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VANED PROJECTILE

Jean Wauters, Brussels, Belgium; vested in the
Alien Property Custodian

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The present invention relates to improvements in vaned projectiles and more especially to those intended to be fired from muzzle-loaded guns or mortars.

It is a known fact that, in order to increase the steadiness of such projectiles along their trajectory, it is advisable to set the centre of gravity as far forward as possible. With this object in view it has been proposed to make the vanes of aluminium or some other substance lighter than the body of the shell which is usually made of cast iron or steel.

When the projectile is provided at the rear with a tail containing the propelling charge, a known means of setting the centre of gravity forwards consists in arranging said tail in such a way that it may become detached from the shell when the shot is fired.

The improvements according to the invention apply more especially to a detachable tail vaned projectile of this nature and are remarkable, in particular, owing to the fact that friction means are applied to temporarily fix said tail to said body up to the moment of firing. According to an embodiment of the invention, said charge-bearing tail is provided with a conical end capable of engaging with a correspondingly shaped recess provided at the rear of the body; the tail being moreover provided with a flange shaped in such a way that when the tail is rotated in its recess, increased friction is applied on the fins of the vane system so as to secure the tail on the shell until it is fired. This method of attachment ensures the correct release of the tail in the gun itself and its ejection immediately after the projectile has issued from the muzzle, through the action of the sudden depression which then occurs in the bore.

According to another peculiarity of the invention, the contour of the portion of the projectile forward of the main diameter and the contour of the fuze are of a shape such, that along a length comprised between one and a half and three times the calibre, the combination forms a concavo-convex contour in which the front concave portion and the rear convex portion merge tangentially.

Experience shows that this peculiar form of the front end of the projectile considerably facilitates its travel through the air by reducing drag; it should be noted that said result has been registered when firing at initial speeds less than those of sound for which projectiles with a more stubby nose: ovoid, elliptic or parabolic, had hitherto been considered as being best.

A further feature of the invention is that the concavo-convex portion of the projectile merges directly with the rear portion of decreasing diameter and the length of the rear portion, up to the point of origin of the vanes, is between 1 and 3 calibres.

The length of the vanes themselves varies between three quarters of the calibre and one and a half calibres.

In one form of embodiment, the vanes are supported by a ring secured to the base of the shell and provided with a conical portion into which the charge bearing tail is fitted.

A further feature of the invention is that the gun-powder relay which ensures the ignition of the detonator is separated from it by a thin stamped gas-check cup or sheath the edges of which, folded back on a plastic washer, are set in a groove of the eye of the projectile.

With this arrangement, the usual screwed relay sheath and sheath head are suppressed which relieves the projectile of an appreciable dead weight load.

Other advantages and peculiarities of the invention will appear in the following description.

In the attached drawing which is given merely as an example:

Figure 1 is an axial section of a projectile embodying the improvements according to the invention;

Figure 2 is an end view;

Figure 3 is a view similar to that in Fig. 2 showing the appearance of the rear of the shell after the tail has been discarded;

Figure 4 is a plan view of an additional propelling charge.

According to the example illustrated, the projectile comprises a body 1 to the front portion of which is fitted a fuse 2 while the rear is fitted with a set of vanes 3 solid with a ring 4 which is screwed onto a threaded teat 5 provided on the base.

The vane blades 3 are preferably slightly inclined with respect to the longitudinal axis of the projectile (less than 4 degrees) in order to impart to it a very slow gyratory motion along its trajectory.

Ring 4 is provided with a conical recess 6 into which penetrates the correspondingly shaped end 7 of a charge-carrying tail 8. A cartridge 9, or some other propelling charge is introduced into the charge-carrying tail for the purpose of igniting additional charges 11 of annular construction, as shown in Figure 4, through radial holes 10.

A varying number of said relays 11 is positioned on tail 8 according to the range desired when this cannot be obtained by means of the cartridge alone.

A flange 12 (Figs. 1 and 2), the outer contour of which assumes the form of eccentric sectors 13 engaging with the inner edges of vanes 13, is secured to tail 8 by welding 12a or other means. In the present example, the distance in a plane perpendicular to the axis of the tail of said axis to the several points of the outline of each sector increases, in the case of each one of them, in a counter-clockwise direction. It is therefore sufficient to rotate the tail in the opposite direction to determine an increasing pressure on vanes 3, by means of flange 12, which pressure is utilised to hold the tail in position. Flange 12 bears against a correspondingly shaped cut 14 (Fig. 3) provided in blades 3 of the set of vanes.

Forward of the main diameter, the projectile and its fuse are shaped in such a manner that their outline assumes a concave contour 15 in front and a convex contour 16 at the rear, the concave and convex portions merging tangentially at point 17, their combined length being between one and a half and three calibres.

On the example shown in the drawing, the total length of the front portion up to the main diameter is approximately 2 calibres and the inflexion point 17 is positioned at approximately 1 calibre from the main diameter. At the rear of said main diameter, the extension 18 of the projectile is of decreasing diameter, the length of which measured up to the point of origin of the vanes is between 1 and 3 calibres. The curve of said rear portion merges tangentially with that of the fore part in proximity to the main diameter.

The length of the vanes is between 0.75 and 1.5 calibres. The blades may be comparatively thin and may be suitably shaped to reduce drag.

Slightly to the rear of the main diameter the projectile is provided, in the known manner, with a groove 19 housing an expanding leak-proof driving band 20 (a split brass ring for instance).

The fuse, the mechanism of which is not shown, causes the ignition of a detonator 22, which consists of an explosive more powerful than the charge of the projectile, through a secondary primer 23 and a conical relay 24 which is separated from the detonator by a thin stamped cup or sheath 25 to prevent leakage. The edges 26 are folded over a plastic washer 27, and are set in a groove 28 of the eye of the shell.

When the fuse 2 is screwed home, it bears on rim 26 of sheath 25 which it secures in position. Secondary primer 23 and relay 24 can with advantage be positioned in a block 29 rotatably fitted in the body of the fuse.

Two channels are drilled through said block, one of which, 30, is empty while the other, 31, contains a pastille 32 of delay-action compound. According to the position given to block 29, one or other of said channels is brought into communication with the firing channel 33 of the fuse so that instantaneous or delayed fire is obtained on impact.

When the projectile is fired from a muzzle loaded smooth bore mortar, the barrel being inclined with respect to the horizon by the desired angle, the projectile, fitted with its cartridge 9 and, in case of need, with its relays 11, is inserted into it. The shell slides into the bore by gravity and, on reaching the bottom, the cartridge strikes the firing pin which protrudes from the breech

and deflagrates and ignites relays 11 through holes 10, the gases of the latter combining with those of the main charge to provide propulsion. The driving band 20 rising along ramp 19 provides a leak-proof joint between the bore and the shell. The tail separates from the projectile upon firing. In case of need, holes might be drilled through flange 12 to give the required intensity to the ejecting effect.

The centre of gravity of the projectile, when relieved of its tail, is moved considerably forward of the position it occupies in the fixed tail projectiles generally in use up to the present. Its steadiness is appreciably improved thereby, thus increasing the accuracy of fire to a great extent. The absence of a tail also contributes to the flight of the shell as the air stream can close freely between the vanes. On the other hand, the capacity in explosive and the offensive value remain the same as in the usual fixed tail type.

The vanes which are slightly inclined with respect to the longitudinal axis of the projectile also contribute to greater precision by remedying any defects in the symmetry of the shell which are compensated by its slow rotational speed along the trajectory.

The reduction in weight of the projectile procures a reduction in the energy of the recoil which is usually applied to a base plate laid on the ground. It is therefore possible to make this plate lighter and smaller which facilitates the transportation thereof.

It should be noted that the vane assembly and the removable tail above described can be fitted to existing projectiles in lieu of the usual fixed tail with a view to improving their ballistic qualities.

The inflexed curvature of point 15, 16 ensures percussion even under low angles of impact at which percussion could not be obtained with a convex or more stubby front portion.

It is to be understood that the invention has been shown and described only as an example and that it is capable of various modifications without departing from the spirit of the invention.

I claim:

1. A projectile comprising a body, a tail for carrying a propelling charge, means for centering said tail along the longitudinal axis of said body and rearwardly of said body, a radially extending flange solid with said tail, stabilizing blades fixed at the rear of said body, the outer contour of said flange assuming the form of eccentric sectors engaging the inner edges of the blades and adapted to exert an increasing pressure thereon when the tail is rotated in an appropriate direction about its longitudinal axis whereby the tail is temporarily fixed to the body, said tail being adapted to be detached from the shell at firing.

2. A projectile comprising a body presenting externally at its rear end an inwardly tapering conical recess, a tail for carrying a propelling charge, said tail having a conical front end corresponding in shape to the conical recess of the body and engaging that recess, stabilizing blades fixed at the rear end of said body, a flange solid with said tail, the outer contour of said flange assuming the form of eccentric sectors engaging the inner edges of the blades and adapted to exert an increasing pressure thereon when the tail is rotated in an appropriate direction in the recess, said tail being adapted to be detached from the shell at firing.

3. A projectile comprising a body, a ring fixed to the rear end of said body and formed with an inwardly tapering conical recess, externally extending stabilizing blades on said ring, a tail for carrying a propelling charge, said tail having a conical front end corresponding in shape to the conical recess in the ring and engaging said recess, a flange solid with said tail, the outer contour of said flange assuming the form of eccentric sectors engaging the inner edges of the blades and adapted to exert an increasing pressure thereon when the tail is rotated in an appropriate direction about its longitudinal axis whereby the tail is temporarily fixed to the body, said tail being adapted to be detached from the shell at firing.

4. A projectile comprising a body having stabilizing blades fixed adjacent the rear end thereof, a tail structure carrying a propelling charge and disposed axially of said body and inwardly from the inner edges of the blades, and means including cam-shaped surfaces projecting sub-

stantially radially from the tail structure and engageable with increasing pressure on the inner edges of the blades upon appropriate rotation of the tail structure for temporarily fixing the said tail structure to said body up to the moment of firing whereby to permit the tail structure to be detached from the body at firing.

5. A projectile comprising a body having stabilizing blades fixed adjacent the rear end thereof, a tail structure carrying a propelling charge and disposed axially of said body and inwardly from the inner edges of the blades, the inner edges of said blades being provided with cut-out portions, and flange means extending substantially radially from said tail structure and having cam-shaped surfaces engageable with the cut-out portions on said blades for temporarily fixing said tail structure to said body up to the moment of firing whereby to permit the tail structure to be detached from the body at firing.

JEAN WAUTERS.