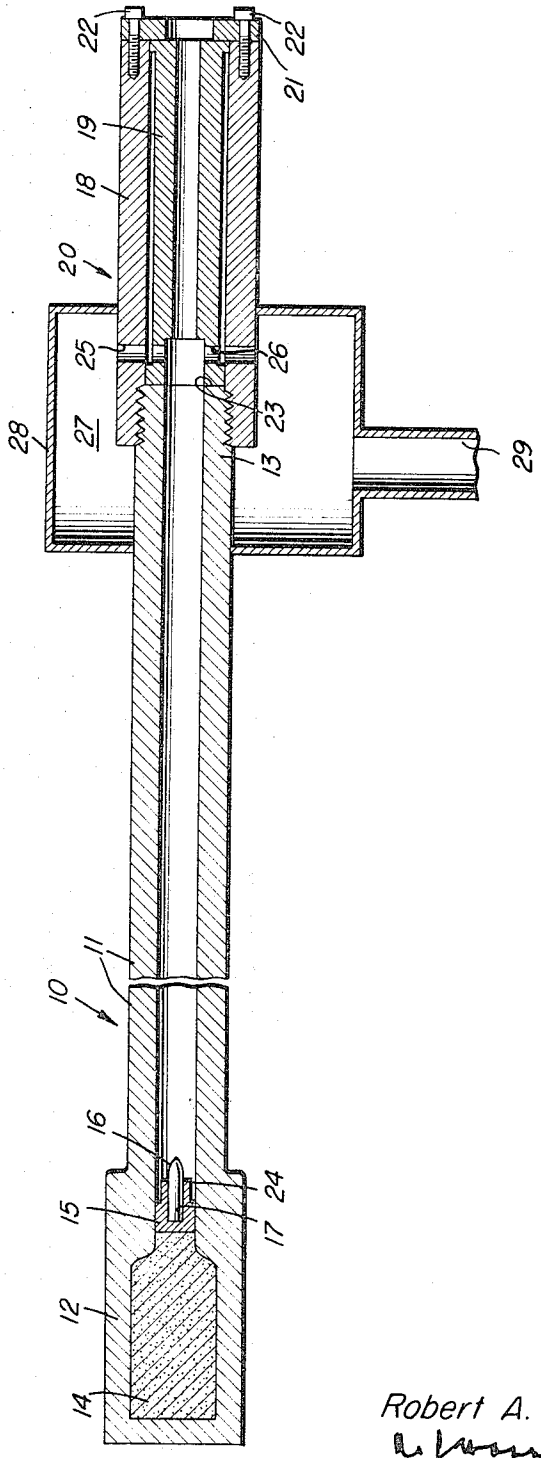
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GUN BLAST AND MUZZLE FLASH ELIMINATOR

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GUN BLAST AND MUZZLE FLASH ELIMINATOR

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ABSTRACT OF THE DISCLOSURE

A gun blast and muzzle flash eliminator having a cylindrical chamber with a cylindrical inner liner for attachment to the muzzle of a standard powder gun. A sabot is provided in the breech end of the barrel to receive the missile projectile. The inner diameter of the liner is greater than the diameter of the missile but less than the diameter of the sabot thus cooperating to arrest the sabot on firing while permitting the missile to pass through at full velocity and prevent gun blast and muzzle flash from emanating from the muzzle by diverting the gas pressure into a silencing chamber.

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 a gun for firing a projectile or ballistic missile at high velocities and under accurately controlled conditions and more particularly to such a gun in combination with an attachment mounted upon the muzzle end thereof for the purposes of minimizing and substantially eliminating the gun blast and muzzle flash which normally accompanies firing of a gun.

There has long been a need for a gun for use in wartime which is capable of firing a projectile without producing any muzzle flash or acoustic blast so that visual and/or audible detection by the enemy would be impaired. The ever increasing efforts in the research and testing of ballistic missiles has also created a demand for a gun having such characteristics. When an explosive charge is detonated in the breech chamber of a gun, the expanding gases produced by the explosion accelerate the projectile down the barrel of the gun until the projectile issues from the muzzle at which moment the propellant gases cease to perform any useful functions and only produce undesirable effects. Exemplary of those undesirable effects when the gun is used as a field weapon, are the visible flash and the acoustic blast produced when the expanding gases make impact with the surrounding air. When such a gun is used for launching a ballistic missile into an observation zone or missile range for photographic research studies of the missile flight characteristics, combustion products and other particles emanate from the muzzle end of the barrel and contaminate the environment into which the ballistic missile is fired. It has also been found that the propellant gases in the gun barrel behind the projectile, which are under extremely high pressure and travel at high velocities, upon the sudden unsealing of the muzzle when the projectile leaves the muzzle, emerge from the muzzle in a blast which causes the projectile to yaw in flight rather than follow a true bore sight trajectory. The expanding propellant gases which surround the trailing edges of the projectile at the moment the projectile issues from the muzzle end of the gun barrel tend to engulf the projectile and create air turbulence which disturbs the true flight of the projectile. Moreover, recent research studies have created the need for a gun to impart high velocities to a projectile for impact with a body of water to facilitate the study of the

effects produced upon impact of the projectile with the water, in which case it is apparent that the emission of propellant gases from the muzzle end of the barrel of the launching gun would, upon impact with the surface of the water, disturb the water to such an extent as to obscure the missile entry effects. Previously known powder guns or compressed gas guns have not functioned entirely satisfactorily for the above-noted purposes because each type of launching gun produced an undesirable muzzle blast and a discharge of contaminates. Catapult types of launching guns have been used in the past but require massive hardware structures and are only capable of imparting limited velocities to the projectiles.

The general purpose of this invention is to provide a ballistic missile launching gun which embraces all the advantages of similarly employed launching guns and yet possesses none of the aforedescribed disadvantages. To attain this result, the present invention contemplates an attachment device for the muzzle end of the launching gun for use with a missile which is mounted upon a sabot, the relative sizes of the missile and the sabot being such that the missile passes through the attachment device while the sabot is captured in the attachment device to completely prevent the emission of propellant gases and contaminant particles from the muzzle of the gun and to divert those gases into a blast silencer chamber. Upon firing of the explosive charge in the breech of the gun, the propelling gases behind the missile and sabot assembly accelerate the assembly down the gun barrel until the sabot contacts the muzzle attachment at which moment the missile separates from the sabot and continues along its trajectory while the sabot is entrapped in the attachment and diverts all of the propellant gases into the blast silencer chamber.

It is an object of the present invention to provide a weapon for launching projectiles at high velocities without producing any gun blast or muzzle flash emanating from the muzzle end of the weapon.

Another object of the invention is the provision of a lightweight device for launching ballistic missiles at high velocities within a test chamber while minimizing the air turbulence within the chamber and preventing the entrance of any contaminant particles from the launching device into the test chamber.

A further object of the invention is to provide a devise for launching ballistic missiles into an observation chamber at any preselected orientation of the missile during its flight.

Referring now to the drawing, a gun device embodying the present invention is shown generally at **10** and is comprised essentially of a gun barrel **11** having a breech chamber formed at one end thereof and a muzzle opening **13** at the other end from which the projectile is discharged. The firing mechanism for the gun has not been shown since conventional firing mechanisms may be incorporated into this invention. Positioned with the breech chamber **12** is an explosive charge **14** and received within the gun barrel adjacent the breech chamber is a sabot **15** which forms a support for a missile or projectile **16**, the missile being received within a cup-shaped recess **17** formed in the sabot. Threadedly coupled upon the muzzle opening **13** of the gun barrel is the gun blast and muzzle flash eliminator assembly shown generally at **20**.

The gun blast and muzzle flash eliminator assembly of this invention is comprised of a cylindrical gun barrel extension member **18** which is threadedly coupled to the muzzle end of the gun barrel. Received within said barrel extension member **18** is a cylindrical sabot arresting element **19** which is axially aligned with the axis of the gun barrel and is held in abutting contact with the muzzle end **13** of the barrel by means of an annular clamping

ring 21. The clamping ring is mounted upon the barrel extension member 18 by means of plurality of screws 22 and engages in abutting contact the discharge end of the sabot arresting element. The sabot arresting element is concentrically positioned within the barrel extension member in axial alignment with the axis of the gun barrel and is radially spaced from the inner peripheral surface of the barrel extension element to permit radial expansion of the sabot arresting element. The sabot arresting element 19 has an inner diameter which is greater than the diameter of the missile but being smaller than the diameter of the sabot such that when the sabot and missile are accelerated along the gun barrel, the missile 16 passes through the sabot arresting element without contact and without deceleration while the sabot is jammed into the sabot arresting element 19 by the high pressure propellant gases to deform the element 19 and expand the element radially outwardly. When it is desired to recover the sabot for reuse thereof, the sabot may be constructed of a strong material such as titanium while the sabot arresting element 19 may be constructed of a material having an acoustic impedance such that the arresting element will deform sufficiently to decelerate the sabot and capture the sabot within the sabot arresting element, one such material being 6061–T6 aluminum.

To assure that the sabot and missile assembly enter the gun blast and muzzle flash eliminator assembly at a predetermined attitude, the sabot arresting element 19 is provided with a counterbore 23 which functions to correct any angular deviations of the sabot and missile as they enter the sabot arresting element. For the same reason, the sabot is provided with a reduced diamteer extension 24, the main body portion of the sabot having a diameter equal to the diameter of the gun barrel. The reduced diameter portion of the sabot is of a slightly smaller diameter than the counterbore of the sabot arresting element to form a complementary function of correcting any angular deviations of the sabot upon its entry into the sabot arresting element.

As shown in the drawings the barrel extension member is provided with a transverse through aperture 25 formed therein adjacent the muzzle end of the gun barrel and the sabot arresting element is provided with a transverse through aperture 26 formed in the vicinity of the muzzle opening of the gun barrel, thereby providing fluid communication between the interior of the gun barrel and the interior 27 of a blast silencer chamber 28. The blast silencer chamber 28 is fixedly secured to the outer peripheral surface of the gun barrel extension member 18 and sealingly engages the outer peripheral surface of a portion of the gun barrel 11, the silencer chamber being additionally provided with an exhaust port 29 to exhaust the propellant gases to the atmosphere.

In operation, it will be seen that when the propellant charge 14 is detonated by any conventional means, the combustion gases accelerate the sabot and missile together down the gun barrel until the moment of impact of the sabot with the sabot arrester 19 at which time the missile continues through the sabot arrester without interference or deceleration and assumes its gun sight trajectory. The momentum of the sabot 15 causes the sabot arrester 19 to deform radially but the interference offered by the sabot arrester overcomes that momentum and captures the sabot, thereby completely obstructing the flow of the gases through the sabot arrester 19, the gases then being vented by means of the through apertures 25 and 26 formed in the barrel extension member and the sabot arrester respectively into the blast silencer chamber.

It may therefore be seen that the present invention enables missiles to be fired from a gun at high velocities while no burning propellant gases are permitted to issue from the muzzle end of the gun, all such gases being vented into the silencer chamber. The elimination of all blast and muzzle flash permits the use of such a gun without risk of audible and/or visual detection. Moreover, the present invention provides a device for launching a missile at high velocities without producing any flight disturbing air turbulence or contaminate particles at the discharge end of the weapon. It will also be appreciated that when the present invention is utilized to launch missiles into an observation chamber, the missile may be launched with its axis coaxial with the axis of the gun, as shown in the drawing, or alternatively the missile receiving recess 17 in the sabot 15 may be formed at an angle offset from the axis of the sabot so that when the missile 16 is positioned within the recess 17, the missile is supported at an angle offset from the axis of the gun to thereby permit the launching of the missile at any preselected attitude or position. It will be readily apparent therefore that this invention enables researchers to study the ballistic flights of missiles at any preselected orientation of the missiles in flight.

Obviously many modifications and variatitons of the present invention are possible in light of the above teachings. It is therefore to be understood, that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A ballistic missile launching device for launching a missile into an observation zone while minimizing the air turbulence within said zone and preventing the entrance of contaminate particles from the launching device into the observation zone comprising,

a gun barrel having an axial bore extending therethrough and having a breech chamber formed at one end thereof and a muzzle opening at the other end thereof,

a sabot received within said gun barrel and having a diameter substantially equal to the diameter of the bore in said barrel,

said sabot having a cup-shaped recess formed in one surface thereof to receive a projectile having a diameter substantially smaller than a diameter of said bore in said barrel,

a sabot capturing assembly removably coupled to the muzzle opening of said barrel and having an axial bore extending therethrough in alignment with said barrel,

said sabot capturing assembly includes a first cylindrical member threadedly mounted upon a muzzle end of said barrel in axial alignment therewith,

a second cylindrical member concentrically positioned within said first cylindrical member and radially spaced therefrom,

clamping means secured to said first cylindrical member and engaging said second cylindrical member to mount said second cylindrical member in axial alignment with the gun barrel,

said first and second cylindrical member having transverse through apertures formed therein in the vicinity of the muzzle opening of said barrel, and

the inner diameter of the bore in said sabot capturing assembly being greater than the diameter of said projectile and smaller than the diameter of said sabot,

whereby the detonation of an explosive charge in said breech chamber accelerates the sabot and missile simultaneously along said barrel until the sabot engages said sabot capturing assembly at which time the projectile passes through the sabot capturing assembly into the observation zone while the sabot is entrapped within said assembly to obstruct the axial bore therethrough and thereby vent the propellant explosive propellant gases via said through apertures.

2. The device of claim 1 wherein said clamping means comprises,

an annular ring removably secured to the first cylindrical member by means of a plurality of screws and having a portion thereof engaging one end of said second cylindrical member in abutting contact to

mount said second cylindrical member within said first cylindrical member in axial alignment with said gun barrel.

3. The device of claim 2 wherein said second cylindrical member has a counterbore formed in the muzzle engaging end thereof.

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