ABSTRACT

The invention relates to an assembly comprising a self-propelled finned projectile and its case that is successively used as a container and as a launching tube. This assembly is fitted at its rear end with an insertable member which can be ejected under the effect of the thrust of the propellant gases of the projectile and which locks at least one movable part of a coupling, that is carried by the rear end of the said projectile, to a fixed part of this coupling that is carried by the rear end of the case. All the elements of this fixed coupling part which projects into the interior of the case are ejected under the effect of the thrust of said gases.

12 Claims, 20 Drawing Figures
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ASSEMBLY COMPRISING A SELF-PROPELLED FINNED PROJECTILE AND ITS CASE

Developments in the firing of self-propelled projectiles from container cases have led to efforts to find the most appropriate means for fixing them in a safe manner in a predetermined longitudinal position until they are used. This mechanism for retaining the projectile should be unaffected by vibrations and impacts applied in any direction, so that it ensures safety should the assembly be dropped during the transportation and handling operations.

If this container tube also performs the function of a launching tube, this retaining means should be capable of readily releasing the projectile at the moment of firing without causing reaction on the launching tube, either as a result of its own mechanical functioning or under the effect of the rush of gases, the free movement of which it might possibly impede.

This absence of reaction on the launching tube is particularly important for firing from the shoulder in the case where the container tube constitutes all or part of a weapon intended for use by the infantry. For the same reason this essential quality enables the weight of any supports or mountings used in aiming to be reduced as much as possible.

In arrangements that have already been proposed to solve this problem, certain retaining means constituted by pins, screws, shear discs etc. are made oversized at the weakest part so as to prevent them from failing prematurely under the effect of vibrations, bending, twisting, impacts etc., so that a greater shear force is thus required at the moment of separation.

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Other arrangements for solving the problem of retaining the projectile involve reductions in the cross-section of the rear portion of the container tube, which reduced portions, impeding movement of the propellant gases, cause a considerable reaction in the rearward direction.

The object of the invention is to provide an assembly comprising a self-propelled finned projectile and its case, which is used successively as a container and a launching tube, the assembly being characterized in that it is fitted at its rear end with an integrable member which can be ejected under the effect of the thrust of the propellant gases of the projectile and which locks at least one movable part of a coupling, that is carried by the free end of the latter, to a fixed part of this coupling that is carried by the rear end of the case, all elements of this fixed coupling part projecting into the interior of the case being ejected under the effect of the thrust of said gases.

The attached drawing illustrates by way of example one form of construction of the assembly according to the invention and 13 modified forms of this assembly.

FIG. 1 of the drawing is a general arrangement view, partly in axial and truncated section, showing the projectile in its case.

FIGS. 2 and 3 are axial sections of part of the arrangement seen in FIG. 1 and illustrating respectively the detachment of the integrable member and the base of the case and the release of the coupling of the projectile from the case after the projectile has been fired.

FIGS. 4 to 9, 11, 12, 14 to 17 and 19 are views of parts of modified forms, each of which illustrates in axial section a variant of the coupling of the projectile to the case.

FIG. 10 is a cross-section on line X—X of FIG. 9.

FIG. 13 is a view of part of the arrangement seen in FIG. 12 and illustrates a fin in elevation.

FIG. 18 is a section on line XVIII—XXVIII through a detail seen in FIG. 17.

FIG. 20 is a cross-section on the line XX—XX through the modified form shown in FIG. 19.

As shown in FIG. 1, the assembly according to the invention comprises a self-propelled finned projectile 1 and its case 2 which is used successively as a container for storing and transporting the projectile, and as a launching tube for the latter.

The case 2 comprises a tubular body 3, a front cover 4 and a rear cover 5. The projectile 1 comprises a forward explosive charge located at 6 and a rear propellant charge located at 7. A venturi 8 enables the propellant gases to escape at the rear of the projectile after the propellant charge 7 has been set off. The fin system comprises fins 9 hinged on a collar 10 and pressed back on the venturi 8 against the action of return springs, not illustrated, while the projectile is contained in the case 2. On that of its sides presented to the wall of the tubular body 3 of the case, each of the fins 9 has a projection 11 which engages in a slot 12 cut in the wall of the tubular body 3 of the case opposite said projection 11.

Each of the slots 12 is reinforced by a metal part 13 which contains a cavity opposite the slot 12 and is fitted on the outer surface of the tubular body 3 of the case 2, said metal part on the one hand reinforcing said slot 12 and on the other closing it on one side. An insertable member constituted by a cap 14 is fitted over the opening in the venturi 8 and when so fitted its edge 15 is inserted between the outer wall of the venturi 8 and the free end of each of the fins 9 forming the fin system of the projectile 1. The fins 9 are thus pushed against the wall of the tubular body 3 and their projections 11 are locked in the engaged position in the corresponding slot 12 in the case. These projections 11 constitute the movable part of a coupling, the fixed part of which is constituted by the corresponding slots 12 in the case and their metal reinforcement 13. This coupling of the rear end of the projectile 1 to the rear end of the case 2 is locked by the cap 14 when its edge 15 is inserted between the outer wall of the venturi 8 and the free ends of the fins 9.

As illustrated in FIG. 2, when the propellant charge 7 of the projectile 1 is fired, the cap 14 is ejected by the thrust of the propellant gases of the projectile 1 escaping through the venturi 8, and the rear cover 5 is likewise ejected. Since the edge 15 of the cap 14 is no longer inserted between the outer wall of the venturi 8 and the free ends of the fins 9, the coupling of the projections 11 on the fins with the slots 12 in the wall of the tubular body 3 of the case 2 is disconnected, and as illustrated in FIG. 3, the projectile 1 will move forward without the propellant gases causing any reaction on the body 3 of the case 2.

It should be pointed out that, because of the principle upon which is based, the coupling described undergoes no reaction opposing its retaining force in the locking position, which force should be directed only against vibrations or the inertia-mass forces of the cap 14 which could occur as the result of dropping of the assembly or impacts during transport and the various handling operations.

When the shot is fired, the cap 14, pushed away by the gases, become disconnected from the venturi 8 and so releases the fins 9. Before this release is complete,
the venturi 8 and the cap 14 will each have travelled a certain distance in opposite directions, which distance will obviously be proportional to their inertia. For the purpose of offsetting the reaction on the launching tube 2, that could be caused by slight displacement of the projectile 1 before the cap 14 is completely disengaged, the bearing edge 15 of the cap 14 is tapered. This tapered form enables the fin 9 and the coupling to begin to detach themselves from their locking means as soon as displacement of the cap commences. This disengagement is further facilitated by the tapered form of projections 11 on the fins 9 and of the cavities in the metal reinforcements 13, the sloping portions of which form retention means and at the same time a ramps release means. For the purpose of fulfilling this double function, the angle of slope is carefully selected so as to avoid all reaction particularly in the direction in which disengagement takes place.

It is obvious that a large number of variations in the form of construction of the above-described assembly can be envisaged. As illustrated in FIG. 4, the cap 14 may be replaced by a plug 16, which is fitted in the end of the venturi 8 and comprises an edge 17 which pushes the fins 9 towards the wall of the tubular body 3 of the case so as to lock the projections 11 on said fins 9 in corresponding slots 12 cut in said wall of the tubular body 3 of the case. It will be seen that in this modified form, the free end of the fins 9 extend beyond the end of the venturi 8 so as to lie against said edge 17 of the plug 16. Also, an annular recess 18 is formed in the inner face of the wall of the venturi 8, and the plug 16 has a peripheral rib 19 which engages in said recess 18 in the venturi 8 to hold it in its operating position until the projectile is fired.

In the modified form illustrated in FIG. 5, the cap 14 and the rear cover 5 of the case are formed as a single piece 20 and the end of the edge 15, engaging on the end of the venturi, has a peripheral thinned portion 21 which engages in a peripheral recess 22 in the outer face of the wall of the venturi 8 so as to be retained therein in the active position until the projectile is fired.

In the modified form illustrated in FIG. 6, the plug 16 (see FIG. 4) and the rear cover 15 of the case are made as a single piece 23.

In the modified form illustrated in FIG. 7, the fins 9 extend beyond the end of the venturi 8 and are held in the position in which their projections 11 engage in the corresponding slots 12 in the wall 3 of the case by an inner, concentric protuberance 24 which constitutes the rear cover 5 of the case.

FIG. 8 illustrates a modified form in which said slots 12 are formed in a metal ring 25 fitted on the rear end of the case and forming an extension of its tubular body 3. It will be seen that in this embodiment there are provided fins 9 each of which has at its free end a nose at right-angles to said metal ring 25, this nose forming the projection 11 on each fin and thus contributing to better retention of the projectile in the rearward direction.

FIG. 9 illustrates a modified form in which the slots 12 formed in the wall of the tubular body 3 of the case and facing said projections 11 are reinforced by an outer metal clamping ring having complementary swaged lipped portions 27 which engage in said slots 12 (see FIG. 10).

FIG. 11 illustrates a modified form in which the fixed part of the coupling in which the projections 11 on the fins 9 are locked is constituted by a circular recess 28 formed opposite said projections 11 in the inner face of the wall of the circular body 3 of the case. In this embodiment too, the cap fitted on the end of the venturi and its edge 15 inserted between the outer wall of the venturi 8 and the free ends of the fins 9 of the projectile form a single piece 20 with the rear cap of the case.

It will be noted that the diameter of the rear end of the case in the zone closed by said cover 20 is greater than the diameter of the body 3 of the case, and the effect of this is further to reduce any possible reaction on the body of the case resulting from the thrust of the gases likely to be released in the recess 28 when the shot is fired.

In the modified form illustrated in FIG. 12, the fixed part of the coupling that is carried by the rear end of the case is constituted by a resilient ring 32, which can be ejected under the effect of the thrust of said propellant gases, this ring being lodged in a circular recess 33 formed in the inner face of the tubular body 3 of the case. The movable part of the coupling is constituted, in this embodiment, by a slot 30 in each fin 9 and on that of its sides opposite the wall of the tubular body 3 of the case (see FIG. 13). In the locked position of the coupling, the slots 30 in the fins 9 bear against the resilient ring 32, the latter however being ejected by the thrust of the propellant gases of the projectile 1 immediately after the latter has been fired, due to the fact that it is no longer retained in the recess 33 by said fins 9 once the cap 14 of the venturi 8, the edge 15 of which locks the coupling, has itself been ejected by the thrust of the gases. Instead of the ejectable resilient ring 32, the fixed part of the coupling may take the form of small rivets which project into the interior of the case opposite slots 30 in the fins of the projectile. Such rivets, fitted in the wall of the tubular body 3 of the case, offer only minimum resistance to the thrust of the gases and this is converted only into a negligible reaction on the case.

In the modified form shown in FIG. 14, which relates to a projectile, the fins of which are folded over towards the front, the movable parts of said coupling are constituted by elements 34 which are hinged by their front ends on hinge-pins on the fins 9 mounted on the collar 10, said elements 34 being arranged along the venturi 8 and each having a projection 35 on that of its sides presented to the tubular wall of the body of the case 3, each projection 35 being located near the free end of the element 34 and opposite a corresponding slot 12 in the body of the case 3, and each slot being provided with a metal reinforcement 13. The above-described coupling is locked by inserting the edge 15 of a removable cap 14 between the outer wall of the venturi 8 and the free ends of said elements 34, the cap 14 closing the free end of the venturi 8.

In the modified form shown in FIG. 15, spring blades 36 curved to form a portion 37 which projects laterally towards slots 12 in the wall of the case are secured by their forward ends to the venturi 8 of the projectile. In this case too, the locking of the coupling is achieved by inserting, between the outer wall of the venturi 8 and the free ends of said spring blades 36, the edge 15 of a removable cap 14 which closes the free end of the venturi 8.

In these last two modified forms, the slots 12 in the wall of the tubular body 3 are reinforced by a metallic part 13 containing a cavity facing each of the slots and
said metallic part being fitted on the outer face of said tubular body 3 of the case 2. As illustrated in FIG. 16, a spring blade 38, curved to form a portion 39 projecting laterally towards a slot 12 opposite the wall of the case may also be detachably hinged by one of its curved ends to engage in a slot contained in each of the fins 9 of a fin system folded over against the venturi 8 towards the rear of the projectile. The free end 40 of each of the said spring blades may be pressed against the wall of the case by an internal concentric protuberance 41 forming part of the rear cover 5 of the case, so that said lateral projection 39 on each blade 38 will be located in the locking position in the corresponding slot 12 in the wall of the case. The advantage of this latter arrangement resides in the fact that when the projectile 1 is fired and it leaves the case 2, the spring blades 38 become detached from the fins 9 while the latter are spreading out.

Another modified form, employing a detachable intermediate retaining element 42 in the case of a fixed fin system, is illustrated in FIGS. 17 and 18. This element 42 is constituted by a blade which is folded over on to itself and the ends of which, remote from the zone of the fold, are connected by being held a certain distance apart by a rivet 43 adapted to engage in a slot 44 formed for the purpose in each of the fins 9 of said fixed fin system. A lateral projection 45 forming part of said element 42 occupies a position opposite a slot 12 in the wall of the tubular body 3 when said element 42 is suspended by its rivet 43 from a fin 9 and when the projectile 1 is placed in the required position inside the case 2. In this position, the coupling is locked by the edge 17 of a plug 16 which is fitted in the venturi 8 as illustrated in the drawing. Preferably, each of the slots 12 is closed on one side by a metal part 13 fitted on the outer face of the tubular body 3 of the case and containing a cavity presented to said slot 12. When the projectile 1 leaves the case 2, the elements 42 become detached under the effect of the gyration of the projectile or as a result of air friction.

The modified form illustrated in FIGS. 19 and 20 relates to a projectile, fins 9 of which when folded are turned over laterally against the venturi 8 about a spindle 46 parallel with the axis of the venturi. Each of the fins 9 has at the rear portion of its free edge opposite the wall of the tubular body of the case a projection 11 adapted to engage in a slot 12 in the wall of the case, which wall is reinforced by a metal part 13 containing a cavity presented to said wall. This coupling is locked by the edge 48 of the plug 47 of the venturi 8. It will be seen that in this form of construction, the plug 47 contains a large axial opening 49 which does not however prevent it from being ejected by the propellant gases of the projectile.

The above-described variations provide an idea of the diversity of the possible forms of construction, and it is obvious that certain details of the methods of reducing the invention to practice and present in one of the modified forms described can be readily combined with other details present in other modified forms whether described or not.

The case for the assembly described is used successively as a container for storing and transporting the projectile and as a tube for launching the projectile.

The means for retaining the projectile in its case, as described, enables safety to be ensured if the assembly is dropped, and it opposes all loads and stressed tending to cause the projectile to move out of the case or to displace it longitudinally in the case, until the shot is fired, at which moment it releases the projectile without causing any reaction on the launching tube. It does not comprise any screw, pin or shear disc etc., nor any protrusion on, or reduction of cross-section in the launching tube that could interfere with the rush or flow of the gases. The essential locking element is constituted by an insertable member which totally or partially closes only the tube, or only the venturi, or the two together. In all cases, this insertable member, whatever its shape or position, comprises a conical or cylindrical portion forming a stop for movable elements for retaining the projectile, which elements are solidly associated with the container tube as a result of the presence of this stop.

These movable elements may be constituted either by the spreadable fins themselves or by intermediate parts fitted on said fins, or hinged to the venturi or any other rear portion of the projectile. The ends of these elements are provided with projections or slots enabling them to engage in cavities or with ejectionable protuberances retained temporarily by the wall of the launching tube (see the various modified forms), thus ensuring that they are immobilized in the longitudinal direction and also in some cases immobilized against rotation. It is obvious that all the modified forms of the insertable member may be combined with all the various forms of the retaining arrangement, so that a large number of combinations is provided.

The primary purpose of the insertable member is to ensure that the projectile is released when said member is ejected by the rush of gas.

The advantages of the retaining means forming part of the assembly described are as follows:

It enables all the other kinds of wedging means ordinarily used to be dispensed with, for example those fitted forwardly of the shell-cap.

The rear base is opened automatically when the shot is fired, without any reaction on the weapon assembly and its case.

Consequently, it effects a saving in the manual operation of opening the rear cover of the case.

It ensures that the assembly is properly sealed prior to the firing of the shot.

During transport and handling operations, it provides greater safety against the effects of the assembly being dropped.

It is suitable for all possible forms of electrical connection for igniting the propellant.

Its very low inertia, further reduced by fragmentation when the shot is fired, does not increase recoil.

It is very inexpensive to produce and furthermore it facilitates the manufacturing and assembly operations.

Because it is simple to dismantle and re-assemble, it greatly facilitates inspection and stock control.

I claim:

1. An assembly comprising a self-propelled finned projectile and its case that is successively used as a container and as a launching tube characterized in that it is fitted at its rear end with an insertable member which can be ejected under the effect of the thrust of the propellant gases of the projectile and which locks at least one movable part of a coupling, that is carried by the rear end of the projectile, to a fixed part of this coupling that is carried by the rear end of the case, all the elements of this fixed coupling part projecting into the
interior of the case being capable of ejection under the effect of the thrust of said gases, said movable part of said coupling being carried by fins of the projectile, said fins being pivotally mounted on the case and folded over toward the rear, said insertable member pushing the free ends of the fins against the wall of the case.

2. An assembly according to claim 1, characterized in that said movable part of said coupling is constituted by a projection which is carried on at least one of said fins on that of its sides presented to the side wall of the case.

3. An assembly according to claim 1, characterized in that said movable part of said coupling is a slot contained in at least one of the fins on that of its sides presented to the wall of the case.

4. An assembly according to claim 1, characterized in that the projectile has a venturi and the free end of each of said fins extends beyond that of the venturi, and in that the ejectable insertable member is constituted by a plug which is fitted in the end of the venturi and is provided with an edge which pushes said fins towards the wall of the case.

5. An assembly according to claim 4, characterized in that said plug and the rear cover of the case are formed as one piece.

6. An assembly according to claim 4, characterized in that said plug contains at least one orifice in its central portion.

7. An assembly comprising a self-propelled finned projectile and its case that is successively used as a container and as a launching tube characterized in that it is fitted at its rear end with an insertable member which can be ejected under the effect of the thrust of the propellant gases of the projectile and which locks at least one movable part of a coupling, that is carried by the rear end of the projectile, to a fixed part of this coupling that is carried by the rear end of the case, all the elements of this fixed coupling part projecting into the interior of the case being capable of ejection under the effect of the thrust of said gases, said fixed part of the coupling being a notch formed in the wall of the case opposite said movable part of the coupling and said movable part of the coupling being constituted by a projection.

8. An assembly comprising a self-propelled finned projectile and its case that is successively used as a container and as a launching tube characterized in that it is fitted at its rear end with an insertable member which can be ejected under the effect of the thrust of the propellant gases of the projectile and which locks at least one movable part of a coupling, that is carried by the rear end of the projectile, to a fixed part of this coupling that is carried by the rear end of the case, all the elements of this fixed coupling part projecting into the interior of the case being capable of ejection under the effect of the thrust of said gases, said projectile having a venturi and said insertable ejectable member being constituted by a cap fitted on the end of the venturi, the edge of said cap being inserted between the outer wall of the venturi and fins on the projectile which are folded toward the venturi.

9. An assembly comprising a self-propelled finned projectile and its case that is successively used as a container and as a launching tube characterized in that it is fitted at its rear end with an insertable member which can be ejected under the effect of the thrust of the propellant gases of the projectile and which locks at least one movable part of a coupling, that is carried by the rear end of the case, all the elements of this fixed coupling part projecting into the interior of the case being capable of ejection under the effect of the thrust of said gases, said fixed part of the coupling being a notch formed in the wall of the case opposite said movable part of the coupling and said movable part of the coupling being constituted by a projection, said notch being reinforced by an outer metallic ring.

10. An assembly comprising a self-propelled finned projectile and its case that is successively used as a container and as a launching tube characterized in that it is fitted at its rear end with an insertable member which can be ejected under the effect of the thrust of the propellant gases of the projectile and which locks at least one movable part of a coupling, that is carried by the rear end of the case, all the elements of this fixed coupling part projecting into the interior of the case being capable of ejection under the effect of the thrust of said gases, said fixed part of the coupling being a notch formed in the wall of the case opposite said movable part of the coupling and said movable part of the coupling being constituted by a projection, said notch being reinforced by an outer metallic part in which is formed a corresponding housing and which closes said notch on one side.

11. An assembly according to claim 10, characterized in that said cap and the rear cover of the case are formed as one piece.

12. An assembly according to claim 10, characterized in that said cap contains at least one orifice in its central portion.