United States Patent

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[73] Assignee **United States of America as represented by the Secretary of the Army. by mesne assignment**

[54] **ROCKET AND CARTRIDGE CASE THEREFOR**
4 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **102/38,** 102/49.7
[51] **Int. Cl.** **F42b 13/28**
[50] **Field of Search** 102/49, 38

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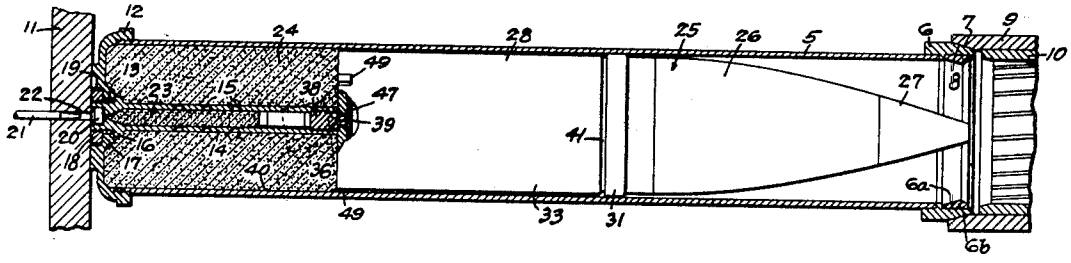
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ABSTRACT: In a rocket-round for a breechless gun barrel, a tube open at its forward end and closed at its rearward end, a self-propelled rocket in said tube, a booster charge in said tube for initiating flight of said rocket when said tube and barrel are in coaxial alignment, and a malleable metallic sealing ring in the forward end of said tube for forming a gas seal between the forward end of said tube and the rear end of said barrel by extrusion of said malleable ring when deformed by the forward movement of said rocket during initial flight thereof.



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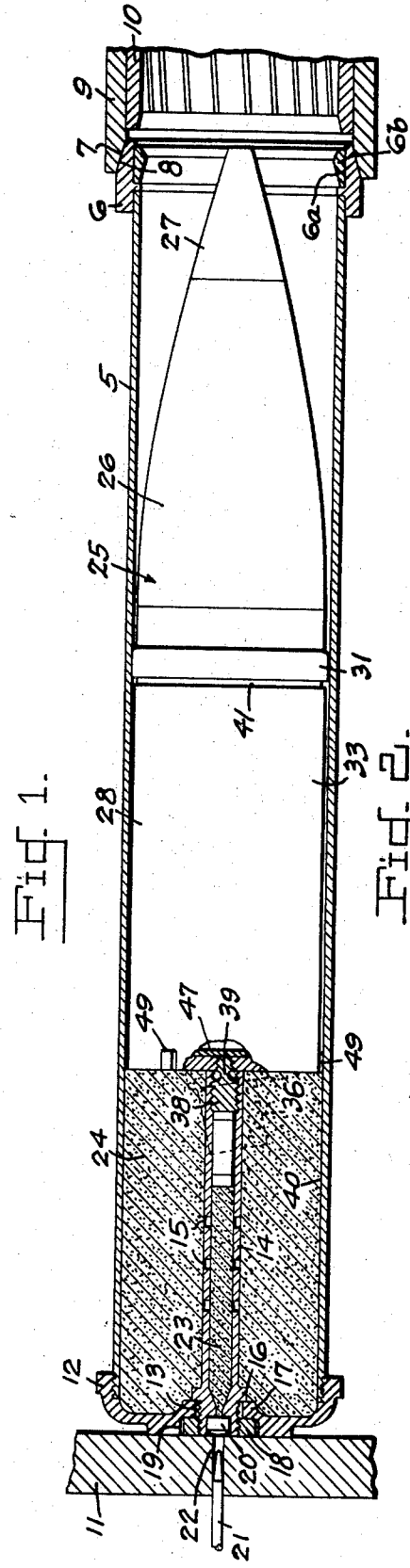


Fig. 1.

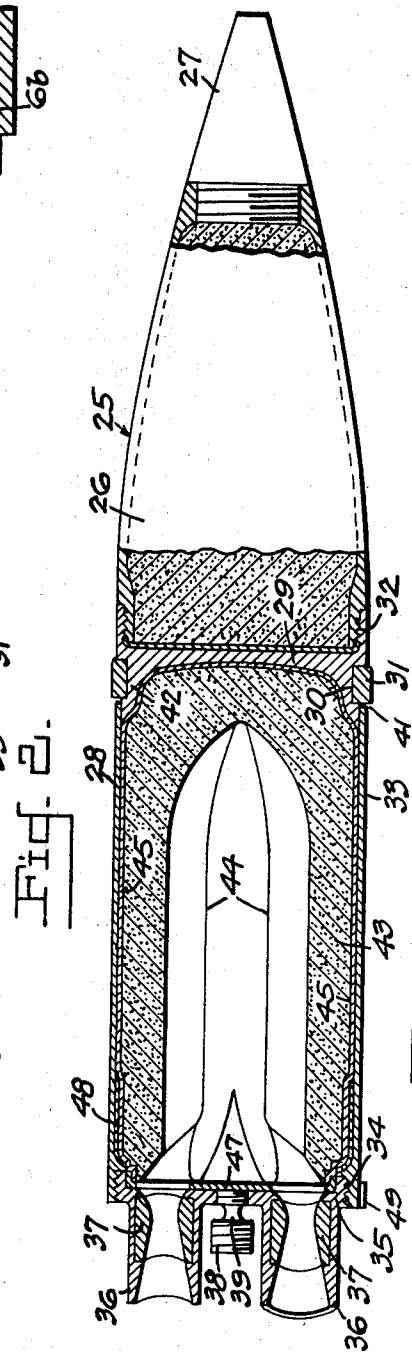


Fig. 2.

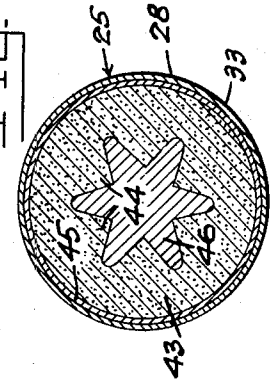


Fig. 4.

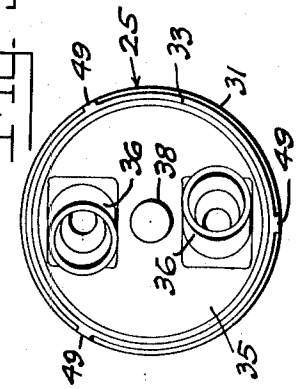


Fig. 5.

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ROCKET AND CARTRIDGE CASE THEREFOR

This invention is a new and improved rocket ammunition round.

An object of the invention is to provide a round wherein the rocket is enclosed entirely within a cartridge case, whereby a plurality of the rounds can be automatically and continuously fed into and launched, at high cyclic rates, from a gun such as one disclosed in a copending application, Ser. No. 431,306, filed May 20, 1954 by W. D. Bobco, et al. now, U.S. Pat. No. 2,965,001.

Another object of the invention is to provide a round which can be fed into and launched from a gun without the delays caused by ramming, extracting and ejecting operations heretofore required.

Another object of the invention is to provide a round having a booster charge of propellent powder in the base thereof, and having a frangible connection between the base cap of the cartridge case and the nozzle plate of the rocket, to delay flight of the rocket until a predetermined gas pressure develops in the booster charge chamber.

Another object of the invention is to provide a round having a cylindrical case whose wall thickness is sufficient to resist the internal pressures developed therein, and whose front end structure cooperates with a seat on the breech end of the aforementioned gun barrel, to insure a gas tight connection therewith.

Another object of the invention is to provide a round wherein aerodynamic stability is increased by reducing the weight of the motor tube and nozzle plate whereby the center of gravity of the entire rocket is moved forward.

Another object of the invention is to provide means within a thin walled rocket motor casing for resisting rotating band pressure.

Another object of the invention is to provide a rocket-round structure which is simple in construction, easily loaded and assembled and which will permit and facilitate high cyclic rates, increased range and improved ballistic performance.

Other objects and advantages will be apparent from the following detailed description and the accompanying drawings, in which:

FIG. 1 is a longitudinal sectional view of the rocket-round with the rocket in side elevation and showing fragmentary complimentary parts of a gun with which the round is used;

FIG. 2 is a longitudinal sectional view of the improved rocket;

FIG. 3 is a rear end view of the rocket; and

FIG. 4 is a cross-sectional view of the rocket motor, showing the shape of a preferred grain of propellant during production thereof.

In the usual method of launching a rocket the missile is fired from a tube open at both ends and the thrust thereof is imparted only by the expulsion at high velocity rearwardly of the gases from the burning propellant. The present round was invented to be used in a closed breech gun wherein the case of the rocket-round serves as the breech.

In the drawings, wherein for the purpose of illustration is shown one form of the invention, the reference character **5** indicates a cylindrical cartridge case having on its forward open end a collar **6** which reinforces the said end against expansion during the high pressure period of launching. The forward end of the collar **6** is beveled as at **7** to seat within an internal bevel **8** formed on the rear end of a sliding sleeve **9** which is a part of the above mentioned gun. The sleeve **9** is slidably mounted on a rifled barrel **10** by means, not shown, to close the gap between the rear end of barrel **10** and the forward end of the collar **6**, after the tube or case **5** has been transversely moved into firing position in alignment with barrel **10**. A copper ring **6***b* is mounted for limited axial translation within a bore in the forward end of collar **6**. The inner periphery of the ring is formed as the surfaces of two frustoconical surfaces to define a circular ridge of slightly lesser diameter than the rotating band **31** of the rocket. As the rocket moves forwardly in its case **5**, the rotating band contacts the ring **6***b* and drives it forwardly into contact with gun or launcher tube **10**. The rising

gas pressure acts on the internal and rear surfaces of ring **6***b* thereby holding the ring tightly against the rear surfaces of the gun tube and at the same time expanding the ring against the recess in collar **6** to effect additional sealing action against loss of pressure. Each sealing ring is ejected with its cartridge case after firing. A back plate **11**, also a part of th gun resists the set back forces on firing.

A base cap **12** is screw-threaded or otherwise secured to the rear end of the case **5** and abuts the back plate **11** when in firing position in the gun. The base cap is centrally bored as at **13** to receive the screw-threaded end of an ignitor tube **14** having flash openings **15** in its walls. A shoulder **16** on the ignitor tube abuts a boss **17** on the base cap and a screw-threaded nut **18**, seated in a counter bore **19** in the base cap, engages the screw-threaded end of the ignitor tube to effect a gas seal. A primer **20** is housed in the rear end of the ignitor tube **14** and axially thereof in a position to be engaged by a firing pin **21** slidable in a bore **22** in the back plate **11**. Fire passes from the primer **20** to the ignitor charge **23** in tube **14**, and thence through the holes **15** to a booster charge **24**. A booster charge found most suitable for this application is the single-perforated propellant coated with 5percent by weight of ethyl centralite and is a progressively burning charge. Such a charge tends to produce gas at an accelerating rate as burning proceeds, thus tending to keep the gas pressure high in the gun barrel as the projectile velocity increases.

A spin stablilized rocket **25** is completely housed within the case **5** forwardly of charge **24** and comprises a war head **26**, a contact fuze **27** and a motor **28**. The motor is closed at its front end by a bulkhead **29**, FIG. **2**, which is grooved at **30** to receive a rotating band **31**. The rotating band is located as close as possible to the bulkhead **29** for the purpose of providing resistance to band pressure during travel of the rocket through the gun barrel. The bulkhead is secured to the war head casing by a screw-threaded connection **32** at its forward end and has a rearwardly extending flange **42** to which a light weight motor casing **33** is secured, as by welding or other suitable means. The motor casing is secured at a spaced distance from the rotating band ro form a small circumferential groove **41** for receiving any burs left on the band **31** after engraving by the rifling in the gun barrel **10**, which might otherwise impair the aerodynamic characteristics of the rocket.

Secured to the rear end of the motor casing by any suitable means, such as screw-threads **34** is a light weight nozzle plate **35**, lined interiorly by a heat insulator **47**, such as asbestos. Centering lugs **49** are circumferentially spaced about the motor casing **28** at its rear end to insure true axial movement of the rocket. Nozzles **36** of steel or other suitable material are formed integral with the nozzle-plate and are provided with inserts **37** of carbon or any other suitable erosion resisting material. The nozzles are equally and oppositely inclined at such an angle to the longitudinal axis of the rocket as to produce a proper spin in flight due to a tangential component of the thrust engendered by the high-velocity gases issuing therefrom.

Axially aligned with the ignitor tube **14** and screw-threadedly secured to the forward end thereof is a frangible delay element **38** which is also screw-threadedly secured to the nozzle plate **35**, centrally thereof. Intermediately of its securing ends the delay element **38** is reduced in diameter as at **39**, FIG. **2**, to a predetermined thickness. Thus the ignitor tube and the delay element hold the rocket in the cartridge case **5**, at a spaced distance from the base cap **12**, thus providing a chamber **40** of predetermined volume for receiving the booster charge **24**. The rocket does not start to move until the gas pressure in the booster chamber has reached about 500 pounds per square inch, at which time the reduced portion **39** of the frangible delay element **38** will break, thus permitting the rocket to begin its forward motion.

In the present invention a fast burning rocket propellant **43** is desirable because it allows the charge to be cast around a fluted or star shaped core **46** (see FIG. 4) to produce thick

webs 44 which are strong enough to prevent crumbling on setback or when ignited. Because the rocket propellant is subjected to extremely high setback forces during launching and also to high centrifugal forces during flight, a propellant of great strength and bondable to the interior of the motor casing 33 is necessary. The material found to be most suitable for this propellant is an outside inhibited composition of Thiokol-perchlorate. A quantity of the inhibitor, in this case Thiokol without the oxidizer, is poured into the motor casing 33 which is rotated to completely cover the interior thereof by centrifugal action. The excess is drained out and the casing is heated sufficiently to partially cure the inhibitor adhering to the inside wall thereof and bond it thereto, in a suitable thickness 45, as can be seen by referring to FIGS. 2 and 4. The core 46 coated with a suitable mold release material is then inserted into the casing 33 and the propellant is poured in around the core. The propellant is then cured and the core 46 removed.

A heat resisting layer 48 of asbestos is cemented internally to the rear part of motor casing 33, to resist the heat from the high pressure gases, which tend to increase the diameter thereof and allow the nozzle plate 35 to come out. The nozzle plate screw threads should also be sealed with a suitable cement. A significant feature of the invention is the improved method of igniting the rocket propellant. This is accomplished by eliminating any form of seal from the nozzles and permitting them to remain open, so that the hot gases from the booster charge 24 will quickly ignite the rocket propellant 43.

By this method of igniting the rocket propellant, the motor casing and nozzle plate are not required to withstand extremely high pressures and may be of lighter weight than would be required if a separate igniter were used. With a lighter weight motor casing and nozzle plate the center of gravity of the entire rocket is moved forward, resulting in increased aerodynamic stability and greater range. With a lighter weight motor casing the wall thickness is less and more propellant can be carried, resulting in an increased range for any given caliber and length of motor chamber. As a further result of the reduced rocket weight the peak launching pressure and consequent trunnion reaction for a given nozzle velocity may be reduced.

It is to be understood that the rocket round herein described can be made in any size or caliber desired, but for the purpose of description and illustration, one having a 2.75 caliber rocket is here shown. It is estimated that such a rocket, carrying a payload of 1 pound of high explosive material, will attain a muzzle velocity of 1,200 feet per second when propelled by a progressively expanding booster charge developing 6,000 pounds per square inch.

It is believed that the construction and operation of the invention have been clearly presented and that therefor further discussion is unnecessary.

While we have disclosed a form of the invention presently preferred by us, various changes and modifications will occur to those skilled in the art after a study of the present disclosure. Hence the disclosure is to be taken in an illustrative rather than a limiting sense; and it is our desire and intention to reserve all modifications falling within the scope of the subjoined claims.

We claim:

1. In a rocket-round for a breechless gun barrel, a tube open at its forward end and closed at its rearward end, a self-propelled rocket in said tube, a booster charge in said tube for initiating flight of said rocket when said tube and barrel are in coaxial alignment, an a malleable metallic sealing ring in the forward end of said tube for forming a gas seal between the forward end of said tube and the rear end of said barrel by extrusion of said malleable ring when deformed by the forward movement of said rocket during initial flight thereof.

2. In a rocket-round for a breechless gun barrel, a tube open at its forward end and closed at its rearward end, a self-propelled rocket having a rotating band thereon and slidably fitting said tube, a booster charge in said tube for initiating flight of said rocket, means for sealing the gap between the gun barrel and the forward open end of the tube said means comprising a reinforcing band about the tube end and a sealing ring housed therein in the path of movement of said rotating band and deformable by pressure of said band to make a gastight seal between the tube and the rear end of said barrel.

3. In a fixed round for a breechless gun barrel having axially slidable means therearound for encircling the breech end of the barrel and the forward end of the round when said round is in coaxial alignment therewith, said round comprising a tube closed at its rear end and open at its forward end, a self-propelled rocket having a rotating band thereon and slidably fitting said tube, a propelling charge in said tube for initial propulsion of said rocket, and a sealing ring in the forward end of said tube deformable by pressure of said rotating band to seal the gap between the forward end of said tube and the rear end of said barrel when said rocket propellant is initiated.

4. In a fixed round of ammunition for a breechless gun barrel, a tube closed at its rearward end and adapted to be positioned in alignment with and with its open forward end contiguous the rearward end of the barrel, a projectile in said tube and having a driving band fixed thereabout, a propelling charge in said tube between the closed end thereof and said projectile, and a sealing ring mounted in the open end of said tube for limited axial movement and having an inner diameter slightly less than the outer diameter of said band, whereby said ring is moved into sealing contact with the end of the barrel by passage thereinto of said band.