United States Patent [19]

Gawlick et al.

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[54] **PROJECTILE**

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[73] Assignee: **Dynamit Novel AG,** Troisdorf, Germany

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[21] Appl. No.: **4,237**

[52] **U.S. Cl.** **244/3.27,** 102/53, 102/87, 102/92.7

[51] **Int. Cl.**.....**F42b 11/16**

[58] **Field of Search**.....102/87, 92.7, 53, 102/92.4, 92.6; 244/3.1, 3.27

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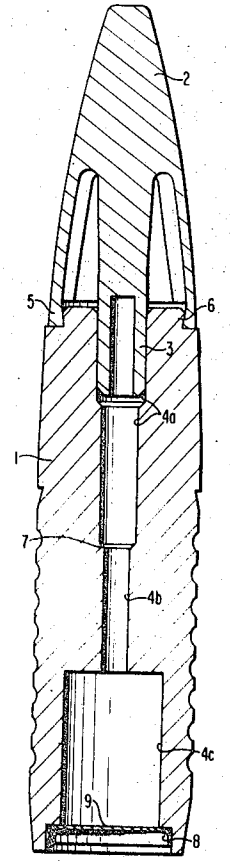
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[57] **ABSTRACT**

A projectile having a continuous axial bore and a cover adapted to drop off provided at the front end of the projectile. The cover is temporarily held on the projectile so as to retain original shape thereof until firing. The front zone of the bore is followed by a zone effective as a jet and having smaller, preferably variable cross-sectional dimensions. The zone of smaller cross-sectional dimensions can pass over into a zone of relatively larger cross-sectional dimensions toward the rear of the projectiles. Spin-braking devices can be provided at the front end of the projectile for limiting the flight range of the projectile to a desired value.

22 Claims, 10 Drawing Figures



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SHEET 1 OF 3

FIG. 1

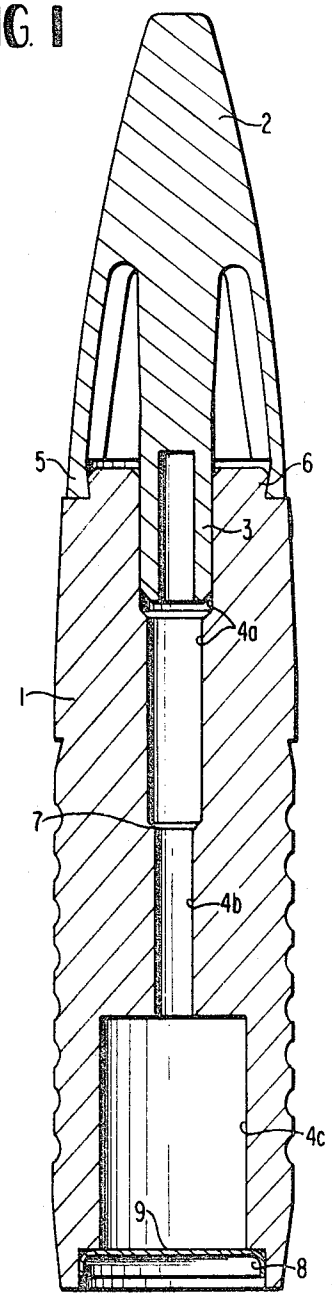


FIG. 3

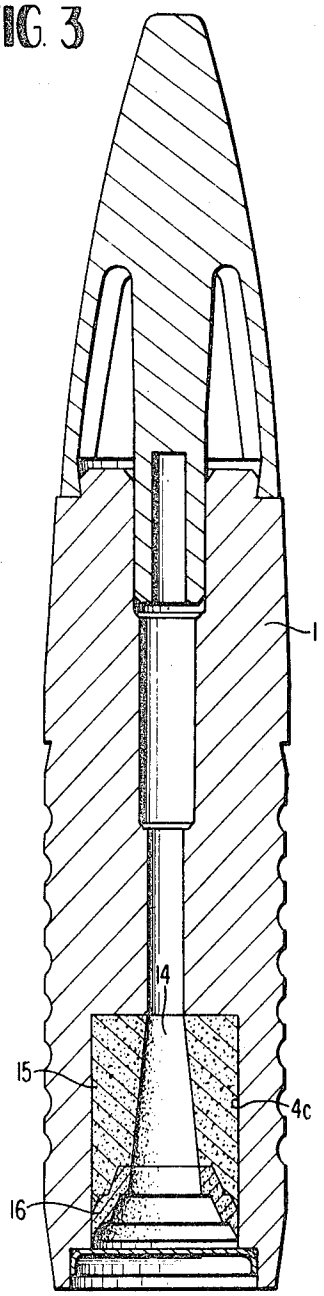


FIG. 2a

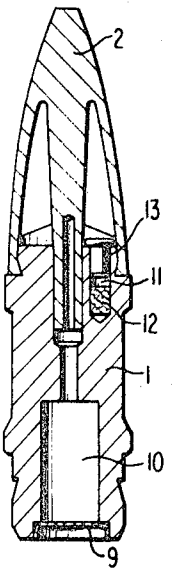
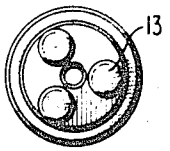


FIG. 2b

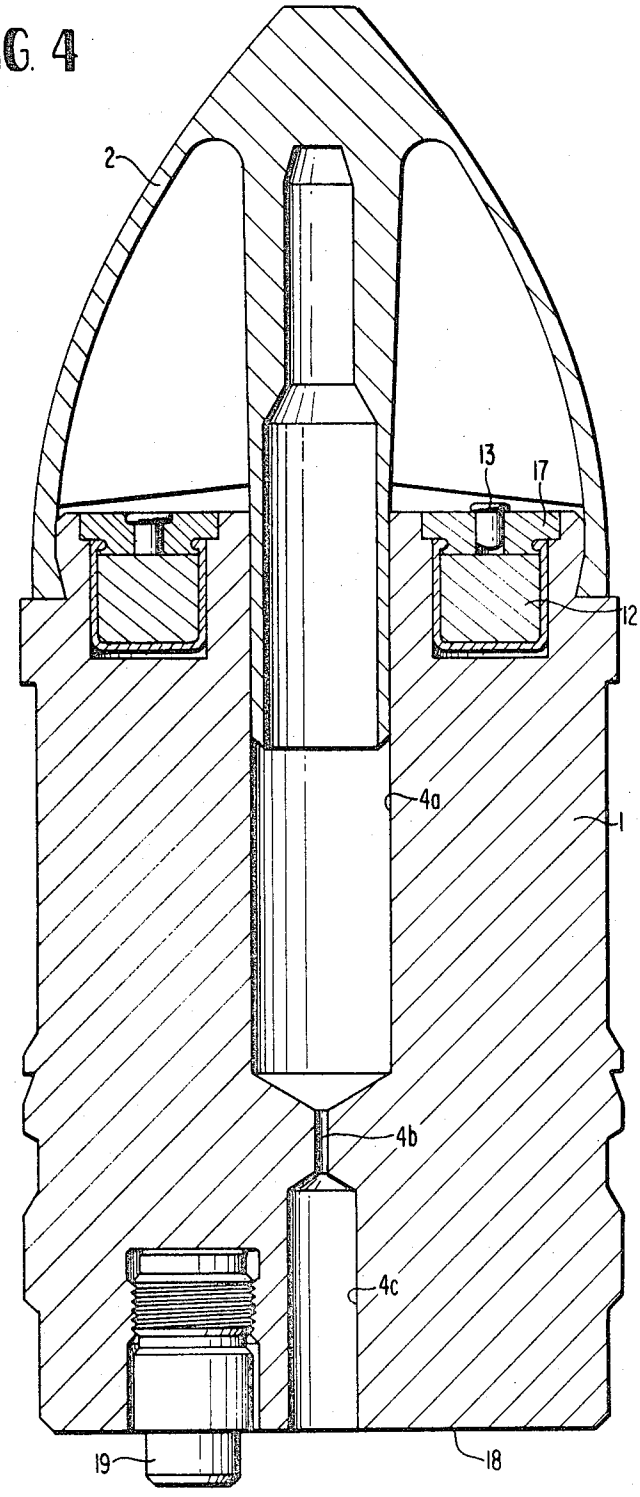


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FIG. 4



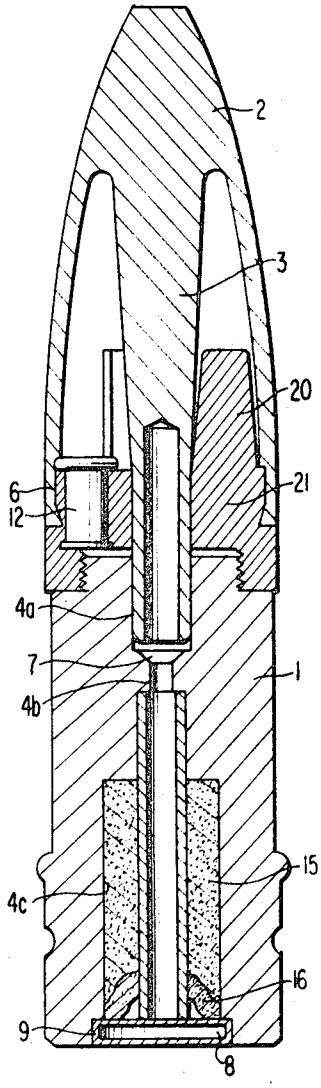


FIG. 5

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FIG. 7a

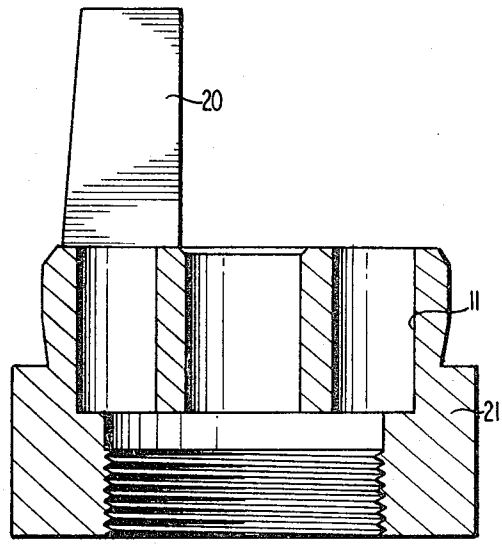


FIG. 6a

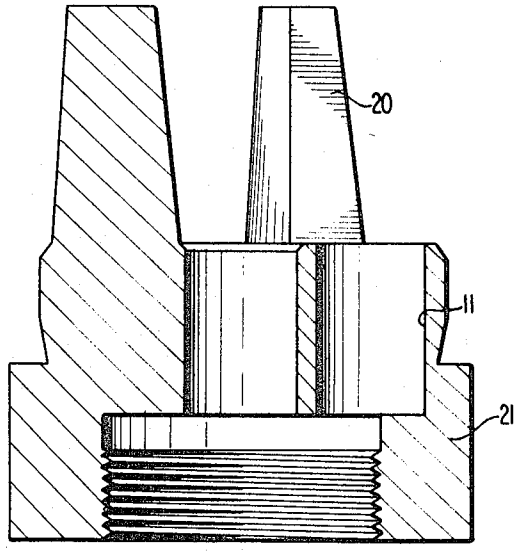


FIG. 7b

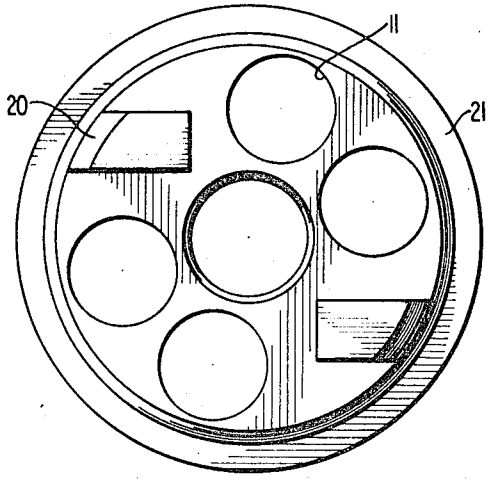
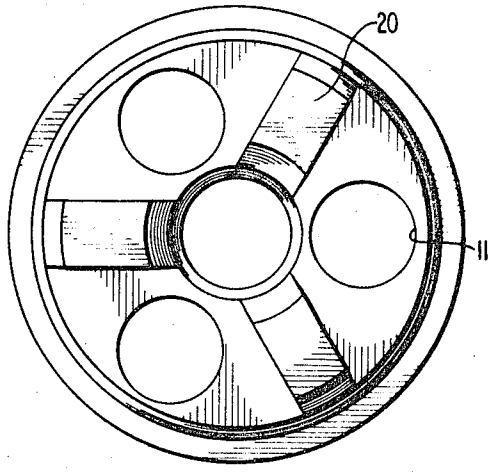


FIG. 6b



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PROJECTILE

BACKGROUND OF THE INVENTION

The present invention relates to a projectile, and more particularly, to a projectile with a continuous axial bore and a droppable cover or cap provided at the front end of the projectile and held thereon by a clamping effect, wherein the cover, in particular, supplements the projectile so that it has its original shape.

As is already known, the measure of providing projectiles with a continuous axial bore or recess is based on the purpose of reducing the flight range of the projectiles to a greater or lesser extent. By the fact that part of the propellant gases can flow off through the bore and be unused, the energy imparted to the projectile is decreased, and correspondingly, the flight range of the projectile is likewise reduced.

SUMMARY OF THE INVENTION

It is the aim of the present invention to provide that a projectile is constructed so that the front zone of the bore is followed by a zone effective as a jet and having smaller, preferably variable cross-sectional dimensions. By the selection of the cross-sectional dimensions, it is possible to realize internal ballistics corresponding to the respective ordnance system being employed so that complete functionality is ensured without changing the firearm. The portion of the bore widened with respect to the jet portion ensures that the cover, especially when the latter extends into the bore with a central, pin-type projection, is under the pressure load of the propellant gases over a sufficiently large area and thus is detached from the projectile still while the projectile is passing through the barrel and is driven through the barrel in front of the projectile, already at a relatively low propellant gas pressure. This relatively low propellant gas pressure can be adjusted or set in a desired manner by appropriately selecting the conditions.

In one suitable embodiment of the invention, the zone of smaller cross-sectional dimensions passes over, toward the rear into a zone of larger cross-sectional dimensions, so that a relatively large cross section is available for the entrance of the propellant gases into the bore of the projectile.

Furthermore, the present invention provides that the zone of the smaller cross-sectional dimensions has different cross-sectional size in the front and rear sections thereof, wherein the change in cross-section can be effected toward the front end or also toward the rear end, namely in the form of a constant as well as stepped variation. In order to enhance the flow of the intended portion of the propellant gases through the bore, the stepped transition points made of a slightly conical shape.

For the purpose of accommodating a ground impact marker charge, the projectile is blunted or flattened at its front end in accordance with the present invention and is provided with a more or less large number of depressions uniformly distributed over the circumference in the region of this flattened front end. A smoke- and/or flash-generating pyrotechnical mixture is placed into these depressions. In this connection, the provision can be made to seal the depressions containing the mixture toward the outer ends thereof by means of respectively one primer element responsive to mechanical stress. The primer elements in accordance

with a further suggestion of the present invention can be secured against unintended ignition by means of the cover, even if they project, in accordance with still another suggestion of the present invention, beyond the front end face of the projectile.

In case the bore of the projectile has a rear portion which is widened in cross-section, the provision can be made to fill this portion with a flare charge, leaving a central passage which is widened preferably conically toward the rear end. This flare charge is ignited by the propellant gases and then burns during the flight of the projectile.

In addition thereto or also in place thereof, the provision can be made, for the same purpose, of flattening the rear end of the projectile and disposing in this flattened area a number of indentations or depressions which extend, uniformly distributed over the circumference, in the direction of the axis of the projectile and which are filled with a flare composition.

In order to limit the flight range of the projectile to the desired value, the present invention furthermore provides spin-braking devices disposed at the front end of the projectile. In this connection, it is self-evident that the number and size of the spin-brakes, preferably being vane-like projections, is determined so that the instability of the flight of the projectile occurs at a previously set distance or at a corresponding flight path of the projectile.

BRIEF DESCRIPTION OF THE DRAWINGS

These and further features, aims and advantages of the present invention will become more apparent from the following description when taken in conjunction with the accompanying drawings which show, for purposes of illustration only, several embodiments in accordance with the present invention, and wherein:

FIG. 1 is a cross-sectional elevation view of a projectile with stepwise offset cross-sectional dimensions of the bore or recess,

FIGS. 2*a* and 2*b* show a projectile in accordance with the present invention with marker charges disposed at the front end of the projectile,

FIG. 3 is a cross-sectional elevation view of a projectile with a flare charge provided in the rear zone of the bore,

FIG. 4 is a cross-sectional elevation view of a projectile with a marker charge arranged at the front end of the projectile and with a flare charge disposed at the rear end,

FIG. 5 is a cross-sectional elevation view of a projectile with spin-brakes formed at the front end of the projectile,

FIG. 6*a* and 6*b* are elevational and plan views, respectively, showing the head or tip of the projectile of FIG. 5 in a sectional view on an enlarged scale, and

FIGS. 7*a* and 7*b* are elevational and plan views, respectively, showing a modification of FIG. 6.

DETAILED DESCRIPTION OF THE DRAWING

Referring now to the drawings and, in particular, to FIG. 1, the cover or cap 2 is attached to the projectile 1 which is flattened at the front end thereof. The cover 2 extends with its central extension 3 into bore or recess 4 and is clamped with conically thickened rim 5 to shoulder 6. By means of conical shoulder 7, the front

zone 4a of the bore passes over into the zone of smaller cross-sectional dimensions denoted by 4*b*. In the same manner, the zone 4*a* is in itself additionally offset in cross section. At the rear end of the projectile, the bore is greatly widened, i.e., the zone 4*b* is followed by the zone 4*c* which is formed with a large inside cross section and has stepped recess 8. The bore 4 is closed off toward the rear by means of readily-destructible cover 9.

At the front and rear end of the projectile 1 of FIG. 2, the covers 2 and 9 are attached in the same manner. At the front end of the projectile and in the depressions 11 extending in the direction of the axis 10 of the projectile, a marker charge 12 is disposed, and the depressions 11 are sealed off toward the outside by means of percussion primer caps or rim primers 13.

In this connection, the cover 2 is shaped so that the primer cap 13 is protected against unintended ignition, as long as the projectile has not yet been fired. The projecting edge of the primer cap 13 can serve, during the flight of the projectile in the subsonic range, as a spin-brake and can thus serve for influencing the flight range. Also, the hit accuracy can be affected thereby.

The projectile 1 of FIG. 3 substantially corresponds to that of FIG. 1, except that the flare charge 15 is provided with the initiation charge 16 pressed thereon in section 4c of the bore 4. In this design, a central passage 14 is left which, in this case, is of a slightly conical configuration.

In the projectile 1 of FIG. 4, the marker charges 12 are again provided at the front end of the projectile with primer caps 13 accommodated in special sealing plugs 17. Prior to firing of the projectile, the primer caps 13 are again protected from unintended ignition by means of the cover 2. The zone 4*b* has the effect of a jet, and the inside diameter of zone 4*b* can, under certain circumstances, be reduced to 1 percent of the diameter of the projectile. The zone 4*c* follows toward the rear end of the projectile after the zone 4*b* and is constructed with a substantially smaller inside cross-section than in the preceding figures, so that this zone cannot be utilized as a receptacle for a flare charge. Therefore, in contradistinction to FIG. 3, the flare charge is accommodated in a number of charges 19 disposed at the rear, flattened end face 18 of the projectile and uniformly distributed over the circumference.

The projectile 1 of FIG. 5 has a threadedly connected projectile tip 21 with web-like projections 20 serving as a spin-brake at the front end thereof. In the projectile tip 21, the marker charge with percussion priming 12 is disposed, for example, as a smoke composition. The front cover 2 is formed as a plastic tip and engages with the central extension 3 thereof between the projections 20 into the bore 4. The front cover 2 is clamped, along with its conically thickened rim, onto the shoulder 6 formed at the tip 21 of the projectile. The front zone 4*a* of the bore 4 again passes over into the zone of smaller cross-sectional dimensions 4*b* by means of the conical shoulder 7. The greatly widened rear zone 4c with the step-like shoulder 8 is closed off by means of cover 9 and contains flare charge 15 with the initiator charge 16.

As can be seen from FIGS. 6*a* and 6*b*, the tip 21 of the projectile is provided with three projections 20 arranged so that they are distributed at equal spacings and extend in the radial direction. Between these projections, likewise in a uniform distribution, respectively one depression 11 is arranged for receiving marker charges or the like.

In contrast thereto, the differently constructed projectile tip 21 of FIGS. 7*a* and 7*b* has only the two web-like projections 20 at the front face thereof. These projections extend in parallel with respect to the same axial sectional plane. Between the projections 20, the two respective depressions 11 are formed for the accommodation of marker charges or the like.

While we have shown and described several embodiments in accordance with the present invention, it is to be understood that the same is susceptible to numerous changes and modifications as will be apparent to a person having ordinary skill in the art, and we, therefore, do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are encompassed by the scope of the present invention.

We claim:

1. Projectile comprising a projectile body having a front and rear end and a continuous central axial bore extending therethrough from the front to rear end, a cover, clamping means for detachably connecting the cover to the front end of the projectile body and for releasing the cover from the projectile body during the movement of the projectile through the barrel of a firearm, said continuous axial bore including a first zone in the region of the front end of the projectile body having predetermined cross sectional dimensions, a second zone adjoining said first zone for providing a jet effect and having variable cross sectional dimensions smaller than the predetermined dimensions of said first zone, and a third zone in the region of the rear end of the projectile body and adjoining said second zone, said third zone having cross sectional dimensions larger than said dimensions of said second zone.

2. Projectile according to claim 1, wherein the second zone of smaller cross-sectional dimensions has varying cross-sectional dimensions at the front and rear portions thereof.

3. Projectile according to claim 1, wherein step-like, slightly conically shaped shoulder means are provided for effecting the variable cross-sectional dimensions of the second zone.

4. Projectile according to claim 3, wherein the second zone of smaller cross-sectional dimensions has varying cross-sectional dimensions in the front and rear portions thereof.

5. Projectile according to claim 1, wherein the front end of said projectile body is substantially flattened and is further provided with at least one depression.

6. Projectile according to claim 5, wherein primer element means are provided responsive to mechanical stresses for sealing off said at least one depression toward the outside.

7. Projectile according to claim 6, wherein said primer element means projects beyond the front face of said projectile body.

8. Projectile according to claim 5, wherein several depressions are provided substantially uniformly distributed over the flattened front portion and are filled with smoke- and/or flash-producing pyrotechnic mixture means.

9. Projectile according to claim 8, wherein step-like, slightly conically shaped shoulder means are provided for effecting the variable cross-sectional dimensions of the second zone.

10. Projectile according to claim 8, wherein primer element means are provided responsive to mechanical stresses for sealing off each of said depressions toward the outside.

11. Projectile according to claim 10, wherein said cover is adapted to protect said primer element means against unintended ignition.

12. Projectile according to claim 10, wherein said primer element means projects beyond the front face of said projectile body.

13. Projectile according to claim 1, wherein the continuous axial bore is widened in a step-like manner at the third zone and is provided with flare charge means in such a manner that a central passage is formed therewith which widens approximately conically toward the rear end of said projectile.

14. Projectile according to claim 13, wherein the second zone of smaller cross-sectional dimensions has varying cross-sectional dimensions in the front and rear portions thereof.

15. Projectile according to claim 14, wherein step-like, slightly conically shaped shoulder means are provided for effecting the variable cross-sectional dimensions.

16. Projectile according to claim 15, wherein the front end of said projectile body is substantially flattened and is further provided with several depressions substantially uniformly distributed over the flattened front portion, and the several depressions being filled with smoke- and/or flash-producing pyrotechnic mixture means.

17. Projectile according to claim 16, wherein primer element means are provided responsive to mechanical stresses for sealing off each of the depressions toward the outside.

18. Projectile according to claim 13, wherein the rear end of said projectile is substantially flattened and provided with a plurality of depressions uniformly distributed over the flattened rear portion, and the depressions being filled with flare charge means.

19. Projectile according to claim 1, wherein spin-braking means are provided at the front end face of said projectile body for limiting the flight range of said projectile to a desired value.

20. Projectile according to claim 19, wherein said spin-braking means include web-like projections extending in the axial direction of said projectile and being substantially uniformly distributed over the front end face.

21. Projectile according to claim 20, wherein said web-like projections are disposed radially with respect to the central axis of said projectile.

22. Projectile according to claim 20, wherein said web-like projections are disposed parallel with respect to a plane passing through the axis of said projectile.

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