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CONTRA-JET MUZZLE BRAKE FOR FIREARMS

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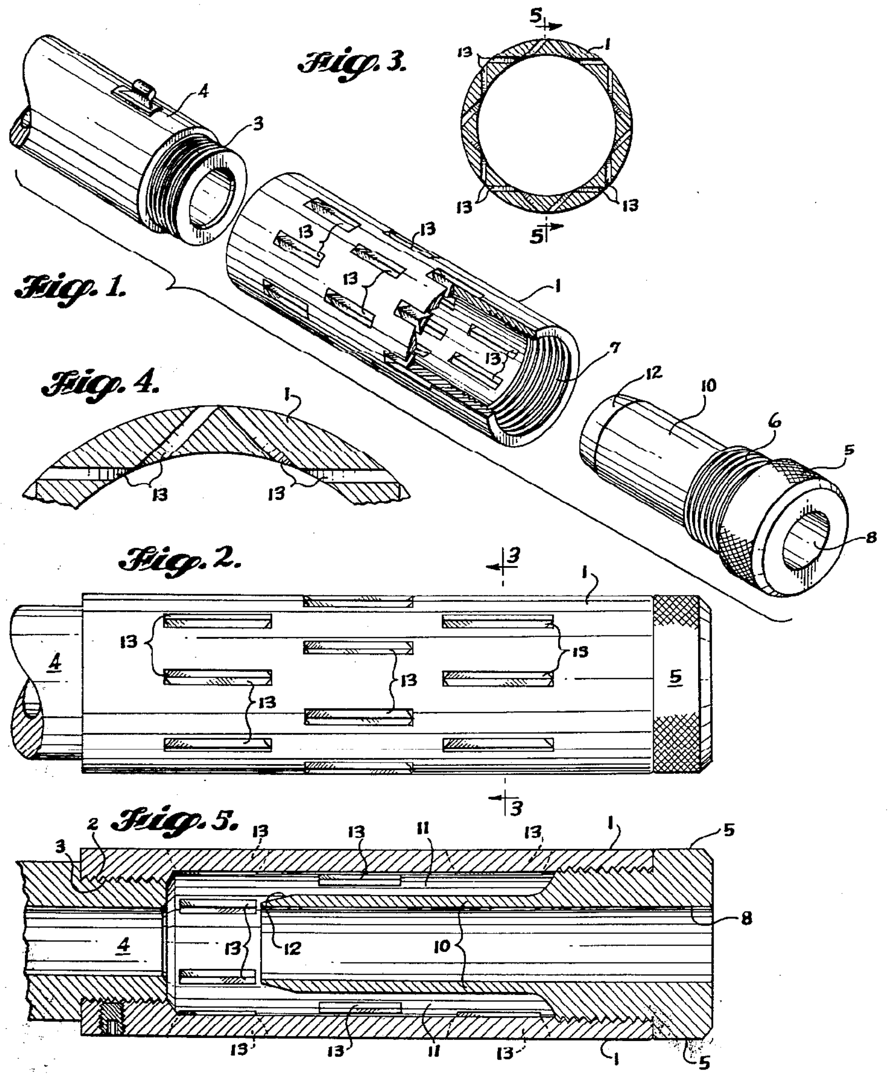

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CONTRA-JET MUZZLE BRAKE FOR FIREARMS

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This invention relates to a muzzle brake for firearms in the form of a barrel extension providing gas escape apertures in the form of slots having their lengths extending longitudinally of the barrel extension.

A principal object of the present muzzle brake is to provide a muzzle brake construction which will reduce recoil of the firearm to a greater extent, decrease the noise or percussion of the explosion, and at the same time minimize the side blast effect and reduce the flash.

It is a further object to accomplish the recoil reduction more effectively so as to enable the firearm to be lighter for a given recoil effect and at the same time to utilize a light and small muzzle brake which will not itself add appreciably to the weight of the firearm, and which will not interfere with sighting the firearm.

Although small and light it is an object to provide a muzzle brake which will be sufficiently rugged and strong as to withstand the stress of repeated firing of the firearm without damage or deformation.

In the operation of the muzzle brake it is an object to provide a large aperture area through which the gas is released and the apertures of which are directed in different directions so as to avoid concentrations of gas jets in a particular direction, or a few directions.

More specifically, it is an object to provide an arrangement of explosion gas discharge slots in a muzzle brake which will eject intersecting gas jets causing interference of the gas streams, which will produce turbulence dissipating the energy of the released gases.

Another object is to utilize in conjunction with the apertured barrel extension an internal control tube tending to trap explosion gas momentarily in an annular chamber encircling the projectile passage, so as to reduce the amount of gas normally ejected from the firearm barrel immediately behind and around the projectile.

A further object is to accomplish the foregoing objects by the use of a muzzle brake of simple and preferably symmetrical construction, having no moving parts, which can be manufactured economically with adequate precision in mass production by the use of known machining techniques.

In general, the muzzle brake is formed as a tubular barrel extension, preferably having a control tube extending from the discharge end of the muzzle brake inward in cantilever fashion and concentric relationship to the outer apertured shell. The apertures in such shell through which the explosive gas escapes are in the form of slots extending longitudinally of the barrel extension and spaced apart circumferentially of such extension. Such slots are disposed parallel to chords of the barrel extension, and adjacent slots preferably intersect substantially perpendicularly at the external periphery of the shell so as to eject crossing gas jets which mutually interfere. Preferably also, a plurality of slots spaced longitudinally of the barrel extension are provided, slots in each group being spaced circumferentially of the barrel extension and the slots in one group being offset circumferentially of the barrel extension from the slots in an adjacent group.

FIGURE 1 is a top perspective of the muzzle brake of the present invention showing components in exploded relationship and having parts broken away.

FIGURE 2 is a side elevation of the muzzle brake and FIGURE 3 is a transverse section through the muzzle brake on line 3—3 of FIGURE 2. FIGURE 4 is a similar view of a fragmentary portion of the muzzle brake drawn on an enlarged scale.

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FIGURE 5 is a longitudinal central section through the muzzle brake taken on line 5—5 of FIGURE 3.

Previous muzzle brakes have been relatively ineffective in reducing recoil of a firearm and they have permitted explosion gas to escape in a comparatively small area, which has increased the blast effect over that resulting from escape of the explosion gas from the end of the barrel in the normal way following dispatch of the projectile. Some of the previous muzzle brakes also have caused explosion gases to be ejected forcefully in directions generally horizontally transversely of the gun barrel so as to have a deafening effect on persons standing at the side of the person shooting, and in some instances such gas has even been ejected rearwardly to a greater or lesser extent so as to cause discomfort to the person shooting.

The muzzle brake of the present invention diffuses the explosion gases generally symmetrically around the end of the firearm's barrel so as to avoid any blast concentration, and jets of gas are projected in a direction somewhat forward, as well as transversely of the gun barrel, so as to minimize discomfort to the person shooting, or to anyone standing beside him, caused by the discharge of gas.

The type of muzzle brake structure found to be most effective for this purpose is shown in FIGURES 1 to 5, inclusive, of the drawings.

The principal component of the muzzle brake is the barrel element diffuser shell **1** having an internal thread **2** at one end, which can be screwed onto the external thread **3** on the end of the barrel **4** of a firearm to constitute a barrel extension. Alternatively the shell could be an integral part of the barrel. While the barrel **4** is shown as being that of a rifle it could be that of a shotgun or, in fact, any kind or size of a firearm including side arms and cannons. The size of the tubular shell **1** would, of course, be selected appropriately in relation to the diameter of the gun barrel and the type of firearm on which the muzzle brake is to be used. The other component of the muzzle brake is an insert tube having a head **5** of approximately the same diameter as the exterior of the shell **1**, and an externally threaded shoulder **6** located immediately behind the head to screw into the internal thread **7** at the end of shell **1** opposite thread **2**.

The insert tube head **5** has a central bore **8** of a size to afford free passage through the insert tube of a bullet projected from the gun barrel **4**. Mounting of the insert tube in the shell **1** and such shell on the end of the barrel locates the bore **8** concentrically with the barrel bore **9**. It is preferred that the insert tube carry a control tube **10** projecting from the head of the insert tube away from its discharge end in cantilever fashion, as shown in FIGURE 5. The bore through such control tube simply constitutes an extension of the bore **8** and preferably is of the same size. The size of the insert tube bore will be determined by the size of the gun barrel bore **9** and the type of firearm to which the muzzle brake is applied. If the firearm is a rifle the bore **8** should be just slightly larger in diameter than the bore **9**, whereas if the firearm is a shotgun the bore of the insert tube should be larger or smaller than the bore **9** of the shotgun barrel to a greater or lesser degree, depending upon the effect of bore **8** desired to control the pattern of the shot.

Thus, in the case of a shotgun the insert tube mounted in the discharge end of the shell **1** would serve as a choke. The larger the bore **8** the greater would be the dispersion of the shot, or the larger would be the pattern. On the contrary, the smaller the bore **8** the greater would be the confinement of the shot and consequently the smaller would be the pattern formed by it. For use of the muzzle brake on shotguns, therefore, several different insert tubes could be provided having bores **8** of different size to enable the insert tubes to be interchanged at will by the person shooting, so as to enable him to alter the pattern of the shotgun shot at any time to the extent desired simply by replacing the insert tube. Moreover, different insert tubes can be provided having control tube portions **10** of different lengths or even an insert tube without any control tube at all, although it is preferred that the insert tube in every instance have a control tube portion.

Preferably the exterior portion of the insert tube head is knurled, as shown in FIGURES 1 and 2, so as to enable a good grip to be obtained on it with the fingers for the purpose of screwing the insert tube into the shell **1**, or removing it from the shell. The overall length of that portion of the insert tube inserted within the shell **1** must in every case be small enough to allow a considerable gap between the extreme end of the cantilever portion of the insert and the end of the gun barrel, as shown in FIGURE 5. Through this gap explosion gas escapes into the blind annular chamber **11** formed between the control tube **10** and the muzzle brake shell **1**. Explosion gases expanding through the gap between the end of the firearm barrel and the adjacent cantilever end of the control tube are therefore projected into such annular chamber and can escape from it only through apertures in the shell **1**. Flow of gas into the annular chamber is facilitated by forming the cantilever end of control tube **10** with the external chamfer **12** which forms an annular gas flow dividing wedge on the end of the control tube.

The gas escape apertures provided in the muzzle brake shell **1** are elongated slots arranged with their lengths extending longitudinally of the muzzle brake shell, that is, parallel to the axis of the shell. The general arrangement of such slots which is preferred is shown best in FIGURES 1, 2 and 3. In FIGURES 1 and 2 three groups of slots **13** are shown, which groups are spaced lengthwise of the shell. The length of the slots in each group and the number of groups of slots can be selected in accordance with the strength of the shell **1** required, the length of the shell and the total amount of slot length desired. Also, the amount of gas escape opening through the shell will depend upon the width of each slot and the number of slots provided in each group. Each slot should be of a length at least several times as great as its width. The spacing of the slots circumferentially of the shell **1** will depend upon the pattern in which such slots are arranged and the strength of the shell stock between them required to withstand the bursting force exerted by the explosion gas on the inner wall of the shell. The strength of the shell wall for a given number of slot groups, each group having a given number of slots in it, is increased by arranging the slots in adjacent groups in circumferentially staggered relationship, as indicated by a comparison of the positions of the slots in the three groups shown in FIGURE 2.

The preferred type of pattern for the gas escape slots **13** through the wall of the shell **1** is illustrated in FIGURES 1 to 4, inclusive, the particular characteristics of the slot arrangement being shown best in FIGURES 3 and 4. In these figures the slots **13** are shown as extending chordwise of the shell **1** and arranged in outwardly convergent pairs. Each pair of slots is formed of two adjacent slots converging outwardly in substantially mutually perpendicular relationship so that jets of gas ejected through these slots interfere with each other to create turbulence which dissipates energy of the gas. The chords of the shell **1** in which such slots of each pair are disposed are located so that such chords intersect substantially at the exterior of the shell, as shown best in FIGURE 4. Also, the pairs of slots may be arranged so that, as shown in FIGURE 3, each slot of a pair will be disposed in the same chord of the shell **1** as a slot of another pair, and consequently will be coplanar with such other slot.

Thus, in FIGURE 3 two aligned upper horizontal chordal slots **13** are shown, which are arranged in perpendicular relationship to left and right upright slots **13**. At the left and right of FIGURE 3 are upper and lower slots disposed in coplanar relationship in vertical planes. At the bottom of this figure are two more coplanar chordal slots disposed mutually perpendicular to the vertical slots at the opposite left and right sides of the shell, disposed in coplanar relationship as stated above. Also, as has been mentioned, it is preferred that the slots of each pair substantially intersect in the outer periphery of the shell **1** and it is further preferred that the thickness of such shell be such that the slots are also arranged substantially tangential to the inner periphery of the shell, as shown best in FIGURE 4. A practical arrangement is to provide eight pairs of outwardly convergent slots, as shown in FIGURE 3, arranged so that the discharge openings of adjacent pairs of slots are spaced apart 45 degrees circumferentially of the shell **1**. Alternate pairs of slots will then be arranged in the square pattern described above, in which the adjacent slots of alternate pairs are disposed in coplanar relationship and the slots of each pair are in mutually perpendicular relationship. In every case, therefore, the slots are shown as being planar and straight.

It will be evident that as gas formed by the explosion in the gun barrel expands lengthwise of the barrel into the muzzle brake the gas expansion will induce gas to flow outwardly through the gap between the end of the barrel and the adjustment end of the cantiliever control tube into the blind annular chamber **11**, instead of all the gas following the bullet through the bore **8**. To the extent that the combustion gas is thus diverted into the chamber **11** for discharge through the slots **13** it will be unable to provide a direct longitudinal jet effect from the gun in the direction to produce a recoil reaction on the gun barrel. Impact of the gas diverted into the chamber **11** against the closed end of such chamber will also tend to reduce the recoil of the gun. By dispersing the discharge of the gas from the chamber **11** in a generally symmetrical pattern circumferentially of the muzzle brake, the production of reaction forces transversely of the barrel will be minimized. It may, however, be desired for the slots on the upper portion of the muzzle brake to be somewhat longer than the slots on the underside of the muzzle brake or to provide more or wider slots on the upper side of the muzzle brake than on the lower side, so as to enable the gas to exert some downward force on the end of the barrel to deter the tendency of the barrel end to jerk upward.

As the gas emerges from the outer ends of the slots of each pair it will be moving at high velocity, and the turbulence caused by interference of the intersecting gas jets from the two slots will dissipate the energy of the expanding gas to a considerable extent for reducing the blast effect of the ejected gas. Because the slots are elongated lengthwise of the muzzle brake the gas jets projected from the slots will still have an appreciable component outward away from the person shooting, which further will reduce the tendency of the gas escaping laterally from the muzzle brake to bother the person shooting, or others standing next to him.

As has been mentioned, all of the slots **13** are planar and consequently they can be cut conveniently with a thin slide milling cutter. Since the milling cutter will penetrate the diffuser shell from the outside inward the external length of each slot **13** will be slightly greater than its internal length, as indicated by a comparison of the external slot lengths in FIGURE 2 with the internal slot lengths in FIGURE 5. Such shells can be milled automatically in a desired pattern by holding the shell in a suitable jig and indexing it through successive angles of 45 degrees.

Alternatively the corresponding slots in all the groups could be in relationship aligned lengthwise of the barrel instead of corresponding slots in adjacent groups being offset circumferentially, if desired. In such case the jets of gas projected from lengthwise adjacent slots may interfere to a greater or lesser extent to effect a further dissipation of energy of the gas.

I claim:

1. A muzzle brake for firearms, comprising a barrel element having therein a plurality of gas ejection slots arranged in pairs, each of which slots, at each location throughout its length, is inclined relative to a radius of the barrel at such location, and the slots of each pair being inclined oppositely relative to each other as to be convergent toward the exterior of said barrel element.

2. The muzzle brake defined in claim **1**, which the slots of each pair substantially meet each other at the external priphery of the barrel element.

3. The muzzle brake defined in claim **1**, in which the slots of each pair have their length extending parallel to the axis of the barrel element and are disposed repectively

parallel to dihedral planes which are substantially mutually perpendicular and parallel to the axis of the barrel element.

4. The muzzle brake defined in claim **3**, in which the thickness of the barrel element and the inclination of each slot relative to the barrel element are such that each slot is substantially tangential to the inner periphery of the barrel element.

5. The muzzle brake defined in claim **3**, in which eight slots are arranged in four similar pairs of converging slots, such pairs of slots being distributed circumferentially around the barrel element.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,187,633 June 8, 1965

David S. Tanabe

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 32, for "adjustment" read -- adjacent --; line 69, for "slide" read -- side --; column 5, line 16, for "other as" read -- other so as --; line 18, before "which" insert -- in --; line 22, for "length" read -- lengths --; same column 5, line 23, for "repectively" read -- respectively --.

Signed and sealed this 21st day of December 1965.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents

UNITED STATES PATENT OFFICE
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