

SUPPORT MEMBER FOR SUPPORTING SHELL INTO BREECH-LOADING WEAPON BARREL, AND METHOD

BACKGROUND OF THE INVENTION

[0001] The invention relates to a support member according to the preamble of claim 1, and particularly to a support member for supporting a mortar shell into a breech-loading weapon barrel, the support member comprising a support element with an edge flange and a firing mechanism for firing the actual primer of the mortar shell and further comprising connecting means for attaching the support element to a tail of the mortar shell. The invention further relates to a method according to the preamble of claim 10 for attaching a support member to a mortar shell, the method comprising arranging in the tail of the mortar shell a support member which comprises a support element; and attaching the support member to the tail of the mortar shell.

[0002] A mortar can be arranged on a movable base, such as an armored vehicle, allowing the mortar to be moved conveniently from one place to another and, on the other hand, allowing it to be rapidly moved from the emplacement into safety. When the intention is to use a mortar for firing vertically or downward, the problem is that the mortar shell does not stay in place in the smoothbore barrel of the mortar, but may slide forward in the barrel, so that it can no longer be fired. US patent 5,503,080 discloses a support member attachable by means of friction to guiding wings in the mortar shell tail. The solution taught by the publication has the problem of requiring extremely accurate dimensions of both the tail of the projectile and the support member itself in order for it to function in at least satisfactorily reliable manner.

BRIEF DESCRIPTION OF THE INVENTION

[0003] An embodiment of the invention thus seeks to provide a support member, and a method for attaching a support member to a mortar shell. According to a first aspect of the present invention, there is provided a support member for supporting a mortar shell into a breech-loading weapon barrel, the support member comprising a support element with an edge flange and a firing mechanism for firing the actual primer of the mortar shell and further comprising connecting means for attaching the support element to a tail of the mortar shell, the tail comprising guiding fins, characterized in that the connecting means for attaching the support element to the tail of the mortar shell comprise at least one flexible part arranged to direct spring force at one or more guiding fins forming a part of the tail of the mortar shell. According to a second aspect of the present invention, there is provided a method for attaching a support member to a mortar shell, the method comprising: arranging in the tail of the mortar shell a support member which comprises a support element; and attaching the support member to the tail of the mortar shell, characterized by attaching the support member to one or more guiding fins forming a part of the mortar shell tail by means of one or

more flexible parts in such a way that when receiving the mortar shell tail, the flexible part directs spring force at one or more guiding fins forming a part of the mortar shell tail.

[0004] Preferred embodiments of the invention are disclosed in the dependent claims.

[0005] An embodiment of the invention is based on a mortar shell being attached to a support member with connecting means which direct spring force at the mortar shell tail. In other words, the connecting means comprise a flexible part by means of which the mortar shell tail is attached to the support member. The flexible part may, in accordance with the embodiment, receive the mortar shell tail in such a way that it directs spring force at the outer periphery of the mortar shell tail or at one or more guiding fins forming a part of the mortar shell tail or, at both the outer periphery of the mortar shell tail and one or more guiding fins. Alternatively, the mortar shell tail may be provided with a counterpart to which the flexible part is attached by means of spring force.

[0006] In an embodiment of the invention, attachment of the support member to the mortar shell tail is based on spring force, whereby the attachment is more reliable than breech based on friction. Further, possible dimensional variance caused by the manufacture of the mortar shell does not affect the magnitude of the attachment forces and the staying in place of the support member as critically as in a friction breech solution. In the solution according to the embodiment of the invention, it is relatively easy to control the attachment forces. Further, it is an advantage of the embodiment of the invention that the support member can be attached to the mortar shell tail easily and quickly even in difficult conditions.

[0007] In accordance with an embodiment of the invention, the support member is provided with a spring ring arranged to receive the mortar shell tail. When receiving the mortar shell tail, the spring ring yields, simultaneously directing spring force at the mortar shell tail. The spring ring may be provided in such a way that spring force is directed at the outer periphery of the mortar shell tail. Alternatively, the spring ring may comprise one or more slots for receiving a guiding fin forming a part of the mortar shell tail in such a way that the guiding fin to be received into the slot makes the spring ring yield, whereby the slot directs spring force at the guiding fin to attach the mortar shell to the support member.

[0008] In another embodiment of the present invention, the support member is provided with a laminated ring which is arranged to receive the mortar shell tail. The laminated ring has been provided in such a way that it directs spring force at the outer periphery of the mortar shell tail. In other words, the mortar shell tail is arranged to be received into a space generated by the laminated ring such that the laminated ring yields at least partly when the mortar shell tail is received, and directs spring force at the mortar shell tail. Alternatively, the laminated ring is arranged to receive one or more guiding fins forming a part of the mortar shell tail such that the laminated ring yields at least partly when receiving one or more guiding fins, and directs spring force at the guiding fin received.

[0009] In yet another embodiment of the invention, the support member is provided with a flexible connecting part which is arranged to receive a counterpart provided in the mortar shell tail. The flexible connecting part may be, for example, a flexible sleeve-like connecting part arranged to yield in the direction transverse to its axis when receiving the counterpart, and to direct spring force at the counterpart to attach the mortar shell to the support member.

BRIEF DESCRIPTION OF THE FIGURES

[0010] The invention will now be described in greater detail in connection with preferred embodiments, with reference to the attached drawings, of which:

Figure 1 shows schematically a mortar shell supported into a weapon barrel by means of a support member according to an embodiment of the invention;

Figure 2 shows schematically an embodiment according to the present invention for attaching a support member to a mortar shell by means of a spring ring;

Figure 3 shows schematically a second embodiment according to the present invention for attaching a support member to a mortar shell by means of a spring ring;

Figure 4 shows schematically a cross-sectional view of an embodiment according to the present invention for attaching a support member to a mortar shell by means of a laminated ring;

Figure 5 shows schematically the laminated ring according to Figure 4; and

Figure 6 shows schematically an embodiment according to the present invention for attaching a support member to a mortar shell by means of a flexible part and a counterpart provided in the mortar shell; and

Figure 7 shows the embodiment according to Figure 6 when the support member has been attached to the mortar shell by means of a flexible part.

BRIEF DESCRIPTION OF THE INVENTION

[0011] Figure 1 shows schematically a mortar shell 1 supported into a barrel 2 of a weapon by means of a support member 6 according to an embodiment of the invention.

[0012] The mortar shell 1 is arranged into the barrel 2 of a breech-loading weapon. The weapon may be a mortar in which the inner surface of the barrel 2 is substantially smooth. The rear part of the mortar shell 1 comprises a tail tube 3 and a tail 4. The tail 4 comprises one or typically more guiding fins 5 for affecting the trajectory of the mortar shell 1. The details of the construction of the mortar shell 1 may deviate from the structure shown in the figure. For the sake of clarity, the breech of the weapon and other details are not shown.

[0013] A support member 6 according to the invention is attached to the tail 4 for keeping the mortar shell 1 in place in the barrel 2 until it is fired. An outer casing 12 in a support element 8 forming a part of the support member 6 is dimensioned such that at least part of the tail 4 of the mortar shell 1 can become placed inside it. An edge flange 7 in the support member 6 prevents the mortar shell 1 from moving forward in the barrel 2 when the barrel 2 is directed horizontally, or even if the barrel 2 pointed downward. The support member 6 is dimensioned to tolerate not only the load caused by the mass of the mortar shell 1 but also any forces caused by vibration and acceleration. The support element 8 further comprises connecting means 10 by means of which the mortar shell 1 is attached to the support member 6.

[0014] The connecting means 10 may be attached to the support element 8 for instance with a threaded joint or another mechanical joint which is preferably openable and closable optionally. Alternatively, the connecting means 10 may be attached to the support element 8 in a fixed manner.

[0015] Figure 2 shows schematically an embodiment according to the invention, where the connecting means 10 provided in the support element 8 comprise a spring ring 13. The spring ring 13 is formed in such a way that it is capable of receiving the mortar shell tail 4. In accordance with Figure 2, the spring ring 13 is formed in such a way that it is capable of receiving particularly that end of the tail tube 3 of the tail 4 that is far from the mortar shell 1. The spring ring 13 thus forms an opening in which the end of the tail tube 3 can be placed. The opening of the spring ring 13 has been provided such that when the tail tube 3 becomes placed in the opening, the spring ring 13 yields and becomes stressed, directing spring force at the outer periphery or outer surface 14 of the tail tube 3, i.e. the mortar shell tail, which spring force makes the mortar shell 1 attach to the support member 6. In other words, the spring ring 13 serves as a flexible element directing spring force at the tail 4 of the mortar shell 1 to attach the mortar shell 1 to the support member 6.

[0016] The spring ring 13 may comprise slots arranged to receive guiding fins 5 forming a part of the tail 4 of the mortar shell 1. The slots allow the end of the tail tube 3 to be placed against the bottom of the support element 8. The spring ring 13 may be further shaped in such a way that the mortar shell 1 can be easily pressed into an opening delimited by the spring ring 13 but that pulling it out requires considerably more force in order for the joint not to open before firing. In accordance with Figure 2, the spring ring 13 directs spring force at the outer periphery 14 of the mortar shell tail 4 in areas between the guiding fins 5. Between the slots or other corresponding openings, there extend claw-like spring members 18 or other corresponding tongue-like flexible parts in the spring ring 13, which parts yield when receiving the tail 4 of the mortar shell. In other words, the opening of the spring ring 13 has been made smaller than the diameter of the tail tube 3 of the mortar shell 1, whereby, when the tail tube 3 is pushed into the spring ring 13, its spring members 18 yield in such a way that the opening of the spring ring 13 increases in size. At the same time, the spring members 18 become stressed and direct thus spring force at the outer periphery 14 of the tail tube 3 of the tail 4 of the mortar shell 1 placed in the opening 14, as shown in Figure 2. Further, in accordance with Figure 2, these spring members 18 are shaped such that their ends have been bent toward the bottom of the support element 8, whereby the tail 4 of the mortar shell can be easily placed in the spring ring 13 but due to the effect of the spring force generated, removing the mortar shell 1 from the spring ring 13

requires considerably more force.

[0017] In an alternative embodiment of the spring ring 13, shown in Figure 3, the slots may be provided such that they yield when receiving the guiding fins 5, whereby they become stressed and direct spring force at the guiding fins 5. In other words, when receiving the guiding fins 5, the slots open, directing spring force at the guiding fin 5 surfaces which are in the direction of the longitudinal axis of the mortar shell 1. Also in this case, the spring members 18 may be shaped such that the tail 4 of the mortar shell can be easily placed in the spring ring 13 but that due to the spring force generated, removing the mortar shell 1 from the spring ring 13 requires considerably more force. Thus, the slots of the spring ring 13 receive the guiding fins 5 relatively easily but, at the same time, the spring ring 13 directs spring force at the guiding fins 5, due to which removing the mortar shell 1 from the spring ring 13 requires considerably more force.

[0018] In yet another embodiment, the spring ring 13 may be provided such that the preceding embodiments are combined, in which case placing the tail tube 3 in the opening of the spring ring 13 generates spring force directed at the outer surface 14 of the tail 4 and, at the same time, placing the guiding fins 5 in the slots 16 generates spring force directed at the guiding fins 5. Referring to the above, it is to be noted that the spring ring 13 may be any type of ring capable of generating spring force directed at the tail 4 of the mortar shell 1 when receiving at least part of the tail 4 of the mortar shell 1.

[0019] Figure 4 shows another embodiment of the present invention in which the connecting means comprise one or more laminated rings 20. In the embodiment of Figure 4, the connecting means of the support member 8 comprise an attachment sleeve 21 and a tension sleeve 23 joined to it. The attachment sleeve 21 may be attached to the support member 8 for example with threads or in a fixed manner, or in another mechanical manner. In Figure 4, two laminated rings 20 have been placed in the space inside the tension sleeve 23. One or more support plates or base plates may be placed (not shown) may be placed between the laminated rings or on the front and/or rear side. The diameter of the hole of the tension sleeve 23 is such that the tension sleeve 23 is capable of receiving the tail tube 3 of the mortar shell 1 or a head part 25 of the tail tube. One embodiment of the laminated ring 20 is shown in Figure 5. The diameter of an opening 24 of the laminated ring 20 inside the tension sleeve 23 is smaller, at least slightly, than the outer diameter of the tail

tube 3 of the mortar shell 1 or the outer diameter of the head part 25. Thus, when the mortar shell 1 is pushed into place in the support member 8, the laminated ring 20 and particularly its lamellas 22 yield and direct spring force at the tail tube 3 of the mortar shell 1 or at the head part 25, the spring force attaching the mortar shell 1 to the support member 8. The diameter of the openings of the support plates and base plates substantially corresponds to the outer diameter of the tail tube 3 of the mortar shell 1 or the outer diameter of the head part 25, whereby they do not direct any resistance or force at the mortar shell.

[0020] As mentioned above, the connecting means 10 preferably comprise one or more laminated rings 20, depending on the magnitude of the desired spring force or on the force required for attaching the mortar shell. The inner periphery of the laminated ring 20 is, in accordance with Figure 5, divided into adjacent lamellas 22 capable of yielding. The number of lamellas 22 and thus the length in the direction of the periphery and in the direction of the radius of the periphery may vary according to the need so that the desired spring force can be generated. The lamella rings 20 may be manufactured of a steel plate by cutting or in another corresponding manner, or of another corresponding material.

[0021] Figure 6 shows schematically an embodiment according to the present invention, where the connecting means 10 of the support element 8 comprise a flexible part 30. Further, a counterpart 32 is provided at the end of the tail tube 3 of the tail 4 of the mortar shell 1. The flexible part 30 is arranged to receive the counterpart 32 in such a way that the flexible part 30 yields, directing spring force at the counterpart received for attaching the mortar shell 1 to the support member 6. In the case of Figure 6, the flexible part is a sleeve-like connecting part 30 caused to yield in a direction transverse to its longitudinal axis when receiving the counterpart 32. The counterpart 32 is provided at the tail 4 of the mortar shell and particularly at the end of the tail tube 3 in accordance with Figure 6. In this embodiment, the connecting part 30 is comprised of several flexible claw-like parts arranged on a circular arch to provide a sleeve-like connecting part.

[0022] In the embodiment of Figure 7, the sleeve-like connecting part 30 receives the counterpart 32 to the inside of it. The counterpart 32 comprises a cone opening away from the tail 4 of the mortar shell. This cone facilitates placement of the mortar shell 1 correctly in the support member 6. Fur-

ther, the cone of the counterpart 32 is pressed against the inner walls of the sleeve-like connecting part 30 as the counterpart 32 becomes placed inside the connecting part 30. Pressing and yielding, the connecting part 30 becomes stressed and simultaneously directs spring force at the outer surface of the counterpart 32 being placed inside it to attach the mortar shell to the support member 6. To achieve the above, the counterpart 32 is dimensioned such that its outer diameter is at least partly greater than the inner diameter of the connecting part 30, whereby the connecting part 30 is forced to yield when the counterpart 32 becomes placed inside it. In a preferred embodiment, the connecting part 30 is pushed into the inside of the counterpart 32 so far that the upper surface of the connecting part 30 passes the cone of the connecting part 32. Thus, the sleeve-like connecting part 30 is tightly placed inside the counterpart 32 and does not tend to get out. The conical shape of the counterpart 32 also allows the counterpart to snap into place inside the connecting part 30, as shown in Figure 7, whereby the mortar shell is not easily detached from the support member 8.

[0023] The counterpart 32 may be provided at the end of the tail tube 3 of the tail 4 of the mortar shell, in which case it is an extension of the tail tube 3 or a part of the tail tube 3. In an alternative embodiment, the counterpart 32 may simply be merely an end of the tail tube 3, left hollow, whereby it forms the counterpart 32.

[0024] The spring force directed at the counterpart 32 by the connecting part 30 can be further increased by means of one or more spring elements (not shown) installed in the connecting part. The spring elements may be individual springs placed on the outer surface of the connecting part 30, or alternatively a spring may be placed around the outer periphery of the connecting part 30. Alternatively, the counterpart 32 may be shaped and provided in such a way that it becomes placed around the connecting part 30, whereby the spring force of the flexible connecting part 30 is directed at the inner surface of the counterpart 32. The counterpart 32 may be the head part 25 of the tail 4 of the mortar shell 1.

[0025] With reference to the above, it is to be noted that both the spring ring receiving the mortar shell tail or a part of to the inside of it and the flexible connecting part receiving around it the counterpart provided at the tail may be shaped and modified in a plurality of ways. In other words, it is essential to the present invention that the mortar shell is attachable to the support

member by means of spring force. The spring force is generated by a flexible part provided in the support element and arranged to yield when the mortar shell is attached to the support member. Further, it is to be noted that in some cases the mortar shell can be attached to the support member 8 by means of two or more embodiments described above.

[0026] It will be obvious to a person skilled in the art that as the technology advances, the basic idea of the invention can be implemented in a plurality of ways. Thus, the invention and its embodiments are not restricted to the above examples but may vary within the scope of the claims.

CLAIMS

1. A support member for supporting a mortar shell into a breech-loading weapon barrel, the support member comprising a support element with an edge flange and a firing mechanism for firing the actual primer of the mortar shell and further comprising connecting means for attaching the support element to a tail of the mortar shell, the tail comprising guiding fins, characterized in that the connecting means for attaching the support element to the tail of the mortar shell comprise at least one flexible part arranged to direct spring force at one or more guiding fins forming a part of the tail of the mortar shell.

2. A support member according to claim 1, characterized in that the flexible part is arranged to direct spring force at the outer periphery of the tail of the mortar shell.

3. A support member according to claim 2, characterized in that the flexible part comprises a spring ring arranged to receive the tail of the mortar shell in such a way that it directs spring force at the outer periphery of the tail of the mortar shell.

4. A support member according to claim 2, characterized in that it comprises one or more laminated rings comprising, on its periphery, two or more adjacent lamellas and arranged to receive the tail of the mortar shell in such a way that one or more lamellas of the laminated ring direct spring force at the outer periphery of the tail of the mortar shell.

5. A support member according to claim 3, characterized in that the flexible part comprises a spring ring with slots arranged to receive one or more guiding fins forming a part of the tail of the mortar shell such that it directs spring force at one or more guiding fins forming a part of the tail of the mortar shell.

6. A method for attaching a support member to a mortar shell, the method comprising:

arranging in the tail of the mortar shell a support member which comprises a support element; and

attaching the support member to the tail of the mortar shell, characterized by attaching the support member to one or more guiding

fins forming a part of the mortar shell tail by means of one or more flexible parts in such a way that when receiving the mortar shell tail, the flexible part directs spring force at one or more guiding fins forming a part of the mortar shell tail.