

ARRANGEMENT AND METHOD FOR SUPPORTING SHELL INTO BREECH-LOADING WEAPON BARREL

FIELD OF THE INVENTION

[0001] The invention relates to an arrangement for supporting a shell into the barrel of a breech-loading weapon, the arrangement comprising means for fastening a rim-flanged support element to a tail of the shell.

[0002] The invention further relates to a method of fastening a support element to a shell, in which method a support element comprising a rim flange is fastened to a tail of the shell.

BACKGROUND OF THE INVENTION

[0003] A shell mortar may be arranged on a movable base, such as a armoured vehicle, allowing the shell mortar to be conveniently moved from one place to another and, on the other hand, allowing it to be rapidly moved from the emplacement into safety. If the intention is to use the shell mortar for firing horizontally or downwards, the problem is that the shell does not remain in position in the unrifled barrel of the shell mortar, but may slip forward in the barrel in such a manner that it can no longer be fired. US patent 5,503,080 discloses a support member attachable by means of friction to control fins in the shell tail. However, the friction bond taught by the publication does not achieve a sufficiently reliable fastening of the support member. In addition, the dimensions of a support member and control fins always show some deviations due to the manufacture that cause variation in the magnitude of the fastening force.

BRIEF DESCRIPTION OF THE INVENTION

[0004] An embodiment of the present invention seeks to provide an arrangement for supporting a shell into the barrel of a breech-loading weapon by using a support element, and a method of fastening such a support element.

[0005] The arrangement of an embodiment of the invention is characterized in that the arrangement for fastening the support element comprises a propelling charge element comprising a propelling charge and a primer, the element having a threading suited for the shell tail in a manner allowing the support element to be fastened to the shell tail by rotating the propelling charge element to the shell tail through the support element. This being so, the propelling charge element is screwed into a threaded cavity inside the shell tail through a centre

opening in the support element, whereby the rim-flanged support element is tightened against the shell tail.

[0006] The method of an embodiment of the invention is characterized by supporting the support element against a rear surface of at least one control fin by rotating the propelling charge element placed through the centre opening of the support element into the shell tail.

[0007] According to an embodiment of the invention, the support element is fastened to the shell tail by means of a new type of propelling charge element. In the propelling charge element, the charge element, e.g. a primer, is in the end part, and the propelling charge, i.e. the so-called basic charge, is placed in the longitudinal shank part thereof. The outer surface of the longitudinal shank part of the propelling charge element is provided with threads. The tail part of the shell is provided with a corresponding cavity for receiving the propelling charge element. The inner surface of the cavity of the tail part is provided with threads matching the threads of the shank part of the charge element. The propelling charge element is fastened to the shell tail through a centre opening in the support element, whereby the support element is tightened against the shell tail. The end part of the propelling charge element and the primer located therein remain visible on the rear surface of the support element. In this case, no separate intermediate triggers are required, since the firing pin of the weapon is able to directly hit the primer of the propelling charge.

[0008] In the embodiment of the invention, the support element is fastened to the shell tail with a mechanical locking, whereby the fastening is more secure than a friction-based locking. A further advantage of the embodiment of the invention is that the support element is easily and rapidly attachable to the shell tail by means of the propelling charge element even under difficult conditions, since the support element may be fastened with the propelling charge element without separate locking pieces.

[0009] According to an embodiment of the invention, the length of the propelling charge element is dimensioned in such a manner that when the propelling charge element is fastened to the shell, a distance remains between the shell tail and the support element, the distance serving as a fracturing breaking point under the action of the forces generated by the firing of the shell.

[0010] In the solution according to the embodiment, the breaking portion is provided on that shank portion of the propelling charge element that

is not surrounded by the shell tail tube or the support element.

[0011] The breaking point of the propelling charge may also comprise a weakened portion. The weakened portion may be accomplished for instance by machining the wall portion remaining open so that it becomes thinner. In this manner the breaking point may be determined more accurately in advance. However, it should be noted that by varying the wall material or the wall thickness of the propelling charge element, a fastening is achieved that endures the fastening of the support element by rotating the propelling charge element or the shell, but breaks at a predetermined point upon firing of the shell. This provides a simple solution, wherein the structure of the propelling charge is utilized by using it both as a locking piece and in providing the breaking point.

[0012] According to an embodiment of the invention, the propelling charge element has a thread suitable for the support element and the shell tail. The thread is on the outer surface in the propelling charge element and on the inner surface in the shell tail.

[0013] According to an embodiment of the invention, a recess portion is in connection with the centre opening in the support element, and a rim flange settling in the recess portion of the support element is in the propelling charge element.

[0014] According to an embodiment of the invention, the rim flange of the propelling charge element has threads and the recess portion of the support element has threads that match the threads of the rim flange of the propelling charge element.

BRIEF DESCRIPTION OF THE FIGURES

[0015] The invention will be described in more detail in the attached drawings, wherein

Figure 1a schematically shows a shell supported into the barrel of a weapon by means of an arrangement according to the invention,

Figure 1b shows a back view of the arrangement of Figure 1a,

Figure 2 schematically shows an embodiment of the arrangement of the invention in partial section,

Figure 3a schematically shows an embodiment of the structure of a propelling charge element,

Figure 3b schematically shows an embodiment of the structure of a

propelling charge element,

Figure 4a schematically shows an embodiment of the arrangement of the invention in partial section,

Figure 4b shows a back view of the embodiment of the arrangement of Figure 4a.

[0016] In the figures, some embodiments of the invention are shown in a simplified manner for the sake of clarity. In the figures, like parts are denoted with like reference numerals.

DETAILED DESCRIPTION OF THE INVENTION

[0017] In Figure 1a, a shell 1 is arranged in a barrel 2 of a breech-loading weapon. The weapon may be a shell mortar, wherein the inner surface of the barrel 2 is substantially smooth. The end part of the shell 1 comprises a tail tube 3 and control fins. The tail 4 comprises one or typically, a plurality of control fins for affecting the trajectory of the shell 1. The details of the structure of the shell 1 may deviate from the structure shown in the figure. For the sake of clarity, the lock of the weapon and the other details thereof are not shown. A support element 6 according to the invention is fastened to the tail 4 for keeping the shell 1 in position in the barrel 2 until it is fired. A rim flange 7 in the support element 6 prevents the shell 1 from shifting forward in the barrel 2 when the barrel 2 is oriented horizontally or even if the barrel 2 pointed downward. Furthermore, the back surface of the weapon barrel may be provided with a groove or a recess into which the rim flange 7 belonging to the support element 6 may settle when the shell 1 provided with the support element 6 is loaded into the barrel. The support element is dimensioned to endure, not only the loads caused by the mass of the shell 1, but also any forces caused by vibration and accelerations.

[0018] Figure 1b shows a back view of the support element arranged in the barrel of the weapon according to Figure 1a. An end part 11 of the propelling charge element and a primer 13 thereof are visible in an opening located in the middle of the support element 6.

[0019] In the following, the structure of an arrangement of the invention will be described with reference to Figures 2 to 4b.

[0020] Figure 2 schematically shows an embodiment of the invention, wherein the support element 6 is fastened to the tail of the shell 1 by means of a propelling charge element 12.

[0021] The propelling charge element 12 has a primer 13 in the end part 11 and a propelling charge 14, i.e. a so-called basic charge, located in a longitudinal shank part 15 thereof. The end part 11 of the propelling charge element and the primer 13 located therein remain visible on the rear surface 62 of the support element, and no separate intermediate triggers are required, since the firing pin of the weapon may directly hit the primer 13 of the propelling charge element 12. The end part 11 of the propelling charge element 12 has a rim flange 17 that settles into a recess in the middle opening of the support element 6. In this case, the rim flange 17 of the propelling charge element 6 also restricts the rotating of the propelling charge element 12 too deep into the support element 6.

[0022] The support element 6 comprises an end 62, an outer jacket 63 and a rim flange 7. The outer jacket 63 of the support element 6 is dimensioned in a manner allowing at least part of the tail 4 of the shell 1 to settle to the inside thereof.

[0023] Furthermore, the mid axis of the support element 6 is provided with a sleeve-like reinforcement portion 65, whose inner circumference is provided with threads for receiving the propelling charge element 12. The propelling charge element 12 is fastened to the tail tube 3 of the shell through the reinforcement portion 65. As the propelling charge element 12 is threaded into the inside of the tail tube, the support element also shifts fixed to the shell tail. When being fastened, a surface 32 of the shell tail 4 settles against a surface 64 of the support element. In this position, a distance remaining between the rear surface 31 of the shell tail tube 3 and an upper surface 61 of the reinforcement portion 65 of the support element (shown with reference numeral 120 in Figure 3) serves as the breaking point.

[0024] The distance between the rear surface 31 of the shell tail tube 3 and the upper surface 61 of the reinforcement portion 65 of the support element may preferably be 0.1 to 10 mm, more preferably 0.5 to 5 mm, and most preferably 1 to 3 mm.

[0025] Figure 3a schematically shows the principle of the structure of the propelling charge element 12, wherein threads 15a are provided on the outer surface of the longitudinal shank part 15 of the propelling charge element, the threads corresponding to the threads in the cavity of the shell tail part. The primer 13 is in the end part 11 of the propelling charge element. In this embodiment, the end part of the propelling charge element 12 has no

threads. This being so, the rim-flanged propelling charge element is fastened to the support element with an interference fit, e.g. by compression. Preferably, the propelling charge element is arranged in the support element in a manner allowing the end part to be detached from the support element after the firing of the shell, and a new propelling charge element to be arranged in said support element.

[0026] Figure 3b schematically shows the principle of the structure of the propelling charge element, wherein the outer surface of the longitudinal shank part 15 of the propelling charge element is provided with threads 15a, which correspond to the threads in the cavity of the shell tail part and in the support element. Herein, the threads also extend to the entire end part 11, but it is clear that an element comprising a rim-flanged primer according to Figure 2 may also be fastened to the end part.

[0027] The length of the propelling charge element is dimensioned in such a manner that when the propelling charge element is fastened to the shell, a distance 120 remains between the support element of the tail tube of the shell, the distance serving as a breaking point fracturing under the action of the forces generated by the firing of the shell. The breaking point is provided on that shank portion of the propelling charge element that is not surrounded by the shell tail tube or the support element. The structure of the propelling charge element 12 is dimensioned to endure the fastening forces required, but, on the other hand, to break under the action of a predetermined force, thus allowing the shell 1 to be detached from the support element 6 once the firing has occurred. The shank portion 15 of the propelling charge element 12 may be manufactured from a metal sheet by cutting and bending. Alternatively, it may be manufactured from a plastic material for instance by injection moulding or it may be a composite structure.

[0028] Figures 4a and 4b schematically show an embodiment of an arrangement of the invention. Herein, the propelling charge element 12 is provided with a threaded portion 65a corresponding to the threads 15a of the propelling charge element, and a rim flange 17 having threads 65b. In this way, the fastening of the end part 11 of the propelling charge element to the support element 6 is reinforced. The end part of the propelling charge element 12 is also provided with two recesses 40, in which a suitable tool may be placed for rotating the propelling charge element into the shell tail or for keeping the propelling charge element 12 in position if the fastening is implemented by rotating

the shell. It is to be noted that the recesses shown in Figure 4b can also be provided in the arrangement shown in Figure 2.

[0029] Figures 2 and 4a show that the end part 11 of the propelling charge element 12 extends from the end surface 62 of the support element 6 at least up to the upper surface 61 of the reinforcement portion 65 of the support element. This being so, the firing of the shell causes no deformation in the reinforcement portion 65 of the support element 6, allowing the support element 6 to be reused after the end portion 11 of the propelling charge element is detached.

[0030] The support element 6 is installed as follows. Firstly, the support element 6, the propelling charge element 12 and the shell 1 are arranged in such a manner that their mid axes are aligned. This being so, the propelling charge element 12 may be pushed through the centre opening of the support element 6 and the shank part 15 of the propelling charge element 12 can be rotated into the threads in the shell tail. The propelling charge element 12 is then rotated around its longitudinal axis, whereby the threads 15a of the shank part 15 of the propelling charge element are threaded into the threads in the centre hole of the shell tail. Alternatively, the propelling charge element is kept in place and the shell is rotated around its longitudinal axis. However, it is essential that the positions of the propelling charge element and the shell are changed relative to one another by rotating one or both of them around their longitudinal axes. In other words, by rotating them relative to one another, their axial positions relative to one another change. When the rotation is continued, the surface 64 of the support element 6 is compressed against the rear surface 32 of the control fin of the tail 4, and the support element 6 is fastened to the shell 1, and the arrangement is ready to be pushed into the barrel of a weapon.

[0031] When the shell 1 is fired, the charge breaks the wall of the shank portion that remained open and substantially no material belonging to the support element 6 leaves along therewith that could damage the barrel of the weapon or affect the trajectory of the shell.

[0032] It is obvious to a person skilled in the art that as technology advances, the basic idea of the invention can be implemented in a variety of ways. Consequently, the invention and its embodiments are not restricted to the above examples, but may vary within the scope of the claims.

CLAIMS

1. An arrangement for supporting a shell having a tail tube and a shell tail comprising a plurality of control fins for affecting the trajectory of the shell into a barrel of a breech-loading weapon, the arrangement comprising a rim-flanged support element to be fastened to a shell tail, characterized in that the arrangement comprises a propelling charge element comprising a propelling charge and a primer, the element having a threading suited for the shell tail in such a manner that by rotating the propelling charge element placed through the support element and the shell relative to one another, the axial position therebetween changes, whereby the support element is displaceable towards the tail of the shell, and that the length of the propelling charge element is dimensioned in such a manner that when the propelling charge element is fastened to the shell, a distance remains between the shell tail tube and the support element, the distance serving as a breaking portion fracturing under the action of forces generated by the firing of the shell.

2. An arrangement as claimed in claim 1, characterized in that the propelling charge element comprises a threading suited for both the support element and the tail of the shell.

3. An arrangement as claimed in claim 1, characterized in that the propelling charge element is fastened to a centre opening of the support element with an interference fit.

4. An arrangement as claimed in any one of the preceding claims, characterized in that the threading is arranged on the outer surface of the propelling charge element and on the inner surface of the tail tube of the shell.

5. An arrangement as claimed in any one of the preceding claims, characterized in that the propelling charge element is provided with a rim flange settling against the support element.

6. An arrangement as claimed in claim 5, characterized in that the outer circumference of the rim flange of the propelling charge element is provided with threads and the support element comprises a matching thread portion.

7. An arrangement as claimed in claim 1, characterized in that the breaking portion of the shank part of the propelling charge comprises a weakened portion.

8. A method of supporting a shell having a tail tube and a shell tail comprising a plurality of control fins for affecting the trajectory of the shell into a barrel of a breech-loading weapon, in which method a support element provided with a rim flange is fastened to a tail of the shell, characterized by fastening the support element to the tail of the shell by rotating a propelling charge element placed through said support element into the shell tail and that the length of the propelling charge element is dimensioned in such a manner that when the propelling charge element is fastened to the shell, a distance remains between the shell tail tube and the support element, the distance serving as a breaking portion fracturing under the action of forces generated by the firing of the shell.