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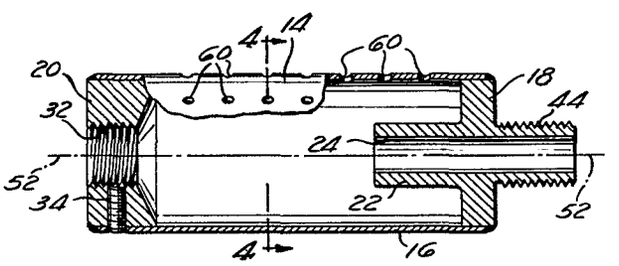
(54) Method and means to reduce climb and swing of a weapon muzzle.

(57) A bored body threadedly attached to the end of a weapon muzzle to reduce climb and swing momental movements during firing. Ports extending laterally of the bore expel propulsion gases during firing. The vector quantities of force of gases expelled through the ports are clocked to oppose such momental movements by rotary adjustement of the body. The bored body optionally can include sound suppression and can have a threaded boss on which can be installed a flash suppressor which was previously on the end of the weapon muzzle.



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METHOD AND MEANS TO REDUCE CLIMB AND SWING OF A WEAPON MUZZLE

My invention relates to a small device attaching to the muzzle of a firearm which controls muzzle climb or swing.

A weapon has a moment arm between the longitudinal axis of the muzzle bore and the effective support of the weapon by the user. The reaction force of the projectile of course reacts substantially along the axis of the muzzle bore. The support by the user is not on that bore axis, but essentially, is below the axis and to the left in the case of a righthanded person or to the right in the case of a lefthanded person. I will term the tendency to swing to the right or to the left as "swing". As to movement of the weapon muzzle upward in the vertical plane I will use the general expression "climb". In the case of a single shot, the word "jump" also would be appropriate but particularly in automatic weapon fire the tendency of the muzzle end to raise is usually termed "climb". It is an objective of my invention to reduce climb and swing momental movements of weapon muzzles during firings thereof.

Additional objectives of my invention include: to reduce recoil; to incorporate sound suppression when desired; to increase accuracy when firing; to achieve the foregoing without alteration of the weapon or its muzzle; to provide a detachable structure; and to provide such means to reduce climb or swing while not interfering with the use of a flash suppressor, which is commonly used on the muzzle end.

The only prior art with which I am acquainted, dealing with reducing weapon climb, is as follows: some parties have provided ports directly in weapon muzzles extending vertically upward relative to the bores of the muzzles, in order to reduce climb. I

do not know of any prior device concerned with reducing swing of a weapon. My device has various advantages over the ports mentioned above including: taking care of swing as well as climb; adjustability; use on existing weapons which were not built with climb suppressors; not violating the integrity of the weapon muzzle; integration with a sound suppression function when desired; and other consequences of providing an attachment rather than a fixed integral feature.

My invention will be best understood, together with additional advantages and objectives thereof, when read with reference to the drawings, in which;

FIGURE 1 is a perspective view of a specific embodiment of my invention in which a device to reduce climb and swing is installed on the muzzle of a weapon. The dashed lines show normal tendencies of the weapon to climb vertically or to swing left or right during firing;

FIGURE 2 is a partial exploded perspective view including the end of the muzzle, a lock nut, a climb and swing reduction device, and, in dashed lines, a flash suppressor;

FIGURE 3 is an enlarged side view, partly in section, of the climb and swing reducing device, per line 3-3 of Figure 4;

FIGURE 4 is a sectional view taken on line 4-4 of Figure 3;

FIGURE 5 is a perspective view of the use of a plurality of climb and swing reducing devices on the same weapon muzzle;

FIGURE 6 is a perspective view of a climb and swing reducing device without sound suppression;

FIGURE 7 is a longitudinal sectional view of the device viewed in Figure 6; and

FIGURE 8 is a cross-sectional taken on line 8-8 of Figure 7.

In Figure 1 is shown a weapon 10, such as an M-16, which is capable of automatic fire. My inven-

tion is particularly important with an automatic weapon in which the reaction forces of projectiles are cumulative and it is difficult to hold the weapon against climb and swing. In Figure 1 in dashed lines, the end of weapon 10 is shown climbing vertically and swinging right or left, depending on whether the user is righthanded or lefthanded. My invention is used to oppose these normal tendencies of the weapon to climb or swing by ejecting gas from projectiles through ports 60 directed laterally of the weapon muzzle 12. It will be understood that if during firing the reaction force of projectiles tends to move the end of muzzle 12 upwardly and to the right or left, this tendency can be represented by a vector quantity 50. The vector 50 in the case of a righthanded user will be to the right of the vertical. In the case of the lefthanded user, the vector 50 will be to the left of the vertical. From the viewpoint of the user, a vector 50 might be at one o'clock in terms of a righthanded user or eleven o'clock in the case of a lefthanded user. A user could establish on a firing range what that vector 50 would be and what the clocked position of compensating device 14 would need to be to compensate for the climb and swing tendencies with that user, and weapon ammunition. On the other hand, the values could be calibrated approximately for various users and set forth in a table so that with a given weapon and ammunition, the clocked position of the climb and swing vector 50 in terms of degrees, taking vertical upwards as 0°, might be 15° in terms of a righthanded user or 345° in terms of a lefthanded user. The opposed vector 54 (the reaction to gases ejecting from ports 60), respectively, would be 195° and 165°.

Device 14 to reduce climb or swing has a body with a bore therethrough to pass projectiles. In the form of the invention shown particularly in Figures

3 and 4, sound suppression is also incorporated into the device 14, so that it may be constructed with a relatively thin walled cylindrical sleeve 16 and front and rear bored plugs 18 and 20 secured in front and rear ends of sleeve 16, such as by welding. In this structure, body 14 is centrally expanded between plugs 18 and 20 thereby achieving a sound suppressing effect.

In the configuration shown, rear plug 20 has a concave forward face flaring at about 22° from its center to its edges and forward plug 18 has a rearwardly extending central internal boss 22 about the bore 24 in plug 18, thereby providing an annular space about boss 22 for expansion of gases. Both the general central expansion in body 14 and the annular space about boss 22 have sound suppression effects, as will be understood by those skilled in the art, so that air to some extent can pass to the side at the end of muzzle 12 and only exit from device 14 after the projectile has passed. The projectile passing before all of the air ahead of it in muzzle 12 also can have an effect on accuracy, as there is less tendency for the projectile to be tumbled by air trying to exit into the atmosphere ahead of the projectile.

It will be understood that the body 14 could be secured on the end of a weapon in various ways. In the construction illustrated, body 14 secures onto the threaded boss 30 at the end of the muzzle which is normally used for mounting of flash suppressors, sound suppressors, etc. Rear plug 20 has a threaded bore 32 which is of a size to mate with threaded boss 30. It is desirable that once body 14 is adjusted to a particular clocked position, it be locked in position. This could be accomplished in various ways but I have illustrated a set screw 34 in body 14 which can be tightened against threaded boss 30, once body 14 is in a selected position, in order to hold body 14 against rotation.

As indicated before, threaded boss 30 on the end of muzzle 12 is provided to mount sound suppressors or flash suppressors. A common type of flash suppressor is illustrated at 40 in Figure 2. It has a threaded bore 42 which is of a size to fit on boss 30 on muzzle 12. In order to mount flash suppressor at the end of body 14, forward plug 18 has a forwardly extending boss 44 with exterior threads of the same size as those on boss 30 of muzzle 12, whereby flash suppressor 40 can be installed on boss 44 with body 14 sandwiched between flash suppressor 40 and muzzle 12.

Figure 5 illustrates a situation in which more than one body 14 is mounted at the end of muzzle 12, in addition to flash suppressor 40. This assembly might be desirable in a situation where more sound suppression is desired than would be obtained from a single body 14, in which case the plurality of bodies 14 in series will further attenuate the sound.

Turning now to Figure 4, a vector 50 is illustrated which indicates the normal tendency of the weapon muzzle to climb upwardly and swing to the right when used by a righthanded user. In order to free firing of the weapon from any tendency to climb or swing due to the moment arm between the users support of the weapon and the longitudinal axis 52 of the weapon muzzle, vector 50 must be opposed by a second vector 54 which is of equal quantity or magnitude and of opposite direction. The opposite vectors 50, 54 are illustrated in Figure 4. The vector 54 is obtained by reaction force to gases exiting from one or more lateral ports 60 in body 14. If there were only one port 60, of course the vector 54 would extend through the center of the single port. In the case of multiple ports 60, as shown, their combined propulsion forces must result in the force represented by vector 54, as will be understood by those familiar

with such subjects. I have shown three rows of openings in the drawing, in which two outer rows have seven openings and the inner row has four openings. However, this number of openings is arbitrary. It may be desirable to have multiple smaller openings rather than one large opening to avoid the possibility that a sizeable foreign object might gain access to the interior of body 14 through a single large opening 60. It will be understood that the vectors 50, 54 and the needed sizes of openings 60 will depend on the weapon, the ammunition, etc. A general statement is that ports 60 can be holes or slots of any shape and usually their total will be not less than 60 percent of the area of the bore of the muzzle 12 and no more than one hundred and sixty percent of the area of the weapon muzzle bore. The optimum might be about one hundred and thirty percent of bore area. The porting pattern is not critical as long as when the body 14 is rotated right or left, ports 60 function as high speed jets to guide muzzle 12 right or left or up and down so the user can compensate for otherwise undesirable muzzle climb or swing.

It is recognized that body 14 could be constructed to incorporate a flash suppressor 40 or a like function, but usually it would seem more desirable to provide the body 14 separately from flash suppressor 40 so that either or both could be used and so that existing flash suppressors 40 can be used and will not have to be discarded when used with a weapon having a body 14 for climb and swing suppression.

In prototype testing, tests showed excellent muzzle control, especially in automatic firing modes. Testing also indicated improved accuracy of weapons upon which bodies 14 were installed. The tests indicated particularly outstanding accuracy for automatic firing. The tests also indicated, in the configuration shown in Figures 3 and 4, that there was

a drastic and important reduction in sound pressure level at the muzzle, thereby reducing the sound level to the exposed ear of the user. Further advantages of the use of the device 14 is that the air expansion room in the device leads to greater velocity of the bullet or projectile. The suppression feature reduces recoil of the weapon but that is true of other suppressors. Note that the functions have been provided with no alteration required of the basic weapon 10. If a different ammunition was used significantly more powerful, a different compensator 14 could be used. If porting were done directly in the weapon barrel 12, as has been done in the prior art, not only would the porting not be adjustable but also sound would be louder, particularly to the user.

In the construction shown in Figures 6-8, the porting 60 and its functioning can be the same as discussed above. The difference in the swing and climb compensating body 114 is that sound suppression is absent. This would be an important feature for particularly the civilian market in which sound suppression would be illegal. There is no appreciable sound suppression in device 114 because there is only a minimal expansion chamber. The device, as shown may be formed from a single piece of metal with a rear threaded bore 116 fitting on the threaded boss 30 of the weapon and with a forward boss 118 with external threads of the same size as on muzzle boss 30 so that a device such as a flash suppressor 40 can be installed thereon.

Having thus described my invention, I do not wish to be understood as limiting myself to the precise structure shown. Instead, I wish to cover those modifications thereof which will occur to those skilled in the art upon learning of my invention and which properly fall within the scope of my invention.

CLAIMS

1. Means attached to the end of a weapon muzzle reducing climb or swing momental movement thereof during firing, comprising:

(a) a body detachably connected to the end of said muzzle forward of the sight,

(b) said muzzle having a bore and said body being coaxially bored to permit passage of a missile therethrough,

(c) said body having sidewall port means directed radially relative to the centerline of said muzzle bore thereby producing a vector quantity of force extending laterally of said centerline, due to the reaction of propulsion gases exiting through said port means, and

(d) variable rotatable adjusting means for said body relative to said weapon muzzle and said vector quantity being adjusted to substantially oppose said momental movement.

2. The subject matter of Claim 1 in which there is a set screw to lock said rotatable adjusting means in adjusted position.

3. The subject matter of Claim 1 in which said muzzle has a boss extending therefrom with external threads and the bore of said body having mating internal threads thereby detachably connecting said body to said end of said muzzle and forming said rotatable adjusting means for said body relative to said muzzle.

4. The subject matter of Claim 3 in which there is a set screw engaging said boss locking said body to said muzzle.

5. The subject matter of Claim 3 in which said body has a boss extending from its forward end with external threads matching the internal threads in its bore at its other end, whereby an object such as a flash suppressor, originally installed on said boss at the end of said muzzle, can be put on the boss on said body when it is replaced on said muzzle by said body.

6. The subject matter of Claim 5 in which said body has a sound suppressing effect and in which there are

a plurality of said bodies installed on said muzzle with the threaded boss of each rear body engaged in the threaded bore of a body forward thereof, so that the sound suppressing effects of said bodies cumulate.

7. The subject matter of Claim 3 in which there is a flash suppressor having a rear threaded bore and originally installed on said boss at the end of said muzzle and said body having a boss extending from its forward end with external threads matching the threads on said boss on said muzzle and said flash suppressor being installed on said boss on said body.

8. The subject matter of Claim 1 in which there are a plurality of parallel rows of small sidewall openings in said body forming said port means, said rows being parallel to said centerline of said muzzle.

9. The subject matter of Claim 1 in which the area of said port means is between 0.6 and 1.6 times the cross-sectional area of said bore of said muzzle.

10. The subject matter of Claim 1 in which said body has a flash suppressor portion on its forward end which is integral with the rest of said body.

11. The subject matter of Claim 10 in which the bore of said body is not centrally chambered so that substantial sound suppressing action is avoided.

12. The subject matter of Claim 1 in which said body has like sized bores at rear and forward ends and said body is centrally expanded thereby achieving a sound suppressing effect.

13. The subject matter of Claim 12 in which said body includes a thin-walled cylindrical sleeve and forward and rear bored plugs secured in the front and rear ends of said sleeve.

14. The subject matter of Claim 13 in which said forward plug has a rearwardly extending central internal boss about the bore in said forward plug thereby providing an annular space about said boss for expansion of gases.

15. The subject matter of Claim 14 in which said muzzle has a boss extending therefrom with external threads and the bore of said rear plug having mating

internal threads thereby detachably connecting said body to said end of said muzzle and forming said rotatable adjusting means for said body relative to said muzzle, a flash suppressor having a rear threaded bore and originally installed on said boss at the end of said muzzle and said forward plug having an external boss extending forwardly from said body and said flash suppressor being installed on said external boss on said forward plug.

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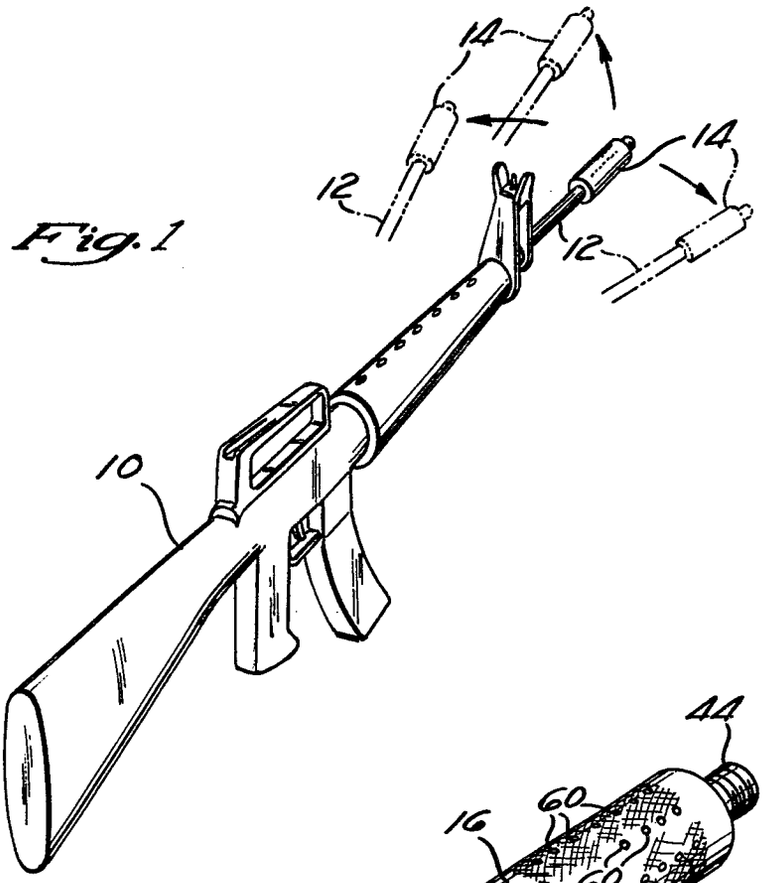

Fig. 1

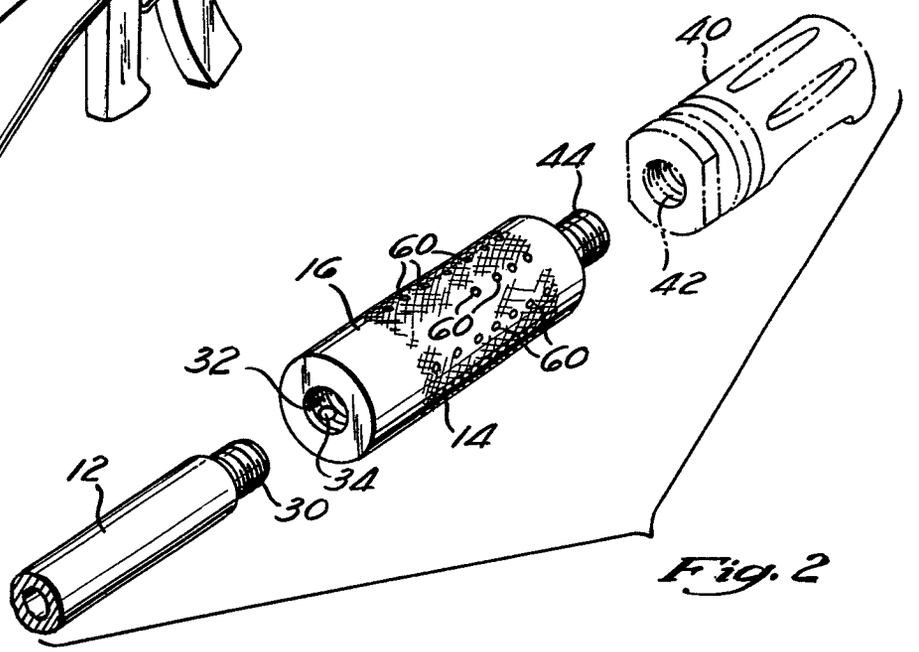

Fig. 2

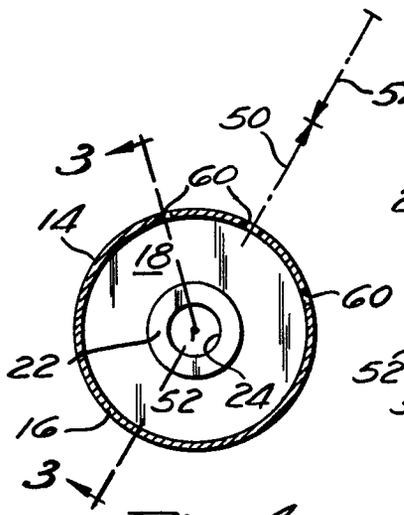

Fig. 4

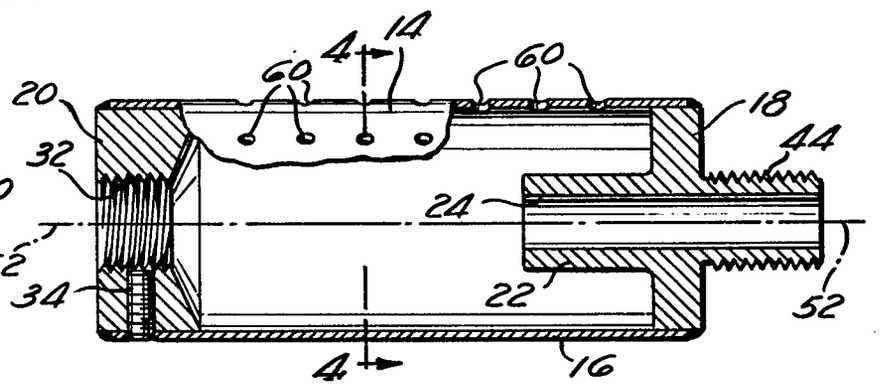

Fig. 3

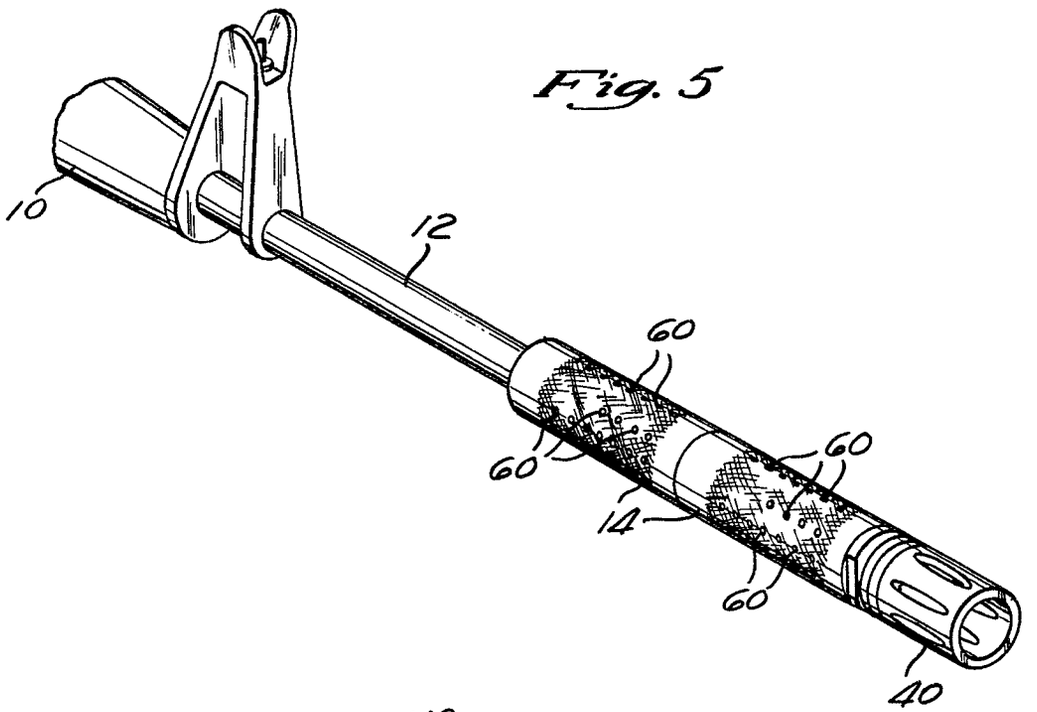

Fig. 5

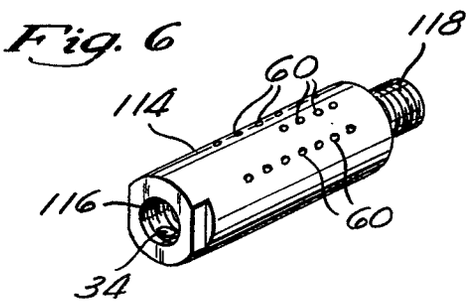

Fig. 6

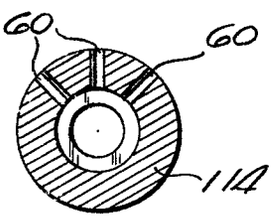

Fig. 8

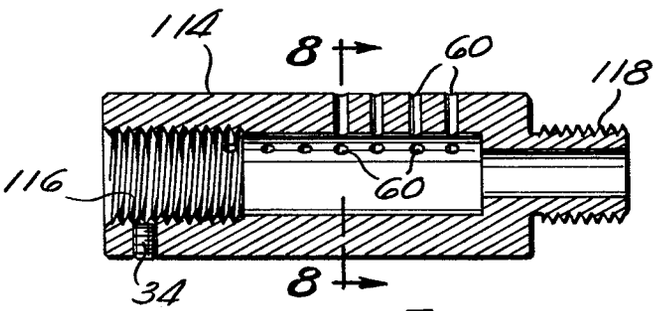

Fig. 7