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(54) Benævnelse: **PROJECTILE CARTRIDGE AND METHOD FOR PRODUCING A PROJECTILE CARTRIDGE**

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DE-A1- 2 210 869
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DESCRIPTION:

The invention relates to a projectile cartridge comprising a projectile and a casing and comprising a sealing between the projectile and the casing, wherein the sealing comprises a highly viscous sealing medium, in particular a bituminous mixture, described for instance in GB2305994 A. The invention furthermore relates to a method for producing a projectile cartridge comprising a sealing of a projectile with the casing, wherein the sealing comprises a highly viscous sealing medium, in particular a bituminous mixture.

In particular for small and medium calibre, sealings are necessary, which tightly seals for a limited under pressure and over pressure and in an intended temperature range for a long time of more than 10 years. The sealing between projectile and casing should happen as cost efficient as possible. The sealing between projectile and casing should further guarantee high extraction forces, and be producible in series as simple as possible.

Sealants comprising highly viscous sealing medium are generally known from the state of the art. Herein, the highly viscous sealing medium comprising associated diluent is applied to the inner surface of the casing. The joining of the projectile into the casing pushes part of the sealing medium into the casing. The remaining sealing medium afterwards forms the sealing. During the process of projectile firing the sealing medium is burnt. The bond of the projectile and the casing by means of the highly viscous sealing medium occurs by force locking and by integral bonding. However, a highly viscous sealing medium is very problematic to handle because of its high viscosity and blurs during the joining of the projectile with the casing.

From DE 198 23 971 A1, a process for manufacturing a cartridge is known, in which an acrylate adhesive is used instead of a highly viscous sealing medium. Such an adhesive has to penetrate into the very small gaps between projectile and casing through capillary forces. Thereby an intrusion of the sealing medium into the loading space is prevented.

From DE 39 38 122 A1, a projectile cartridge is known, wherein a projectile is sealed with a cartridge casing sealed using a two component adhesive.

It is disadvantageous for the known projectile cartridge and its production that the extraction forces should be higher than 400 N. The materials used in particular for the casing are brass and copper alloys do not realize a suitable adhesion partner for synthetic adhesives. Because of this, due to the use of known acrylate adhesives or two component adhesives, only low extraction forces are possible. The extraction force is provided purely through the force locked bond when synthetic adhesives are applied.

The invention bases on the problem to develop a projectile cartridge according to the initially presented genus further, such that it enables high extraction forces with low variance. Furthermore, a method for manufacturing a projectile cartridge shall be provided, which allows high extraction forces with low variance.

The first mentioned problem is resolved according to the invention in that, two layers consisting of a highly viscous sealing medium, particularly having a bituminous mixture, wherein a first layer comprises the sealing medium with an additive for increasing the sliding properties of the sealing medium and a second layer comprises no or a smaller proportion of the additive than the first layer.

Due to this design, the second layer ensures the sealing capabilities of the projectile cartridge. The first layer protects the second layer from being sheared off during joining of the projectile with the casing. Due to this, an exceptional high tightness of the projectile cartridge is realized. Because of the adhesion properties of the highly viscous sealing medium on the casing material being significantly better than those of an acrylate adhesive, according to the state of the art, the projectile is also kept in place through an integral bond. The second layer generates a homogenous first layer with the additive, whereby the extraction force variance and the velocity span of the projectile cartridge is kept particularly low. Preferably, the highly viscous sealing medium is mixed with a suitable diluent. The projectile cartridge is producible at particularly low prices, if the highly viscous sealing medium is a bituminous mixture.

A shearing off of the first layer during joining of the projectile into the casing is easily prevented by using another beneficial improvement of the invention, when the two layers lie on top of each other in a sandwich-like manner and that the first layer faces the projectile and the second layer faces the casing.

A high tightness can easily be realized according to another beneficial further development of the invention, when both layers are circulating the projectile.

Exceptionally unique lubrication properties of the additive comprising layer can easily be ascertained by another beneficial further development of the invention, when the additive contains graphite. Furthermore, graphite as additive is particularly inexpensive and easily processible. Furthermore, graphite is high temperature resistant and remains, if the bitumen is burnt during firing. Due to this, the lubrication properties are increased during firing.

An exceptional low variance of the extraction forces is easily ascertained according to another advantageous further development of the invention, when the mixing ratio of bitumen and graphite in the first layer corresponds to 2,5 to 3. Due to this selection of materials, the bitumen is burnt up during firing and the graphite remains persistent and forms a high temperature resistant lubrication layer.

Basically, almost all powdery lubrication additives are applicable. Preferably molybdenum sulphide, boron nitride or Teflon can be used as the additive in the first layer alternatively or additionally to graphite .

The sealing media are particularly advantageous. High extraction forces with low variance are achieved with another advantageous further development of the invention, when the first layer includes 48 - 35 % in wt. bitumen, 8 – 25 % in wt. graphite and the rest being diluent and/or if the second layer includes 55 – 75 % in wt. bitumen and 45 – 25 % in wt. diluent.

The second issue, namely the provision of a process for the manufacturing of a projectile cartridge, which enables high extraction forces with low variance, is solved by the invention in that, before the joining of the projectile with the casing are two layers of bitumen placed on the projectile or the casing one after another, wherein the layer closest to the part opposite from the projectile or the casing comprises an additive for the increase of the lubrication properties.

Due to this design, two layers are realized between projectile and casing, wherein one layer contributes to the creation of a high tightness and wherein the layer comprising the additive ensures the low variance of the extraction forces.

A blurring of the layers can easily be prevented according to another beneficial further development of the invention, when the two layers are applied to the inner side of the casing, wherein a first layer arranged closer to the edge of the casing comprises the additive and a second layer arranged deeper inside the casing comprises no or a smaller proportion of the additive than the first layer. Due to this design, the first layer which comprises the additive is pushed against the other second layer. Thereby, the first layer provided with the additive is smoothened out and thus produces a particularly homogeneous layer.

The development allows for several embodiments. For further elucidation of its fundamental principle one thereof is shown in the drawing and described herein below. This shows in

Fig. 1-3	a schematic view of multiple processing steps for the generation of a projectile cartridge,
Fig. 4	a stress-strain curve of extraction forces of several projectile cartridges,
Fig. 5	a stress-strain curve of extraction forces of several projectile cartridges according to the state of the art.

Figure 1 shows a projectile 1 and a casing 2 before joining them to a projectile cartridge 3 shown in figure 3. The casing 2 is represented in a cross-sectional view. Two layers 4, 5 are applied on the inner side of the casing 2. The first layer 5 aligned closer to the free edge of the casing 2 comprises bitumen provided with an additive. A second layer aligned deeper in the casing

comprises bitumen without any additive. The layers 4, 5 can be produced by using an appropriate tooling preferably through a spraying technique in a single cycle.

In test series, the following favorable mixtures were found. The first layer 4 comprises 42 % in wt. bitumen, 42% in wt. diluent and 16 % in wt. graphite. For the width of the first layer 4 of about 1 mm an amount of approx. 0,7 mg is sufficient. The second layer 5 comprises 66 % in wt. bitumen and 34 % in wt. diluent. For the width of the second layer 5 of 3 mm the amount is approx. 0,8 mg. The distance between the two layers 4, 5 measures less than 1,5 mm.

Figure 2 shows the projectile 1 and the casing 2 according to figure 1 during the joining. It is recognizable that the additive comprising first layer 4 is pressed against the second layer 5. Thereby, the second layer 5 prevents a pressing trough of the additive comprising first layer 4.

Figure 3 shows strongly schematic the projectile cartridge 3 made according to the process. It is recognizable herein, that both layers 4,5 realize a sealing 6 of the projectile 1 with respect to the casing 2.

Figure 4 shows a stress-strain curve of the extraction forces of multiple projectile cartridges 3. The variance of the extraction forces of different projectile cartridges is particularly low. The projectile cartridges 3 according to the invention have an initial extraction force of more than 600 N.

Figure 5 shows a stress-strain curve of extraction forces of multiple projectile cartridges according to the state of the art, which have only a force locked bond of the projectile 1 with the casing 2. The comparison of figures 4 and 5 shows that the path of the purely force locked bond with respect to the strain according to figure 5 is significantly more irregular. Furthermore, the initial extraction force of the purely force locked bond only measures half of the extraction force of the projectile cartridge 3 according to the invention.

PATENTKRAV

1. Patron (3) med et projektil (1) og et hylster (2) og med en tætning (6) mellem projektilet (1) og hylsteret (2), hvor tætningen (6) indeholder et højviskost tætningsmedium, særligt en bitumenblanding, kendetegnet ved, at tætningen (6) omfatter to lag (4, 5) af tætningsmediet, hvor et første lag (4) indeholder tætningsmediet med et tilsætningsmiddel til forøgelse af tætningsmediets glideegenskaber, og et andet lag (5) ikke indeholder et tilsætningsmiddel eller indeholder en mindre andel af tilsætningsmiddel end det første lag (4).

2. Patron ifølge krav 1, kendetegnet ved, at de to lag (4, 5) ligger oven over hinanden i en sandwichkonstruktion, og ved at det første lag (4) vender mod projektilet (1), og det andet lag (5) vender mod hylsteret (2).

3. Patron ifølge krav 1 eller 2, kendetegnet ved, at begge lag (4, 5) løber rundt om projektilet (1).

4. Patron ifølge et af kravene 1 til 3, kendetegnet ved, at tilsætningsmidlet indeholder grafit.

5. Patron ifølge et af kravene 1 til 4, kendetegnet ved, at blandingsforholdet af bitumen i forhold til grafit i det første lag svarer til 2,5 til 3.

6. Patron ifølge et af kravene 1 til 5, kendetegnet ved, at det første lag (4) indeholder 48 til 35 vægtprocent bitumen, 8 til 25 vægtprocent grafit og som rest indeholder fortyndingsmiddel.

7. Patron ifølge et af kravene 1 til 6, kendetegnet ved, at det andet lag (5) indeholder 55 til 75 vægtprocent bitumen og 45 til 25 vægtprocent fortyndingsmiddel.

8. Patron ifølge et af kravene 1 til 7, kendetegnet ved, at tilsætningsmidlet indeholder molybdændisulfid, bornitrid eller teflon.

9. Fremgangsmåde til fremstilling af en patron (3) med en tætning (6) af et projektil (1) i forhold til et hylster (2), hvor tætningen (6) indeholder et højviskost tætningsmedium, særligt en bitumenblanding, kendetegnet ved, at der inden sammenføjningen af projektilet (1) med hylsteret (2) på projektilet (1) eller hylsteret (2) påføres to lag (4, 5) af højviskost tætningsmedium, særligt en bitumenblanding, efter hinanden, hvor laget (4), der ligger tættest på den overfor liggende del af projektilet (1) eller hylsteret (2), indeholder et tilsætningsmiddel til forøgelse af glideegenskaberne ved det højviskose tætningsmedium, særligt en bitumenblanding.

10. Fremgangsmåde ifølge krav 9, kendetegnet ved, at de to lag (4, 5) påføres på indersiden af hylsteret (2), hvor et første lag, der er placeret tættere på kanten af hylsteret (2), indeholder tilsætningsmidlet, og et andet lag (5), der er placeret længere nede i hylsteret (2), ikke indeholder et tilsætningsmiddel eller indeholder en mindre andel af tilsætningsmiddel end det første lag (4).

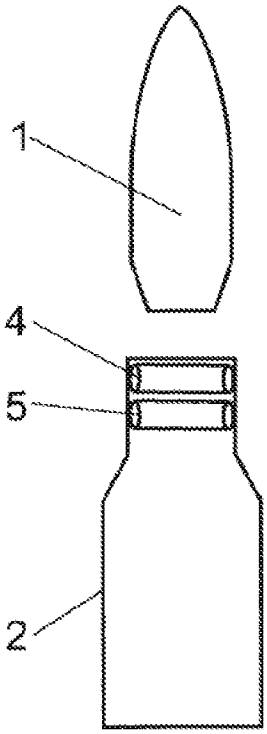

FIG 1

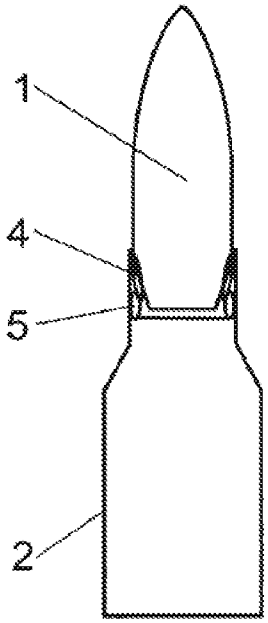

FIG 2

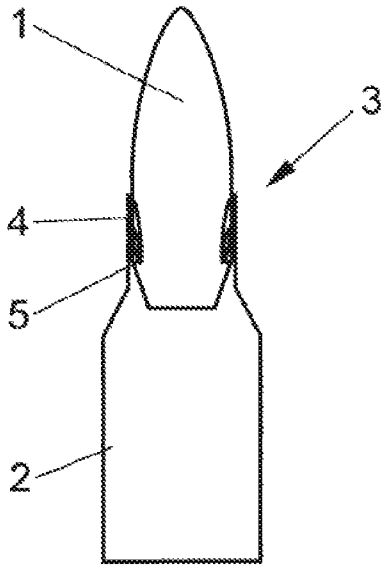

FIG 3

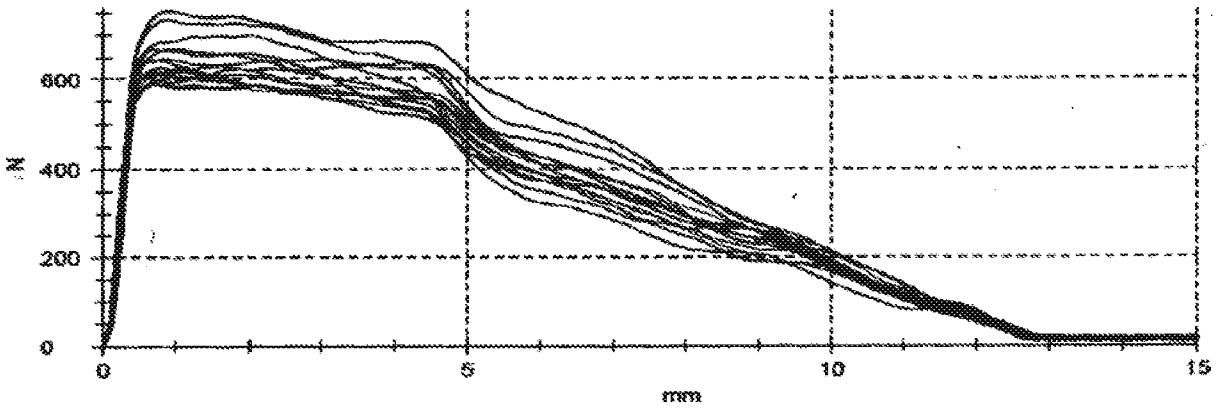

FIG 4

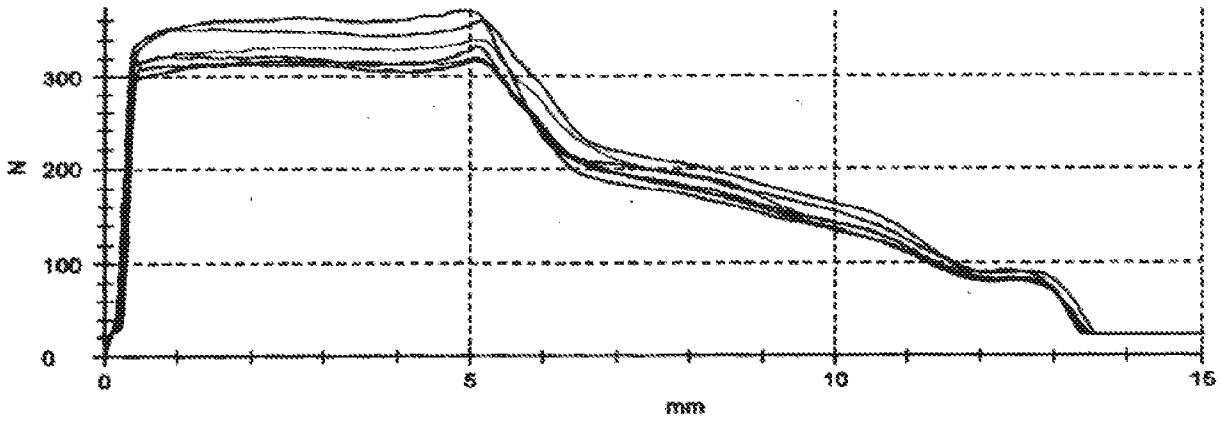

FIG 5