

[54] **PULLER SABOT AMMUNITION WITH SLIP SEAL**

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[51] Int. Cl. **F42b 31/00**

[58] Field of Search..... 102/DIG. 7, 93, 94

[56]

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[57]

ABSTRACT

Discarding sabot ammunition adapted for a rifled barrel, including a cartridge having a finned flechette projectile with a projectile-gripping puller sabot riding within the lands of a rifled barrel and a radially protruding anti-friction annular slip seal engaging and riding in sealing relation with the grooves between the rifling lands.

15 Claims, 2 Drawing Figures

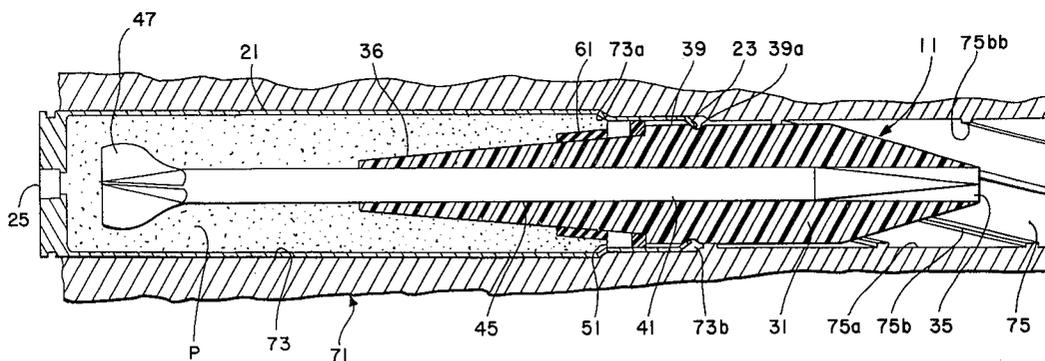


FIG. 1

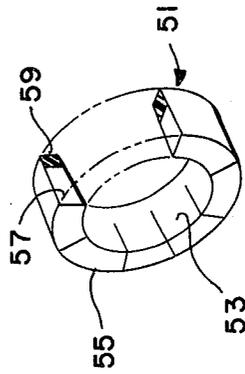
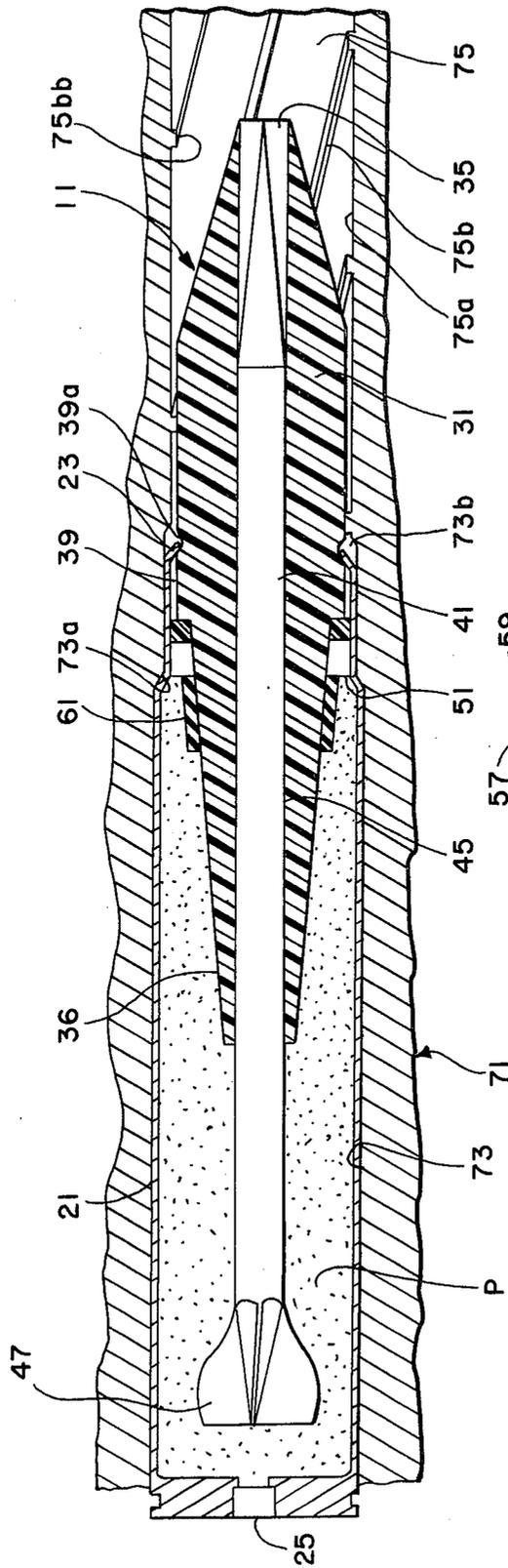


FIG. 2

PULLER SABOT AMMUNITION WITH SLIP SEAL

This invention relates to puller sabot ammunition which is particularly adapted to be fired from a rifled barrel.

When fin stabilized discarding puller sabot ammunition is fired from a rifled barrel, it is conventional practice to have the sabot engage in self-cutting relation with the rifling so as to maintain the desired gas seal with the rifled barrel bore. The sabot and the finned projectile being pulled thereby are thus spun up rapidly by this sabot-to-rifling interengagement, and this rapid spin tends to bend the projectile and reduce its accuracy in flight.

It is an object and feature of this invention to provide puller sabot finned projectile ammunition which enables adequate sabot sealing and launching of the finned projectile in a rifled barrel, with substantial reduction in rifling-derived spin-effecting forces being transmitted to the projectile during its passage along a rifled barrel, to thereby aid in minimizing inaccuracies caused by high spin bending of the projectile in flight.

Still other objects, features and attendant advantages will become apparent from a reading of the following detailed description of a preferred embodiment constructed in accordance with the invention, taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a longitudinal section view of an embodiment constructed in accordance with the invention.

FIG. 2 is a perspective view of the anti-friction slip seal of the embodiment of FIG. 1.

Referring now in detail to the figures of the drawings, in the illustrated embodiment a cartridge 11 includes a case 21 having a primer 25 which may be of any conventional or desired construction, and a charge of propellant generally indicated at P. Fin-stabilized projectile 41 having stabilizing fins 57, a central cylindrical section 45, and a tapered forward nose end 43, is carried within a puller sabot 31, which in turn is secured within the case 21, as by a crimped forward lip 23 of case 21 which engages with an annular securing groove 39a formed in the outer midsection peripheral cylindrical surface 39 of puller sabot 31. The puller sabot may take various forms, and may employ various means for pulling securement thereof with the projectile 31, including frictional gripping, as illustrated, or positive interface gripping such as through the medium of a complementary threaded interface, although the preferred embodiment is as illustrated in which an initial friction gripping action exists between the bore 35 of sabot 31 and the cylindrical midsection 45 of the finned projectile 41, with increased frictional gripping being effected as a function of gas pressure exerted on the rear tapered surface 36 of the sabot upon firing of the cartridge 11 and ignition of the propellant charge P which generally surrounds the rear exposed section of the projectile 41 and the rear tapered surface 36 of sabot 31.

The sabot 31 has a tapered forward end 33, and the forward end of the bore 35 may be open as illustrated, in order to aid in discarding of the sabot from the projectile upon exit from the bore 75 of a barrel 71 in which the cartridge is chambered and fired. The sabot may be formed of various suitable materials, a preferred material being glass-impregnated nylon.

Puller sabot 31 has formed at the intersection between rear tapered surface 36 and cylindrical surface 39, a step shoulder 37, adjoining which is disposed a slip seal 51. Slip seal 51 is formed of low friction or anti-friction material, a preferred material being an anti-friction polyfluorocarbon, such as is sold under the trademarks Teflon, Kel-F, etc.

It is preferred to form the slip seal in a manner such that it not only forms a slip seal for the purposes to be hereinafter described, but also for ease of rupture and discarding upon exit of the sabot and projectile assembly from the barrel bore 75. To this end, the slip seal 51 has a continuous annular web section 59, and the rear face of the slip seal 51 has slits 57 formed therein. Under centrifugal force resulting from the high rate of spin imparted to this slip seal 51 in the course of travel through a rifled bore 75, the slip seal 51 will rupture after exit from the bore 75 and fly apart. As a further aid in discarding of the sabot 31 from the projectile upon exit from the bore 75, the sabot 31 is preferably formed in longitudinal segments (as for instance into four longitudinal quadrant segments or two halves) which are either totally separate from one another or joined together by a relatively thin web therebetween, although the invention may operate, but to a less desirable extent, with other less desirable sabot constructions.

An elastic securing band 61, formed of an elastomer such as rubber, is secured in stretched configuration immediately rearwardly of the slip seal 51, and aids in holding the sabot 31 together and in initial frictional engagement with the projectile 41 during assembly and prior to firing.

The cartridge 11, with its sabot 31, slip seal 51 and fin-stabilized projectile 41 is particularly adapted to be fired in a rifled bore 75, the rifling of which is schematically illustrated at 75a, 75b, the barrel 71 having a cartridge-receiving and seating chamber 73 with a forward seating shoulder 73a which serves to establish the forwardmost seated position of the cartridge within the chamber 73. It will be noted that the chamber 73 includes a space 73b forward of the crimped lip 23 of case 21 which enables the lip 23 to be moved outwardly upon firing of the cartridge 11, sufficiently to thereby enable the anti-friction slip seal 51 to pass into the bore 75 under the influence of the gas pressure exerted thereupon upon firing of the propellant charge P.

The effective outer diameter of anti-friction slip seal 51 is substantially complementary to and provides a seal with the grooves 75a formed between the rifling lands 75b, which the cylindrical outer periphery 39 of puller sabot 31 is formed of a diameter substantially complementary to the radially inner surface diameter 75bb of rifling lands 75b. The sabot 31 thus rides on the lands 75b, while slip seal 51 rides in rifling grooves 75a and serves to seal the sabot 31 with the bore 75 during the travel of the sabot in projectile assembly along the bore 75 upon firing of the cartridge 11. Substantially complementary engagement of the relatively long outer cylindrical surface 39 with the surface 75bb of rifling lands 75b aids in stabilizing and preventing any yawing movement of the sabot within the bore 75 during its forward travel, while slip seal 51 provides the desired full sealing with the bore 75. As a less desirable alternative, the sabot 31 may be of lesser diameter than the lands 75b, in which event the slip seal 51 may be substantially elongated to provide increased contact length

with the bore 75 to afford stability to the sabot and projectile during its travel along the bore 75, whereas in the illustrated and preferred embodiment the anti-yaw stability is afforded primarily by the sabot 31 riding in smooth engagement with the lands 75b.

In operation the cartridge 11 is chambered within the barrel 71 in the position as shown in FIG. 1, and the cartridge may be thereupon fired in a conventional manner, as by percussive striking of the primer 25, thereby igniting the propellant charge P and creating the propellant gases necessary to propel the sabot-projectile assembly through the barrel bore 75. The propellant gases exert their pressure on the projectile 41 and the exposed rear of sabot 31, as well as on elastic securing band 61 and slip seal 51. Vector forces of this gas pressure will result in both a radial gripping action being transmitted through the rear tapered surface 36 of the sabot 31 to the projectile 41, as well as a forward moving vector force which will effect forward motion of the sabot-projectile assembly from the cartridge case 21 and along the barrel bore 75. Forward motion of the sabot-projectile will effect outward bending of crimp securing lip 23, after which the entire assembly 31, 41, 51, 61 will project along the barrel bore as an assembly until exit thereof from the bore. While traveling through the bore the sabot 31 will ride on the land surfaces 75bb, and the slip seal 51 will engage in sealing relation with the rifling grooves 75a and be rotated as a function of interengagement with the rifling lands 75b. Sealing action will be effected by the slip seal 51 during this forward travel with the sabot 31, and due to the low friction or anti-friction characteristic of the material forming the slip seal 51, the slip seal 51 will be enabled to rotate without imparting the same degree of rotation to the sabot 31. The precise degree of slip and differential in rate of rotation between the slip seal 51 and sabot 31 will be a function of the particular interface friction characteristic between the material of slip seal 51 and sabot 31. As noted previously, the most desired material in this respect is that found in the polyfluorocarbons, such as Teflon, and with such materials a substantial differential in rate of rotation of slip seal 51 and sabot 31 may be satisfactorily obtained. Upon exit of the sabot, projectile, slip seal assembly from the muzzle of bore 75, the high rate of rotation of slip seal 51 will result in the slitted slip seal 51 flying apart and separating from the sabot 31 to thereby enable the sabot itself to separate from the projectile 41, the elastic securing band 61 having been substantially annihilated or effectively reduced in strength by the firing of the propellant charge P and thereby having little or no impeding effect on such separation of the sabot segments. The sabot, projectile, slip seal assembly will thus be propelled from the barrel bore 75, and upon separation from the sabot 31 the projectile 41 will be free to travel downrange as a single entity, with stabilization being primarily effected by the stabilizing fins 47.

While the invention has been described with respect to a single illustrative and preferred embodiment, it will be apparent that various modifications and improvements can be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited by the single illustrative embodiment, but only by the scope of the appended claims.

I claim:

1. Ammunition, comprising

a flechette projectile having a finned rear end, a discarding bore-riding puller sabot engaging the peripheral midsection of said flechette in carrying and driving relation and having a bore riding midsection larger in diameter than said finned rear end of said flechette projectile,

a shoulder formed on said discarding sabot, and a peripheral pusher slip seal formed of low friction material and rotationally slidably engaging said shoulder,

said slip seal having an outer diameter larger than the outer diameter of said discarding puller sabot for riding in the grooves of a rifled bore while said discarding puller sabot rides on the lands of the rifled bore.

2. Ammunition according to claim 1, said peripheral slip seal comprising a ring.

3. Ammunition according to claim 2, said peripheral slip seal being formed of an anti-friction fluoro-carbon compound.

4. Ammunition according to claim 1, said peripheral slip seal having slits therein for ease of rupture under centrifugal force.

5. Ammunition according to claim 1, said discarding puller sabot comprising a segmented sabot, and said slip seal having slits therein for ease of rupture under centrifugal force.

6. Ammunition according to claim 5, further comprising an elastic securing band disposed about said segmented puller sabot rearwardly of and in adjacent relation to said slip seal.

7. Ammunition according to claim 6, further comprising a cartridge case having a forward end removably secured to the midsection of said sabot, with said finned rear end of said flechette projectile disposed in said case,

a charge of propellant powder in said case, and a primer for igniting said propellant charge.

8. Ammunition according to claim 7, further comprising

a gun barrel having a rifled bore with a rifling groove diameter substantially complementary to said seal outer diameter, and a rifling land inner diameter substantially complementary to the outer diameter of said discarding puller sabot.

9. Ammunition according to claim 5, a cartridge case having a forward end removably secured to the midsection of said sabot, with said finned rear end of said flechette projectile disposed in said case,

a charge of propellant powder in said case, and a primer for igniting said propellant charge.

10. Ammunition according to claim 9, a gun barrel having a rifled bore with a rifling groove diameter substantially complementary to the effective said slip seal outer diameter, and a rifling land inner diameter at least as great as the outer diameter of said discarding puller sabot.

11. Ammunition according to claim 4, a cartridge case having a forward end removably secured to the midsection of said sabot, with said finned rear end of said flechette projectile disposed in said case,

a charge of propellant powder in said case, and a primer for igniting said propellant charge.

5

- 12. Ammunition according to claim 11, further comprising a gun barrel having a rifled bore with a rifling groove diameter substantially complementary to the effective said slip seal outer diameter, and a rifling land inner diameter at least as great as the outer diameter of said discarding puller sabot.
- 13. Ammunition according to claim 12, said rifling land inner diameter being substantially complementary to the outer diameter of said discarding puller sabot.
- 14. Ammunition according to claim 1,

6

- said puller sabot being formed of material which is responsive to radial propellant gas pressure thereon to transmit radial forces to and effect radial gripping action on said projectile as a function of the pressure of propellant gases thereon, and having a reduced diameter rear section subject to radial propellant gas pressure upon firing from a cartridge.
- 15. Ammunition according to claim 14, said puller sabot having a tapered rear end surface.

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