-trinitrochlorbenzene, or 2,4,6-trinitroresorcin, or 2,4,6-trinitroanisol, or 1,3-diamino-2,4,6-trinitrobenzene, or 1,3,5-triamino-2,4,6-trinitrobenzenes, or 2,4,6-TNT, or trinitrocreosol, or 1,3,5-trinitrobenzene, or 1-methyl-3-tert-butyl-2,4,6-trinitrobenzene, or 1,3-dimethyl-5-tert-butyl-2,4,6-trinitrobenzene, or 2,4,6-trinitro-meta-xylene, or an isomer of tetranitrobenzene.

27. Modifier as claimed in Claim 1 whereas it is a modifier for explosive from the range: 1,3,5-trinitro-1,3,5-triazacyclohexane or 1,3,5,7-tetranitro-1,3,5,7-tetraazocyclooctane.

28. Modifier as claimed in Claim 1 whereas it is a modifier for explosive from the range: 2,2', 4,4', 6,6'-hexanitrodiphenyl, 2,2', 4,4', 6,6'-hexanitrodiphenylsulphide, 2,2', 4,4', 6,6'-hexanitrodiphenylsulfone, 2,2', 4,4', 6,6'-hexanitrostylbene, 3,3'-diamino-2,2', 4,4', 6,6'-hexanitrodiphenyl, 2,4,6-hexanitrodiphenylamine, an isomer of trinitronaphthalene, an isomer of tetranitronaphthalene.

29. Modifier as claimed in Claim 1 whereas it is a modifier for explosive from the range: tetranitromethane, 1,2-dinitroethane, 1,1-dinitroethane, 1,1,1-trinitroethane, hexanitroethane.

30. Modifier as claimed in Claim 1 whereas it is a modifier for explosive from the range: trinitrotriazidobenzene or cyanurtriazide.

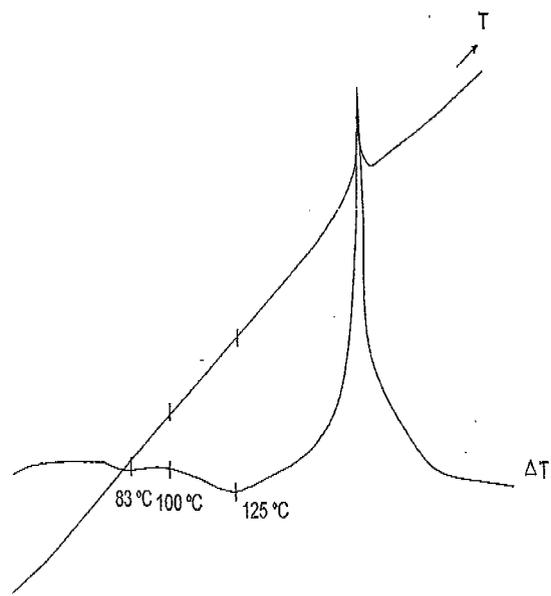


Fig. 1

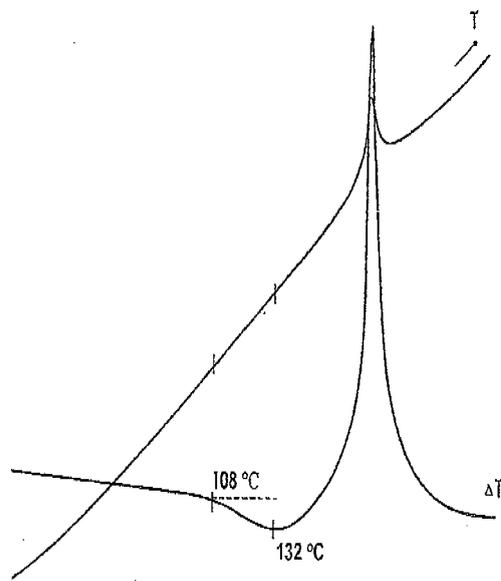


Fig. 2

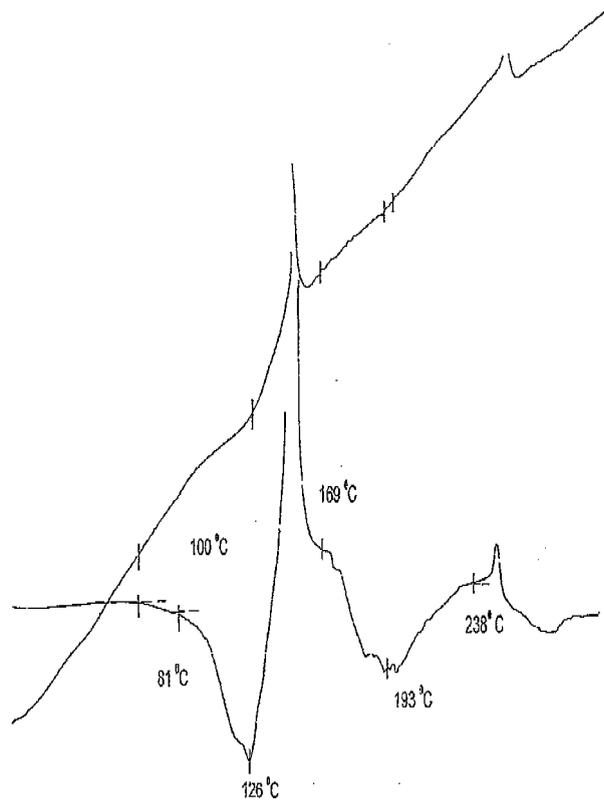


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- RU 2226522 C1 [0011]
- RU 1810321 [0012]
- RU 2021239 [0012]
- RU 2026274 [0012]
- RU 2026275 [0012]
- RU 2046117 [0012]
- RU 2074160 [0012]
- RU 2092473 [0012]
- RU 2099396 [0012]
- RU 2130446 [0012]
- RU 2176632 [0012]
- RU 2086524 C1 [0012]
- RU 2122990 C1 [0012]
- RU 2096396 C1 [0012]
- GB 1265718 A [0012]
- GB 1307967 A [0012]
- US 3235425 A [0012]
- US 3186882 A [0012]
- US 3713917 A [0012]
- US 4555276 A [0012]
- US 5445690 A [0012]
- RU 2252925 C1 [0013] [0017]
- RU 2199540 [0014]
- US 5587533 A [0015]
- RU 2063944 C1 [0018]
- US 3108916 C1 [0020]
- US 2988436 A [0020]
- US 4011114 C1 [0020]
- US 3423256 C1 [0020]
- US 3723204 C1 [0022]
- GB 1297706 C1 [0022]
- RU 2105746 C1 [0024]
- US 3873579 C1 [0025]
- US 3639183 C1 [0025]
- RU 2244703 C1 [0026]

Non-patent literature cited in the description

- Soviet encyclopaedic dictionary.-M.: Soviet encyclopedia. 1983, 119 [0011]
- **Kuk M.A.** *Industrial explosives science - M.: Nedra, 1980, 28 [0012]*
- **Simpson R.L. ; Urtiew P.A. ; Ornellas D.L. et al.** *CL-20 performance exceeds that of HMX and its sensitivity is moderate // Propellants, Explosives, 1997, 249-255 [0016]*
- **Svetlov B.Ya. ; Yaremenko N.E.** *The theory and properties of industrial explosives. M.: Nedra, 1973, 185 [0023]*