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(54) A propelling charge for large-calibre weapons

(57) A propelling charge designed as a module has all the environmentally-sensitive ignition elements 15, 16 to 19 and charge propellant constituents 6 inside a cartridge container 3. The ignitability of the propellant 6 over greater areas is ensured by a pyrotechnical layer 15 arranged in a high-pressure chamber 11 of the cartridge container 3. The high-pressure chamber 11 bring about the intensive and large-area ignition of the propellant 6. In addition to this it is ensured that a subsequently-arranged module 30 is reliably ignited. The layer 15 is ignited by a jet 25 of hot particles and gases whose effect is enhanced by burning particles 28 emanating from rings 16 and 18.

Fig.1

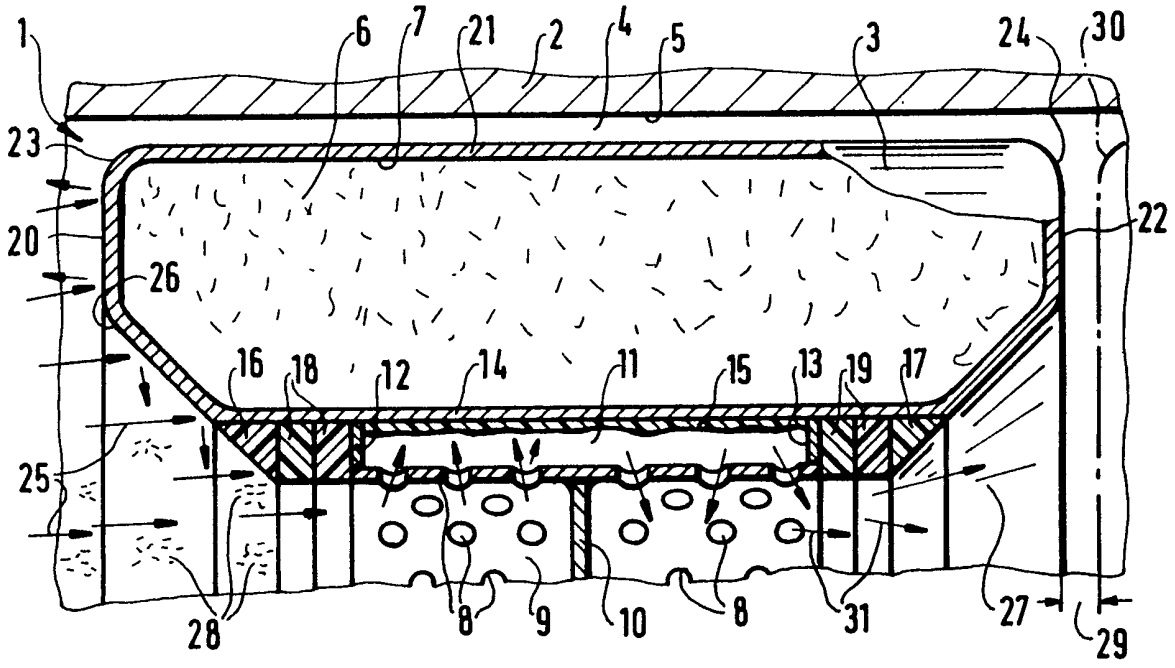

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Fig.1

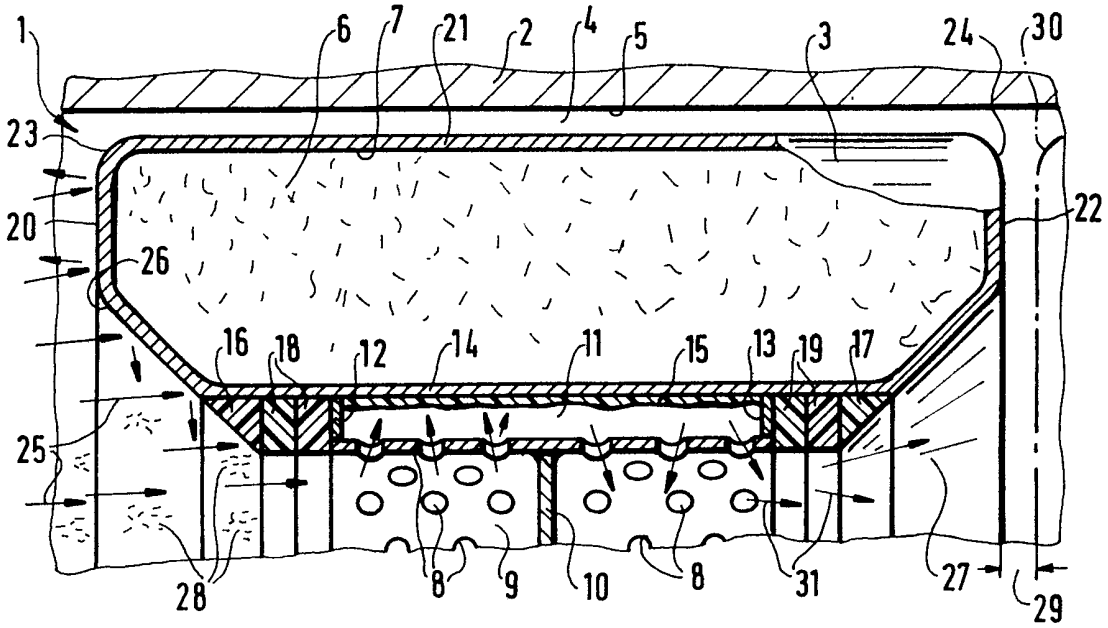


Fig. 2

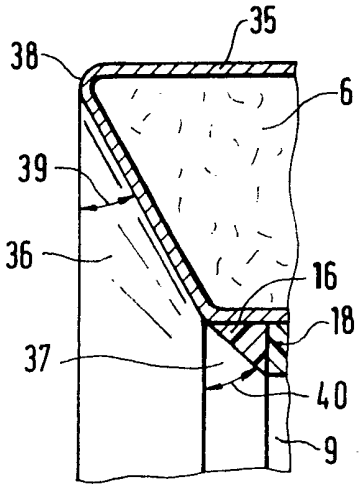


Fig.3

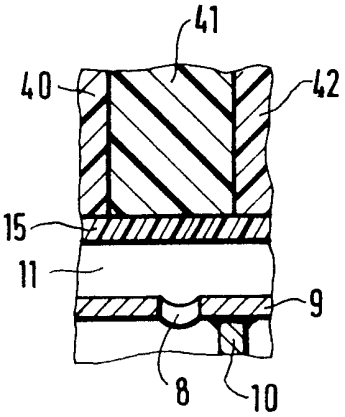
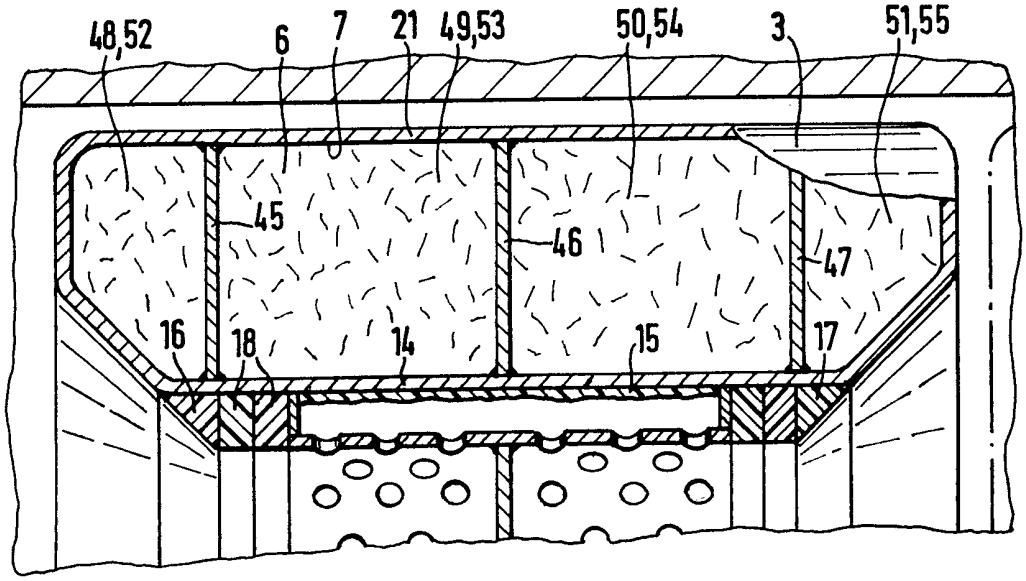


FIG. 4



SPECIFICATION

A propelling charge for large-calibre weapons

The invention relates to a propelling charge for large-calibre weapons.

A cartridge container made from combustible cardboard is known form German Offenlegungsschrift No. 31 13 406. This cartridge container has, on the ignition side, an ignition-jet, collecting funnel. This contains a priming charge of black powder. Subsequent thereto there follows a perforated centre tube, about which the propelling charge propellant is stored in the cartridge container. A propagation composition and a booster composition are arranged in the centre tube itself. In the event of a centre offset of the cartridge container in the charge chamber of a weapon, as a result of the ignition-jet collecting funnel it is ensured that the ignition jet strikes against the inside of the walling of the ignition-jet collecting funnel and against the priming charge that is to be initiated. On account of the priming charge that is arranged in the said funnel, the cartridge container is, however, not locationally secure to the necessary degree. The priming charge impairs the storage safety of the cartridge container in the event of burning particles flying around. Moreover, the cartridge container is, as a result of this arrangement of the priming charge, not protected against shock and moisture stresses.

The task of the invention consists in proposing a propelling charge which is protected against environmental loads and is ignitable irrespective of the charging density in the charge chamber of a weapon.

According to the present invention there is provided a propelling charge for large-calibre weapons having ignition means for igniting a propellant located in a ring chamber in a cartridge container, characterised in that the ignition means is arranged in a high-pressure chamber disposed between the ring chamber and a perforate centre tube.

The invention also provides a propellant charge, for large-calibre weapons, generally of a kind having ignition elements which are arranged with the propellant of the propelling charge in a combustible cartridge container, in which respect the cartridge container has a cone on the ignition side, a perforated centre tube and a ring chamber for the propellant, and which is characterised in that the cartridge container has a high-pressure chamber between the centre tube and the ring chamber, and has ignition means, responsive to hot particles, for the propelling charge arranged in the high-pressure chamber. In the propelling charge of the invention the ignition means, such as priming charges, lie completely inside the cartridge container, so that this is protected by possible additional measures, such as penetrable foils, against burning particles. Even shock stresses or the effects of moisture do not impair the operability of the propelling charge.

The propelling charge is actuable irrespective of the distance between the breech mechanism of the weapon and the cartridge container. Adaptation to different ranges is effected by selection of the number of cartridge containers which are to be inserted into the charge chamber of the weapon. The ignition means, e.g. ignition elements, present in the high-pressure chamber then ignite, besides the propellant in the first cartridge container, the ignition means of the second cartridge container, and so on to establish a chain reaction along the number of cartridge containers.

The high-pressure chamber guarantees, by reason of the gas pressure prevailing in this chamber, the reproducible ignition of the propellant. Since the high-pressure chamber has a constant volume, the aforementioned reproducibility is independent of the distance of the cartridge container from the firing cartridge arranged in the breech mechanism. This distance is merely a criterion for the initiability of the ignition means. The ignition means may be in the form of a pyrotechnical layer chosen for appropriate ignition-sensitive characteristics.

The propelling charge preferably comprises a combustible baffle plate which contains nitrocellulose and is arranged fixedly in the centre tube to divide the space in the tube into a first portion and a second portion, so that the hot particles of the firing cartridge are deflected out of the axial direction into the radial direction, to pass through the holes of the centre tube from the first portion into the high-pressure chamber for the ignition of the ignition means. The hot particles flowing out of the high-pressure chamber into the second portion are prevented from flowing back inside the centre tube to the first portiion. Thus, with respect to the ability of these hot particles to ignite a subsequent charge, a limited volume exists in the second porton, so that the intensity of the hot particles is not dissipated in a large residual volume.

In the case of a propellant compact or compacted propellant, the pyrotechnical layer may be applied directly to this. In the case of a loose e.g. granular or powder propellant, the pyrotechnical layer may be applied to an intermediate wall, consisting of cardboard which contains nitrocellulose. Thus an extensive, direct and large-area ignition propagation onto the propellant is ensured.

Pyrotechnical rings, made from material which generate hot particle-rich gas, such as iron oxide, zirconium–nickel alloy are preferably arranged in the flow path of the ignition gas so that the ignition of the propelling charge and the further ignition of a next

cartridge container are considerably improved.

The baffle plate is preferably seated approximately on half the length of the propelling charge; the cartridge container is preferably designed, with respct to the geometrical shape and construction thereof, symmetrically, in order words in mirror-inverted manner, to the centre tube; and cones or conically tapered openings are preferably provided, and possibly also pyrotechnical rings, at both ends of the centre tube, whereby to provide a reversible symmetrical modular propelling charge homologous with other such charges. In this way not only production but also handling of the charge module is simplified, whereby a considerable saving in cost and time exists. The cones arranged on both sides on the centre tube centre the particle jet of the firing cartridge in the direction of the baffle plate, whereby a possible centre offset of the cartridge container with respect to the main axis of the charge chamber of the weapon is compensated for. The pyrotechnical rings seated in each case at the beginning and end of the high-pressure chamber assist, at the breech side, the ignition pressure in the high-pressure chamber and, at the projectile side, the further ignition effect for said chain reaction ignition of the charges.

The cartridge container is preferably adapted to the length of the charge chamber of the weapon e.g. is a fraction of the length of the chamber, so that in case of need the charge chamber can accommodate 2, 3, 4 or more cartridge containers. Thus the cartridge container is optimised with respct to its usability for various ranges of fire. Said fraction may, for example, be about one third or one quarter.

The cartridge container preferably has, at each end, a projecting ring portion or zone, possibly filled with propellant, which merges in stepless manner with the cone or conical opening, and the latter preferably have relatively wide cone angles, so that the cartridge container is protected against shock, by having portions or zones capable of deformation which do not impair its loadability into the weapon.

The wide-opening cone angles make it possible to provide a relatively large volume for the propelling charge, and are so designed that the ignition gases with the particles are deflected or respectively flow into the central space, and are possibly reflected several times in the central space, until they penetrate into the high-pressure chamber.

Each ring portion or zone preferably provides small radius shoulder, supported by the cone or parts defining the conical opening, and the latter preferably comprises an outer portion making a relatively small angle with the surface of the ring portion or zone, and an inner portion, between the outer portion and the centre tube, which tapers at a smaller cone (apex) angle for the formation of a cone which tapers in a realtively tight manner.

These shoulders at the ends of the cartridge container, provide a high shock strength and are curved at a comparatively small radius. The two portion cones or conical openings have the property that the ignition gases with the solid particles are captured and deflected towards the centre tube better than in the case of single angle cone or conical opening, so that the reflection intensity of the burning solid particles in the centre tube is very strong and thus the number of particles rushing into the high-pressure chamber is high. Thus, the ignition delay time of the propelling charge is very small.

The or a pyrotechnical ring is preferably arranged flush with the surface of the cone or conical opening or adjacent thereto, and said ring may form part of the inlet cone or define part of the conical opening adjacent to the centre tube, to promote the flow of and to increase the effectiveness of the ignition gases.

Radially arranged nitrocellulose cardboard discs are preferably provided in the ring chamber to subdivide the propellant power into partial amounts which are separated from one another, so that mechanical loads in and on the propellant which arise upon transportation, such as radial and axial pressure shocks which can occur upon the dropping of the propelling charge onto the ground, are mechanically intercepted.

The cardboard discs made of nitrocellulose cardboard subdivide, in accordance with their number, the charge chamber into several sections or chambers. The partial propellant portions which are arranged in the sections and which customarily consist of granulated powder, exert, in the case of mechanical shock loads, in each case only slight forces, so that a bursting open of the outer wall of the cartridge container is reliably avoided.

It is material that, through the compartmented arrangement of the propelling-charge chamber by means of the cardboard discs made of nitrocellulose cardboard, upon the ignition a very rapid radial flame propagation ensues, which at the start of the ignition of the catridge already brings about a considerably better pressure rise than in the case of the non-subdivided, in other words unitary charge chamber.

The amounts of propellant arranged in the individual sections of the cartridge are, by reason of the additional cardboard discs, ignited in a large-area manner.

Exemplified embodiments of the invention are shown in the drawings.

Figure 1 shows a propelling charge arranged in a charge chamber of a weapon;

Figure 2 shows a detail of a further propelling charge;

Figure 3 shows a further development of a

propelling charge;

Figure 4 shows the propelling charge in accordance with Fig. 1 with partial amounts of propellant.

In the embodiment of propelling charge shown in Fig. 1, a cartridge container 3 consisting of combustible cardboard, lies, by reason of a slightly smaller diameter, in a charge chamber 1 of a large-calibre weapon at a spacing 4 with regard to the surface of the charge chamber 1.

A centrally arranged combustible baffle plate 10 is provided in a centre tube 9 which is provided with holes 8.

Linking to the centre tube 9 is a high-pressure chamber 11, which is bounded frontally by walls 12, 13 and peripherally by a wall 14.

In the high-pressure chamber 11 ignition means, in the form of a pyrotechnical layer 15, is applied to the wall 14 and covers this completely.

Adjacent to the high-pressure chamber 11 are pyrotechnical rings 16 to 19 for generating a particle-rich gas, and they define end parts of a central space which continues within the centre tube 9, as well as defining parts of cones or conical openings 26, 27.

Propelling-charge powder 6 is filled in an annular chamber 7 and is bounded by the wall 14, end walls 20 and 22, peripheral wall 21, and radiused shoulders 23, 24 between the wall 21 and the walls 20 and 22. The end walls 20 and 22 define further parts of the conical openings 26 and 27.

Regarding the function of the cartridge container:

An ignition jet, which consists of hot particles and gases and which is indicated by arrows 25, flows from a firing cartridge (not shown) past the rings 16, 18 and through the holes 8 into the high-pressure chamber 11. In so doing, particles 28 are freed from the rings 16, 18 and ignited. The ignition jet is thus enriched with burning particles.

The baffle plate 10 assists the deflection of the particle jet into the high-pressure chamber 11. In the high-pressure chamber 11 this ignition jet ignites the pyrotechnical layer 15 in a large-area manner. The high pressure in the high-pressure chamber, which is generated by the pyrotechnical layer 15, burns through the wall 14 and ignites the propellant 6 in a large-area manner.

If in the charge chamber 1 at a spacing 29 yet a further carteridge container 30 is present, as is indicated by the lines shown in a dot-dash manner, then the particle stream designated by arrows 31 as well as ignition gas leads to the ignition of the cartridge container 30 in the aforedescribed manner.

If, instead of the loose propellant 6, a compactly designed propellant, for example in the form of propellant compacts, is present, then the wall 14 is dispensed with. The pyrotechnical layer 15 is then applied directly to the inside of the compact. This inside then forms, with the centre tube 9, the high-pressure chamber.

The pyrotechnical rings 16 to 19 are not compulsorily prescribed. In the case of smaller weapon calibres, the energy of the pyrotechnical layer 15 is sufficient to ignite the propelling charge and to further ignite a following cartridge container or respectively a propelling charge.

For larger weapon calibres, the pyrotechnical rings 16 to 19 act in a supporting manner with respect to the ignition and further ignition.

In the embodiment shown in Fig. 2, one or each end of a cartridge container 35 is provided with two cone defining surfaces 36, 37 and a ring portion 38 having a very small radius. The base angle 39 of the outer cone surface 36 is approximately half as large as the base angle 40 of the inner cone surface 37. The cone surface 27 is formed by the ring 16 described with reference to Fig. 1. The shock strength of the shoulder provided by the ring portion 38 is greater and the funnel effect or respectively trapping effect with respect to the ignition jet of the conical opening is better than those of the embodiment described with regard to Fig. 1.

In the embodiment shown in Fig. 3, propellant compacts 40 to 42, inside a form of the cartridge container (not shown) not having a wall 14, are directly provided with the pyrotechnical layer 15.

In the embodiment shown in Fig. 4, the cartridge container 3 has three cardboard discs 45 to 47 which subdivide the ring chamber 7 into portions 48 to 51. Partial amounts of propellant 52 to 55 of the propellant powder 6 are contained in these portions 48 to 51.

The ignition of the partial amounts of propellant 52 to 55 is, in addition to the functions hereinbefore described, assisted in that the wall 14 is ignited by the pyrotechnical layer 15 and the rings 16 to 18 ignite the cardboard discs 45 to 47. In this way a large-area ignition of the amounts of propellant 52 to 55 is achieved.

The cardboard discs 45 to 47 can be glued into the cartridge container 3 or be fixed by mechanical retaining means.

With respect to the mechanical retaining means, knobs or grooves on the inside of the wall 21 and the wall 14 are suitable.

Also, the cardboard discs 45 to 46 can be inserted into the cartridge container 3 and be held by the partial amounts 52 to 55 of propellant with an appropriate degree of filling of the charge.

The features of the embodiments described may be employed in any suitable combination, and in combination with other features generally disclosed herein, within the scope of

the invention as defined by the appended claims.

CLAIMS

1. A propelling charge for large-calibre weapons having ignition means for igniting a propellant located in a ring chamber in a cartridge container, characterised in that the ignition means is arranged in a high-pressure chamber disposed between the ring chamber and a perforate centre tube.

2. A propelling charge as claimed in Claim 1, characterised in that a combustible baffle plate which contains nitrocelluose is disposed securely in the centre tube.

3. A propelling charge as claimed in Claim 1 or 2, characterised in that the ignition means comprises a pyrotechnical layer which is provided on an intermediate wall between the ring and high pressure chambers, or is provided directly on compact of the propellant.

4. A propelling charge as claimed in Claim 1, 2 or 3, characterised in that one or more pyrotechnical rings, made from materials which generate hot particle-rich gas, such as iron oxide, zirconium–nickel alloy, are disposed in front of the high-pressure chamber.

5. A propelling charge as claimed in Claim 2 or Claim 3 or 4 as appended to Claim 2, characterised in that the baffle plate is seated approximately half way along the length of the propelling charge, and in that the cartridge container is geometrically shaped and constructed so as to be substantially symmetrical about a median plane normal to central axis of the perforate tube.

6. A propelling charge as claimed in any preceding Claim, characterised in that the cartridge container has, at each end, a longitudinally projecting ring portion which extends peripherally from and merges in a stepless manner with a conically tapered opening leading inwards to the interior of the propelling charge.

7. A propelling charge as claimed in Claim 6 wherein said ring portions contain propellant.

8. A propelling charge as claimed in Claim 6 or 7, characterised in that the conically tapered opening comprises an outer portion and an inner portion, the outer portion having a larger cone angle than the inner portion and a greater radial extent than the ring portion.

9. A propelling charge as claimed in Claim 6, 7 or 8 wherein the radial extent of the ring portions is less than the radial extent of the conical openings; and wherein each ring portion is shaped to provide a curved or rounded shoulder between the conical opening and a cylindrical peripheral surface of the cartridge container.

10. A propelling charge as claimed in any one of Claims 6, 7, 8 and 9 as appended to Claim 4, characterised in that the or one pyrotechnical ring is arranged surface-flush with the conically tapered opening.

11. A propelling charge as claimed in Claim 10, characterised in that said pyrotechnical ring forms the inner portion of the conically tapered opening.

12. A propelling charge as claimed in any preceding claim, characterised in that provided in the ring chamber are radially arranged nitrocellulose cardboard discs which subdivide the propellant into separate portions.

13. A propelling charge substantially as hereinbefore described with reference to Fig. 1 or Fig. 4, or Fig. 1 or Fig. 4 as modified by Fig. 2 or Fig. 3 or by Figs. 2 and 3.

14. In a gun having a charge chamber, a propelling charge as claimed in any preceding claim, characterised in that the cartridge container is designed as a standard container or module having an axial length which amounts to a fraction, such as about one-third, of the entire useful length of the charge chamber.

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