

Description

Munition, in particular a programmable large-caliber munition

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Various approaches are known for data transmission for setting or for programming a munition in a tube weapon system.

- 10 CH 691 143 A5 discloses an apparatus for measuring the projectile velocity at the muzzle of a weapon barrel of high cadence. Once the velocity has been measured, the fuze is programmed directly after leaving the barrel muzzle. For this type of programming, the fuze has a
15 programming coil. CH 693 248 A5 describes a similar apparatus.

A method and an apparatus for transmitting information to programmable projectiles are also disclosed in
20 EP 0 992 762 B1. In this case as well, the information is transmitted inductively. With reference to US 5,343,795 A, the problem is addressed that it is important to be able to reset a munition in the loaded state, as well.

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Particularly in the case of large-caliber munitions which are stored for a relatively long time and do not have their own voltage or power supply for integrated electronics, the power supply and/or data supply for
30 the munition is provided via a conductive connecting line between the system electronics in the weapon and the munition electronics. This line is for this purpose located within the munition from the cartridge base to the electronics in the flying projectile. For
35 information transmission, the line must represent a continuous, fixed, configurable connection. This results in a problem when, during firing, parts of the line are admittedly thrown out of the weapon to the

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rear with the cartridge base, while further parts of the line have to leave the tube or barrel at the muzzle end. This can lead to undesirable residues of the line or parts of the line in the tube or barrel, which
5 represents a hazard, in particular for operation of the weapon, for example in a tank.

In the past, in addition to cables or lines which were firmly connected at one end to the propellant charge
10 igniter and at the other end were firmly connected to the flying projectile, open plug connections were also used at which it was intended that the line would be disconnected. This did not ensure that no parts of the plug connections remained in the weapon barrel.

15 In this case, the object of the invention is to provide definable disconnection of the continuous line without any plugs, in order to prevent undesirable line residues from remaining in the tube or barrel.

20 The object is achieved by the features of patent claim 1.

Advantageous embodiments are specified in the dependent
25 claims.

The invention is based on the idea of including a disconnection apparatus by means of which the line is disconnected at the earliest possible time. This line
30 should preferably be disconnected adjacent to the propellant charge igniter. Disconnection at an early stage assists the initial driving of the line which is cut off in a defined manner. In consequence, cable or line residues are driven out of the tube or barrel at
35 the front.

The disconnection apparatus is in this case included in the munition and in one preferred embodiment is formed

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mainly from a piston which is guided in a firmly clamped-in cylinder and preferably has a sharp edge as a cutting device, which is positioned by a shear collar in the unloaded state. The cable is preferably guided
5 fixed in a protective tube, which is connected to the propellant charge igniter, to the tip of the propellant charge igniter, to which the disconnection apparatus is attached, and is laid further to the projectile tail of the projectile. In this case, the cable is passed
10 through a hole, which is preferably located transversely with respect to the acceleration direction of the cutting device, in the upper area of the disconnection apparatus, in this case the cylinder, such that, when the cutting device moves forwards, the
15 cable is disconnected by a sharp edge.

It has been found to have a positive effect for the cable to be attached to existing components. For example, the cable can be routed on the first section
20 adjacent to the propellant charge fuze, and over the rest of its path adjacent to the flying projectile. Since the piece of cable which is exposed between the propellant charge igniter and the flying projectile is accelerated forward out of the tube or barrel together
25 with the flying projectile, the disconnection device is preferably included adjacent to the propellant charge igniter.

A piston is provided in order to disconnect the cable and, guided in a cylinder, is held in the state free
30 from pressure by suitable measures, for example a clamped-in shear collar. The piston is caused to move only by a buildup of pressure in the interior of the propellant charge igniter, which is created by the initiation process on firing of the loaded cartridge
35 and, as the process of firing the shot develops, initiates the powder bed. The cable, which is preferably located transversely with respect to the piston, is cut off by a disconnection device, such as a

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cutting edge on the surface of the piston opposite the pressure area. This is done at an early stage during the progress of firing.

5 The disconnection of the cable is therefore coupled to the buildup of pressure that is required for the progress of firing, and this has the further advantage that the time of disconnection is reproducible. The cable is disconnected even before the pyrotechnic
10 materials in the propellant charge igniter are initiated. The components of the disconnection apparatus are preferably encapsulated, in order to prevent the possibility of residues being created by the disconnection apparatus itself. The line, which is
15 closed until the time of firing, can also be reset in an advantageous manner prior to the time of firing.

A further advantage is that simple and low-cost conversion is possible. The propellant charge igniter
20 design that is known for initiation needs only minor modification, with the solution in the simplest variant being located in the closure screw of the propellant charge igniter. This precludes any influence on the initiation path of the propellant charge igniter, and
25 on the initiation of the powder bed.

The additional components can be modified by further measures without adversely affecting the requirements for the propellant charge igniter. For example, the
30 interior of the propellant charge igniter can be protected by sealing rings or disks on the piston against the ingress of moisture.

The invention will be explained in more detail with
35 reference to one exemplary embodiment in the drawing, in which:

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Figure 1 shows a detail of a munition, illustrated in the form of a section,
Figure 2 shows an enlarged illustration of the detail A from Figure 1,
5 Figures 3, 3a, b show an illustration of a shear collar for the disconnection device shown in Figure 2,
Figure 4 shows different holes for optimization within the disconnection device shown in
10 Figure 2, and
Figure 5 shows the seals for the propellant charge igniter shown in Figure 1.

Figure 1 shows a section view of, for example, a large-
15 caliber munition 100 together with the parts which are necessary for the explanation. The munition 100 has a propellant charge igniter 1 which is integrated in the drive and is part of the cartridge base 2. The propellant charge igniter 1 has a line or a cable 3 via
20 which electrical power and/or data are/is passed to an electronic fuze 4 in the projectile 101. In one preferred embodiment, the cable 3 is guided fixed in a protective tube 5, which is connected to the propellant charge igniter 1, to the tip 6 of the propellant charge
25 igniter 1, and is laid, preferably without any further interruption, from the propellant charge igniter 1 to the projectile tail 7, where it can then be firmly anchored.

30 In order to provide defined disconnection of the unprotected cable section 3a, a disconnection apparatus 102 (Figure 2) is preferably screwed to the initiation tube 1a at the tip 6 of the propellant charge igniter 1. This disconnection apparatus 102 allows the
35 cable 3 to be disconnected in the area 8a.

In one very simple embodiment, the disconnection apparatus 102 may be formed mainly from a piston 9

which is guided in a firmly clamped-in cylinder 8 and has a sharp edge, which is positioned by a shear collar 10 in the unloaded state. In the upper area of the cylinder 8, the cable 3 is passed through a hole 8a, which is preferably located transversely with respect to the acceleration direction of the piston 9, such that, when the piston 9 moves forward, the cable 3 is disconnected by the sharp edge of the piston 9. The piston 9 is accelerated by the internal pressure being applied in the propellant charge igniter 1 to the piston 9 through an aperture hole 14 which is arranged on the inside, and the strength of the shear collar 10 is exceeded. As soon as the required conversion of the powder for initiation of the drive, and therefore a buildup of pressure P take place in the interior of the propellant charge igniter 1, pressure is also applied to the piston surface. Once the shear collar 10 has been sheared off, this internal pressure P drives the piston 9 forward at high speed, as a result of which the cutting edge cuts through the cable. Once the cable 3 has been disconnected in this way, the movement of the piston 9 is stopped, for example by a reduction in the diameter of the cylinder 8. The powder bed that is being consumed now ensures that the cable 3a is transported in the direction of the muzzle of a tube or barrel, which is not illustrated in any more detail. At this time, the cable 3 is no longer firmly connected to the propellant charge igniter 1.

The components comprising the cylinder 8 and piston 9 are preferably integrated in the closure screw 15, which is arranged at the end, of the propellant charge igniter 1. In the illustrated embodiment, the piston 9 and cylinder 8 are therefore held by screwed-on or plugged-on parts such as a union nut 11 and bush 12 in the closure screw 15, and are thus anchored, so that the parts of the disconnection apparatus 102 cannot themselves create any residues outside the propellant

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charge igniter 1. The free spaces 13 which may be required for the fitting of the cable 3 and of the components or parts can be encapsulated, if required, with a liquid curable compound, such as epoxy resin.

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The piston 9 is preferably composed of a material whose strength is higher than that of the material of the cable 3. In the preferred embodiment here, the piston 3 is composed of a metal. The operation of the piston 3 can be optimized by variation of the shear collar thickness s , the shear collar geometry and/or the edge geometry. The cutting edge should preferably run at an angle w which is as acute as possible in order to optimize the disconnection process (Figure 3). The thickness s of the shear collar 10 may vary depending on the pressure level in the interior of the propellant charge igniter 1. The shear collar 10 (Figure 3a) which, for example, is round, may also have a shape as shown in Figure 3b, by reducing the shear areas.

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The pressure is preferably applied through a hole 14 (Figure 4) in the closure screw 15. The diameter and the shape of the hole 14 (14.1, 14.2, 14.3) are governed by the physical and geometric characteristics at the tip 6 of the propellant charge igniter 1. In order to prevent the hole 14 from becoming blocked by parts which enter the hole 14 when the pressure builds up and close the channel, the hole 14.2 may also be formed with a plurality of steps. A pyrotechnic additional charge 16 can be integrated in the piston 9 in order to assist the shearing-off process. This additional charge 16 is in this case initiated by the gases in the propellant charge igniter 1, and assists the movement of the piston 9.

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The shearing-off process of the shear collar 10 can also be influenced in a suitable supporting manner by providing a recess 17 between the shear collar 10 and

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the piston surface (Figure 5a). In order to positively assist the freedom of movement of the piston 9, the piston 9 may have a turned recess 18 on the circumference (Figure 5b). Sealing elements 19, 20 may be included in order to seal the interior of the propellant charge igniter 1 and/or as protection against moisture. An embodiment which is illustrated in Figure 5c has an O-ring seal 19 composed of preferably soft material, which has been integrated in the piston 9. Figure 5d shows a further embodiment. The seal is provided by a sealing disk 20 which acts over the entire internal diameter of the cylinder 8 and is arranged underneath the piston 9. This seal 20 is preferably also formed from a soft material, such as plastic.

CLAIMS

1. Ammunition, comprising: a projectile; an electronic fuse arranged in the projectile; at least one propellant charge primer integrated in a propulsion system, the propellant charge primer having a line or a cable by which electric power and/or data is supplied to the electronic fuse in the projectile; and a separating device operatively mounted on a tip of the propellant charge primer for separating the line or cable.

2. The ammunition in accordance with Claim 1, and further comprising a protective tube connected with the propellant charge primer and in which the cable is securely supported and guided as far as the tip of the propellant charge primer, and the cable extending to a rear end of the projectile.

3. The ammunition in accordance with Claim 1, wherein the separating device is screwed onto a primer tube.

4. The ammunition in accordance with Claim 1, wherein the separating device includes a piston guided in a rigidly mounted cylinder.

5. The ammunition in accordance with Claim 4, wherein the piston has a sharp edge.

6. The ammunition in accordance with Claim 4, and further comprising a shear flange arranged to position the piston in an unloaded state.

7. The ammunition in accordance with Claim 5, wherein a bore is provided in an upper area of the cylinder, the cable being guided through the bore so that when the piston moves forward the cable is separated by the sharp edge of the piston.

8. The ammunition in accordance with Claim 7, wherein the bore lies transversely to a direction of acceleration of the piston.

9. The ammunition in accordance with Claim 6, wherein a through-bore is arranged in the propellant charge primer so that an applied internal pressure of the propellant charge primer acts on the piston through the through-bore when strength of the shear flange is exceeded.

10. The ammunition in accordance with Claim 4, wherein the cylinder has a diameter reduction provided so as to stop movement of the piston.

11. The ammunition in accordance with Claim 4, wherein the propellant charge primer has a screw plug, the cylinder and the piston being integrated in the screw plug of the propellant charge primer, the screw plug being mounted on an end face of the propellant charge primer.

12. The ammunition in accordance with Claim 11, wherein the piston and the cylinder are held in and anchored with the screw plug by parts that are screwed on or inserted.

13. The ammunition in accordance with Claim 12, wherein the piston and the cylinder are held in an anchored with the screw plug by a screw cap and a bushing.

14. The ammunition in accordance with Claim 1, wherein free spaces present for working through the cable and the separating device are filled in with a liquid, curable compound.

15. The ammunition in accordance with Claim 4, and further comprising sealing elements are incorporated in or below the piston to seal an interior of the propellant charge primer and/or to protect against moisture.