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BLAST SUPPRESSOR

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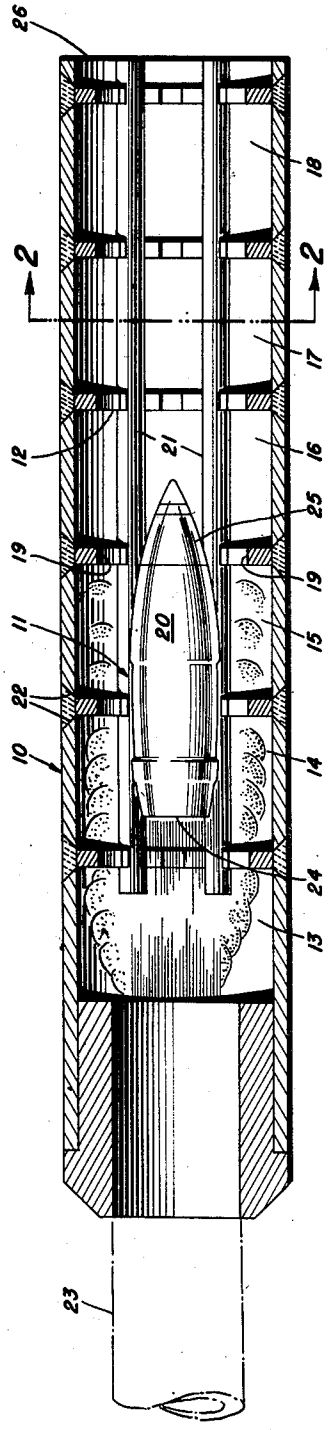


FIG. 1

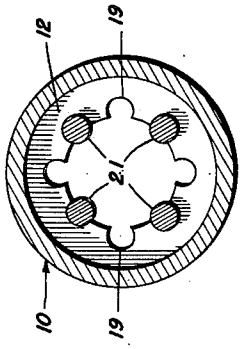


FIG. 2

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BLAST SUPPRESSOR

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4 Claims. (Cl. 89—14)

(Granted under Title 35, U. S. Code (1952), sec. 266)

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.

This invention relates to firearms and more particularly to an improved blast suppressor for eliminating blast destruction, reducing flash and shock front pressure at the muzzle end of a gun.

Blast deflectors, silencers, and reducers have been devised heretofore through which a projectile is discharged which necessitated gradual enlarging rings progressively positioned within a cylindrical chamber to assure clearance for free passage for the fired projectile. Other devices utilized elongated slots with associated bar supports spaced to permit gas expansion about the bars through to the slots which also served as a guide means for the projectile without any provision for setting up turbulence within the compartmented gas receiving chambers. However, in the prior art devices, any possible slight misalignment of the suppressor bore with the bore of the gun would cause disastrous results.

Baffles and bars in prior devices were used particularly to serve as flash hiders or suppressors and silencers because there was little if any concern for the shock front pressures encountered with the use of the old guns and propellants. However, the present trend in ordnance, wherein the use of modern propellants and projectiles cause shock front pressures of dangerous magnitudes, has required that suppressors concentrate on the dissipation of the shock front pressures in addition to the objectives accomplished by the prior devices.

Many highly explosive projectiles employ extremely sensitive fuses that are armed prior to loading, as for use in aircraft guns and require unimpeded travel including sufficient lateral clearance during propulsion otherwise premature detonation may occur upon glancing contact within the conventional blast suppressor.

An object of this invention is to effectuate an efficient, reliable blast suppressor which will set up multiple wave reflections and turbulence within the blast suppressor to cause an appreciable reduction in the shock front pressure accompanying projectile discharge.

A further object of this invention is to provide a device capable of gradually dissipating the harmful effects attendant from the rapid expansion of the hot gases and the shock front pressure as a projectile is propulsed from the muzzle of a gun.

Still another object of this invention is to provide a suppressor that will guide a highly sensitive fused projectile thereby assuring against premature detonation.

The present invention overcomes the disadvantages of the prior art devices by providing a blast suppressor with a tubular housing which encloses a group of spaced baffle rings forming gas chambers or compartments within which the hot gases surrounding the projectile may expand rapidly to set up multiple wave reflections and turbulence thereby dissipating the accompanying shock front pressure, the gas velocity, and the rapidly expanding gases surrounding the projectile. Longitudinal rods extending parallel to the axis of the gun bore and secured to the inner periphery of the baffle rings prevent the propelled projectile from impinging or ricochetting against the baffle rings as it passes through the blast suppressor. By selectively spacing the rings and the ring supporting projectile guides separately compartmented gas chambers are formed and the missile is guided past each chamber without the danger of undue yawing or skewing before projecting into space. The rapidly expanding gases are retarded within the various chambers and propel rather than impede the forward momentum of the missile.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a longitudinal sectional view of a blast suppressor shown with a projectile passing therethrough; and

Fig. 2 is a transverse sectional view taken along a line substantially corresponding to line 2—2 of Fig. 1 illustrating the internal spacing of the baffle ring and rod framework positioned within the housing.

Referring to the drawings in the embodiment illustrated a tubular housing **10** encloses the internal cage-like framework **11**, all of which is formed sturdily and of a material which is capable of withstanding increased temperatures, pressures, and vibrations when subjected to the operation of rapid-fire discharge of projectiles. The housing diameter is designed to afford sufficient volume within the elongated length to provide a plurality of interconnected compartments which will gradually dissipate the increased pressures accompanying projectile discharge.

The cage-like compartmentation within the tubular housing **10** comprises a plurality of annular baffle rings **12** spaced in accordance with the most desirable characteristics for the specific application. In the embodiment shown in Fig. 1 the rings **12** are spaced equally throughout the cylindrical cavity normal to the longitudinal axis of the housing **10** to form individual gas receiving chambers **13** through **18** which will dissipate the shock pressure front accompanying the projectile discharge. Each ring plate **12** as shown in Fig. 1 which constitutes one of the sides of the gas receiving chambers **13** through **18** is machined to engage concentrically the internal periphery of the tubular housing **10**. Guide rods mounted within receiving holes or apertures **19** are drilled within each plate **12** which serve not only to guide the projectile **20** through the blast suppressor but also to support rigidly the inner periphery of the various ring baffle plates **12** in place.

A suitable manner for constructing the guide rod receiving ring plates **12** is to lay off the rod positions or holes **19** on a solid disk by inscribing a circle on the disk with a radius equal to the radius of the projectile **20** plus the requisite clearance desired between the projectile periphery when positioned suitably within the suppressor and a circle formed tangent to the inner peripheries of the guide rods **21** when positioned within the chambers **13** through **18**. Guide rod supporting apertures **19** accommodating the guide rods **21** are drilled with the center of each aperture located at each apex of the vertices formed by the sides of an octagonal polygon. A central hole with a radius greater than the sum of the radii of the projectile **20** and the clearance required between the guide rod and the projectile but less than the radius measured from the center of the ring **12** to an apex of the octagonal polygon is drilled, thereby exposing each of the eight guide supporting apertures to the inner periphery of the ring by

approximately 90°. The remaining arc within each of the guide supports 19 is sufficient to provide adequate support for each of the guide rods 21 thereby preventing them from becoming disengaged, and confining the projectile path but permitting free expansion of the longitudinal rods 21 within the blast suppressor housing 10. Suitable fastening means of a more permanent nature may be used to maintain the guide rods 21 in position if necessary. However, frictionally supporting the guide rods throughout 270° at selected intervals affords sufficient support for maintaining the guide rods 21 in position within the baffle rings 12. Suitable results obtained by utilizing only half the number of guide rods 21 as provided for by the receiving holes 19 have been obtained. Upon wear and extended use replacement rods may be substituted for the worn rods or replacement rods may be inserted in the other remaining guide rod supporting apertures.

The guide rod apertures 19 serve to permit gas passage between compartments 13 through 18 as the pressure builds up within the rearmost chambers thereby rapidly dissipating the shock pressure front to the adjoining chambers as shown in Fig. 1. Insertion or removal of guide rods 21 will afford an appropriate means to regulate or dampen the dissipation of this shock pressure front between chambers.

To facilitate assemblage of the various components and assure alignment the longitudinal guide rods 21 are slidably inserted within the guide rod apertures 19 and the rings 12 are appropriately spaced, making up with cage-like structure 11. Each rod 21 may be securely fastened as by spot-welding, at one point on each rod to prevent longitudinal movement but to allow for the requisite expansion during operation. The cage-like structure after assemblage is then inserted within the tubular casing or housing 10 affording a series of individual compartmentalized gas chambers 13 through 18 which are interconnected.

Fig. 1 shows a means of retaining the aligned rings 12 within the housing 10. Countersunk holes 22 circumferentially spaced about the housing periphery for each baffle ring 12 are used to locate the rings within the housing 10 and then are plug-welded thereby securing the rings 12 in permanent relationship. The rings 12 formulating the sides of the gas receiving chambers 13 through 18 provide large surface areas which may also serve as radial fins to dissipate rapidly the high temperatures accompanying the massive gas discharge which follows the projectile 20 out of the muzzle of the gun 23, thereby reducing the gas pressures and volumes in accordance with the fundamental gas laws.

The foremost gas receiving chamber 13 may be made devoid substantially of any longitudinal supporting guide rods 21. Escape ports may be drilled in the cylindrical tubular wall permitting gas to be released from the individual chambers within the blast suppressor to dissipate some of the intense pressure accompanying shell discharge. These ports are sufficiently small and appropriately spaced so as not to permit an excessive gas discharge which will cause multiple small shock fronts about the gun. Depending on the blast suppressor application gas escape ports may be necessary to avoid excessive pressure buildup in rapid firing operation or in relatively long blast suppressors. The blast suppressor is readily adaptable for use in various caliber guns since it may be mounted directly on the gun muzzle thereby recoiling with the gun proper or it may be mounted on one end of a sleeve within which the gun barrel slides during recoil.

Operation of the blast suppressor may be visualized best by considering a projectile 20 fired from the gun 23 as it emerges from the gun muzzle spinning about the longitudinal axis and propelled by the rapidly expanding hot gases which follow and surround the boat tail and base 24 of the projectile 20. As the ogive end 25 enters the blast suppressor the longitudinal guide rod 21, which are circumferentially spaced, provide sufficient clearance for normal yaw preventing possible deflection into the rings 12 which form the compartmented chambers 13 through 18. As the projectile 20 advances, the hot expanding gases expand initially in the first open chamber 13 resulting in a reduction in pressure by providing a greater volume of gas expansion than the constricted volume within the bore of the gun. Some heat is dissipated through the ring 12 toward the outer cylindrical surface 10. Since the gas receiving compartmented chambers 13 through 18 are interconnected, expanding gases can infiltrate into the adjacent chambers through the space provided by the extra rod apertures 19 and the annular cavity formed between the projectile periphery and the ring plate 12 as the projectile passes through the chambers progressively thereby restricting the forward movement of the gases. As part of the shock front impinges against the leading baffle ring 12 in chamber 13 the wave is reflected back by the same ring toward the cylindrical wall to set up a turbulent mass front. This turbulent mass will attempt to disturb any laminar flow attendant beyond the wake of the projectile 20. As the projectile 20 advances to the next chamber 14, as gases expand further, the attendant shock front is reflected by the next ring 12 in chamber 14 and the heat is dissipated within the chamber 14 to the ring plate 12 and so on throughout the length of the suppressor. As the projectile emerges from the discharge end 26 of the suppressor, the wave reflections and turbulence induced by the ring plates 12 cause the one time disastrous shock front pressure to be reduced considerably from that evidenced at the muzzle area 23. Furthermore, the hot gases having been detained now leave the blast suppressor with a lower velocity over a longer interval of time than they leave the muzzle of the gun.

Obviously many modifications and variations of the present invention are possible in the 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 blast suppressor for rapid fire guns comprising; an elongated cylinder, a plurality of spaced notched rings mounted therein and forming a plurality of separate chambers with openings interconnecting adjacent chambers, a plurality of spaced longitudinally extending rods connected to the inner periphery of said rings and forming an open-ended suspended cage, said rods having a substantial portion thereof extending beyond said inner periphery of said rings for engaging and guiding the passage of a projectile therethrough in spaced relation with respect to said inner periphery of the rings, and said notches connecting each chamber for progressively dissipating the shock wave and high pressure projectile gases by expansion and turbulence therein.

2. A blast suppressor mounted on the muzzle end of a gun through which a projectile is fired comprising; an elongated tubular housing, plate baffle rings selectively spaced within the tubular housing forming compartmented interconnected gas receiving chambers, and a plurality of longitudinal disposed rods spaced about the inner periphery of said rings, said rods having a substantial portion thereof extending beyond said inner periphery of the rings for engaging and guiding the projectile through the suppressor chambers and rings in spaced relation with respect to the inner periphery of the rings whereby the shock wave and high pressure gases attending projectile discharge are progressively dissipated by turbulence and expansion therein.

3. A blast suppressor mounted on the muzzle of a gun through which a projectile is fired comprising; an elongated cylindrical tube, rings selectively spaced within the tube forming compartmented interconnecting gas receiving chambers, and a plurality of spaced longitudinal rods diametrically opposed about the inner periphery of said rings, said rods having a substantial portion there-

of extending beyond said inner periphery of the ring for engaging and guiding the projectile through the suppressor chambers and rings in spaced relation with respect to the inner periphery of the rings whereby the shock wave and high pressure gases attending projectile discharge are progressively dissipated by turbulence and expansion therein.

4. For use in a tubular blast suppressor to be mounted on the muzzle end of a gun through which a projectile is fired, an assembly comprising; a plurality of spaced rings mounted to form a series of gas deflector baffles, a plurality of spaced longitudinally extending rods connected to the inner periphery of said rings forming an open-ended cage, said rod having a substantial portion thereby extending beyond said inner periphery of the

rings for engaging and guiding the passage of a projectile therethrough in spaced relation with respect to the inner periphery of the ring, said assembly insertable within said tubular suppressor to dissipate the shock wave and high pressure gases attendant upon projectile propulsion.

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