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SPIN STABILIZED HOLLOW CHARGE PROJECTILE

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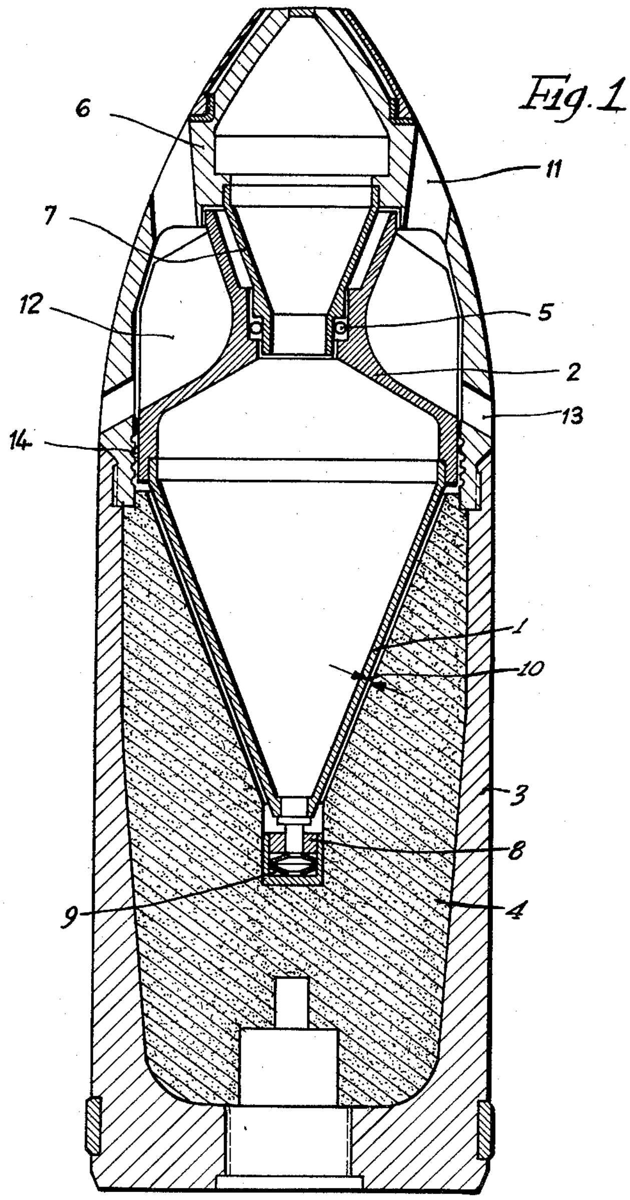

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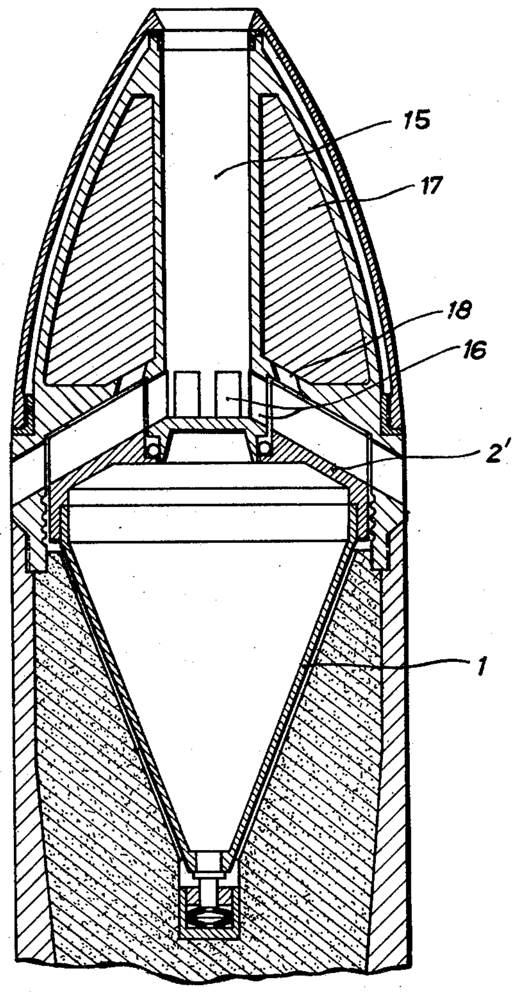
Fig. 2



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SPIN STABILIZED HOLLOW CHARGE PROJECTILE

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The present invention relates to a spin-stabilized hollow-charge projectile, consisting as usual of a body with an explosive charge and a detonator and also an insert.

It is known that, owing to the spin of a projectile, which is indispensable for stabilizing it in flight, a loss of power occurs on penetration of a target. The object of the present invention is to reduce or completely eliminate this loss of power in spin-stabilized hollow-charge projectiles.

Proposals for solving this problem have already become known which, however, can be carried into effect only by a particularly large expenditure in manufacturing the projectiles and postulate substantial drawbacks of another kind or only provide a partial solution. For example, it has been proposed to arrange the entire explosive portion of the projectile, that is the explosive charge with the detonator and insert, within the projectile body in a second inner jacket consisting of a casing and base for the explosive charge, connect said inner jacket fixedly to a braking turbine and mount it rotatably with respect to the projectile body in antifriction bearings. The inertia forces of this portion of the projectile, which makes up almost one half of the weight thereof, are intercepted on firing by powder gases conveyed into the interior of the projectile. An acceleration of rotation is imparted to the inner rotatably mounted portion of the projectile on firing and also during the continued flight of said projectile by the friction in the antifriction bearings, which, however, is counteracted by the braking turbine to which the pressure of the outside air dammed up during the flight of the projectile is applied. This type of construction, however, has considerable drawbacks, since a higher weight of the projectile, great complexity and high cost are unavoidable; moreover, a considerable part of the mass of the projectile does not assist in the stabilization of the latter.

Furthermore, a proposal has become known in which spin compensation is intended to be achieved by a special stepped inclined position of the operative surfaces of the insert and/or by special provisions made in the explosive charge, with the object of producing a tangential thrust component. In this case, however, the circular symmetry of the insert and the circular-symmetrical action of the gases on the insert must be relinquished and, thereby, it is necessary to put up with disturbances which result in only partial success as regards the spin compensation.

The shortcomings of the proposals mentioned and of all other proposals which have become known are obviated by the hollow-charge projectile according to the invention which likewise comprises a section rotatably mounted in the interior of the projectile body and driving means therefor. A characteristic feature of the type of construction according to the invention is that the rotatably mounted parts of the projectile consist only of the insert connected to the driving means and designed as a coaxial body of revolution.

The hollow-charge projectile according to the invention is based on two new discoveries connected with explosion engineering. On the one hand, the malfunctioning of a strongly rotating hollow charge is due especially to the rotation of the insert mass and only to a very small extent to the rotation of the explosive. On the other

hand, the explosive charge must not rest absolutely closely against the insert in order to achieve a high penetration effect, but rather there should also be a narrow circular-symmetrical gap between the insert and explosive charge. In this way, it is possible by the method according to the invention to obtain full spin compensation when the projectile reaches the target, in that precautions are taken to see that the insert is not rotating or is rotating only slowly when the projectile reaches the target, whereas the projectile body is rotating together with the explosive charge at the speed due to the spin.

Embodiments of hollow-charge projectiles according to the invention are described hereinafter in detail with reference to the accompanying drawings, in which:

FIG. 1 shows a hollow-charge projectile designed for the application of pressure to the driving impeller by atmospheric air;

FIG. 2 shows a hollow-charge projectile designed for the application of pressure by powder gases and by atmospheric air.

The hollow-charge projectile according to FIG. 1 has an insert 1 which is fixedly connected to the driving impeller 2; the two parts can rotate together with respect to the projectile body 3 and the explosive charge 4. An antifriction bearing 5 is arranged in the supporting member 7 fixedly connected to the nose 6 of the projectile body 3, while a plain pivot bearing 8 is let into the explosive charge 4. Said bearing rests on a spring 9 which yields on firing until the gap 10, which separates the insert 1 from the explosive charge 4, is closed. Thus, during the acceleration of the projectile in the barrel, the insert is pressed against the explosive charge 4 owing to its inertia and assumes at first the full spinning speed of said projectile. Thereafter, however, the spring 9 overcomes the ram pressure which is now applied to the driving wheel 2 and pushes the insert 1 forward until the gap 10 becomes operative again. At the same time, the air passing through the ducts 11 and striking against the vanes 12 of the driving impeller 2 and issuing through the ducts 13 produces a strong torque at the driving impeller 2 and thereby reduces the speed of the insert 1 fixedly connected to it to a small value in a short time, so that spin compensation is already achieved and the maximum hollow-charge effect ensured after the shot has travelled a small distance. By means of a suitable tangential angular position of the ducts 11 and/or of the vanes 12, it is possible to produce and maintain zero speed for the insert 1, for which purpose the driving impeller 2 must supply a torque corresponding to the friction moments occurring in the rotatable parts of the projectile. Similarly, it is possible to increase the oppositely directed drive of the insert 1 until; in relation to a stationary reference system, it performs a slow rotating movement in the opposite direction to the rotation of the projectile body 3 together with the explosive charge 4, in order to compensate the slight rotary impulse transmitted to the insert 1 on the detonation of the projectile by the rotating gases produced by the explosive charge 4.

For all those purposes where firing is carried out also at very short battle ranges, the gap 10 can be filled with a liquid of low viscosity. During the acceleration of the projectile in the barrel, a high liquid pressure is then produced for a short time in the gap 10. By suitable design and by dimensioning of the labyrinth packing 14, the volume of liquid can either be kept constant in the gap 10 on firing or part of the liquid can be forced through the labyrinth packing 14; in the last-mentioned case, the planned width of the gap 10 is restored only when the acceleration of the projectile abates, in accordance with the dimensioning of the spring 9 and the load applied to the driving impeller 2 by the dynamic air pressure during the flight of said projectile. In both types of liquid cushion in the gap 10 which have been described, only a very slight rotation which is not harmful to the hollow-charge effect is imparted to the insert 1 on firing owing to the liquid friction and the additional bearing friction, this rotation being compensated in a very short time by a particularly lightly constructed driving impeller 2, so that, even for the shortest battle range which may be concerned, for example 100 metres, the insert has zero speed with respect to a stationary reference system or a small speed in the opposite direction to the spin and retains this speed during the further flight of the projectile.

FIG. 2 shows a hollow-charge projectile with an advantageous design of the driving impeller 2'. The air accumulated or dammed up during the flight of the projectile is fed centrally to the driving impeller 2' through an air duct 15 coaxial with said projectile and the connected ducts 16, so that the full ram pressure is utilised for said impeller. In the nose 6 of the projectile there is provided a hollow space 17 in which, in addition, there can be accommodated a powder propelling composition which is advantageously ignited immediately as the projectile leaves the barrel. The powder gases escape through the bores 18 and impinge on the driving impeller 2 substantially more strongly than it is possible for the dynamic air pressure to do. With this arrangement, even without providing the above-described liquid cushion, the speed of the insert 1 can already have dropped to such an extent at a battle range of a few hundred metres that an unreduced hollow-charge effect is obtained.

The hollow-charge projectiles according to the invention are of simple construction; the additional weight employed as compared with a similar hollow-charge projectile in which there is no spin compensation is only a few percent of the weight thereof. Likewise, the reduction of the explosive charge due to the gap between the insert and said explosive charge is extremely small. Important also is the fact that, in spite of the spin compensation, there is practically no loss of stability in flight and no worsening of the position of the centre of gravity as compared with a hollow-charge projectile without spin compensation, since only spin compensation of the insert takes place.

The hollow-charge projectiles described above with reference to FIGS. 1 and 2 merely represent embodiments of the present invention, which is by no means limited thereto, but covers in principle all hollow-charge projectiles provided with a more or less marked spin compensation of the insert.

What I claim is:

1. Method of increasing the penetrating power of a hollow-charge projectile stabilized in flight by spin, comprising rotating the projectile body together with the explosive charge at a speed dependent on the spin at least

on reaching the target, and rotating the insert in the opposite direction to the point of approximate compensation of the movement due to the spin.

2. Method according to claim 1, characterized in that the drive of the insert in the opposite direction is increased until it follows a rotating movement in the opposite direction to the spin in relation to a stationary reference system.

3. Spin-stabilized hollow-charge projectile with stabilized penetrating power comprising a body having an explosive charge with a detonator therein, an insert in the body, driving means connected to the insert mounted rotatably in the interior of the body to obtain a rotary movement of the insert in the projectile in the direction opposite to the spin thereof, the insert connected to the driving means forming a coaxial body of revolution, and the outer surface of the insert forms together with the surface of a corresponding cavity in the explosive charge a narrow gap which renders possible contact-free rotation of the insert with respect to the explosive charge resting fixedly in the projectile body.

4. Spin-stabilized hollow-charge projectile with stabilized penetrating power comprising a body having an explosive charge with a detonator therein, an insert in the body, driving means connected to the insert mounted rotatably in the interior of the body to obtain a rotary movement of the insert in the projectile in the direction opposite to the spin thereof, the insert connected to the driving means forming a coaxial body of revolution, the driving means is in the form of an impeller on the insert as a turbine impeller to provide the application of pressure during the flight of the projectile by a stream of air conducted through the interior of the body, said nose of the projectile having a powder composition therein, whereby the gases from the powder propelling composition will drive the turbine.

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