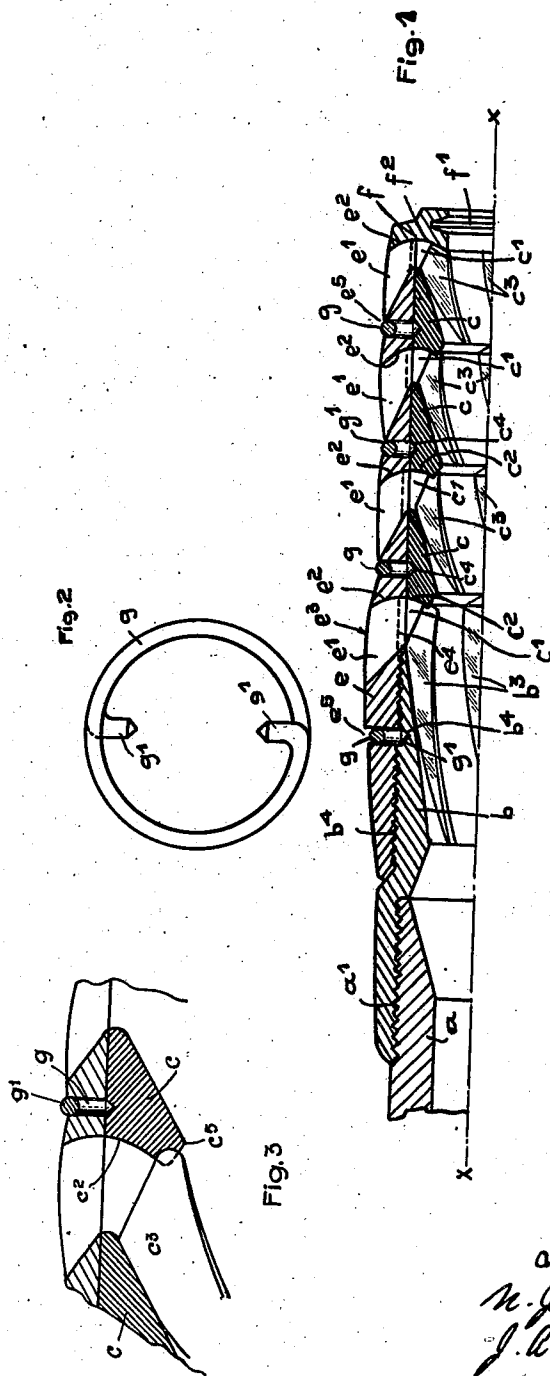


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RECOIL ABSORBER FOR FIREARMS

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RECOIL ABSORBER FOR FIREARMS

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The present invention relates to "muzzle checks" or recoil absorbers for firearms of the type including one or several convergent-divergent nozzles fixed to the end of the barrel or tube of the arm, along the axis thereof, and intended to increase the kinetic energy of the gases, which are subsequently deflected and discharged to the outside by means of a stationary deflector system including deflecting surfaces generated by the revolution, about the longitudinal axis of the barrel, of one or more curvilinear arcs having their concavity turned toward the rear of the weapon, whereby the energy of the gases which escape through this deflector system is utilized for exerting a tractive force in a direction opposed to that of the force producing the recoil of the arm.

The present invention relates especially to the construction and assembly of the deflector elements.

It has already been proposed, in our Patent No. 2,143,596 dated January 10, 1939, to constitute the deflector elements partly by the curved rear faces of the nozzles, and partly by the front faces of the apertures provided in an outer casing for the outflow of the gases. In the construction described in this patent, each of the nozzles is provided with inwardly extending helical partitions or ridges serving to maintain and accelerate the rotary movement of the gases around the axis of the weapon produced by the rifling in the barrel.

The object of the present invention is to provide a simplified construction of a recoil absorber of this type.

According to the essential feature of the present invention, these internal ridges carried by the respective nozzles are prolonged toward the front so as to be in contact each with the part of a deflector element formed by the rear face of the next nozzle in said forward direction.

According to another feature of the present invention in order to oppose rotary displacement of the nozzles as might result from the reaction of the gases on said ridges, we provide steel wire rings, acting as springs, adapted to fit in circular grooves provided in the envelope, opposite the nozzles, and carrying radial inward projections, which extend through the envelope and penetrate into corresponding holes of the nozzles.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present inven-

tion will be hereinafter described, with reference to the accompanying drawing, given merely by way of example, and in which:

Fig. 1 is a partial longitudinal section along the axis of a recoil absorber made according to the present invention and fitted on the front end of the barrel of a firearm;

Fig. 2 is a separate view of one of the rings provided for fixing the nozzles.

Fig. 3 is a separate view showing a modification of the form of the nozzles, according to the present invention.

In the drawing, *a* designates the barrel of a firearm; *b* is a first convergent-divergent nozzle, screwed to the front end of the barrel; *c*, *c*, *c* are three other convergent-divergent nozzles, mounted in front of the first one, behind one another, on the inside of envelope or casing *e*. The front part *f* of said casing constitutes an inward flange and surrounds a circumferentially grooved axial opening *f*¹ for the passage of the projectile. Reference characters *c*¹, *c*¹ designate annular outlet passages, limited toward the front by the rear faces *c*² of the next respective nozzles, (or for the last passage *c*¹ toward the right hand side of Fig. 1) by the rear face *f*² of the flange *f* of casing *e*, all these surfaces being of revolution about axis *x—x*. Nozzles *b*, *c*, *c* and *c* are provided with helical inward ridges *b*³, *c*³, *c*³, and *c*³ respectively, in such manner as to constitute riflings which prolong the riflings of the bore of the barrel.

These helical inner ridges *b*³, *c*³, *c*³ and *c*³ of course turn in the same direction as the rifling of the barrel. Preferably, the pitch of the ridges *b*³ of the nozzle *b* is shorter than that of the said rifling. In a like manner, the pitch of the ridges *c*³ of each of the nozzles *c* is shorter than that of the preceding one, so that these ridges *b*³, *c*³, *c*³, *c*³ will maintain and even accelerate the rotary movement of the gases about axis *x—x*, produced by the rifling of the barrel.

The gases, which are thus given a high speed rotary (or rather helical) movement about axis *x—x* through passages *c*¹ and apertures *e*¹ provided in casing *e*, passing between suitably shaped arms or partitions *e*³ which are for instance bevel-shaped on their inner edge. The curved front face *e*² of each of these apertures *e*¹ prolongs the curved rear face *c*² of each of the nozzles *c* respectively or the curved rear face *f*² of flange *f*. In this way, each of the deflector surfaces is constituted partly by the rear face *c*² of a nozzle (or by the rear face *f*² of flange *f*) and partly by the front face of the ports *e*¹ provided in casing *e*.

As shown by the drawing, casing *e* is fixed, by screwing at *b*⁴, on the first nozzle *b*, itself screwed at *a*¹ to the barrel. The other nozzles *c*, *c*, *c* are housed, behind one another, in the smooth cylindrical bore of casing *e*.

In order to keep these nozzles suitably spaced from one another, according to our invention, the internal ridges *b*³ or *c*³ carried by each of said nozzles are prolonged toward the front so that their front ends constitute bevelled or wedge-shaped noses extending across passages *c*¹ and bearing against the rear edges of the next nozzles, respectively (or, for the last set of ridges, carried by the last nozzle toward the right of the drawing, against the rear edge of flange *f*). In other words, according to the present invention, the wedge-shaped noses constituted by the front ends of the ridges *b*³ and *c*³ act as longitudinal spacing members for maintaining the desired intervals between the successive nozzles.

With such an arrangement, the thrust exerted by the gases is transmitted from one nozzle to the next one through these helical partitions *b*³, *c*³ thus prolonged.

In order positively to prevent rotation of the nozzles we may provide, in the outer face of casing *e*, opposite each of the nozzles *b*, *c*, a circular groove *e*⁵, in which is engaged a steel wire ring *g*, constituting a spring. This ring *g* (Fig. 2) is provided with radial pointed projections *g*¹, extending inwardly, through suitable radial holes provided in the casing into corresponding holes *b*⁴ or *c*⁴ provided in nozzles *b* or *c*, which prevents any rotation of said nozzles. When assembling the parts, it suffices to open the ring slightly by elastically deforming it, in such manner as to force the pointed projections outwardly, so as to permit of fitting the ring in position in a groove *e*⁵. Under the effect of the elasticity of the ring, pointed projections *g*¹ penetrate into the holes of the casing and the nozzle thus preventing relative rotation thereof. Removal of the rings is effected in a similar manner.

We might also (as shown by Fig. 3) provide, in the rear face (*c*², *f*²) of each nozzle, small recesses *c*⁵ in which would be engaged the front ends of the noses of the helical ridges *b*³, *c*³ so as to prevent rotary displacement of the nozzles under the effect of the reaction resulting from the thrust of the gases upon these helical ridges.

Also, it should be well understood that this arrangement might apply to a muzzle check system in which the internal ridges of the nozzles would be parallel to the axis of the barrel instead of being helically disposed with respect thereto.

In brakes which are strongly cooled, as those employed in aviation, in which mechanical qualities are more important than resistance to wear, the envelope may be made of a light alloy, preferably containing a high percentage of silicium or another alloy having a coefficient of expansion approximating that of steel.

In this case, in order to reduce the fatigue of the partitions provided between the gas exhaust apertures of the casing (which fatigue is due to the obliquity of the helical ports), these partitions may be made parallel to the axis of the weapon.

In all cases, the nozzles will be preferably made of inoxidizable steel, in order to facilitate the removal by sliding.

For the same purpose, the nozzles may have their outer lateral face of slightly conical shape, instead of being cylindrical, the small base of the cone being on the side of the front end of the arm; the bore of the casing will be correspondingly conical.

In a general manner, while we have, in the above description, disclosed that we deem to be practical and efficient embodiments of the present invention, it should be well understood that we do not wish to be limited thereto as there might be changes made in the arrangement, position and form of the parts without departing from the principle of the present invention as comprehended within the scope of the appended claims.

What we claim is:

1. In connection with a firearm having a barrel, a recoil absorber for said firearm which comprises, in combination, a convergent-divergent nozzle fixed directly to the end of said barrel, in line therewith a casing coaxial with said barrel fixed directly to said nozzle, and at least two other convergent-divergent nozzles mounted in said casing, in line with said first mentioned nozzle, said casing being provided with apertures corresponding with the intervals between said nozzles and the front walls of which prolong the rear faces of the respective nozzles so as to form, together with them, deflector surfaces for causing the gases escaping through said intervals and said apertures to flow out in a rearward direction and helical inward ridges carried by each of said nozzles having their front ends prolonged toward the front to engage each the rear part of the next nozzle for keeping said nozzles in correct relative longitudinal spacing relation with respect to one another.

2. A recoil absorber according to claim 1 in which said casing and said nozzles are provided with radial holes adapted to register with one another when all the parts are in correct relative positions, which further includes elastic steel wire rings adapted to fit radially around said envelope, and inward projections carried by said rings adapted to engage in said corresponding holes of said envelope and said nozzles, so as to lock said part in correct angular position about the axis of said firearm.

3. A recoil absorber according to claim 1 in which the front end prolonged portions of said ridges, located ahead of the front edge of the divergent part of each nozzle that carries them, are wedge-shaped and have their apexes applied against the rear edge of the convergent part of the next nozzle in the direction of the front of the firearm.

4. A recoil absorber according to claim 1, in which the rear edge of the convergent part of each nozzle is provided with notches adapted to receive the apexes of the prolonged portions of the inward ridges carried by the preceding nozzle.

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