

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 843 806 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

22.05.2002 Bulletin 2002/21

(21) Application number: **95905158.2**

(22) Date of filing: **10.01.1995**

(51) Int Cl.7: **F41A 29/00**

(86) International application number:
PCT/FI95/00006

(87) International publication number:
WO 96/21837 (18.07.1996 Gazette 1996/33)

(54) **METHOD AND CLEANING AGENT COMPOSITION FOR CLEANING THE BARREL OF A GUN**

VERFAHREN UND MITTEL ZUR REINIGUNG EINES GEWEHRLAUFES

PROCEDE ET COMPOSITION D'AGENT DE NETTOYAGE DU CANON D'UNE ARME

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IE IT LI NL SE

(43) Date of publication of application:
27.05.1998 Bulletin 1998/22

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EP 0 843 806 B1

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Description

[0001] The present invention relates to a method for cleaning the barrel of a firearm as presented in claim 1.

[0002] The barrel of a firearm has to be cleaned at regular intervals to remove the remnants of bullets and combustion residue such as soot, powder and burnt grease, accumulated in the barrel. In this context, bullet remnants means the metal residue left in the barrel from bullets, such as, in the case of commonly used bullets containing copper, residue of copper, possible copper compounds and other alloyed metals, e.g. copper and zinc residue and, in the case of lead bullets, lead residue.

[0003] Various methods and cleaning agents for the cleaning of a gun barrel are known. However, current cleaning methods often involve mechanical cleaning by scrubbing the barrel with a hard brush, such as a bronze brush. For example, in a commonly used cleaning method the cleaning agent contains aluminium particles which scrub off impurities from the barrel surface during mechanical cleaning.

[0004] Mechanical scrubbing is a laborious and time-consuming operation. Naturally it also causes wear of the barrel surface, thus shortening the service life of the firearm.

[0005] To remove the copper residue left in the barrel from copper bullets, cleaning agents acting chemically on copper have also been tried. This type of cleaning agents usually contain ammonia, and the problem has been that ammonia is very volatile, i.e. the cleaning agent quickly becomes ineffective as the active component evaporates. Furthermore, when such cleaning agents are used, the barrel must nevertheless be cleaned mechanically as well, so they do not eliminate the drawbacks associated with mechanical cleaning. Moreover, the evaporating gases are detrimental and undesirable. EP specification 75 113 presents a composition of substances that contains ammonia or amine compounds mixed in a gel to prevent evaporation.

[0006] In addition, the commonest cleaning agents currently used are relatively expensive.

[0007] The object of the present invention is to eliminate the drawbacks referred to above.

[0008] A special object of the invention is to produce an effective cleaning method of a new type that reduces the need for mechanical cleaning and thus significantly extends the service life of the barrel.

[0009] A further object of the invention is to produce a new type of cleaning method that is faster and more user-friendly than earlier methods.

[0010] As for the features characteristic of the invention, reference is made to the claims.

[0011] The invention is based on the unexpected observation made during investigations that bullet residue can be removed by using a foam that, in the case of bullets containing copper, contains an alkaloamine and, in the case of bullets containing lead, a nitrate salt. Thanks to the invention, a method has now been discovered that makes it possible to effectively and quickly remove the metal residue left by bullets in a barrel, without damaging the steel of the barrel.

[0012] In the method of the invention, ammonia can also be used for the cleaning of a barrel because the foam prevents evaporation of ammonia, so the cleaning agent does not lose any of its effectiveness.

[0013] For the first time, the present invention produces a firearm cleaning method that uses a foam containing substances that remove bullet residue. The foam to be used can be produced by using a tenside. The tenside may be any commonly used, foam-producing surface-active substance, such as coconut diethanolamide.

[0014] Further, nitrate salt has now been used for the first time as a material that chemically removes bullet residue. It was observed during investigations carried out that lead residue in a barrel reacts due to nitrate salt in a way that allows the lead to be removed from the barrel surface without mechanical scrubbing. The nitric salt used is preferably an inorganic nitrate, such as alkaline nitrate, alkaline earth nitrate or ammonium nitrate, especially sodium nitrate. In the method of the invention, the cleaning can be performed by using any substance that forms a foam, preferably a consistent foam, that contains e.g. exclusively nitrate salt, in which case it is applicable for the cleaning of firearms using lead bullets. The pH of the nitrate salt solution is preferably adjusted to an alkalic value if necessary. However, e.g. in the case of sodium nitrate, no pH adjustment is needed. There is no indication that, when used in the manner described, nitrates cause wear of the steel material of the barrel. The reaction product is removed automatically from the barrel surface, or it can be removed by using only a soft felt plug, i.e. without actual mechanical scrubbing. Thus, when the method of the invention is used, bullet residue can be effectively removed from the barrel by wiping it with a material or plug commonly used for the cleaning of firearms, without damaging the steel material of the barrel.

[0015] In an embodiment of the method of the invention, preferably a consistent foam containing an alkanolamine and/or a nitrate salt is used, in which case the method is applicable for the cleaning of both firearms using lead bullets and firearms using copper/copper compound bullets. In addition to its primary purpose in the method of the invention, the alkanolamine can also be used for the adjustment of the pH of the solution to an alkalic value in connection with solutions containing a nitrate salt. The alkanolamine is preferably monoethanolamine or diethanolamine or a compound of these, especially monoethanolamine.

[0016] In the cleaning method of the invention, a foam is used that contains about 1 - 80 w-%, preferably about 20 - 70 w-% nitrate salt, such as sodium nitrate, and/or about 1 - 70 w-%, preferably about 1 - 30 w-%, e.g. 2 - 25 w-% alkanolamine, such as monoethanolamine or diethanolamine.

[0017] In the method of the invention, a foam is used that preferably additionally contains an organic solvent for the removal of combustion residue such as soot, gunpowder remnants and/or burnt grease. For this purpose, any solvent or solvents, especially a water-soluble/mixable solvent, may be used. In an especially advantageous case, the composition contains under 50 w-%, e.g. 1 - 15 w-% methylpyrrolidone and/or under 50 w-%, e.g. 1 - 15 w-% butoxyethanol, which have proved to be effective in removing combustion residue.

[0018] The amount of tenside used in the cleaning method is e.g. under 50 w-%, e.g. about 0.1 - 25 w-% of the composition, depending on the intended application.

[0019] The foam used in the cleaning method may further contain about 1 - 90 w-% added water. By varying the amount of water, it is possible e.g. to adjust the concentrations of the active substances as desired. The amount of water added may be e.g. 5 - 60 w-%.

[0020] In a preferable embodiment, an amount of under 15 w-%, e.g. about 0.1 - 3 w-%, of sodium salt of m-nitrobenzenesulfonic acid has been added to a composition containing alkanolamine to assist in removing from the barrel surface the reaction products formed by residue from bullets containing copper.

[0021] The composition used in the method of the invention may additionally contain an amount of about 0.1 - 30 w-%, e.g. 1 - 10 w-%, of a barrel protecting substance, such as commonly known arms oil or preferably so-called cutting lubricant, which may be of semi-synthetic or synthetic type and which prevents copper from sticking to the barrel. The agent used for barrel treatment may be a water-mixable substance or it can be emulsified in water using e.g. a tenside and/or solvent, such as butoxyethanol.

[0022] The composition of substances used in the method of the invention can be implemented in any suitable form. Preferably the composition is in the form of a foaming liquid or, suitably, in the form of a spray sprayable as a foam, in which case it is packed in a container equipped to produce a spray, together with propellants if required. The composition may also contain an agent that increases viscosity.

[0023] In the following, the invention is described in greater detail by the aid of examples, which are only intended to illustrate the invention without limiting it.

Example 1: Producing a composition of substances for use in the cleaning method of the invention.

[0024] A cleaning solution composed according to one of the following alternatives is prepared:

Components	w-%	preferred	composition				
			A	B	C	D	E
coconut diethanolamide	0.1-50		4	25	2	3	
monoethanolamine	0-70	1-30	25	2		15	70
sodium nitrate	0-70	20-70	40	20	70	40	
methylpyrrolidone	0-30	1-15	5	15	5	10	5
1-butoxyethanol	0-30	1-15	5	15	5	10	5
sodium salt of m-nitrobenzenesulfonic acid	0-30	0.1-3	1	3		2	10
semi-synthetic cutting lubricant	0-30	1-10	10	10		10	10
water added	0-60	1-30	10	10	12	10	

[0025] When compounding the components, the sodium nitrate is solved in the water added. It can also be added to other components in the form of a rich water solution. Instead of monoethanolamine, other alkanolamines can also be used, such as diethanolamine. When the composition is produced in the form of a foaming liquid, the formulation is performed by using a tenside in an amount of e.g. about 0.1 - 30 w-%. When the composition is produced in the form of a spray, the amount of tenside used is e.g. 0.1 - 4 w-%. The concentrations of active components are selected e.g. on the basis of the length of time the cleaning agent is to be allowed to act in the barrel. This action time may vary e.g. between 0.1 - 30 min., whereupon the composition is removed by using a plug of a medium, e.g. a felt plug.

[0026] The finished composition has an alkalic pH value. The cleaning method of the invention is less hazardous to the user and the environment than earlier methods and the composition emits no toxic gases as compared with previous compositions. Moreover, consisting of cheap components, it is advantageous in respect of cost. The composition used does not suffer any loss of efficiency during storage or use. Furthermore, the composition used in the method protects the barrel, and the addition of cutting oil has the effect that a smaller amount of bullet residue, such as copper, sticks to the barrel surface.

[0027] Generally, the cleaning method of the invention is applicable for the cleaning of the barrel part of a firearm of any type and any size.

Example 2:

[0028] An experiment was carried out to test the effectiveness and applicability of a cleaning method as provided the invention, designed for firearms using copper/copper compound bullets.

Composition of the foam used in the method	
Components	w-%
monoethanolamine	ca.25
methylpyrrolidone	ca. 5
1-butoxyethanol	ca. 5
sodium salt of m-nitrobenzenesulfonic acid	ca. 1
coconut diethanolamide	ca. 4
water added	ca. 50
semi-synthetic cutting lubricant	ca. 10

[0029] The composition was prepared in the form of a spray. To clean a firearm, the foaming alkalic composition was sprayed into the barrel and allowed to act for ca. 10 min., whereupon it was removed by pushing a felt plug through the barrel.

[0030] The firearm cleaning method was tested in field conditions during half a year. It was established that the cleaning method worked in cold and hot weather. Moreover, the method was found to be effective and easy to use.

[0031] In comparing a barrel cleaned by the method of the invention was compared with a barrel cleaned by the traditional mechanical method, the barrels were inspected using an endoscope and it was established that the barrel treated by the method of the invention was in a considerably better condition, i.e. it showed less wear and burn damage, than the reference barrel. It is estimated that, by using the cleaning method of the invention, the service life of a firearm is extended by about 50 %.

Claims

1. Method for cleaning the barrel of a firearm, **characterized in that** a composition containing an agent that removes bullet residue is applied into the fire arm barrel to be cleaned from a spray bottle in the form of a foam, allowing the foam to act for 0.1 - 30 minutes and removing the foam from the barrel.
2. Cleaning method as defined in claim 1, **characterized in that** the agent is allowed to be active in the barrel for 1 - 20 minutes.
3. Cleaning method as defined in claim 1 or 2, **characterized in that** the foaming agent used is a tenside.
4. Cleaning method as defined in any one of claims 1 - 3, **characterized in that** the foaming agent used is coconut diethanol amide.
5. Cleaning method as defined in any one of claims 1 - 4, **characterized in that** the proportion of foam material is under 50 w-%, e.g. 0.1 - 25 w-%, of the whole amount of the composition.
6. Cleaning method as defined in claim 1, **characterized in that** the foam is sprayed from a spray bottle through an elastic sealing fitted on the end of the barrel.
7. Cleaning method as defined in any one of claims 1 - 6, **characterized in that** the substance used for removing bullet residue is an alkanol amine and/or an inorganic nitrate.
8. Cleaning method as defined in any one of claims 1 - 7, **characterized in that** the alkanol amine used is monoethanol amine and/or diethanol amine.
9. Cleaning method as defined in any one of claims 1 - 8, **characterized in that** the nitrate salt used is an inorganic nitrate, such as sodium nitrate.

10. Cleaning method as defined in any one of claims 1 - 9, **characterized in that** the method involves the use of a foam containing a solvent designed to remove combustion residue.
- 5 11. Cleaning method as defined in any one of claims 1 - 10, **characterized in that** it involves the use of a foam that contains under 50 w-%, preferably 1 - 15 w-% methyl pyrrolidone and/or under 50 w-%, preferably 1 - 15 w-% butoxy ethanol.
- 10 12. Cleaning method as defined in any one of claims 1 - 11, **characterized in that** it involves the use of a foam that contains about 0 - 90 w-% water added.
13. Cleaning method as defined in any one of claims 1 - 12, **characterized in that** it involves the use of a foam that, in conjunction with the alkanol amine, contains under 5 w-% sodium salt of nitrobenzene sulfonic acid.
- 15 14. Cleaning method as defined in any one of claims 1 - 13, **characterized in that** it involves the use of a foam that contains a substance lubricating and protecting the firearm barrel, such as semisynthetic or synthetic cutting lubricant or arms oil.
- 20 15. Use of a composition containing a tenside, an alkanol amine and/or a nitrate salt for removing bullet residue, in the form of a foam in the method according to any one of claims 1 - 14 for cleaning of a barrel of a firearm.

Patentansprüche

- 25 1. Ein Verfahren zur Reinigung des Laufs einer Feuerwaffe, **dadurch gekennzeichnet, dass** eine Zusammensetzung, die ein Mittel zur Entfernung von Geschossrückständen enthält, in den zu reinigenden Lauf der Feuerwaffe von einer Sprühflasche in Form eines Schaums eingebracht wird, dass man den Schaum 0,1 bis 30 min einwirken lässt und dass der Schaum aus dem Lauf entfernt wird.
- 30 2. Reinigungsverfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** man das Mittel 1 bis 20 min in dem Lauf einwirken lässt.
3. Reinigungsverfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das verwendete schäumende Mittel ein Tensid ist.
- 35 4. Reinigungsverfahren nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** das verwendete schäumende Mittel Kokosdiethanolamid ist.
- 40 5. Reinigungsverfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** der Anteil des Schaummaterials bei unter 50 Gew.-% der Gesamtmenge der Zusammensetzung liegt, z.B. bei 0,1 bis 25 Gew.-%.
6. Reinigungsverfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** der Schaum von einer Sprühflasche durch eine elastische Dichtung gesprüht wird, die auf das Ende des Laufs aufgesetzt ist.
- 45 7. Reinigungsverfahren nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** die zur Entfernung von Geschossrückständen verwendete Substanz ein Alkanolamin und/oder ein anorganisches Nitrat ist.
8. Reinigungsverfahren nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** das verwendete Alkanolamin Monoethanolamin und/oder Diethanolamin ist.
- 50 9. Reinigungsverfahren nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** das verwendete Nitratsalz ein anorganisches Nitrat wie z.B. Natriumnitrat ist.
- 55 10. Reinigungsverfahren nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet, dass** das Verfahren die Verwendung eines Schaums umfasst, der ein Lösungsmittel enthält, das zur Entfernung von Verbrennungsrückständen geeignet ist.
11. Reinigungsverfahren nach einem der Ansprüche 1 bis 10, **dadurch gekennzeichnet, dass** es die Verwendung eines Schaums umfasst, der unter 50 Gew.-%, vorzugsweise 1 bis 15 Gew.-% Methylpyrrolidon und/oder unter

50 Gew.-%, vorzugsweise 1 bis 15 Gew.-% Butoxyethanol enthält.

12. Reinigungsverfahren nach einem der Ansprüche 1 bis 11, **dadurch gekennzeichnet, dass** es die Verwendung eines Schaums umfasst, der etwa 0 bis 90 Gew.-% zugesetztes Wasser enthält.

13. Reinigungsverfahren nach einem der Ansprüche 1 bis 12, **dadurch gekennzeichnet, dass** es die Verwendung eines Schaums umfasst, der in Verbindung mit dem Alkanolamin unter 5 Gew.-% des Natriumsalzes von Nitrobenzolsulfonsäure enthält.

14. Reinigungsverfahren nach einem der Ansprüche 1 bis 13, **dadurch gekennzeichnet, dass** es die Verwendung eines Schaums umfasst, der eine Substanz enthält, die den Lauf der Feuerwaffe schmiert und schützt, wie z.B. ein halbsynthetisches oder synthetisches Schneidschmiermittel oder Waffenöl.

15. Verwendung einer Zusammensetzung, die ein Tensid, ein Alkanolamin und/oder ein Nitratsalz enthält, zur Entfernung von Geschossrückständen in Form eines Schaums in dem Verfahren nach einem der Ansprüche 1 bis 14 zur Reinigung des Laufs einer Feuerwaffe.

Revendications

1. Procédé pour nettoyer le canon d'une arme à feu, **caractérisé en ce que** l'on applique une composition contenant un agent qui enlève les résidus de balles à l'intérieur du canon de l'arme à feu à nettoyer à partir d'un flacon de vaporisation sous la forme d'une mousse, on laisse agir la mousse pendant 0,1 à 30 minutes et on enlève la mousse du canon.

2. Procédé de nettoyage selon la revendication 1, **caractérisé en ce qu'**on laisse agir l'agent dans le canon pendant 1 à 20 minutes.

3. Procédé de nettoyage selon la revendication 1 ou 2, **caractérisé en ce que** l'agent moussant utilisé est un tensioactif.

4. Procédé de nettoyage selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** l'agent moussant utilisé est une diéthanolamide de noix de coco.

5. Procédé de nettoyage selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** la proportion de matériau moussant est inférieure à 50 % en poids, par exemple 0,1 à 25% en poids, de la quantité totale de composition.

6. Procédé de nettoyage selon la revendication 1, **caractérisé en ce que** la mousse est vaporisée à partir d'un flacon de vaporisation à travers un organe d'étanchéité élastique placé sur l'extrémité du canon.

7. Procédé de nettoyage selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** la substance utilisée pour enlever les résidus de balles est une alcanolamine et/ou un nitrate inorganique.

8. Procédé de nettoyage selon l'une quelconque des revendications 1 à 7, **caractérisé en ce que** l'alcanolamine utilisée est une mono-éthanolamine et/ou une di-éthanolamine.

9. Procédé de nettoyage selon l'une quelconque des revendications 1 à 8, **caractérisé en ce que** le sel de nitrate utilisé est un nitrate inorganique, tel que du nitrate de sodium.

10. Procédé de nettoyage selon l'une quelconque des revendications 1 à 9, **caractérisé en ce que** le procédé comprend l'utilisation d'une mousse contenant un solvant destiné à enlever les résidus de combustion.

11. Procédé de nettoyage selon l'une quelconque des revendications 1 à 10, **caractérisé en ce qu'**il comprend l'utilisation d'une mousse qui contient moins de 50% en poids, de préférence 1-15% en poids, de pyrrolidone méthylée et/ou moins de 50% en poids, de préférence 1-15% en poids, de butoxyéthanol.

12. Procédé de nettoyage selon l'une quelconque des revendications 1 à 11, **caractérisé en ce qu'**il comprend l'uti-

lisation d'une mousse qui contient environ 0-90% en poids d'eau ajoutée.

5 13. Procédé de nettoyage selon l'une quelconque des revendications 1 à 12, **caractérisé en ce qu'il** comprend l'utilisation d'une mousse qui, conjointement avec l'alcanolamine, contient moins de 5% en poids de sel de sodium d'acide sulfonique de nitrobenzène.

10 14. Procédé de nettoyage selon l'une quelconque des revendications 1 à 13, **caractérisé en ce qu'il** comprend l'utilisation d'une mousse qui contient une substance de lubrification et de protection du canon de l'arme à feu, tels qu'un lubrifiant de coupe semisynthétique ou synthétique ou une huile pour arme.

15 15. Utilisation d'une composition contenant un tensio-actif, une alcanolamine et/ou un sel de nitrate pour enlever les résidus de balles, sous la forme d'une mousse dans le procédé selon l'une quelconque des revendications 1 à 14 pour le nettoyage du canon d'une arme à feu.

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