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R. C. LANCE

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LIFT COMPENSATOR FOR FIREARMS

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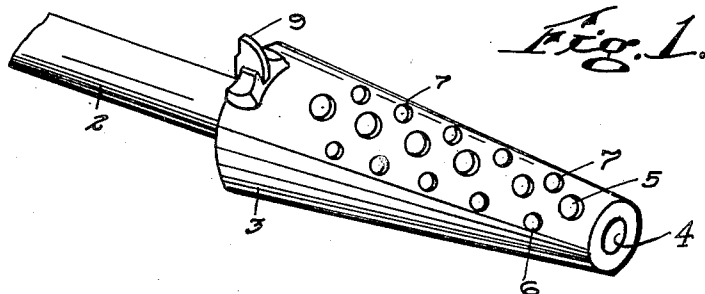


*Fig. 1.*

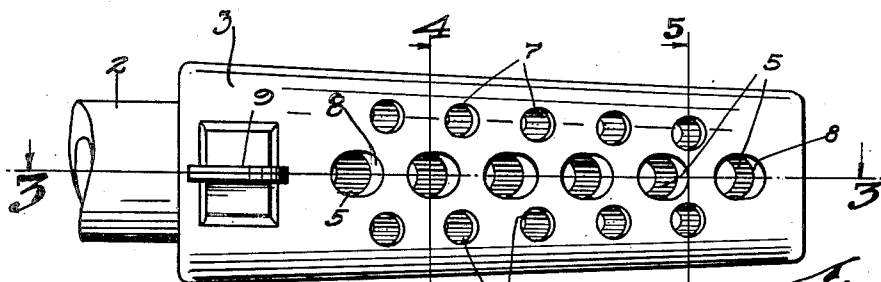


*Fig. 2.*

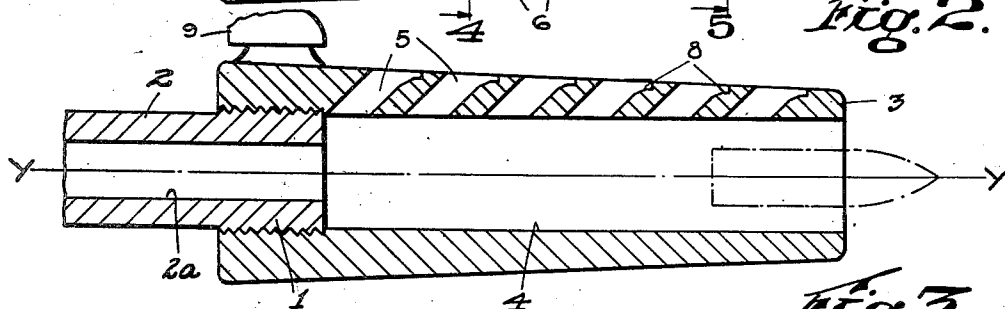


*Fig. 3.*

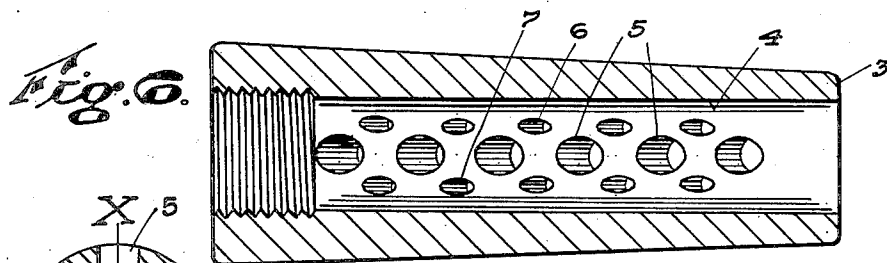


*Fig. 5.*

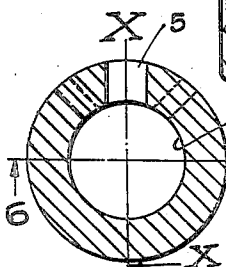


*Fig. 4.*

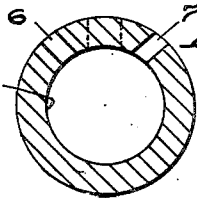


*Fig. 6.*

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## UNITED STATES PATENT OFFICE

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## LIFT COMPENSATOR FOR FIREARMS

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1 Claim. (Cl. 89—14)

The present invention relates to a compensator for firearms, adapted to overcome the muzzle lift or climb, as well as to reduce the recoil, of machine guns, automatic and semiautomatic rifles of various sizes, and other types of firearms.

The object of the invention is to provide a device of the above indicated character that will effectively overcome lift or climb of the muzzle of the firearm, under rapid fire conditions, so that the arm can be held steady on the target. Prior devices of this character have utilized the principle of providing a chamber beyond the muzzle, to receive the gases of explosion, with the chamber being vented above its horizontal axis to permit escape of a portion of the gases in an upward direction, while the unvented portion of the chamber is subjected to a downward pressure, to counteract any lifting or climbing tendency of the muzzle.

The present invention contemplates an improvement over previous lift compensators, by providing a novel arrangement and form of discharging apertures for the gas chamber, so as to obtain an extremely uniform and effective compensating effect, with a resulting increased accuracy of rapid fire, not heretofore obtainable. The above and other advantageous features of the invention will hereinafter more fully appear from the following description, with reference to the accompanying drawing, in which:

Fig. 1 is a perspective view of a compensator embodying the invention, as applied to a rifle barrel.

Fig. 2 is a top plan view, on an enlarged scale, of the compensator shown in Fig. 1.

Fig. 3 is a vertical sectional view along the line 3—3 of Fig. 2.

Figs. 4 and 5 are transverse sectional views, along the lines 4—4 and 5—5, respectively, of Fig. 2, looking in the direction of the arrows.

Fig. 6 is a horizontal sectional view, along the line 6—6 of Fig. 4, looking upwardly in the direction of the arrows.

Referring to the drawing, the muzzle 1 of a rifle barrel 2 is externally threaded to receive the compensator 3, which is of externally tapered form and provides an internal cylindrical bore or chamber 4 of uniform diameter. It is to be noted that the chamber 4 is of a diameter appreciably greater than the bore 2a of the rifle, or other weapon to which the compensator may be attached, and that the walls of the chamber 4 are of decreasing cross-section in a direction away from the muzzle 1, due to the outside taper of the

compensator body, for a purpose which will hereafter appear.

The wall of the chamber 4 provides a series of apertures 5, spaced uniformly along a vertical plane  $x-x$ , see Fig. 4, passing through the longitudinal axis  $y-y$  of the chamber 4, with the apertures 5 being forwardly inclined away from the muzzle 1, at a uniform angle. The chamber wall also provides a second and a third series of apertures 6 and 7 lying in planes also passing through the axis  $y-y$ , and disposed at equal angles to the vertical plane  $x-x$ , preferably less than  $45^\circ$ . The apertures 6 and 7 are of smaller diameter than the apertures 5, and have substantially the same forward inclination away from the muzzle 1. As is evident from a consideration of Fig. 2, the three series of apertures 5, 6 and 7 are symmetrically disposed with reference to the plane  $x-x$ , with the smaller apertures 6 and 7 preferably arranged in staggered relation, with respect to the larger apertures 5.

Due to the fact that the apertures 6 and 7 lie in planes radiating from the central axis  $y-y$  of the chamber 4, at an inclination substantially less than  $45^\circ$  from the plane  $x-x$  in which the apertures 5 are located, the entire upper portion, or roof, of the chamber 4 is perforated, as indicated in Fig. 6, owing to the much closer spacing of the several series of apertures, where they enter the chamber 4, as compared to the spacing of the outer ends of the apertures on the outside of the compensator body, as viewed in Fig. 2. In other words, the apertures 5, 6 and 7 are concentrated in that portion of the upper chamber wall in which the vertical forces, or vertical components of radial forces, due to expanding gases of combustion within the chamber, are at a maximum, with all other portions of the chamber wall being imperforate.

In forming the apertures 5, 6 and 7, a preliminary cut is made with a suitable drill, operating about an axis at right angles to the axis  $y-y$ , so that when the main or through cut is made with the same drill operating about an axis inclined with respect to the axis  $y-y$ , a shoulder 8 remains at the outer lip of each aperture, as best shown in Fig. 3. As will hereinafter appear, these shoulders 8 relieve the gases of combustion as they emerge from the apertures 5, 6 and 7, and have the general effect of quenching the flame of discharge and materially reducing the visibility of the firearm when discharged.

When the rifle or other firearm to which the compensator 3 may be attached is fired, and the bullet leaves the muzzle 1, the gases of combus-

tion propelling the bullet will enter the chamber 4 and expand, under considerable pressure, which reaches a maximum just before the bullet leaves the end of the chamber, as indicated in Fig. 3, when the open mouth of the chamber is partially closed. These expanding gases will immediately escape along the entire upper portion of the chamber 4, through the apertures 5, 6 and 7, and since the chamber wall immediately below the perforated upper portion is solid, a reaction is produced, in a direction generally opposite to the direction of gas discharge, which will tend to force the muzzle 1 downwardly, and thereby compensate for the lift or climb effect which would otherwise occur, were the firearm not equipped with the compensator.

The forward inclination of the apertures 5, 6 and 7 away from the muzzle 1 greatly facilitates ready escape of the generally forwardly moving gases within the chamber 4, as compared to radial or rearwardly inclined apertures. As the discharge gases emerge from the apertures, the shoulders 8 have the effect of changing the direction of the gases as they pass into the atmosphere, to exert a flame-quenching effect.

As previously pointed out, the body of the compensator 3 has an outside taper, which is such that the wall of the chamber 4 is relatively thin at its open end, as compared to that portion of the wall adjacent to the muzzle. As a result of this varying wall thickness, the apertures 5, 6 and 7, adjacent the muzzle 1, are appreciably longer than are the apertures at the open end of the chamber. Therefore, the relatively greater mass of metal surrounding the apertures near the muzzle 1, is better adapted to withstand the higher temperatures of the gases at that point, than near the open end of the chamber 4, so that the compensator as a whole, tends to maintain a uniform temperature, without becoming overheated.

As a result of the uniform forward inclination of the apertures 5, 6 and 7, and the outside taper of the compensator body, projections of these apertures onto a plane normal to the plane of the drawing and to the axis Y—Y, are of varying areas. Since these projected areas are smallest near the muzzle and become progressively greater away from the muzzle, as is evident from Figs. 2 and 3, there follows a progressively greater relief or venting of the gases of explosion as the bullet travels from the muzzle through the chamber 4. The net result is that resistance to the passage of gases through the apertures progressively decreases in a direction away from the muzzle, so

that the downward compensating effect, due to positive action of the gases on the bottom wall of the compensator is greatest within the zone of maximum pressure, where the bullet leaves the end of the chamber, as indicated by the dot and dash lines in Fig. 3.

From the foregoing, it is apparent that by the present invention there is provided an improved lift compensator for firearms, particularly adapted to effectively overcome the lifting or climbing effect which tends to raise the muzzle off the target when the arm is fired rapidly. The lift compensator embodying the present invention is particularly characterized by the fact that the gas discharge apertures are so arranged that the major portion of the gas expansion chamber above a horizontal plane is perforated, so that the compensating effect takes place where the upward forces exerted by the gases would otherwise be at a maximum. Furthermore, the gas discharge apertures are arranged absolutely symmetrically with respect to the vertical plane  $x-x$  passing through the chamber axis. To insure this symmetrical disposition, a sight 9 may be mounted on the compensator which lies in the plane  $x-x$ , as shown in Fig. 2. Obviously, lining up of this sight with the rear sights on the barrel, automatically insures the attachment of the compensator to the barrel muzzle, with all the apertures 5, 6 and 7 disposed in the proper angular position to obtain a perfect balance of the lift compensating effect on opposite sides of the plane  $x-x$ .

I claim:

35 An attachment for the muzzle of a firearm to prevent climb, comprising means forming a chamber extending beyond the muzzle for receiving the gases of explosion, a wall of said chamber being of uniform inside diameter greater than the bore of the firearm, said wall having an outside taper away from the muzzle, said chamber wall having apertures of uniform diameter extending therethrough and forwardly inclined at the same angle with respect to a horizontal plane passing through the chamber axis, said chamber wall below said plane being solid, said apertures forming unobstructed passages normal to said plane and varying from a minimum at the muzzle to a maximum at the discharge end of said chamber, to obtain by reason of varying degree of resistance to the flow of gas offered by said apertures a downward compensating effect progressively increasing in a direction away from the muzzle.

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