

April 9, 1946.

W. L. FINLAY ET AL

2,398,298

FIREARM

Filed March 22, 1944

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Fig. 1

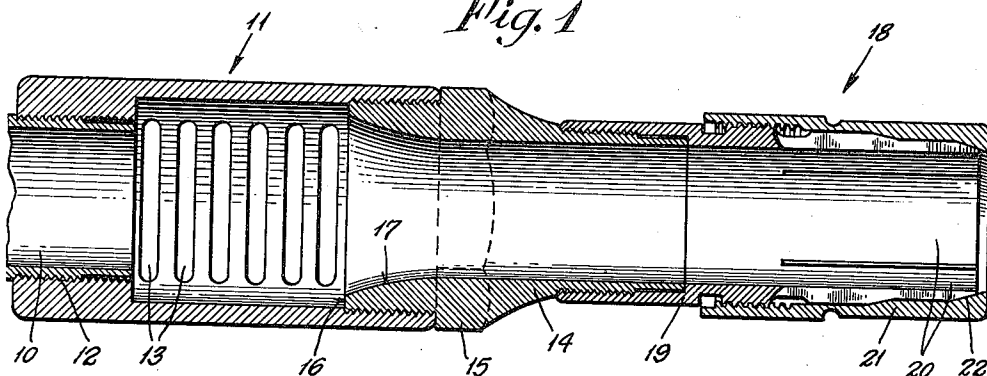


Fig. 2

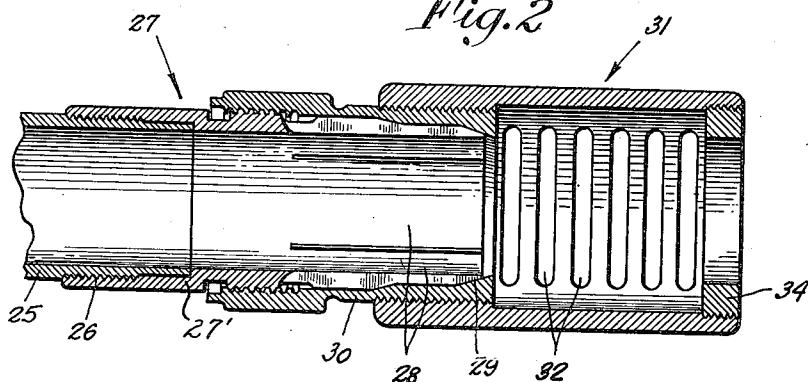
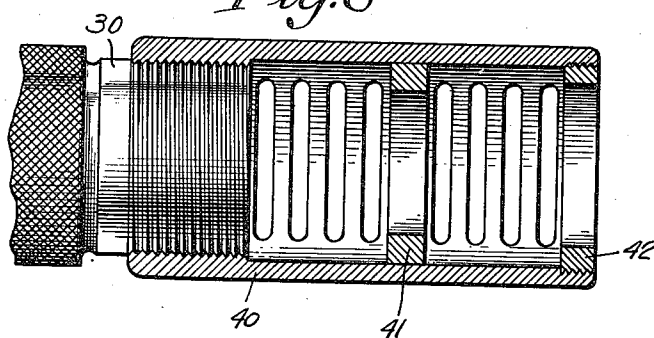


Fig. 3



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Fig. 4

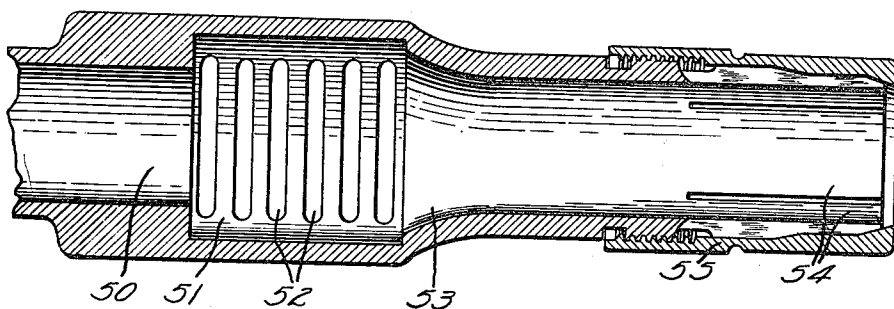
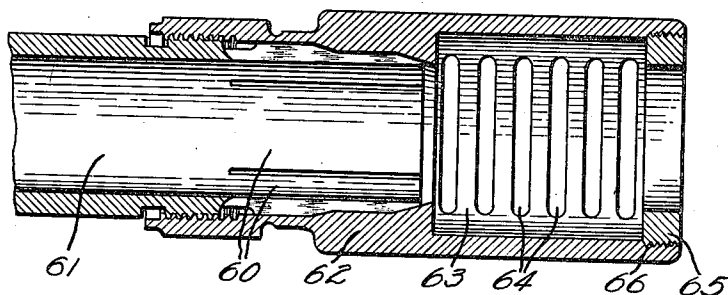


Fig. 5



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UNITED STATES PATENT OFFICE

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FIREARM

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Application March 22, 1944, Serial No. 527,558

3 Claims. (Cl. 42-79)

This invention relates to a combination pattern-controlling and recoil-reducing device for shotguns, and contemplates an efficient device for attachment to or integration with a shotgun barrel, which device will materially reduce recoil and, at the same time, enable full control of pattern.

The "pattern" of a shot charge, as fired from a gun, is ordinarily measured as the percentage of the entire charge of pellets which falls within a 30" circle at a range of 40 yards. Different densities of pattern are required for different types of shooting. For a rapidly moving target at close range, such as pheasant, grouse in timber, or "Skeet" targets, an open or widely spread pattern is desirable, for the reason that the conditions of shooting do not enable high accuracy of aim, and in hunting a great concentration of shot is too destructive to the target. On the other hand, handicap trap shooting and the shooting of ducks, geese, etc., requires a concentrated pattern, for the reason that the target is at a greater range, and a substantial concentration of shot at a long range is needed for effective results. While under extreme conditions patterns having a greater speed or a greater density may be desirable, the ordinary range of shotgun uses is satisfied by an "open," "cylinder" or "scattered" pattern, in which about 40% of the shot pellets fall within the standard 30" circle at 40 yards; and a "full choke," "close" or "dense" pattern, in which about 70% of the shot pellets fall within the 30" circle at 40 yards.

The opening or scattering of a shot pattern appears to be effected chiefly by the driving of the wad into the shot mass at the moment of emergence from the barrel, and close or dense patterns are secured by so constricting the muzzle as to retard the wad and permit the shot mass to emerge from the barrel without interference from the wad. Such constriction, which may also straighten the movement of shot on the outside of the shot mass, may be fixed or variable, and may be an integral part of the gun barrel, or an attachment thereto, such, for example, as the device shown in the patent to White, No. 1,892,522, Dec. 27, 1932.

The "recoil" of a gun may be considered as the total rearward momentum which is imparted to it by the rearward reaction to the force which produced the forward acceleration of the shot charge, wads and powder gas, and it can be measured by supporting the gun for free rearward movement as part of a pendulum. Complete elimination of eliminable recoil would thus take place if the motion of all of the powder gas were completely reversed, that is, if the entire volume of powder gas were turned through 180° and caused to travel toward the breech of the gun. Practically, it would be undesirable to thus direct powder gas back toward the shooter; but, theo-

retically, such complete deflection of the gas would represent a 100% or complete elimination of that portion of recoil which it is possible to eliminate. The fraction of the theoretical total of avoidable recoil which is eliminated by a particular recoil reducing device or "compensator" is the ratio of the actual reduction in recoil to the total possible reduction in recoil.

A common recoil reducing device comprises means for permitting and forcing the lateral escape of powder gas from a member integral with or joined to the gun barrel. The lateral gas escape ports are usually associated with an interiorly enlarged chamber, and in any event it is necessary, in order to secure any appreciable reduction in recoil, that the forward movement of the powder gas be positively retarded and the energy of its forward movement transmitted to the gun barrel. It is not sufficient merely to provide lateral escape passages, means must also be provided for deflecting a portion of the gas toward and through such passages. A shot charge is invariably followed by one or more wads, through which the powder gas pressure is transmitted to the shot, and the wad is usually an important element in deflecting powder gas through lateral ports. One such compensating device is shown in the patent to Cutts, No. 1,773,260, August 19, 1930. This device comprises a chamber of greater diameter than the gun bore, to permit the lateral expansion of the powder gases, lateral ports for the escape of such gases, and a constriction at the forward end of the chamber which momentarily halts and is obstructed by the wad, forcing the gas laterally.

The present invention comprises the discovery of certain means, constructions and proportions by which compensating or recoil reducing devices may be used in conjunction with pattern controlling devices to secure a combined effect of pattern control and recoil reduction, without the interference of one of these effects with the other which has characterized prior attempts to combine them. The device embodies an enlarged and laterally vented compensator in conjunction with a variable constriction, and the invention resides in part in the arrangement and proportioning of these parts in such a manner that the compensator does not interfere with pattern control or vice versa.

In the drawings:

Fig. 1 is a sectional side elevation of a form of the invention, in which the compensator is applied directly to the gun barrel and the pattern control is placed ahead of the compensator.

Fig. 2 is a sectional side elevation of a form of the invention, in which the pattern control or variable choke device is applied directly to the gun barrel and the compensator is placed ahead of it.

Fig. 3 is a sectional side elevation of a modification of Fig. 2.

Fig. 4 is a modification of the Fig. 1 arrangement, showing compensator and pattern control devices which are integral with each other and with the barrel.

Fig. 5 is a modification of the arrangement of Fig. 2, showing an integral structure.

Consideration will first be given to the form of device illustrated in Fig. 1. Secured to the gun barrel 10 by a threaded connection 12 is a compensator identified generally by numeral 11. The compensator is provided with lateral openings, vents or ports 13 and, in order to secure adequate vent area, and at the same time comply with the other necessary conditions hereinafter discussed, the interior diameter of the compensator is somewhat greater than the interior diameter of the barrel. Integral with or secured to the forward end of the compensator is a connector 14, which terminates rearwardly in a shoulder 16 and is provided with a rearwardly enlarged throat portion 17, the sloping surface of which merges with a substantially cylindrical bore which is preferably of a diameter such as to be filled by and offer some resistance to the passage of the wads. Forward movement of the powder gas being thus opposed, a substantial portion thereof is deflected laterally through the vents 13. To the forward end of the connector is secured a pattern control member identified generally by numeral 18 and comprising a tubular member 19, the forward portion of which is split into separate segments 20. The exterior surface of each segment 20 is tapered, to enable its inward displacement by cam surface 22 on a sleeve member 21 having a manually adjustable threaded connection with tube 19. It will be understood that any other form of adjustable choke or pattern control may be used.

The construction as illustrated in Fig. 1 embodies several separate elements secured together by threaded connections. It is entirely feasible to unite all of these elements into one integral unit, as illustrated in Fig. 4.

In the Fig. 1 device as above described, a shot charge which has moved down the barrel 10 under rapid acceleration and lateral confinement first enters the chamber of the compensator 11, where it is not laterally confined. Having traversed the chamber, it is again laterally confined in passing through the connector 14 and the pattern control member 18. If the segments 20 have been drawn together to "full choke" position a dense pattern should result, while if the segments are separated to "cylinder" position the pattern should be open.

It has been found that in the construction of the compensator certain critical dimensions and proportions must be observed in order to enable full pattern control. The reason is as follows: Upon entering the transversely enlarged chamber of the compensator 11, the shot mass is freed from the lateral confinement to which it was subjected during passage through the barrel 10 and begins to spread laterally. The greater the length of the compensator chamber, the greater will be the lateral enlargement of the shot mass. Having traversed the compensator chamber, the laterally distended shot mass is, during its passage through connector 14, brought back to substantially its original transverse dimensions. Such realignment of the shot tends to produce dense patterns regardless of the setting of the pattern control member 18. The wad has been retarded

in the compensator and, within practicable lengths of connector and pattern control, will not again contact the shot with sufficient force to scatter it. However, it has been found possible to shorten the compensator, without substantial detriment to recoil reduction, to a length such that its effect on pattern control is negligible. The maximum permissible length of compensator is about 1.25". If the length of the compensator is of the order of 1", and preferably somewhat less than 1", the shot have not spread enough so that the effect of realignment on pattern control is appreciable, and the full range of patterns from maximum density to maximum spread can be secured. It has likewise been found that an adequate compensating effect is secured by the use of a compensating chamber somewhat less than 1" in length, that lengthening the compensating chamber to about 1.25" increases its recoil reducing effect only slightly, and that lengthening the compensating chamber beyond 1.25" does not measurably increase recoil reduction. A chamber of a length of .84" enables the provision of four lateral vents 13, and this is applicant's preferred construction. With this arrangement, a full range of pattern control is secured, as well as a reduction in recoil of the order of 45%. Increasing the length of the compensator chamber to about 1.2" effects a slight increase in recoil reduction, such reduction then being of the order of 51%. Any further increase in the length of the compensator chamber up to 3" or more does not effect any measurable increase in recoil reduction, while it does have a detrimental effect on pattern control. For example: A Cutts compensator, as supplied by its manufacturers, with a length of about 3" and twelve lateral vents used between the gun barrel and a pattern control of the type illustrated substantially completely destroys the effect of the pattern control. Patterns of the order of 60% to 70% are regularly secured, regardless of the setting of the pattern control. However, as heretofore stated, if the length of the compensator is reduced to 1.2" and six vents, the recoil reduction remains substantially the same, but 46% patterns can be secured; while if the compensator is further reduced to .84" and four vents, the recoil reduction is diminished only to 44.5% and patterns as low as 38.6% (average of 50) are secured.

In the arrangement illustrated in Fig. 2, the pattern control member 27 is threadedly secured as at 26 directly to the barrel 25 and comprises a tubular member 27', the forward portion of which is split into separate segments 28, the exterior surface of each segment being tapered to enable its inward displacement by cam surface 29 on a sleeve member 30 having a manually adjustable connection with the tube 27'. The sleeve member 30 carries a compensator 31 provided with lateral vents 32. In this arrangement, the shot mass, which has traversed the barrel 25 under lateral confinement, continues through the pattern control device 27 under confinement, the wad which follows the shot being retarded or not, according to the setting of the pattern control. The pattern control performs its usual functions in the usual manner, delivering the shot mass into the compensator 31, where it is free from lateral confinement.

The compensator must have throughout an interior diameter such that it is not engaged by the shot mass which, while traversing the compensator, is constantly expanding laterally. The compensator must also be provided with means

which, acting by itself or in conjunction with the wad, offers a substantial resistance to forward motion of the powder gas and deflects this gas through lateral vents. While these requirements may be satisfied in various ways, the form shown in Fig. 2 comprises a chamber of a diameter substantially greater than the bore of the gun barrel 25 and the passage through the pattern control member. In the outer end of the compensator is secured a baffle ring 34. The aperture supplied by this ring is just large enough to freely pass the shot mass which has been laterally enlarged during its passage through the compensator chamber, which means that it is necessarily somewhat larger than the bore of the gun. The amount of lateral spreading is generally proportional to the length of the compensator chamber, and the diameter of the baffle aperture is thus a fraction of the length of the compensator. Since the effectiveness of the compensator is in part dependent upon the baffle area which is engaged by the powder gas, and since lengthening the compensator necessitates enlarging the baffle aperture and correspondingly reducing the baffle area, it is desirable that the compensator be kept at a minimum length.

As heretofore shown, the effectiveness of a compensator is proportional to its length but only up to a length of about 1.2", the added compensation (recoil reduction) secured by further lengthening the compensator being negligible. It has been found that a compensator having a length of 1.2" and six lateral vents and provided with an aperture of a diameter which just clears the shot mass has a compensating effect of about 44%. It will be noted that this compensation is somewhat less than the compensation secured with the arrangement shown in Fig. 1, due to the necessity of providing an opening in the baffle which will pass the expanded shot mass. For a 12 gauge shotgun having a bore diameter of .730" to .735" and a compensator length of 1.2", as above described, the baffle aperture should have a diameter about .775".

Fig. 5 illustrates a modification of the arrangement shown in Fig. 2, wherein the sleeve member 30 is formed as an integral part of the compensator.

If desired, the compensation or recoil reduction can be increased by the use of a plurality of baffles having apertures of increasing diameter toward the free end of the compensator. Any number of such baffles may be used, provided only their apertures are of graduated size, to enable the free passage of the shot charge. A typical arrangement is shown in Fig. 3, in which the compensator 40 secured to the forward end of the pattern control device 30 has a length of eight vents. Beyond the fourth vent is placed a baffle 41 having an aperture such as to just clear the shot mass; and at the end of the compensator is a second baffle 42 having an aperture of greater diameter, the shot mass having further expanded while traversing the increased length of the compensator.

Fig. 4 shows a modified form of the construction shown in Fig. 1. In the modified form the barrel 50 has formed integrally with its muzzle end a section 51 of enlarged diameter which is provided with recoil control ports 52. Forward of the ports 52 the bore is constricted at 53 and provided with an adjustable pattern control device. The pattern control device may comprise a plurality of segments 54 formed by slotting the forward end of the tube and an adjustable collar 55 capable

of constricting the segments to the degree necessary for pattern control. The critical factors influencing the choice of dimensions of this modification are the same as those governing the Fig. 1 modification.

Fig. 5 shows a modification of the form of the invention shown in Fig. 2. The modified form comprises pattern control segments 60 formed in the end of the barrel 61. Threadably mounted on the barrel is the constricting collar 62 which has formed integral with its forward end an enlarged chamber 63 provided with recoil control ports 64. The forward baffle 65 may be formed integral with the collar or may be secured therein as by a threaded connection 66. This form is subject to the same design limitations as is that shown in Fig. 2.

It will be seen that the invention comprises the discovery of certain hitherto unknown and fundamental relationships and proportions which must be observed in effectively applying both a pattern control device and a recoil reducing device to a firearm. Certain specific constructions have been shown in the drawings, but it is to be understood that these are illustrative only, the invention being susceptible to embodiment in other forms, all falling within the scope of the appended claims.

What is claimed is:

1. The combination with a shotgun barrel, of means for effecting both an adequate recoil reduction and a full range of pattern control, said means comprising in combination a variable shot pattern controlling device and a recoil reducing device comprising an enlarged vented chamber and a constriction which are traversed by the shot mass, the length of said enlarged vented chamber being not greater than about 1.2 inches and the diameter of said constriction being such as to effect in conjunction with said enlarged vented chamber a reduction of not less than 44% of recoil due to the forward movement of gas.

2. The combination with a shotgun barrel, of means for effecting both an adequate recoil reduction and a full range of pattern control, said means comprising in combination a recoil reducing device and a variable shot pattern controlling device which are traversed by the shot mass in the sequence named, said recoil reducing device comprising an enlarged vented chamber and a constriction, the length of said enlarged chamber being not over substantially 1.2 inches and the diameter of said constriction being such as to effect in conjunction with said enlarged vented chamber a reduction of not less than 50% of recoil due to the forward movement of gas without interference with the full control of shot patterns by said variable shot pattern controlling device.

3. The combination with a shotgun barrel, of means for effecting a full range of pattern control simultaneously with a recoil reduction not less than substantially 44%, said means comprising a pattern controlling device and a recoil reducing device which are traversed by the shot mass in the sequence named, said recoil reducing device comprising an enlarged vented chamber having an apertured baffle adjacent the forward end thereof, the inside diameter of said baffle being enlarged with respect to the maximum inside diameter of the exit of said variable pattern control device in the ratio substantially .775 to .735 in a chamber length of 1.2 inches.

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