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[Continued on next page]

(54) Title: A MATERIAL FOR USE IN WEAPON AMMUNITION, A METHOD FOR PRODUCTION THEREOF, AND AMMUNITION

(57) Abstract: A material for use in weapon ammunition comprising a mixture of pitch-coal and water-glass. Furthermore, the invention relates to a method for production of such a material and ammunition, which is characterized by comprising said material.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
A material for use in weapon ammunition, a method for production thereof and ammunition

The invention is related to a material for use in weapon ammunition and a method for production thereof. The invention is also related to ammunition.

In shooting, sports shooting as well as hunting shooting, ammunition almost exclusively being of the type containing lead is used. In this description and in the following claims ammunition relates to matter intended for damaging action and matter replacing said matter in education. The reason for almost exclusively ammunition containing lead being used is that such ammunition has a plurality of desired characteristics. The serious shooter has great demands as regards the ballistic characteristics of the ammunition, for achieving precise shooting characteristics. In this context, the weight of the ammunition is of importance, lead having suitable weight for achieving the desired ballistic characteristics. Another requirement being put on ammunition is that it should have sufficient strength when impacting and penetrating into the target. Also this requirement is met by means of lead ammunition. Furthermore, ammunition containing lead has known deformation characteristics, which are advantageous for hunting. This aspect is especially important for ammunition in case the projectile part included in the ammunition consists of a bullet, that is not smallshot. The intention is
that the projectile is to be deformed due to the resistance it
meets when impacting against the animal body and that thereby
the cross-section area of the projectile will increase for im-
proved damaging effect. At the same time, the deformation has
to be effected in such a way that the projectile, when subse-
quently to impact and penetration travelling inside the animal
body, does not cause too much damage to the meat, in case the
meat is intended for being used as food. Furthermore, the
"softness" which lead has, is advantageous partly because rico-
chets are counteracted thereby, which reduces the risk of fire
among other things, and partly because the ammunition thereby
being gentle to the bore of the weapon.

As a consequence of the widespread use of lead ammunition,
Swedish shooters spread hundreds of tons of lead in the nature,
resulting in environmental problems, for instance due to lead
leaching in the nature.

It may further be mentioned that conventional lead smallshots
are not dissolved until after more than 100 years, factors such
as character, type of humus and acidity of the earth being of im-
portance. Lead smallshots also cause death and poisoning
among birds, for instance ducks and geese, when they mistake
the lead smallshots for being gravel for the digestion or seeds.

In the light of the negative environmental effects of the lead, the
Swedish parliament has passed a resolution on phasing out the
use of lead in ammunition.

Thus, there is a need for finding a material, which can replace
lead in weapon ammunition for achieving a reduction in the
negative environmental effects of the weapon ammunition. When
searching for a suitable replacing material, it has proven difficult
to at the same time obtain characteristics suitable for ammuni-
tion, as regards weight, ballistics, strength, "softness" and de-
formation.
SUMMARY OF THE INVENTION

The object of the present invention is to present a material for use in weapon ammunition, which is more environment friendly than lead and at the same has characteristics suitable for ammunition.

This object is obtained by providing a material, which comprises a mixture of pit-coal and water-glass. This material is more environment friendly than lead and has characteristics suitable for ammunition, as regards weight, ballistics, strength, "softness" and deformation.

Another object of the present invention is to provide ammunition, which is more environment friendly than lead and at the same time has characteristics suitable for ammunition.

This object is obtained according to the invention by means of the features being defined in the characterizing part of the subsequent claim 15.

In this description and in the subsequent claims water-glass relates to alkali silicates, preferably sodium silicate, which under high temperature and pressure dissolve in water, hence the name water-glass.

The invention is also related to a method for production of a material for use in weapon ammunition according to claim 8.

BRIEF DESCRIPTION OF THE DRAWINGS

Below follows a description of preferred embodiments of the present invention cited as examples with reference to the appended drawings, on which:
Fig 1 is a schematic partly cut view illustrating a first type of ammunition according to a preferred embodiment of the invention, and

Fig 2 is a schematic partly cut view illustrating a second type of ammunition according to another preferred embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

A material according to the invention for use in weapon ammunition comprises a mixture of pit-coal and water-glass, which gives the material characteristics suitable for ammunition at the same time as the material is more environment friendly than lead.

Pit-coal is found in the nature and has a very high percentage of carbon. As mentioned above, water-glass is alkali silicates, usually sodium silicate, which dissolve in water under high temperature and pressure. The proportion between $\text{SiO}_2$ and $\text{M}_2\text{O}$ (where $\text{M}$ indicates the element Na or K) is normally between 3.2 and 3.5, but also more alkaline types of water-glass are possible. Water-glass usually has a heavy and sticky consistency similar to the consistency of syrup.

According to a preferred embodiment of the present invention, the material is a substantially solid mass produced by heating and subsequently cooling a mixture comprising pit-coal and water-glass. Thanks to this advantageous production comprising heating and cooling, the material has particularly suitable characteristics for use in weapon ammunition.

According to another preferred embodiment of the invention, the mixture has been heated, during the heating, to a temperature between 50°C and 140°C, preferably between 70°C and 120°C,
and most preferred between 90°C and 100°C. Such a heating of the mixture achieves a particularly satisfactory reaction of the components included in the mixture. Thereby, the substantially solid mass is formed in an advantageous manner and the material is given particularly suitable characteristics for ammunition.

According to another preferred embodiment of the present invention said mixture has been given, by means of pressure action, a density suitable for ammunition, which further improves the characteristics of the material as regards use in ammunition.

According to another preferred embodiment of the invention the pit-coal is atomized in said mixture for obtaining a particularly good mixing of the pit-coal together with the water-glass and thereby improving the characteristics of the material suitable for ammunition.

According to another preferred embodiment of the present invention the ratio pit-coal/water-glass in said mixture is >1, preferably >1.5 and most preferred >2. Said ratio gives the material according to the invention characteristics particularly suitable for ammunition.

According to another preferred embodiment of the present invention, said mixture comprises iron, which further improves the characteristics of the material as regards use in ammunition.

For instance, a material according to the present invention may be produced by first atomizing pit-coal to a small grain size, for example a grain size < 1mm, and then mixing it with water-glass. By means of the atomizing, a better mixing of the parts included is obtained than if no atomizing is done and thereby the characteristics of the material as regards use in weapon ammunition are improved. In the mixture containing pit-coal and water-glass, the ratio pit-coal/water-glass is >2, for instance. Preferably, also iron is mixed with the pit-coal and the water-
glass. For obtaining a particularly good mixing of the parts included, the mixing may for instance be done stirring. Furthermore, according to this example of production, the mixture is heated to a temperature between 90°C and 100°C, after which the mixture is allowed to cool. During this cooling, the mixture solidifies and forms a substantially solid mass, which has characteristics suitable for ammunition. For achieving particularly suitable characteristics, the material may be given a density suitable for ammunition, for instance during the course of cooling.

An advantage with the material according to the invention is that it, particularly at the heating, is in such liquid state that the material is formable to optional geometrical shape. This makes conventional production methods for ammunition applicable, the material according to the invention being used instead, where previously lead has been used. It is appreciated that this is economically very advantageous as no other measures than replacing lead with the material according to the invention have to be taken for production of ammunition.

Another advantage with the material according to the invention is that it is relatively inexpensive in comparison with lead.

In Fig 1, a type of ammunition according to a preferred embodiment of the present invention is illustrated. The ammunition here consists of a bullet cartridge 1. The cartridge 1 comprises a projectile 2, a case 3, a booster charge 4 and an ignition means 5. When firing, the ignition means 5 ignites the booster charge 4, which gives the projectile 2 required energy for reaching and having effect in the target intended. Thus, it is the characteristics of the projectile that are of crucial importance for the characteristics of the ammunition as regards ballistics, strength, deformation, weight, and "softness". Of course, also the design of the projectile is of importance, but which projectile designs that are most advantageous is previously known. Since the material
according to the invention is formable into optional shape, the material does not constitute a limiting factor for the design of the projectile, for which reason this aspect will not be discussed further.

The ammunition illustrated in Fig 1 comprises a material according to what has been described above, that is a material comprising a mixture of pit-coal and water-glass. Preferably, the projectile part, which in this embodiment is the projectile 2, is made of such a material, at least partly. This gives the ammunition advantageous characteristics as regards ballistics, strength, deformation, weight and "softness". The projectile 2 in the present example consists of a bullet.

In ammunition comprising a projectile in the shape of a bullet, the bullet is usually jacketed, completely or partly, but also bullets not jacketed are possible. A jacketed bullet is a bullet consisting of a core, which is surrounded by a thin layer of some other material, for instance a metal or metal alloy. A full jacket bullet has a core completely surrounded by another material, whereas a half jacket bullet has a core being only partly surrounded by another material. For example, in the half jacket case, the point of the projectile may consist of the protruding core. The choice of full jacket or half jacket bullet when hunting, for example, is made based on desired effect when the ammunition hits the target. The diameter of a half jacket bullet is increased upon impact, which gives an improved effect, whereas a full jacket bullet, when impacting against an animal body, substantially maintains its shape and is able to pass straight through the body without giving away all its energy.

The projectile 2 illustrated in Fig 1 is a full jacket bullet, preferably consisting of a core of the material according to the invention and having a covering layer of some other material, for instance brass.
This ammunition has suitable characteristics as regards ballistics, strength, deformation, weight and "softness" at the same time as it is more environment friendly than corresponding ammunition with a bullet comprising lead.

In Fig 2, another type of ammunition according to the present invention is illustrated. In this case, the ammunition consists of a smallshot cartridge 6, which comprises a projectile 7, a case 8, a booster charge (not shown) and an ignition means 5'. Firing works substantially similar to the cartridge 1, that is the ignition means 5' ignites the booster charge, which gives the projectile 7 required energy for reaching and having effect in the target intended. In this cartridge 6, however, the projectile part consists of a plurality of smaller projectiles 71, for instance having substantially spherical shape, which are called smallshots.

Also the ammunition illustrated in Fig 2 comprises a material according to what has been described above, that is a material comprising a mixture of pit-coal and water-glass. Preferably the projectile part, which in the present example means smallshots 71 together constituting projectile 7, at least partially consists of such a material. For example, the smallshots may have substantially spherical shape, but also other geometrical shapes are possible. The diameter for the single smallshots in the cartridge 6 is usually between 1-4 mm, but other sizes may of course also be used, if desired. The single smallshots may for instance consist of a core of the material according to the invention surrounded by a layer of some other material, for instance copper, brass or similar. Another possibility is that the single smallshots consist exclusively of the material according to the invention.

This ammunition has suitable characteristics, as regards ballistics, strength, deformation, weight and "softness" at the same time as it is more environment friendly than corresponding ammunition with smallshots comprising lead.
The present inventors have, in experiments carried out with ammunition according to the present invention, established the fact that the ammunition has very good characteristics suitable for ammunition according to the above.

Accordingly, the present invention provides a material, which has characteristics suitable for ammunition, as regards weight, ballistics, strength, "softness" and deformation. Thus, this material is well suited for use in weapon ammunition. In particular, the material according to the invention may replace lead in conventional weapon ammunition and thereby reduce the negative environmental effect of the weapon ammunition, without deteriorating said advantageous characteristics of the ammunition.

The invention is not in any way restricted to the embodiments described above, but many possibilities to modifications thereof should be obvious to a person skilled in the art, without departing from the basic idea of the invention.

Although the embodiments described above primarily relates to ammunition in the form of cartridges, such as bullet cartridge and smallshot cartridge, it is pointed out that the present invention is also applicable to other types of ammunition of all kinds.
Claims

1. A material for use in weapon ammunition, characterized in that it comprises a mixture of pit-coal and water-glass.

2. A material according to claim 1, characterized in that it is a substantially solid mass produced by heating and subsequently cooling a mixture comprising pit-coal and water-glass.

3. A material according to claim 2, characterized in that said mixture at the heating was heated to a temperature between 50°C and 140°C, preferably between 70°C and 120°C and most preferred between 90°C and 100°C.

4. A material according to any of the preceding claims, characterized in that said mixture by means of pressure influence has been given a density suitable for ammunition.

5. A material according to any of the preceding claims, characterized in that the pit-coal in said mixture is atomized.

6. A material according to any of the preceding claims, characterized in that the ratio pit-coal/water-glass in said mixture is >1, preferably >1.5 and most preferred >2.

7. A material according to any of the preceding claims, characterized in that said mixture comprises iron.

8. A method for production of a material for use in weapon ammunition, characterized in that pit-coal is mixed with water-glass.

9. A method according to claim 8, characterized in that the mixture comprising pit-coal and water-glass is heated and is allowed to cool, the mixture solidifying and thereby forming a substantially solid mass.
10. A method according to claim 9, characterized in that the mixture is heated to a temperature between 50°C and 140°C, preferably between 70°C and 120°C and most preferred between 90°C and 100°C.

11. A method according to claim 8, 9 or 10, characterized in that said mixture by means of pressure influence is given a density suitable for ammunition.

12. A method according to any of claims 8-11, characterized in that the pit-coal is atomized prior to the mixing with the water-glass.

13. A method according to any of claims 8-12, characterized in that said mixture is given a ratio pit-coal/water-glass in said mixture >1, preferably >1.5 and most preferred >2.

14. A method according to any of claims 8-13, characterized in that iron is mixed with the pit-coal and the water-glass.

15. Ammunition, characterized in that it comprises a material according to any of claims 1 to 7.

16. Ammunition according to claim 15, characterized in that the projectile part included in the ammunition at least partly consists of a material according to any of claims 1 to 7.

17. Ammunition according to claim 15 or 16, characterized in that the projectile part included in the ammunition consists of a bullet.

18. Ammunition according to claim 15 or 16, characterized in that the projectile part included in the ammunition consists of smallshots.
### A. CLASSIFICATION OF SUBJECT MATTER

**IPC7: F42B 12/72**

According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC7: F42B**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

### EPO-INTERNAL, WPI DATA, PAJ

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>US 5777258 A (M.T. SOON), 7 July 1998 (07.07.98), column 15, line 63 - column 17, line 30</td>
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<tr>
<td>A</td>
<td>US 6016754 A (K.E. ENLOW ET AL), 25 January 2000 (25.01.00), abstract</td>
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- **A** - document defining the general state of the art which is not considered to be of particular relevance
- **E** - earlier application or patent but published on or after the international filing date
- **L** - document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- **O** - document referring to an oral disclosure, use, exhibition or other means
- **P** - document published prior to the international filing date but later than the priority date claimed
- **T** - later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- **X** - document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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- **&** - document member of the same patent family

Further documents are listed in the continuation of Box C.

[See patent family annex.]

Date of the actual completion of the international search: 7 February 2002

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Form PCT/ISA/210 (second sheet) (July 1998)
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