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FIXED-ANGLE VARIABLE-RANGE MARKER LAUNCHER

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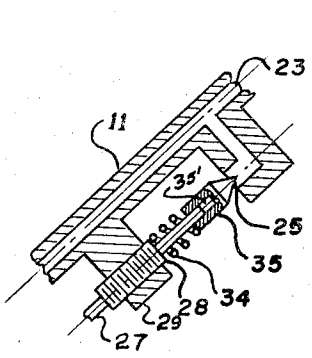


FIG. 2

FIG. 1

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FIXED-ANGLE VARIABLE-RANGE MARKER LAUNCHER

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ABSTRACT OF THE DISCLOSURE

A fixed elevation, variable range, variable azimuth projectile launcher having an adjustable gas venting valve for varying the projectile launch pressure in such manner as to effect desired projectile range. Both the range determining gas venting valve adjustment and the azimuth adjustment are controlled by a sonar system, so as to accurately fire the projectile at a target previously acquired thereby.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates to variable-range projectile launchers of the rifle-grenade-type and more particularly to such launchers which under the control of a ship's sonar can propel a marker projectile through an air-water trajectory to a point on the ocean floor near a sonar contact which has been classified as a mine.

In certain mine hunting operations a sonar equipped search ship proceeds through an area thought to be mined until a contact is detected. Thereafter the ship for the sake of safety remains at least 100 yards from the contact until it can be classified as mine-like or not and when appropriate marks the location of the mine-like contact for later neutralization while the ship continues to search for new contacts.

In accordance with the present invention the marker luncher has a fixed elevation angle, and range is varied by adjusting a gas venting valve to vary the pressure acting to accelerate the projectile (marker). Also in accordance with the invention the launcher is automatically controlled in range and bearing by the ship's sonar.

Known method employed for varying range in launching military rifle grenades and in the firing of mortar shells include in both cases the varying of the elevation angle of the rifle and mortar barrels. The desired accuracy of the present launcher suffers, especially at short ranges, from the use of such range varying practices because at short ranges the elevation angle becomes very high or very low resulting in correspondingly very high or very low trajectories. The high trajectory results in a long exposure to wind while the low trajectory may cause the projectile to richochet on a rough water surface.

It is also known in antisubmarine warfare for launching relatively heavy depth charges to employ adjustable exhaust gas venting structures to vary the range of a missile fired from a projector having a fixed barrel elevation.

An object of the present invention is to provide a launcher for a relatively light weight marker having variable range and bearing controls coupled to a ship's search sonar for marking the location of a sonar target which has been classified as being mine-like.

Another object of the invention is to provide a simple arrangement for controlling the venting to the atmosphere of gases from the propellent explosive for varying the range of a projected marker.

Other objects and many of the attendant advantages of this invention will be readily appreciated by those skilled

in the art from the following description when read in connection with the accompanying drawing in which:

FIG. 1 is a side elevation partly in section of a preferred embodiment of the invention; and

FIG. 2 is a fragmentary sectional view of an alternative gas venting arrangement.

Referring now to the drawing wherein like reference characters denote like parts in the two views, FIG. 1 illustrates a preferred embodiment wherein a firing mechanism **10**, here shown as comprising a modified rifle, is provided with a barrel **11** which fits into the tail tube of a projectile **12** which in the presently intended use comprises a marker of known construction and operation for identifying the position on the bottom of an underwater mine-like target. The firing mechanism **10** is mounted on a frame **13** which is gimbal-mounted with freedom in two orthogonal vertical planes on a support arm **14** by means of a Y-shaped yoke **15** the primary shaft of which rotates freely in a bearing **15'** provided on the arm **14** and the two secondary shafts of which engage trunnions **16** provided on the barrel **11** in a well known manner. The frame **13** comprises two spaced parallel plates the front one as viewed in FIG. 1 being omitted for the sake of clarity. The frame **13** has secured thereto as by bolts **40** a pendulous weight **17** for utilizing the force of gravity to tend to maintain the orientation of the frame **13**, and hence of the barrel **11**, with respect to the vertical during angular movement during pitch and roll of a ship the deck **41** of which supports a cabinet **42** which mounts the support arm **14** for rotation about a vertical axis. In order to make the gimbal-mounted assembly relatively insensitive to angular movement of the ship's deck **41** it is designed to have a natural frequency, say one cycle per second, which is high relative to the frequency of the ship's movement. Preferably the gimbal-mounted assembly including the pendulum **17** is so supported that the rifle barrel **11** will assume a 45-degree elevation when loaded with a marker projectile **12**. This assembly is moved as a unit to train the barrel **11** in bearing by a servo motor **18** which rotates the support arm **14** through gears **19** to the azimuth of the ship's sonar transducer through a synchro control transformer **20** adjustable by one of the gears **19** and a bearing amplifier **21** in accordance with a sonar transducer bearing signal **43** derived from a synchro transmitter usually located in the sonar's transducer dome.

A gas producing cartridge **22**, e.g., a caliber .30 M3 rifle-grenade cartridge, loaded in the firing mechanism **10** is adapted to be fired by a solenoid **36** under the control of the sonar operator via a switch **44** to produce a gas pressure in the bore **23** of the barrel **11**. This gas pressure acts on the bottom area of the tail tube of the projectile **12** to accelerate the projectile **12** along the barrel **11** to a velocity sufficient to obtain the desired range.

Variations in range of the projectile **12** are obtained by venting to the atmosphere some of the gas propellant through a conduit **24** providing a passageway connecting the bore **23** to an exit orifice **25** the effective area of which is varied by adjusting the position of a tapered plug **26** extending into the orifice **25**, this latter assembly constituting an adjustable needle valve.

The tapered plug **26** is mounted on the distal end of a shaft **27** equipped with a lead screw thread **28** in threaded engagement with a nut **29** rigidly secured to the barrel **11**. The shaft **27** as here shown comprises an extension of the shaft of a range control motor **30** which rotates the shaft **27** to move the tapered plug **26** toward or away from the orifice **25** to vary its effective gas venting area. The range control motor **30** has its shaft **27** connected through gears **45** to the adjustable element of a potentiometer **32**. The settings of the ship's sonar range cursor **31** and of the potentiometer **32** provide inputs to a range

comparison network and amplifier **33** the output of which operates the range control motor **30** to position the plug **26** in accordance with a pre-selected calibration curve the preparation of which being not presently pertinent.

The bearing amplifier **21** and the range comparison network and amplifier **33** are preferably mounted within the cabinet **42**. The sonar range cursor **31**, the sonar transducer bearing signal source **43** and the firing switch **44** are located in the ship's sonar room and are here shown as being a part of the sonar console **46**.

The embodiment of the propellent gas venting arrangement shown in FIG. 2 has a tapered plug **35** (corresponding to the plug **26** in FIG. 1) the flat end of which forms a shoulder for holding a spring **34** seated between said shoulder and the facing end of the lead screw thread member **28**. The tapered plug **35** is provided with a well **35'** into which the end of the shaft **27** slidably extends a distance less than the depth of the well **35'** so as to permit the spring **34** to deform, i.e., be compressed, under the force imposed by the gas pressure on the plug **35**. Such deformation of the spring **34** allows the plug **35** to move away from the orifice **25** to thereby increase the venting area and provide a pressure regulating effect with a consequent increase in accuracy because an increase in pressure from one cartridge over another will result in a greater venting area for the higher pressure cartridge. It may be noted that in each embodiment the venting orifice **25** faces a direction such that the thrust of the vented gas opposes the recoil thrust of the barrel **11**.

It will be evident from the foregoing that the projectile launcher is automatically controlled in range and bearing and that since a sonar contact would be centered in the classification display at the time it is determined to be mine-like the classifying sonarman can press the firing switch **44** knowing that the launcher has the proper range and bearing settings.

Most propellent gases are quite dirty and known prior venting systems quickly "gum" up and require frequent cleaning. In the arrangement of this invention the taper on the plugs **26** and **35**, respectively, divert the vented gas away from the lead threads **28** to prevent fouling and require very infrequent cleaning. In addition these threads **28** are readily accessible for cleaning whereas prior art valves generally required some dismantling for this purpose.

The rifle firing assembly has not been described in detail because it is a Model 1903 Springfield rifle having a single shot, bolt action mechanism with proven reliability and readily available to the government. The rifle has been modified by shortening its original barrel and adding a new barrel assembly fitted with the above described adjustable needle valve.

Although obvious to one skilled in this art it is to be understood that means such as mechanical stops will be

provided to limit the rotation of the support arm **14** to that sector through which markers can be safely fired without hitting the superstructure of the ship and that safety switches will be provided, such as at the launcher, so that they must be closed before the closing of the switch **44** can actuate the launcher firing circuit.

While for the purpose of disclosing the invention specific embodiments thereof have been described, it will be evident to those skilled in the art that many modifications may be made in the system without departing from the invention the scope of which is pointed out in the appended claims.

What is claimed is:

1. In combination with a gun barrel having a longitudinal bore therethrough for the passage of the expanding gases generated upon the firing of a cartridge therein for propelling a projectile slidably mounted on the muzzle of the barrel,

conduit means connecting said barrel bore to the atmosphere and having an orifice at its distal end,

a tapered plug movable toward and away from said orifice for varying its effective gas venting area,

means including a pendulous weight for supporting said barrel at a fixed elevation with respect to the horizontal when a projectile is mounted on the muzzle of said barrel, and

means to adjust the position of said plug with respect to said orifice to produce variable venting of expanding gases in accordance with the range desired for said projectile.

2. The projectile propelling apparatus in accordance with claim **1** wherein said conduit means is so oriented that the thrust of the gases vented through the orifice of said conduit is in opposition to the thrust of the projectile propelling gases.

3. The apparatus in accordance with claim **1** wherein said tapered plug is spring mounted to allow limited movement of said plug away from said orifice to deform the spring as a direct function of the pressure of the propelling gases thereby compensating for variiations in the gas pressure produced by different cartridges.

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