PATENT SPECIFICATION (11) 1 361 235

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(21) Application No. 48032/71 (22) Filed 15 Oct. 1971 (19)

(61) Patent of Addition to No. 1 179 517 dated 12 Feb 1968

(31) Convention Application No. P 20 51 035.4

(32) Filed 17 Oct. 1970 in

(33) Germany (DT)

(44) Complete Specification published 24 July 1974

(51) International Classification F42B 13/00

(52) Index at acceptance

F3A 2B3 2F 2K 2N

(54) FIN-STABILISED PROJECTILES

(71) We, OY TAMPELLA Ab., a Finnish Company, of Tampere, Finland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention is an improvement in or modification of that disclosed in our Patent Specification No. 1,179,517 and, like that prior specification, relates to a fin-stabilised projectile, particularly a mortar grenade for grenade launchers.

In claim 1 of the prior specification there is claimed a non-gyrating fin stabilised projectile having a body which—in the longitudinal section—is shaped like an ellipse, is provided with a tail unit comprising radial fins, and is provided in the region of its maximum diameter with circumferential grooves being undercut towards the nose of the projectile body.

Such an arrangement reduces or eliminates deviation and impact effects of the projectile as it passes through the smooth bore of the weapon. The gases located in the annular slot between the projectile body and smooth bore are more caught up with this design of groove than previously. Eddies in the explosion gases are caused, which prevent the passage of the following gases in a forward direction. There is no possibility of these gases flowing past in the slot between projectile body and bore without being used. As the velocity of the gases in the annular slot is reduced, the pressure of the gases around the projectile body is increased. This is of particular advantage on the lower side of the projectile body—seen in cross-section —in comparison to the space on the upper side of the projectile body. The projectile is more securely held suspended in the theoretical axial position of the bore. This excludes swinging axial movements of the projectile in the bore, and the projectile passes through the bore more quietly, favourably affecting the ballistic properties of the projectile.

[*Price 25p*]

The purpose of the invention is to design more securely and to increase the favourable ballistic properties of the projectile body as it passes through the bore.

According to the present invention there is provided an improvement in or modification of a fin-stabilised projectile according to claim 1 of Patent Specification No. 1,179,517, wherein the lateral surfaces of each groove are flat and parallel to each other.

The oblique position of the grooves can in this case be in the range of about 50° to 30° to the longitudinal axis of the projectile.

It has been established that such a design of the annular grooves on the projectile body of a fin-stabilised projectile best meets the requirements necessary to hold it as far as possible in a parallel position relative to the bore axis as it passes through said bore. Whereas the previous undercut grooves, seen in cross-section, were rounded at the sides, the grooves according to the invention are precisely-formed, parallel-wall annular channels which lie at a pre-determined oblique angle to the projectile's longitudinal axis. These relatively narrow annular channels are advantageously suitable on the one hand to catch the passing explosion gases, and on the other hand to form a build-up of pressure in said gases, which acts on the annular slot between projectile body and smooth bore. Turbulence is to a large extent eliminated. On the contrary, there are formed on the annular channels gas-pressure columns so to speak, which are in an even better position than before to impart to the projectile as it passes through the smooth bore a smooth, low-swing path. The grooves advantageously can be replaced by convolutions of a single helical groove.

The base surface of the annular grooves may preferably be rounded or flat. Again, the annular grooves may be divided into groups by depth, the forward group of grooves being advantageously deeper than the rear group. The forward group of an-

nular grooves is exactly in the region of the largest diameter of the projectile body. The high build-up of pressure in the grooves is reinforced by the greater depth of the annular grooves.

A larger spacing may be provided between groups of grooves of varying depths than between the individual grooves of a group. The grooves are advantageously so formed that the forward edge of the oblique groove remains sharp-edged, while its rear edge is bevelled or rounded. This has the advantage that the explosion gases can more easily flow into the oblique annular grooves, and yet it is difficult for said gases to escape in a forward direction.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings, in which:—

Fig. 1 shows a fin-stabilised projectile in side view, in partial section, with annular grooves shown diagrammatically;

Fig. 2 shows the annular grooves in section and on a larger scale;

Fig. 3 shows a further view of two adjacent annular grooves on an even larger scale and in cross-section; and

Fig. 4 shows a further design of the annular grooves on a fin-stabilised projectile body.

The projectile 1 has a body 2 provided at one end with a tailpipe 3 carrying a fine assembly 4. Seen in longitudinal section, the projectile body is ellipsoid in shape. In the region 5 of the greatest diameter of the projectile body, the said body is provided with annular grooves 6.

As Figs. 2 and 3 show, the annular grooves have parallel side surfaces 7*a* and 7*b*; the base surface 8 may be slightly rounded. The oblique position of the grooves relative to the longitudinal axis of the projectile may be in the range of about 50°—30°. In the embodiment shown, angle 9, which is equal to the angle between the side surface 7*b* and the longitudinal axis of the projectile, comes to 40°. The forward edge 10 of the oblique annular grooves preferable remains sharp, while the rear edge has a bevel 11 or a rounded finish.

Only a few oblique grooves are needed in the region of the largest diameter on projectile body 2. In the example shown eight annular grooves are provided. These are divided into two groups. The forward group 6*a*, with four annular grooves, has deeper grooves than rear group 6*b*. In this case the forward group of grooves is located directly in the region of largest diameter of the projectile body, while the rear group of grooves is provided in the part of the projectile body which gradually tapers towards the tail end. 12 indicates the tube wall of the smooth bore, in which the stabilised projectile is fired off. Between the bore wall 12 and projectile body 2 there is also, in the maximum-diameter region, a slight degree of play 13, in which the build-up of explosion gases is intended to act, in order to hold the projectile in the bore in a position parallel to the bore's longitudinal axis. The oblique annular grooves of forward group 6*a* take-up the largest part for this purpose. The annular grooves themselves are relatively narrow. Their width can be about 2—3mm., and can advantageously be 2.5mm. The depth of the grooves of forward group 6*a* comes to about 5mm., measured in the medial longitudinal plane of the grooves. The grooves themselves are slightly wider than the portions between the grooves.

In the embodiment in Fig. 4, two groups of oblique annular grooves according to the invention are provided, with varying depths the grooves of the forward group 6*a* being deeper than the grooves of the rear group 6*b*. The spacing 14 between these groups 6*a* and 6*b* is in this case greater, preferably twice as large as the spacing between individual grooves in each group. The spacer portion 14 has the largest diameter of the projectile body. The body tapers appropriately towards the forward nose end and the rear tail end, the taper towards the tail end being more pronouunced than that towards the nose end of the projectile body.

WHAT WE CLAIM IS:—

1. An improvement in or modification of a fin-stabilised projectile according to claim 1 of Patent Specification No. 1,179,517, wherein the lateral surface of each groove are flat and parallel to each other.

2. A projectile according to claim 1, wherein the oblique position of each groove is in an angular range of 50 to 30° to the longitudinal axis of the projectile.

3. A projectile according to claim 1 or 2, wherein the grooves include grooves the base surface of each of which, seen in cross-section, is rounded.

4. A projectile according to claim 1 or 2 wherein the grooves include grooves the base surface of each of which seen in cross-section, is flat.

5. A projectile according to any one of claims 1 to 4, wherein the grooves are wider than the portions between adjacent grooves.

6. A projectile according to any one of claims 1 to 5, wherein the forward edge of each groove is sharp-edged, whereas the rear edge is bevelled or rounded.

7. A projectile according to any one of claims 1 to 6, wherein each groove in a forward group of the grooves is deeper than each groove in a rearward group of the grooves.

8. A projectile according to claim 7

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4. A projectile according to claim 1 or 2 wherein the grooves include grooves the base surface of each of which seen in cross-section, is flat.

5. A projectile according to any one of claims 1 to 4, wherein the grooves are wider than the portions between adjacent grooves.

6. A projectile according to any one of claims 1 to 5, wherein the forward edge of each groove is sharp-edged, whereas the rear edge is bevelled or rounded.

7. A projectile according to any one of claims 1 to 6, wherein each groove in a forward group of the grooves is deeper than each groove in a rearward group of the grooves.

8. A projectile according to claim 7

* C L M S *

wherein a larger space is provided between the groups than between the individual grooves within each group.

9. A projectile according to claim 7 or 8 wherein the group with the deeper grooves is arranged, as seen from the nose end of the projectile, in front of the region of maximum diameter on the projectile body.

10. A projectile according to any one of claims 1 to 9, but modified in that the circumferential grooves are replaced by convolutions of a single helical groove.

11. A fin-stabilised projectile substantially as hereinbefore described with reference to Figs. 1 to 3 of the accompanying drawings.

12. A projectile according to claim 11, but modified substantially as hereinbefore described with reference to Fig. 4 of the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1974.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

