SHELL DESIGNED FOR QUICK AND EASY ASSEMBLY

Technical field

The present invention relates to a shell for firing from a gun barrel, which shell comprises a front shell body part, a rear shell body part and a girdle, mutually joined together.

Background and problem definition

A shell for firing from a gun barrel, for example a mortar shell or an artillery shell, usually comprises a front and a rear shell body part, and a girdle, joined together to form a unit. The girdle is normally constituted by a metal or plastics band arranged around the body of the shell. When the shell is fired from the gun barrel, the girdle constitutes the only physical contact of the shell with the inner side of the gun barrel and has the function of forming a seal between the shell and the inner side of the gun barrel to prevent gases from a firing charge from streaming past the shell, reduce friction forces between the shell and the gun barrel and help stabilize the movement of the shell in the tube. The girdle can be fastened to the shell body in a variety of ways. One way is to press the girdle mechanically in place around the envelope surface of the shell. Another way, described in document GB 121,628, involves the girdle being slipped onto the shell body. The shell in GB 121,628 comprises a rear and a front shell body part, as well as a girdle. The rear shell body part is configured with two screw threads, one of which is arranged on a front protruding part of the shell body part, in the form of a threaded pin, and is used to thread together the shell body parts. The other thread is used to fasten the girdle.

During combat against a target, there is often a need to be able quickly and easily to adapt a shell by

combining different effect and propellant charges with regard to the position and nature of the target. For example, the target can be short-range and at the same time constitute a strong armour protection. The shell may then need to be adapted so that its front part comprises one or more explosive charges, possibly with forward-directed explosive effect. If the target is long-range or medium-range, some type of propellant charge may also be required in the rear part of the shell in order to extend the range of the shell, for example a rocket motor or base flow charge. In other applications, there may be a need for smoke, light or fire effects. Shells which are kept in store and which, for various reasons, need to be destroyed are also a problem. Due to the design of the shell, often the only options in terms of destruction are to explode the shells or open the front of the shell, alternatively to cut the shell, and melt out the explosive.

In order easily to be able to adapt a shell by combining different effect and propellant charges or facilitate the destruction and/or recovery process, there is therefore a need to be able to disassemble the shell in a quick and easy manner.

Joining together of the two shell body parts and the girdle according to the method in GB 121,628 has proved awkward and time-consuming, especially in situations where effect and propellant charges need to be changed quickly or where the shell needs to be disassembled for destruction and/or recovery.

Object of the invention and its distinguishing features

A primary object of the present invention is a shell for firing from a gun barrel, comprising a shell body, comprising a front shell body part and a rear shell body part, and a girdle, in which the said shell body parts and girdle, where necessary, can be quickly and easily assembled or disassembled, and in which the

design of the shell signifies a cost saving in terms of production, maintenance and destruction/recovery.

The said objects, as well as other objects which are not listed here, are satisfactorily met within the scope of that which is specified in the present independent patent claims.

According to the present invention, therefore, a shell for firing from a gun barrel has been provided, comprising a girdle and a front shell body part and a rear shell body part and allowing quicker and easier joining together or disassembly of the shell, characterized in that the girdle constitutes a binding element for the shell body parts.

According to further aspects of a shell according to the invention:

the girdle is designed as a circular band and the front and the rear shell body parts each comprise an end flange, the outer diameter of which corresponds with the inner diameter of the girdle for joining together of the shell body parts with the girdle,

the inner boundary surface of the girdle is constituted by a helical thread and on the end flanges of the shell body parts there are arranged helical threads, corresponding to the girdle, for joining together of the shell body parts with the girdle,

the end flanges of the shell body parts comprise a device for mutual centring of end flanges in the joining operation,

the girdle is arranged recessed in the shell body to prevent axial displacement of the girdle on the shell,

on the end flanges of the shell body parts there are arranged splines for joining together of the shell body parts with the girdle,

a locking device is arranged between the girdle and the shell body parts for locking of the girdle to the shell body parts,

the locking device comprises at least two locking pins arranged radially in the girdle, which locking pins allow the shell body parts to be locked when the locking pins are pressed down into purpose-built cavities provided in the shell body parts,

the locking pins are pretensioned with a resilient material and the locking pins are arranged movably between an unlocked and a locked position in the girdle,

at least two snap-locking devices are arranged between the girdle and the shell body parts to allow locking of the shell body parts,

the snap-locking device comprises a plunger arranged movably in a cylinder, which cylinder is arranged radially in the shell body,

the plunger is arranged, pretensioned, in a cylindrical container and on the inner side of the girdle cavities are provided, having a depth corresponding to approximately half the length of the plunger,

a bayonet coupling is arranged between the girdle and the shell body parts to allow the shell body parts to be locked to the girdle,

the bayonet coupling comprises at least two radially arranged locking pins arranged on the inner side of the girdle and at least two locking grooves, corresponding to the locking pins, arranged on the end flanges (16) of the shell body parts (3, 4).

Advantages and effects of the invention

According to the present invention, a number of effects and advantages are obtained. The device according to the invention signifies a considerable simplification in the assembly/disassembly of a shell, which means cost savings in terms of production, maintenance and destruction.

1. No special tools and/or girdle presses are required in the assembly of the girdle. Also simpler mechanical workshops are able to produce and join together the shell body parts and the girdle, which means cost savings.

2. The dual function of the girdle, firstly as a contact element between the shell and the gun barrel and secondly as a binding element for the shell body parts, signifies a simpler and cheaper shell design, no special thread being required for assembly of the girdle.

3. The shell signifies a quicker and more flexible method when the effect charges/propellant charges of the shell need to be exchanged, or when there is a need to destroy and/or recover the shell and its various parts. Girdle and shell body parts can be easily assembled/disassembled without being destroyed.

4. The customer can buy the shell in parts and can himself assemble the shell into a live shell or training shell as the need arises, for example in the

field. No additional working of the shell is necessary once the parts are assembled.

Further advantages and effects according to the invention will emerge from a study and consideration of the following, detailed description of the invention, including a number of its most advantageous embodiments, patent claims and the appended drawing figures, in which:

Fig. 1 shows a longitudinal section of a shell comprising a front shell part, a rear shell part and a girdle, in which the girdle constitutes a binding element for the shell parts and in which the shell parts are joined together with the girdle by threading,

Fig. 2 shows a longitudinal section of a shell comprising a front shell part, a rear shell part and a girdle, in which the girdle constitutes a binding element for the shell parts and in which the shell parts are joined together with the girdle by pressing with splines,

Fig. 3 shows a side view of the shell according to Figure 2, in which the shell is dismantled,

Fig. 4 shows a longitudinal section of a shell comprising a front shell part, a rear shell part and a girdle, in which the girdle constitutes a binding element for the shell parts and in which the shell parts are joined together with the girdle and locked in place with a snap lock,

Fig. 5 shows a part-enlargement of the girdle and the snap lock according to Figure 4,

Fig. 6 shows a side view of the shell according to Figure 4, in which the shell is dismantled,

Fig. 7 shows a longitudinal section of a shell comprising a front shell part, a rear shell part and a girdle, in which the girdle constitutes a binding element for the shell parts and in which the shell parts are joined together with the girdle and locked in place with a bayonet coupling,

Fig. 8 shows a side view of the shell according to Figure 7, in which the shell is dismantled.

Detailed description

Figure 1 shows a shell 1 for firing from a gun barrel, according to a first embodiment of the invention. The shell 1 comprises a shell body 2 and a girdle 7, which shell body 2 comprises a front shell body part 3 and a rear shell body part 4. The girdle 7 constitutes a binding element 7 for the shell body parts 3, 4, in that these are joined together with the girdle 7. The girdle 7 is configured as a circular band 7, also referred to as a girdle band 7, which girdle band 7 has an outer diameter which is greater than the outer diameter of the shell body 2.

The girdle 7 is delimited by an outer boundary surface 8 constituting the contact surface 8 of the shell 1 against the inner face of the gun barrel, an inner boundary surface 9 constituting the contact surface 9 of the girdle 7 against the shell body parts 3, 4, and two end faces 10 which delimit the girdle 7 in the lateral direction against the shell body parts 3, 4. For joining together of the shell body parts 3, 4 with the girdle 7, a thread 11 is arranged on the contact surface 9 of the girdle 7, as well as two corresponding threads 11', preferably a helical thread, on the shell body parts 3, 4.

As can be seen from Figure 1, the threads on the shell body parts 3, 4 are recessed, which means that the girdle 7, after having been joined together with the

shell body parts 3, 4, is to some extent recessed in the shell 1. One aim of the recessing of the girdle 7 is to prevent it from sliding or moving on the shell under the influence of friction forces as it is fired from the gun barrel, even if the threads, for example, were for some reason to be damaged. For the mutual centring of the shell parts 3, 4, a guide device 12 is arranged on the end faces of the shell body parts 3, 4. The guide device 12 comprises a protruding part arranged on the end face of one of the shell body parts, which protruding part is configured such that, as the shell body parts 3, 4 are joined together, it is introduced into a corresponding depression arranged on the other shell body part.

The front shell body part 2 is configured with an open front 5, in which proximity fuses, control electronics and an initiating device, etc. can be fitted. The interior 6 of the shell body parts 3, 4 constitutes the loading space 6 of the shell for the accommodation of one or more effect parts, which effect parts are preferably constituted by conventional-type explosive charges or explosive charges with forward-directed effect, alternatively explosive charges with smoke, light or fire effects. Propellant charges may also possibly be incorporated in the rear shell body part 4, which calls, however, for another embodiment of the rear shell body part 4 than that which is shown in Figure 1.

The design of the shell 1 according to present embodiments requires, however, that the effect charges of the shell 1 exist as separate units which can be installed in the shell body parts 3, 4 without casting, for example by press-fitting, whereafter the shell body parts 3, 4 are joined together.

Figures 2 and 3 show a shell 1 according to a second preferred embodiment of the invention. The shell 1

comprises a shell body 2, comprising a front shell body part 3 and a rear shell body part 4, as well as a girdle 7. As in the first embodiment, Figure 1, the girdle 7 constitutes a binding element 7 for the shell body parts 3, 4. The joining together is realized by the shell body parts 3, 4 being pressed into the girdle 7. On the end faces of the shell body parts 3, 4, flanges 16 are provided, on which splines 15 (also referred to as ribs 15) are arranged. Splines 15 are preferably constituted by ribs 15 arranged axially (longitudinally) on the flanges. The ribs 15 can have different shape and dimension and can also be differently spaced apart.

In the joining together of the shell body parts 3, 4, when the flanges 16 are pressed into the girdle, the ribs 15 cause the inner side of the girdle to deform, which means that the shell body parts 3, 4 become wedged in the girdle 7. In order to lock the shell body parts 3, 4 in a certain position in the girdle and prevent movements in the axial direction, a locking device is also arranged between the girdle 7 and the shell body parts 3, 4. The locking device preferably consists of locking pins 13 arranged radially in the girdle 7, which locking pins 13, upon locking, are pressed into the shell body 3 in purpose-built cavities 14. The locking pins 13 are pretensioned by a resilient material, preferably a spring, and are movable, can change position, from an unlocked position (non-depressed pin) into a locked position (depressed pin). For centring (and sealing) of the shell parts 3, 4 as they are joined together, it is also advantageous to have a guide element 12 arranged on the mutually opposing end flanges 16.

Figures 4, 5 and 6 show a shell 1 according to a third embodiment of the invention. The shell 1 comprises a shell body 2 comprising a front shell body part 3 and a rear shell body part 4, as well as a girdle 7. As in

the first and second embodiments, Figures 1, 2 and 3, the girdle 7 here constitutes a binding element 7. On the mutually opposing end faces of the shell body parts 3, 4, flanges 16 are provided, which flanges 16 have an outer diameter corresponding to the inner diameter of the girdle 7. As the shell body parts 3, 4 are joined together, the flanges 16 are guided into the girdle 7 and meet after approximately half the width of the girdle 7. After this, the girdle 7 is turned by a certain distance into a locking position in which the shell body parts 3, 4 and the girdle 7 are locked with the aid of at least two snap-locking mechanisms 17, one for each shell body part 3, 4, see Figure 5.

The snap-locking mechanism 17 is arranged between the girdle 7 and the shell body 2 and comprises a plunger 20 arranged movably in a cylinder 18, which cylinder 18 is arranged radially in the shell body 2. The plunger 20 is pretensioned by a resilient material 21, preferably a spring 21, which spring is arranged in the cylinder 18 behind the plunger 20, which means that the spring force presses the plunger 20 radially outwards from the shell body 2. On the inner side of the girdle 7, cavities are provided 19, having a depth corresponding to approximately half the length of the plunger 20. Under the turning moment of the girdle 7, the plunger 20 is held fully depressed in the cylinder 18 due to the resistance from the girdle 7. Once the girdle 7 has reached its locking position, which is corresponded to by the location of a cavity 19 directly above the plunger 20, the plunger is pressed into the cavity 19 by the spring force to approximately half its length, whereby the locking is activated.

For sealing and centring of the shell parts 3, 4 as they are joined together, it is advantageous, here too, to have a guide element 12 arranged on the end flanges 16 of the shell body parts 3, 4, in the same way as the preceding embodiments.

Figures 7 and 8 show a shell 1 according to a fourth embodiment of the invention. The shell 1 comprises a shell body 2 comprising a front shell body part 3 and a rear shell body part 4, as well as a girdle 7. As in the preceding embodiments, Figures 1-6, the girdle 7, here too, is a binding element 7 for the shell parts 3, 4. On the mutually opposing end faces of the shell body parts 3, 4, flanges 16 are provided, which flanges 16 have an outer diameter corresponding to the inner diameter of the girdle 7. As the shell body parts 3, 4 are joined together, the flanges 16 are guided into the girdle 7 and meet approximately after half the width of the girdle. After this, the girdle is turned by a certain distance, into a locking position in which the shell body parts 3, 4 and the girdle are locked with the aid of a bayonet coupling 22, 23.

The bayonet coupling 22, 23 is arranged between the girdle 7 and the shell body 2 and comprises at least two radially arranged locking pins 22 on the inner side of the girdle 7 and at least two locking grooves 23 (also referred to as bayonet grooves 23) corresponding to the locking pins 22, which bayonet grooves 23 are arranged on the end flanges 16 of the shell body parts 3, 4, one on each end flange 16. The bayonet groove 23, which has a depth corresponding to the length of the locking pin 22, runs from the outer end of the end face in the axial direction, by a distance corresponding to approximately half the width of the end face, so as thereafter to deviate radially, by a distance corresponding to at least the thickness of the locking pin 22. For sealing and centring of the shell parts 3, 4 as they are joined together, it is advantageous, here too, to have a guide element 12 arranged on the end flanges 16, in the same way as described for preceding embodiments.

An alternative method of joining together the abovementioned embodiments is to shrink the girdle 7 in place over the end flanges 16 of the shell body parts 3, 4. The technique involves the girdle 7 being heated to a temperature of at least 500°C, which means that the girdle 7 can be slipped over the end flanges 16 of the shell body parts 3, 4. After this, the girdle 7 is cooled, whereupon the girdle 7 shrinks, contracts and is clamped in place on the shell body 2, roughly in the form of a reducing joint. Correspondingly, upon disassembly, the shell 1 is heated, whereupon the girdle expands and the shell body parts 3, 4 can be taken apart.

Patent claims

1. Shell (1) for firing from a gun barrel, which shell (1) comprises a shell body (2), comprising a front shell body part (3) and a rear shell body part (4), and a girdle (7), mutually joined together, characterized in that the girdle constitutes a binding element (7) for the shell body parts (3, 4).

2. Shell (1) according to Claim 1, characterized in that the girdle (7) is designed as a circular band (7) and in that the front and the rear shell body parts (3, 4) each comprise an end flange (15), the outer diameter of which corresponds with the inner diameter of the girdle (7) for joining together of the shell body parts (3, 4) with the girdle (7),

3. Shell (1) according to either of Claims 1 or 2, characterized in that the inner boundary surface (11) of the girdle (6) is constituted by a helical thread (9) and in that on the end flanges (15) of the shell body parts (3, 4) there are arranged corresponding helical threads (9) for joining together of the shell body parts (3, 4) with the girdle (7).

4. Shell (1) according to any one of the preceding claims, characterized in that the end faces of the shell body parts (3, 4) comprise a device (12) for centring of the shell body parts (3, 4).

5. Shell according to any one of the preceding claims, characterized in that the girdle (7) is arranged recessed in the shell body (2) to prevent axial displacement of the girdle (7) on the shell (1).

6. Shell according to either of Claims 1 or 2, characterized in that on the end flanges (16) of the shell body parts (3, 4) there are arranged splines (15)

for joining together of the shell body parts (3, 4) with the girdle (7).

7. Shell according to Claim 6, characterized in that a locking device (13, 14) is arranged between the girdle (7) and the shell body parts (3, 4) for locking of the girdle (7) to the shell body parts (3, 4).

8. Shell according to Claim 7, characterized in that the locking device (13, 14) comprises at least two locking pins (13) arranged radially in the girdle (7), which locking pins (13) allow the shell body parts (3, 4) to be locked when the locking pins (13) are pressed down into purpose-built cavities (14) provided in the shell body parts (3, 4).

9. Shell according to Claim 7, characterized in that the locking pins (13) are pretensioned with a resilient material (21) and in that the locking pins (13) are arranged movably between an unlocked and a locked position in the girdle (7).

10. Shell according to either of Claims 1 or 2, characterized in that at least two snap-locking devices (17) are arranged between the girdle (7) and the shell body parts (3, 4) to allow locking of the shell body parts (3, 4).

11. Shell according to Claim 10, characterized in that the snap-locking device (17) comprises a plunger (20) arranged movably in a cylinder (18), which cylinder (18) is arranged radially in the shell body (2).

12. Shell according to Claim 11, characterized in that the plunger (20) is arranged, pretensioned, in a cylindrical container (18) and in that on the inner side of the girdle (7) cavities (19) are provided,

having a depth corresponding to approximately half the length of the plunger (18).

13. Shell according to either of Claims 1 or 2, characterized in that a bayonet coupling (22, 23) is arranged between the girdle (7) and the shell body parts (3, 4) to allow the shell body parts (3, 4) to be locked to the girdle (7).

14. Shell according to Claim 13, characterized in that the bayonet coupling (22, 23) comprises at least two radially arranged locking pins (22) arranged on the inner side (11) of the girdle (7) and at least two locking grooves (23), corresponding to the locking pins (22), arranged on the end flanges (16) of the shell body parts (3, 4).