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Austin, Jr. et al.

[11] **3,919,799**

[45] **Nov. 18, 1975**

[54] **GRENADE LAUNCHER AND ANNULAR CARTRIDGE THEREFOR**

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[73] Assignee: **United States of America as represented by the Secretary of the Army**, Washington, D.C.

[22] Filed: **June 4, 1974**

[21] Appl. No.: **476,251**

[52] **U.S. Cl.** ..... **42/1 F**; 42/76 R; 102/38; 102/93

[51] **Int. Cl.²**.. **F41C 27/06**; F42B 9/00; F42B 13/16

[58] **Field of Search** ..... 42/1 F, 76 R; 102/93, 38

[56] **References Cited**

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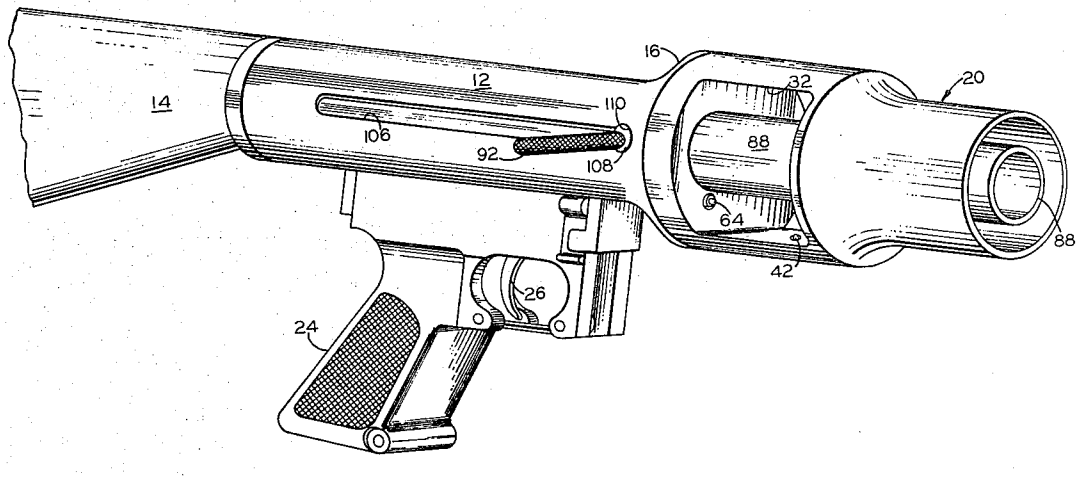
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Primary Examiner—Verlin R. Pendegrass
Assistant Examiner—C. T. Jordan
Attorney, Agent, or Firm—Nathan Edelberg; Robert P. Gibson; Harold H. Card, Jr.

[57] **ABSTRACT**

A grenade launcher for firing an annular grenade cartridge includes a hollow receiver, a barrel having a transverse feedway therethrough and a rifled bore of greater diameter than the receiver extending forwardly of the feedway, and a tubular cartridge support slidably disposed in the receiver in position to cock the launcher firing mechanism when drawn to the rear and arranged when returned to the forward position thereof to pass through the annular cartridge and cooperate with the barrel to define an annular bore therebetween. The annular cartridge is provided with an annular primer and propellant charge in the rear end of an annular cartridge case having an enlarged counterbored portion at the forward end thereof. An annular piston is slidably disposed in obturating engagement with the exterior periphery of the tubular cartridge support and is arranged to be driven forwardly by the firing of the propellant charge to impart corresponding movement to an annular sabot releasably seated in the counterbored portion of the cartridge case.

8 Claims, 7 Drawing Figures



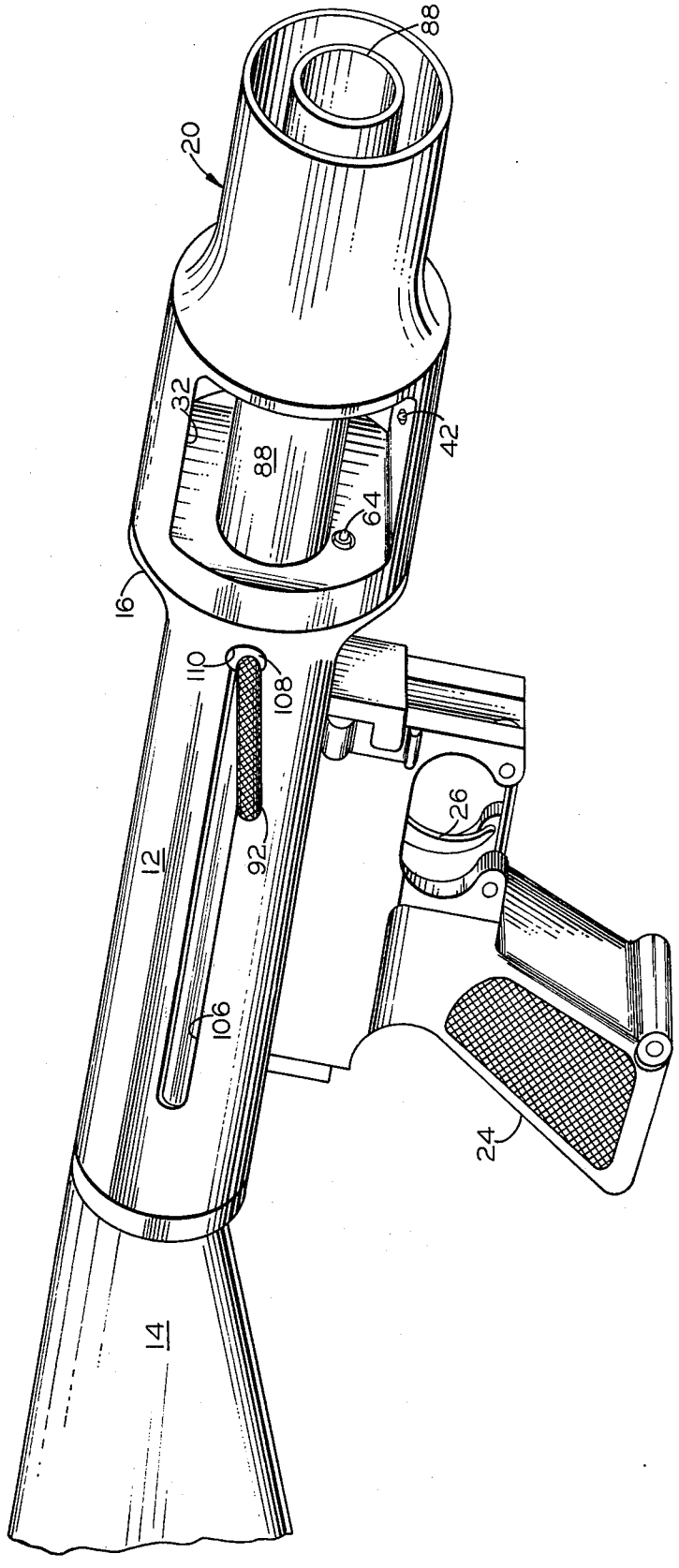


Fig. 1

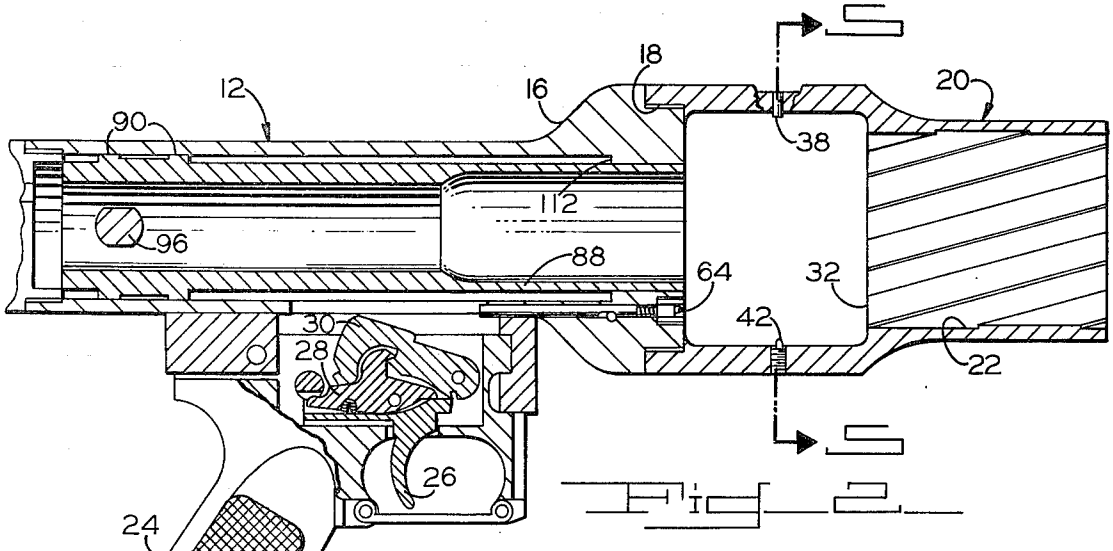
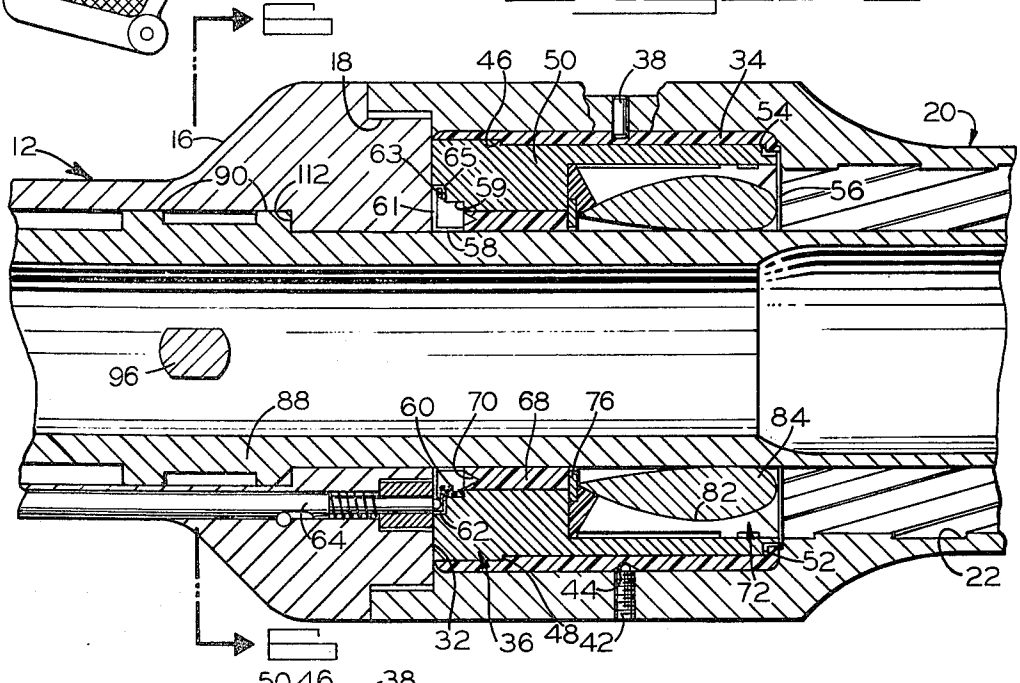


Fig. 2

Fig. 3



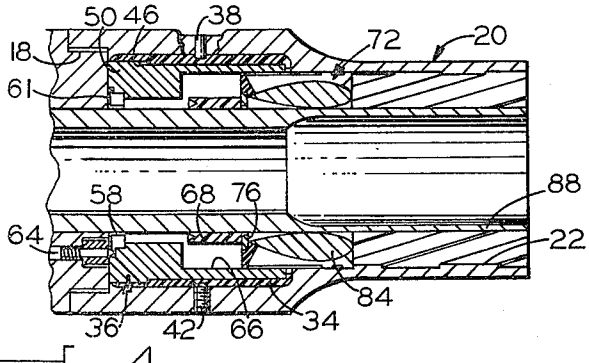


Fig. 4

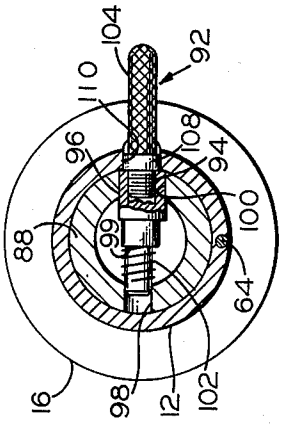


FIG. 6

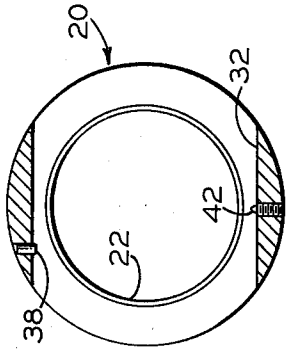


FIG. 5

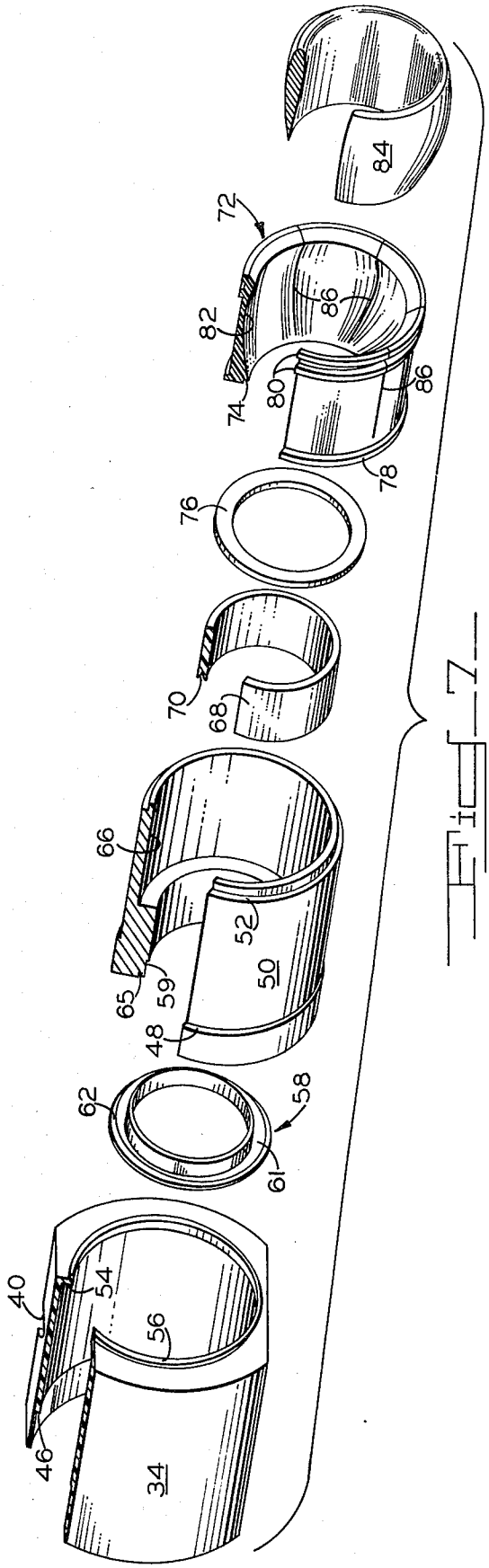


FIG. 7

GRENADE LAUNCHER AND ANNULAR CARTRIDGE THEREFOR

BACKGROUND OF THE INVENTION

This invention relates to grenade launchers and is more particularly directed to a firearm for launching grenade projectiles of annular configuration.

The launching of grenade projectiles has attained sufficient importance as a means for increasing infantry firepower to warrant the development of a separate firearm with a relatively short barrel of greater caliber than the M79 Launcher in current use by the Armed Forces. Although these special firearms display considerably better results than those obtained with the type of auxiliary attachments customarily provided on conventional infantry firearms, they have not yet been standardized for military use primarily because the rather heavy and bulky grenade projectiles currently available limit the firing thereof to relatively short ranges.

One recent innovation which has resulted in a significant increase in the firing range of a grenade projectile involves a change from the usual hollow ball or bullet-shaped configuration to an annular shape having an airfoil cross section as taught in U.S. Pat. No. 3,877,383 to Abraham Flatau. These annular shaped projectiles are generally enclosed in a plastic carrier or sabot which is, in turn, loaded in a metallic cup-shaped cartridge case to form a complete round of ammunition. The flatter trajectory and increased range of annular airfoil grenade projectiles has been clearly demonstrated, but a means to minimize the ejecta from the muzzle when launching these normally greater than **40mm** projectiles from a full bore was found to be necessary in order to reduce the recoil forces transmitted to the shoulder of the firearm user. The parasitic weight of the sabot is excessively high because of the need to plug the bore of the annular projectile, thereby requiring launch at lower velocities for acceptable recoil, and resulting in a reduction in achievable range as well as an increase in the size and weight of the complete cartridge assembly.

It is therefore an object of this invention to provide a simple and reliable grenade launching firearm from which an annular projectile can be fired to a greater range than heretofore possible without a corresponding increase in the recoil forces on the user.

Another object of the present invention resides in the provision of a grenade launcher having a barrel bore of annulus configuration for the passage of an annular projectile therethrough.

It is also an object of the present invention to provide a grenade launcher for firing annular cartridges wherein a slidable tube is arranged to be actuated in one direction to cock the firing mechanism and in the opposite direction to pass through the cartridge in supporting engagement therewith.

A further object of this invention is to provide an improved cartridge designed to be fired from a grenade launcher with an annulus bore wherein the individual components of the cartridge are each of annular configuration thereby providing a desirable reduction in the total weight thereof as well as a corresponding decrease in the recoil forces produced during firing and consequently in the quantity of the propellant charge required to fire the projectile to a given range.

Still another object of this invention is to provide an annular cartridge, as aforesaid, wherein the actuating piston and the sabot are in respective obturating engagement with the inner and outer surfaces of the annulus bore of the grenade launcher prior to exit from the muzzle end thereof.

SUMMARY OF THE INVENTION

It has been found that the foregoing objects can be achieved by a grenade launcher wherein an interiorly rifled barrel is fixed to the forward end of the receiver and a tubular cartridge support of smaller diameter is slidably disposed in the receiver in spaced concentric relation to the barrel to form an annulus bore therebetween. A transverse rectangular slot through the rearward portion of the barrel forms a feedway into which an annular cartridge can be manually loaded once the cartridge support has been drawn to the rear by a charging handle thereon projecting through the side of the receiver. As the cartridge support is being retracted, it also cocks a firing mechanism disposed in a pistol grip depending from the underside of the receiver. Upon being returned to forward position thereof, the tubular support passes through the annular cartridge to position a firing pin therein for subsequent firing impact with the cartridge in response to the release of a pivotal hammer by the trigger mechanism.

The annular cartridge is seated in a cylindrical holder of plastic material and is provided with an annular aluminum case containing a correspondingly shaped primer and propellant charge assembly. The interior diameter of the cartridge case is forwardly counterbored to seat an annular plastic sabot enclosing an annular projectile. Disposed between the primer and the sabot is an annular actuating piston arranged to be driven forwardly in response to the discharge gases generated by the firing of the propellant charge to impart corresponding movement to the sabot into rotational obturating engagement with the rifling in the barrel. Once the actuating piston leaves the annular space between the smaller diameter interior surface of the cartridge case and the exterior of the cartridge support, the relatively high pressure gases acting on the rear end of the piston expand into the area vacated by the sabot to impart additional momentum thereto. The sabot is provided with a plurality of circumferentially spaced peripheral cuts of sufficient length to permit the fragmentation or the opening thereof into petal form immediately upon exit from the barrel without interfering with the flight of the spinning annular projectile. While the actuating piston also exits from the barrel, the obturating engagement thereof with the cartridge support and the absence of any spin thereon rapidly dissipate the forward velocity thereof. Thus, the grenade launcher of the present invention is able to impart greater range and accuracy to an annular projectile than heretofore possible with existing grenade guns or the auxiliary firing attachments of conventional firearms.

BRIEF DESCRIPTION OF THE DRAWINGS

The exact nature of the invention as well as other objects and advantages thereof will be readily apparent from consideration of the following specification relating to the annexed drawings, wherein:

FIG. **1** is a perspective view of the grenade launcher;

FIG. **2** is a vertical section of the launcher forwardly of the stock portion thereof shown prior to the loading

of a grenade cartridge therein and with the tubular cartridge support retracted for cocking the firing mechanism;

FIG. 3 is an enlarged fragmentary view of FIG. 2 with the tubular cartridge support in the forward position thereof at the instant of firing;

FIG. 4 is a fragmentary view of FIG. 3 reduced in size and showing the components of the cartridge subsequent to firing but prior to exit of the projectile from the barrel;

FIG. 5 is a section taken along line 5—5 in FIG. 2 to show the interior configuration of the cartridge feedway in the barrel;

FIG. 6 is a section taken along line 6—6 in FIG. 3 to show the details of the retracting handle on the cartridge support; and

FIG. 7 is an exploded perspective view of the components of the grenade cartridge and the holder therefor.

DESCRIPTION OF A PREFERRED EMBODIMENT

As shown in the drawings wherein similar reference characters are utilized to designate corresponding parts throughout, the grenade launcher of the present invention essentially comprises a hollow receiver **12** secured at the rear end thereof to a conventional shoulder stock **14.** The forward end of receiver **12** is circumferentially enlarged, as indicated at **16,** and is externally threaded to engage with a correspondingly threaded section **18** at the rear end of a barrel **20** provided with a conventionally rifled bore **22.** A pistol type of hand grip **24** depends from receiver **12** and houses a pivotal trigger **26** which serves to actuate a pivotal sear **28** for releasing a spring-biased hammer **30** in a manner well known in the art of semiautomatic firing mechanisms. A rectangular opening extends transversely through barrel **20** to provide a feedway **32** for an annular holder **34** containing an annular cartridge **36.** Holder **34** is suitably slabbed at the top and bottom thereof to permit the slidable insertion thereof into feedway **32.** A fixed stop pin **38** located laterally beyond the center of feedway **32** extends downwardly therein in position to contact the end of a transverse groove **40** in the slabbed top of holder **34** for halting cartridge **36** in the firing position thereof. A spring-biased detent **42** projects upwardly into feedway **32** from the bottom thereof to engage in a mating depression **44** in the slabbed underside of holder **34** for insuring the releasable retention thereof in firing position.

Cartridge holder **34** is preferably formed of a high density polyethylene and is counterbored at the rear end thereof to provide an interior stop shoulder **46.** A corresponding circular shoulder **48** is located on the exterior periphery of an annular cartridge case **50** so that when the latter is inserted into holder **34** from the rear end thereof the contact between shoulders **46** and **48** positions the front and rear faces of case **50** into flush alignment with the respective faces of holder **34.** The forward end of case **50** is of reduced diameter to form a forwardly facing shoulder **52** which upon insertion into holder **34** is normally disposed, as best shown in FIG. **3,** in spaced relation to an inwardly turned flange **54** at the front end of the latter which serves to retain case **50** therein during the firing of cartridge **36.** In addition, the front face of holder **34** is suitably ridged around the axial hole therethrough, as best indicated at **56** in FIG. **7,** to provide obturating contact with the corresponding front face of feedway **32** in receiver **12.** A cylindrical insert **58,** preferably of brass, extends into the rear end of cartridge case **50** in spaced relation to a counterbore **59** therein to define a chamber for a propellant charge **60.** The rear end of insert **58** is formed with an integral flange **61** of larger diameter terminating in a rolled edge **62** arranged to retain a primer **63** therebeneath in position to ignite propellant charge **60** in response to the impact of a firing pin **64** slidably retained in the forward portion of receiver **12.** The rear face of cartridge case **50** is forwardly grooved, as at **65,** to receive rolled edge **62** on flange **61** and thereby bring the latter into flush alignment with the rear face of case **50.** The forward end of case **50** is also counterbored, as indicated at **66,** to provide an intermediate inner periphery coextensive with a slidable annular piston **68** initially disposed in abutment with the forward end of insert **58.** A forwardly converging V-notch **70** is provided in the rear end of piston **68** to receive the thrust produced by the discharge gases generated by the firing of propellant charge **60.**

An annular sabot **72** of polyethylene plastic is rearwardly counterbored, as indicated at **74,** to seat a thrust ring **76** of aluminum and is arranged to be assembled into counterbore **66** of cartridge case **50** with ring **76** in abutment with the front face of piston **68.** The rear end of sabot **72** is diametrically enlarged to provide a circumferential obturating ring **78** while the forward end of sabot **72** is similarly provided with a pair of spaced apart rotating bands **80** of greater width than ring **78.** The interior of sabot **72** is inwardly curved from front to rear, as best indicated at **82** in FIG. **7,** for mating engagement with the airfoil-shaped exterior of an annular grenade projectile **84.** In addition, sabot **72** is circumferentially provided with a plurality of spaced slits **86** extending rearwardly from the front end thereof to terminate forwardly of obturating ring **78.** Slits **86** provide sabot **72** with the flexibility required to permit the maximum diameter portion of projectile **84** to pass through the slightly smaller diameter opening at the front end of sabot **72.**

Once holder **34** containing a fully assembled cartridge **36** has been inserted into feedway **32** in receiver **12** to the extent permitted by fixed stop pin **38,** such cartridge **36** is retained in firing position by the passage therethrough of a tubular cartridge support **88** slidably disposed in receiver **12.** The rear portion of support **88** is provided with a pair of spaced circumferential bearing pads **90** for slidable engagement with the hollow interior of receiver **12.** The slidable movement of support **88** is imparted thereto by a charging handle **92** projecting outwardly therefrom in the vicinity of bearing pads **90.** The inner end of handle **92** is threaded, as indicated at **94** in FIG. **6,** for engagement in the larger diameter end of a stepped guide member **96** which is, in turn, slidably seated in axially aligned transverse openings **98** and **100** in support **88.** The smaller diameter end of guide member **96** extends into opening **98** and is circumferentially provided with a shoulder **99** for seating a compression spring **102** in position to normally bias handle **92** outwardly of receiver **12.** The outer end of handle **92** is preferably knurled, as indicated at **104,** and extends through a longitudinal slot **106** in the side of receiver **12.** Between threaded portion **94** and knurled portion **104,** handle **92** is diametrically enlarged, as at **108,** to slidably fit into a correspondingly enlarged recess **110** at the forward end of slot **106.** Thus, handle **92** is normally locked against movement to the rear until forced inwardly against the spring-biased guide member **96** whereupon the enlarged diam-

eter portion **108** thereon moves into the interior of receiver **12** to permit subsequent retraction of handle **92** along slot **106.** As handle **92** is retracted, the rear face of cartridge support **88** pivots hammer **30** into cocking engagement with sear **28** as best shown in FIG. **2.** The retraction of support **88** also exposes feedway **32** for the insertion of a cartridge holder **34** with a cartridge **36** therein. Thus, when support **88** is returned to the forward position thereof, it passes through annular cartridge **36** in supporting engagement therewith. The forward movement of support **88** is halted in flush alignment with the forward end of barrel **20** as the front face of the forward bearing pad **90** thereon contacts a mating circular shoulder **112** within the interior of receiver **12.**

Thus, when trigger **26** is pulled, sear **28** is pivoted to release hammer **30** for impact against the protruding end of firing pin **64** to fire propellant charge **60.** The expansion of the resulting discharge gases imparts forward movement to piston **68** and to sabot **72** in abutment therewith. At the same time, the notched rear end of piston **68** is expanded into slidable obturating contact with the adjacent inner periphery of cartridge case **50** and with the adjacent exterior periphery of cartridge support **88.** As a result, the initial expansion of the discharge gases is confined to the relatively small annular area which opens up behind the advancing piston **68** thereby producing a relatively high initial pressure thereagainst which will impart a maximum degree of velocity to sabot **72** together with projectile **84** therein. In fact, the desired pressure can be obtained with a substantially lesser propellant charge than that heretofore required to impart equivalent velocity to a solid sabot containing a non-annular grenade projectile of the same caliber size.

As soon as piston **68** moves beyond the rear of counterbore **66** in cartridge case **50,** as best shown in FIG. **4,** the rapid increase in the area provided for the expanding discharge gases results in a corresponding decrease in the acceleration imparted to piston **68** and to sabot **72.** However, in view of the difference in area between the rear face of sabot **72** and that of piston **68,** a considerably larger proportion of the total thrust produced by the continued expansion of the discharge gases is available to drive sabot **72** and thereby projectile **84** out of barrel **20.** Because of the plurality of slits **86** about the circumference of sabot **72,** the latter begins to fragment or petal, as the case may be, immediately upon emergence from barrel **20** without any appreciable effect on the considerable velocity imparted to projectile **84.** In view of the airfoil configuration of projectile **84** and the high rate of spin imparted thereto by rifling **22** in outer barrel **20,** the flight thereof is considerably longer and potentially more accurate than heretofore achieved with grenade projectiles of conventional non-annular shape or even of annular shape when carried in a non-annular sabot. As support **88** is retracted to cock hammer **30,** holder **34** and the fired cartridge case **50** can be readily removed from feedway **32** to permit the reloading of the launcher with another grenade cartridge **36.**

The foregoing disclosure and description of the invention is illustrative only. Various changes may be made within the scope of the appended claims without departing from the spirit of the invention.

We claim:

1. A firearm for launching grenade projectiles of annular configuration comprising,

a hollow receiver,

a barrel having a rifled bore of larger diameter than said receiver secured to the forward end thereof, said barrel having a transverse feedway therethrough rearwardly adjacent said rifled bore for retaining an annular grenade projectile in position to be fired therefrom,

a tubular member slidably disposed in said receiver for movement between a rearward position wherein said feedway is exposed for the insertion of an annular cartridge therein and a forward position passing through the annular projectile in supporting engagement therewith, and

a charging handle projecting outwardly from said tubular member for imparting slidable movement thereto within said receiver between said forward and rearward positions thereof.

2. The firearm as defined in Claim **1** including,

a stop pin in said feedway for halting the annular projectile in axial alignment with said tubular member, and

a spring-biased detent projecting upwardly into said feedway to releasably retain the annular projectile therein.

3. The firearm as defined in claim **1** wherein said receiver includes a longitudinal slot terminating in a locking recess at the forward end thereof, and spring means normally biasing said charging handle outwardly of said receiver into locking engagement in said locking recess when said tubular member is in said forward position thereof.

4. In a grenade launcher for firing an annular grenade cartridge, the combination of,

a hollow receiver terminating in a circumferentially enlarged forward end,

a barrel threadably secured to said forward end of said receiver and having a rifled bore of larger diameter than said receiver in axial alignment therewith,

a feedway extending transversely through said outer barrel between said forward end of said receiver and said rifled bore for retaining the annular cartridge in position to be fired,

a tubular cartridge support slidably disposed within said receiver for concentric cooperation with said rifled bore to define an annulus for passage of the fired projectile therethrough, and

a charging handle projecting outwardly from said cartridge support for imparting slidable movement thereto between a rearward position wherein said feedway is exposed for the insertion of an annular cartridge therein and a forward position through the cartridge for establishing said annulus passage therefor.

5. The grenade launcher as defined in claim **4** including,

spring means normally biasing said charging handle into locking engagement with said receiver in the forward position of said inner barrel, and

a firing pin slidably disposed in the forward end of said receiver for firing impact with the rear end of the annular cartridge.

6. In a grenade launcher for firing an annular grenade projectile, the combination of

a hollow receiver,

a barrel of larger diameter than said receiver secured thereto in axial alignment therewith, said barrel having a rifled bore and a transverse feedway

therethrough rearwardly adjacent said bore,

an annular holder surrounding an annular grenade cartridge, comprising,

an annular cartridge case having a combined annular primer and propellant charge in the rear end thereof,

an annular sabot in said cartridge case in resilient gripping engagement with the annular projectile, and

an annular piston disposed between said propellant charge and said sabot for imparting forward movement thereto in response to the firing of said propellant charge,

a tubular cartridge support slidably disposed in said receiver for movement between a rearward position wherein said feedway is exposed for the insertion of said holder together with said cartridge therein and a forward position through said piston and said sabot to cooperate with said barrel for defining an annulus passage for the annular projectile,

a charging handle projecting outwardly from the rear end of said cartridge support for imparting slidable movement thereto within said receiver between said forward and rearward positions, and

a firing pin slidably disposed in said receiver for impact with said primer.

7. The combination defined in claim **6** including,

a stop pin in said receiver extending into engagement with said holder for halting said annular cartridge in position for passage therethrough of said tubular support,

a spring-biased detent projecting upwardly from said receiver into engagement with said annular cartridge holder for the releasable retention thereof in said feedway prior to the passage of said support through said annular cartridge, and

an inwardly turned flange at the front end of said holder for retaining said cartridge case therein during the exit of said sabot therefrom.

8. The combination defined in claim **6** wherein said piston includes obturating means at the rear end thereof engageable with the exterior surface of said cartridge support to seal against the discharge gases generated during the firing of said propellant charge, and said sabot is provided with an obturating ring at the rear end thereof for sealing engagement with the interior surface of said cartridge case and a plurality of rotating bands on the forward end thereof engageable with said rifled bore in said barrel for imparting rotation to said sabot.

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