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SHOTGUN MUZZLE DEVICE COMPRISING A COMPENSATOR AND CHOKE

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Fig. 1

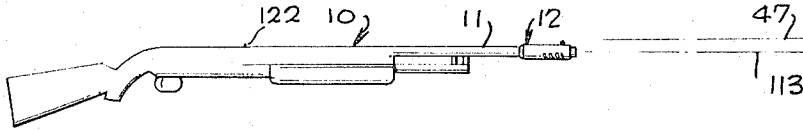


Fig. 2

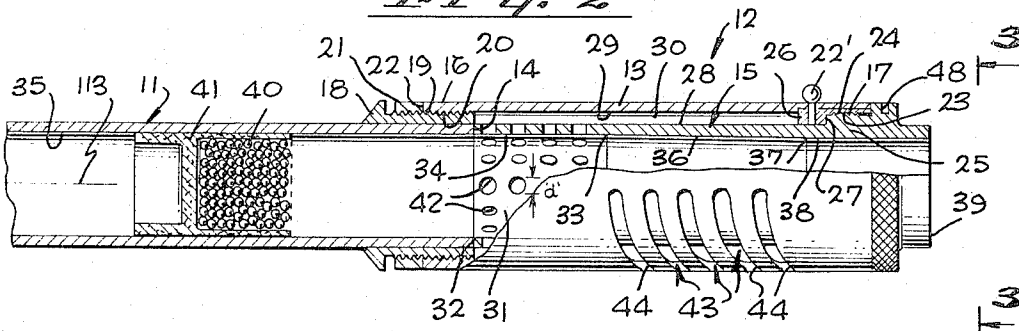


Fig. 3

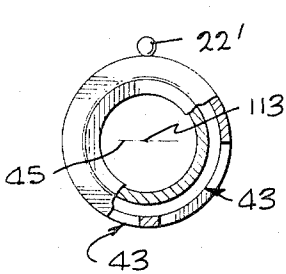


Fig. 4

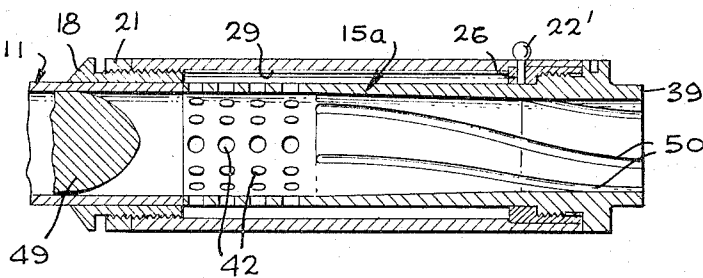
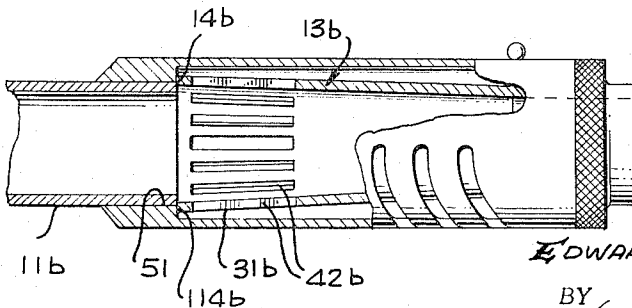


Fig. 5



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SHOTGUN MUZZLE DEVICE COMPRISING A COMPENSATOR AND CHOKE

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ABSTRACT OF THE DISCLOSURE

A shotgun muzzle device having an outer tubular cage containing a removable choke tube which is connected to the forward end of the cage and projects rearwardly therein in alignment with the gun barrel, and in spaced relation to the cage to provide a gas discharge space radially between the cage and tube. The choke tube has a rear portion containing apertures of relatively small size through which gases of combustion discharge laterally. Forwardly of these apertures, the tube first tapers to a reduced diameter, and then has a straight cylindrical portion continuing forwardly at that reduced diameter. The gases discharge from the device into the atmosphere more in a downward direction than in an upward direction to produce a net upward reaction against the muzzle end of the gun barrel.

This invention relates to improved gun muzzle attachments, to be secured to the barrel of a gun, for the purposes of reducing recoil, reducing sound emission, and/or controlling the flight of the projectile or projectiles. The invention will be described primarily as applied to shotgun type firearms, though it is contemplated that certain features of the invention may also be applicable to rifles or other guns.

In my prior Patent Number 2,447,205, issued Aug. 17, 1948, on "Shotgun Muzzle Device," I have disclosed a muzzle attachment which is capable of very effectively reducing the recoil of a shotgun, and at the same time controlling the shot pattern fired by the gun. The device shown in that patent includes an outer substantially tubular cage having a shot pattern control tube disposed longitudinally therein, in spaced relation to the muzzle end of the gun barrel, so that gases may vent laterally from the gun barrel axially between the barrel and the shot pattern control tube, and into a space about the tube and within the cage, to ultimately vent laterally from that space to atmosphere. Since issuance of my specified prior patent, there have been developed certain improved types of shotgun shells, utilizing wads of a type referred to as obturating or "over powder" wads, which tend to expand radially outwardly under the influence of the propellant gases, to form a gas seal in the barrel behind the wad and shot. This obturating type of wad has proven undesirable for use in the muzzle attachment shown in my prior patent, by reason of the fact that the wad tends to expand as it passes the space or gap axially between the muzzle end of the barrel and the shot pattern control tube, with the result that the wad may be mutilated or shredded in a manner forming small particles of the wad which can then escape into the space radially between the tube and outer cage, in a manner plugging that space and destroying the effectiveness of the muzzle attachment for its intended purpose.

A major object of the invention is to provide an improved muzzle attachment structure which is essentially very similar to that disclosed in my prior patent, to attain the advantages of that prior arrangement, but which is so constructed as to be compatible with the discussed obturating or over powder wads, so that such a wad may pass through a muzzle attachment embodying the invention without damage of any type to the wad, and without

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the formation of small particles tending to accumulate in and destroy the effectiveness of the muzzle device. Further contemplated is an improved arrangement in which the sound emitted by the muzzle attachment upon firing is altered from a relatively low pitch characteristic of my prior device to a higher pitch condition, in which the sound is less noticeable. These results are attained by providing the inner tube of the device with a rear perforated portion, having a series of apertures formed in its side wall of a size small enough to prevent lateral expansion of the wad radially outwardly, but capable of permitting lateral escape of the gases following the wad. These relatively small apertures thus protect the wad against damages, and by virtue of their small size also serve to break up the sound produced by firing of the gun into a higher pitch sound. Preferably, the tube extends rearwardly far enough to directly engage, or substantially engage, the muzzle end of the gun barrel, to form with the barrel a substantially continuous tubular structure through which the shot passes, without requiring that the shot and wad cross a gap or space of the type required in my prior patent.

The inner tube of the device is so mounted as to be removable forwardly from the cage, to enable selective insertion of any of several different tubes, for producing different effects on the shot or other projectile being discharged. Preferably, these tubes have different choke patterns, while an additional tube may be provided having rifling in its inner surface for use in conjunction with a shell or cartridge having a single slug as the projectile.

As indicated previously, the gases are ultimately emitted laterally to atmosphere through opening means formed in the side wall of the outer cage. A particular object of the invention is to so locate these opening means as to direct the discharging gases in a manner further minimizing the sound which is heard by persons in the vicinity. Additionally, it is desired that the opening means in the cage be located in a manner causing a slight upward motion of the muzzle end of the gun barrel upon firing, in order to in this way compensate for the elevation of the forward gun sight which necessarily results from mounting the sight on the enlarged muzzle attachment, rather than on the initially smaller diameter gun barrel itself. To attain these two results, I desirably locate the opening or openings in the cage wall in a manner such that these openings are located more in the lower half of the cage wall than in its upper half, and preferably are substantially entirely in the lower half of the cage. Also, the openings should be located forwardly of the gas venting apertures in the tube.

The above and other features and objects of the invention will be better understood from the following detailed description of the typical embodiments illustrated in the accompanying drawing, in which:

FIG. 1 is a view showing a shotgun having a muzzle attachment of the present type attached to its barrel;

FIG. 2 is a greatly enlarged axial section through the muzzle attachment of FIG. 1;

FIG. 3 is an end view taken on line 3-3 of FIG. 2, and partially broken away to the location of one of the openings in the outer cage;

FIG. 4 is a view similar to FIG. 2, but showing an inner tube having rifling formed in its inner surface; and

FIG. 5 is a fragmentary axial section through a variational form of the invention.

Referring first to FIG. 1, I have shown at 10 a conventional shotgun, having the usual barrel 11, to the muzzle end of which there has been secured a muzzle attachment 12 constructed in accordance with the invention. As seen in FIG. 2, the barrel 11 is cylindrical and centered about an axis 113, and terminates forwardly at a transverse annular end surface 14.

The muzzle attachment 12 includes an outer tubular cage 13 into which any one of several different choke tubes 15 may be detachably and selectively connected, to provide different shot patterns upon firing of the gun. Cage 13 may be of essentially straight cylindrical configuration, and be disposed and centered about axis 113, and be rigidly connectible at its rear end 16 to the forward or muzzle end of barrel 11. The inner choke tube 15 is then connected at 17 to the forward end of cage 13, and projects rearwardly into engagement with the end of the barrel.

The connection between the rear end of cage 13 and the gun muzzle may be effected in any convenient way, as by provision of an annular adapter ring 18 about the gun muzzle, with this ring being internally cylindrical and suitably brazed to and a close fit on the gun muzzle, and having external threads at 19 engageable with internal threads 20 in the cage, to form the desired mounting connection. A lock ring 21 may be provided on the threads rearwardly of the cage, and be tightenable against the annular rear transverse surface 22 on the cage to lock the cage in fixed position relative to the barrel, with a gun sight 22' carried at the forward end of the cage in upwardly projecting position. Instead of the adapter ring arrangement of FIG. 2, it is contemplated that threads 19 may be formed directly on the gun barrel itself, or the cage may be brazed or otherwise secured directly to the gun barrel without threads, or other convenient methods of attachment may be utilized.

The detachable connection 17 at the forward end of the cage, between the cage and inner tube 15, may be formed by provision of internal threads 23 within the cage, engageable with external threads 24 formed on the outer surface of an enlarged forward portion 25 of tube 15. Desirably, internal threads 23 in the cage are formed by providing in the forward end of the cage an annular ring 26, which is suitably secured rigidly to the cage by any convenient means such as brazing, or by extension of sight 22' radially through the two parts 13 and 26. Rearwardly of threads 23 and 24, the parts 15 and 26 may have annularly engaging transverse shoulders 27 which contact to form a gas seal preventing access of any of the products of combustion forwardly to the threads. It is also contemplated that in some instances a bayonet connection or other quick change connection may be substituted for the threaded connection 23-24.

Tube 15 is centered about axis 113, and has an external cylindrical surface 28 which is smaller in diameter than the inner cylindrical surface 29 of cage 13, to form an annular space 30 radially between tube 15 and cage 13. Outer surface 28 of tube 15 may correspond approximately to the external diameter of gun barrel 11. Internally, tube 15 may have a rear portion 31, extending from a rear transverse annular surface 32 of the tube to a location 33, and having an internal preferably straight cylindrical surface 34 of a diameter desirably corresponding substantially to, or in some instances slightly larger than (but preferably not smaller than), the diameter of inner surface 35 of gun barrel 11. Forwardly of the location 33, the inner surface of tube 15 desirably tapers gradually and frusto-conically at 36 to a location 37 forwardly beyond which the inner surface of the tube may be of straight cylindrical configuration at 38 to the forward end 39 of the tube. Thus, the tapering surface 36 and straight cylindrical surface 38 form a choke portion of the tube, for reducing the diameter of the shot mass 40, and thus producing a controlled pattern at the target.

The rear surface 32 of tube 15 preferably directly engages the forward annular end surface 14 of the gun barrel, to effectively confine the wad 41 following shot mass 40 as it passes from the gun barrel to tube 15. Between the locations 32 and 33, tube 15 contains a large number of apertures 42, through which gases of combustion following wad 41 are able to escape laterally from within

tube 15 and into the annular space 30 about the tube. These apertures, however, are small enough to prevent lateral expansion of the over powder wad 41 outwardly into or through any of the apertures, and to prevent mutilation of or damage to the wad. For this purpose, each of the individual apertures 42 has a dimension d circularly about axis 113, which is very small as compared with the 360 degree circular extent of the side wall of portion 31 of tube 15 about axis 113, and desirably is not greater than about one-sixth of that circular extent of the perforated portion of tube 15. It is also desirable that the dimension d be not greater than about one-fourth of an inch, and preferably not greater than about one-eighth of an inch. In some instances, it may be possible for apertures 42 to be longer axially than circularly about axis 113, but in most instances, it is preferred that no dimension of the individual apertures 42 be greater than about one-fourth of an inch, and for best results not greater than about one-eighth of an inch. The optimum configuration for apertures 42 is circular, as shown. It is also desirable that the apertured portion of tube 15 occupy not more than about one-half of the total axial length of that tube, and for best results not more than about one-third of that length, with the rest of the tube being imperforate, as shown.

Cage 13 has openings or outlets 43 formed in its side wall, through which the gases of combustion are vented laterally from space 30. These openings 43 may take the form of elongated essentially arcuate and parallel slits, cut in the side wall of the tube by an appropriate milling cutter. The slits are desirably elongated in a direction extending generally circularly about axis 113, to form forward edges of the slits at 44 against which the forwardly moving gases of combustion are engageable to exert a forward force against the cage in a manner reducing the recoiling effect of the gun, in conjunction with a similar recoil compensating effect caused by engagement of the gases with ring 26.

Openings 43 are desirably all located forwardly of apertures 42 in tube 15, so that the gases must follow a somewhat circuitous route in discharging to atmosphere. Rearwardly of the rearmost opening 43, cage 13 should be imperforate. It is also desired that, as will be apparent from FIGS. 2 and 3, the openings 43 in cage 13 be located more in the lower half of cage 13 (the half beneath a horizontal plane 45 extending through axis 113) than in the upper half (above plane 45). For optimum results, it is desired that openings 43 be located entirely, or substantially entirely, within the lower half of the cage, and beneath plane 45.

To now describe the manner of use of the device shown in FIGS. 1 to 3, assume that tube 15 has been connected into cage 13, and that a shell having an obturating or over powder wad such as that shown at 41 has been fired in the gun. It is noted that this wad forms a rearwardly facing annular cup-like structure, which tends to expand radially outwardly against the wall of the barrel to provide an annular gas seal. As the wad and the shot 40 reach the location of tube 15, they first pass through the apertured portion 31 of the tube, and are then constricted by tapering portion 36, to thereby choke the shot to a reduced diameter condition for producing a particular desired shot pattern at a target spaced a predetermined distance from the gun. The small size of apertures 42 prevents the wad from expanding outwardly at the location of portion 31 of tube 15, but the gases following the wad are able to expand outwardly through apertures 42, to flow into annular space 30 and forwardly through that space to outlet openings 43 in cage 13, and to then discharge laterally through those openings. As stated previously, the engagement of the gases with the forward edges 44 of openings 43, and with ring 26, reduces recoil of the gun. Additionally, the positioning of openings 43 primarily, or desirably entirely, in the lower half of cage 13, causes these gases to emit more downwardly

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than upwardly, and thereby produce an upward reactive force on cage 13, in a manner causing the muzzle device 12 and the muzzle end of the gun barrel to move slightly upwardly, to thereby compensate for the fact that sight 22 is located higher than it would be if mounted directly to the gun barrel 11. In this connection, it is noted in FIG. 1 that the line of sight 47 between the rear sight 122 and the elevated forward sight 22' is at a slight upward angle relative to the axis 113 of the barrel, to thus introduce an error into the aiming of the gun except for the upwardly deflecting effect caused by positioning of openings 43 more in the lower half than in the upper half of cage 13.

The upward reactive force produced by openings 43 is further enhanced by so forming these openings that their forward edges 44, against which the forwardly moving gases of combustion impinge, face more in a downward direction than in an upward direction. To achieve this result openings 43 and their edges 44 are so formed as to gradually advance forwardly as they advance downwardly.

Besides applying an upward reactive force to the gun muzzle, the positioning of openings 43 primarily in the lower half of the cage also has the effect of directing the sound waves produced by the gases of combustion downwardly toward the earth, rather than directly laterally, with the result that these sound waves tend to be absorbed by the earth, or to move away in close proximity to the earth, beneath the ear level of persons in the vicinity, so that the sound produced is less bothersome. Further, the small size of apertures 42 tends to break up the gases and their sound, in a manner producing a higher pitch tone than would otherwise result, which tone is less objectionable than a very low pitch booming noise such as results when a large gap is provided at the gas discharge location.

When it is desired to produce a different shot pattern, as for longer or shorter range firing, the tube 15 is unscrewed from cage 13, typically by a tool extending into a tool receiving recess 48 formed in the forward portion of tube 15, with threads 24 moving out of engagement with threads 23. Tube 15 is thus withdrawn forwardly from the cage, and another one of the various interchangeable tubes is substituted in the position of FIG. 2, with that tube having a different taper at 36, and a different diameter at 38, to produce different choking results. Also, when it is desired to fire a shell having a single slug such as that shown at 49 in FIG. 4, rather than the scatter shot 40 of FIG. 2, another tube 15a may be substituted for the choke tubes 15, with this tube 15a containing spiral or helical rifling projections or grooves 50 for giving a spinning motion to the slug 49 about axis 113, to stabilize the slug in flight.

FIG. 5 shows fragmentarily a variational form of the invention which may be the same as that shown in FIGS. 1 through 3, except with respect to the changes specifically discussed below. In the first place, instead of mounting cage 13b of FIG. 5 by an adapter ring as shown at 18 in FIG. 2, I form the cage to have an integral inwardly projecting annular shoulder 51, which is a close fit on and may be brazed or otherwise secured directly to the gun barrel 11b. Also, the rear apertured portion 31b of tube 15b may flare rearwardly to an internal diameter greater than the internal diameter of barrel 11b, to preferably engage annularly only the radially outer portion of forward end surface 14b of the barrel, and a portion of an annular transverse surface 114b on cage 13b. Further, the apertures 42b in FIG. 5 are elongated to a greater dimension axially than in FIGS. 1 through 3, though still having the same small dimension circularly about the axis of the gun barrel as in the first form of the invention.

The functioning of the device of FIG. 5 is basically the same as has been discussed in connection with the first form of the invention, except that the wad 41 is permitted to expand slightly as it enters portion 31 of tube 15. The wad is of course still retained effectively and completely

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within tube 15 as it passes apertures 42b, in a manner preventing mutilation of or damage to the wad, while still permitting lateral escape of the gases to attain the results of the invention.

While I have typically illustrated certain embodiments of my invention, it is to be understood that the invention is not limited to these specific arrangements, but rather is applicable broadly to any apparatus falling within the scope of the appended claims.

I claim:

1. A shotgun muzzle device comprising an outer generally tubular compensator cage to be mounted to the forward end of a gun barrel and project forwardly from and beyond said barrel, said cage having a rear portion adapted to be connected to said forward end of the gun barrel to mount the cage thereon, a removable choke tube extending longitudinally within said cage at a location to be aligned with said gun barrel, connector means for detachably securing said choke tube near its forward end to a forward portion of said cage with the choke tube projecting rearwardly within the cage and being removable forwardly from the cage, said cage being spaced radially from said choke tube to provide a gas space radially between the cage and tube, said tube having a rear portion to be received closely adjacent said gun barrel and having a series of apertures in its side wall through which gases from within the tube may vent laterally and then advance forwardly within said space, individual ones of said apertures having dimensions circularly about the axis of said tube which occupy not more than about one-sixth of the circular extent of the tube itself, said side wall of the tube being imperforate from the location of said apertures to the forward end of the tube, said side wall in extending forwardly beyond the apertures having an imperforate choke portion within said cage containing an internal surface which tapers gradually forwardly to a reduced diameter, and then having an imperforate forward portion with a substantially straight cylindrical internal surface continuing forwardly at said reduced diameter, there being opening means in the wall of said cage through which said gases which pass through said apertures into said space between the cage and tube may discharge from said space to atmosphere.

2. A shotgun muzzle device as recited in claim 1, in which said rear portion of said choke tube, which contains said apertures, has an internal surface which tapers forwardly at the location of the apertures and which merges forwardly with said tapering internal surface of said choke portion of the tube.

3. A shotgun muzzle device as recited in claim 1, in which said apertures are elongated axially to a length several times as great as their dimensions circularly about said axis.

4. A shotgun muzzle device as recited in claim 1, in which said apertures have maximum dimensions circularly about said axis of not over about one-fourth of an inch.

5. A shotgun muzzle device as recited in claim 1, in which said choke tube projects rearwardly to a position for directly axially abutting the forward end of the gun barrel.

6. A shotgun muzzle device as recited in claim 1, including means at the rear end of said cage forming an essentially annular forwardly facing shoulder, said choke tube projecting rearwardly into direct axial abutting contact with said forwardly facing shoulder.

7. A shotgun muzzle device as recited in claim 1, in which said opening means in the cage wall form a greater area opening downwardly into the atmosphere than upwardly thereinto.

8. A shotgun muzzle device as recited in claim 1, in which said connector means include threads on the forward end of said choke tube detachably connectible to threads on the forward end of said cage.

9. A shotgun muzzle device as recited in claim 1, in

which said opening means have forward gas impingement edges which face more downwardly than upwardly.

10. A shotgun muzzle device as recited in claim 1, in which said apertures have maximum dimensions circularly about said axis not over about one-fourth of an inch, said choke tube projecting rearwardly to a position for directly axially abutting the forward end of the gun barrel, said connector means including threads on the forward end of said tube detachably connectible to threads on the forward end of said cage, said opening means being located forwardly of said apertures and primarily in the lower half of said cage wall and having forward gas impingement edges which face more downwardly than upwardly.

11. A shotgun muzzle device as recited in claim 1, in which said apertures are elongated axially and have maximum dimensions circularly about said axis not over about one-fourth of an inch, said choke tube projecting rearwardly to a position for directly axially abutting the forward end of the gun barrel, said rear portion of the choke tube which contains said apertures containing an internal surface which tapers forwardly at the location of said apertures and merges forwardly with said tapering internal surface of said choke portion of the tube, said connector means including threads on the forward end of said tube detachably connectible to threads on the forward end of said cage, said opening means being located forwardly of said apertures and primarily in the lower half of said cage wall and having forward gas impingement edges which face more downwardly than upwardly.

12. A shotgun muzzle device as recited in claim 11, in combination with and connected at its rear end to a shotgun barrel.

13. A shotgun muzzle device as recited in claim 1, in combination with and connected at its rear end to a shotgun barrel.

14. For connection into an outer generally tubular gun muzzle device cage which is connected at its rear end to a gun barrel and projects forwardly therefrom and has a wall containing at least one opening: a removable choke

tube adapted to extend longitudinally within said cage at a location to be aligned with the gun barrel, connector means carried by said choke tube near its forward end for connecting the tube to a forward portion of the cage with the choke tube projecting rearwardly within the cage and being removable forwardly from the cage and being spaced radially from said cage to provide a gas space radially between the cage and tube, said tube having a rear portion to be received closely adjacent said gun barrel and having a series of apertures in its side wall through which gases from within the tube may vent laterally and then advance forwardly within said space for ultimate discharge to atmosphere through said opening in the wall of said cage, individual ones of said apertures having dimensions circularly about the axis of said tube which occupy not more than about one-sixth of the circular extent of the tube itself, said side wall of the tube being imperforate from the location of said apertures to the forward end of the tube, said side wall in extending forwardly beyond the apertures having an imperforate first choke portion within said cage containing an internal surface which tapers gradually forwardly to a reduced diameter, and then having an imperforate forward portion with a substantially straight cylindrical internal surface continuing forwardly at said reduced diameter.

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