

[54] **SILENCER**

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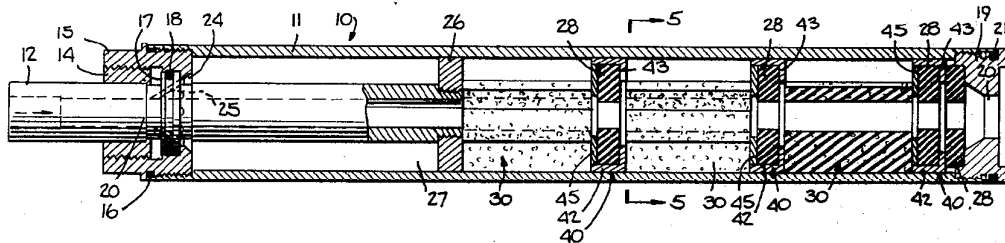
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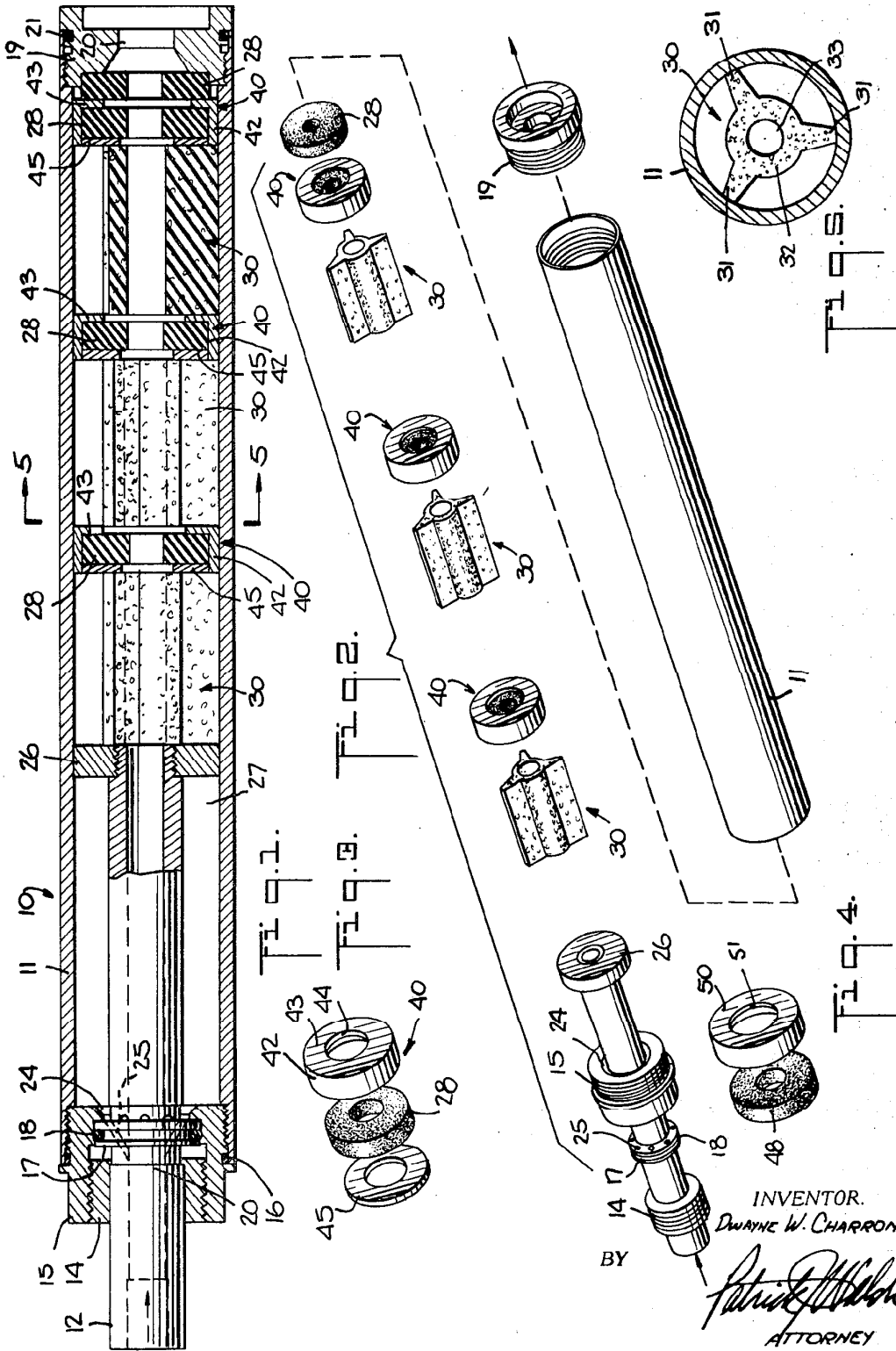
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[57] **ABSTRACT**

A silencer for firearms comprising a casing enclosing a plurality of sealing members positioned within the casing at spaced intervals, each sealing member being formed of elastomeric material and having an aperture of diameter less than the diameter of a firearms projectile that passes through the silencer; and a plurality of filtering members separating the sealing members within the casing, each filtering member being formed of compacted metal particles of brass, bronze or stainless steel, and each filtering member having an aperture for free passage of a firearms projectile through the silencer. The sealing members momentarily provide an interference fit around a projectile passing therethrough so that the gases may expand both rearwardly and forwardly through filtering members with consequent reduction in velocity of the gases.

**13 Claims, 5 Drawing Figures**





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## SILENCER

## BACKGROUND OF THE INVENTION

This invention relates to a silencer for firearms. More particularly, this invention relates to a firearms silencer containing a plurality of elastomeric sealing members and a plurality of porous metallic filtering members, the combination of which provides improved repression of noise.

It is known that effective repression of the report accompanying firing of a gun involves containment of the exploding gases following a projectile through a gun barrel so as to avoid the normal unrestrained expansion of the gases out of the gun barrel. In addition to containment of the exploding gases, it is known to divide the exploding gases within the silencer into a plurality of paths, by means of baffles, perforated discs, and the like, in order to reduce the velocity of the gases, preferably in stages.

The problem of silencing is especially acute in connection with automatic firearms. In such firearms the repeated shock to a silencer of rapid discharge and reload sequences requires silencer components having strength and stability so that the silencing elements within a silencer casing in particular have economical use life. Normally, also, it is advantageous in silencers for automatic firearms to utilize a portion of the expansion force of the discharge gases for moving the bolt of the gun into reload position with simultaneous ejection of the spent cartridge.

## SUMMARY OF THE INVENTION

Accordingly, a primary object of the invention is to provide a new and improved device for attachment to firearms that effectively reduces the sound of the discharge.

Another object is to provide a silencer especially adaptable for use with automatic firearms which require silencer components of extraordinary strength and stability.

A further object of the invention is to provide a silencer having means for directing at least a portion of the propellant gases against the spent cartridge shell remaining in the breech of a gun, the force of expansion moving the bolt of the gun to reload position, said reloading being accompanied by ejection of the cartridge shell.

These and other objects, features and advantages will in part be apparent and in part will be obvious from the detailed description which follows.

The improved silencing provided by the silencer of the invention results primarily from the use of a plurality of filtering members positioned within the casing of the silencer at spaced intervals, the filters being formed of compacted metal particles, in combination with a plurality of elastomeric sealing members or diaphragms having central apertures less than the diameter of the projectile that passes through the silencer so as to momentarily seal the exploding gases behind the projectile and thereby to force the gases through the metallic filters.

## DETAILED DESCRIPTION

The preferred embodiments of the invention are illustrated in the accompanying drawing in which:

FIG. 1 is a longitudinal section through a silencer of the invention shown attached to the end of the barrel of a firearm;

FIG. 2 is an exploded perspective view of the interior assembly of the silencer of FIG. 1, also showing the silencer attached to the end of the barrel of a firearm;

FIG. 3 is an exploded perspective view of a sealing member assembly from the interior of a silencer of the invention;

FIG. 4 is an exploded perspective view of another embodiment of a sealing member assembly; and

FIG. 5 is a front sectional view of a filtering member of the invention shown in position within the casing of a silencer of the invention, the view being taken along line 5—5 of FIG. 1.

As shown in FIGS. 1 and 2, a silencer 10 having a casing 11 is removably secured to the end of a gun barrel 12 and a discharge aperture 20.

A front plug or cap 19 closes the discharge end of the silencer. It will be noted that front plug 19 is internally threaded for attachment to casing 11 and is provided with gasket 21 to seal the closure.

Within the casing 11 are positioned at spaced intervals a plurality of sealing members 28. Behind each sealing member 28, relative to discharge aperture 20, and separating the sealing members, are filtering members 30. As shown in FIG. 1, the sealing members 28 are each positioned within rigid holders 40, said holders also separating the sealing members from the filtering members. The rigid holders 40 comprise a peripheral portion 42 surrounding the periphery of the sealing member 28, and a flange 43 extending radially inwardly from the peripheral portion 42 and engaging one end face of the sealing member 28. The rigid holder 40 has a central aperture 44 of diameter larger than the diameter of a projectile that passes through the silencer. A retaining ring or disc 45 frictionally engages the inner surface of peripheral portion 42 of holder 40, as by a press fit, and engages the end face of sealing member 28 opposite the end face engaged by flange 43 to thereby securely retain sealing member 28 in the holder.

Also shown in FIGS. 1 and 2 is a rigid member 26 positioned adjacent the filtering member 30 closest to the end of gun barrel 12, and having a central aperture which sealingly engages the end of gun barrel 12, preferably by threading (as shown). A rear plug 15 is threaded into the end of casing 11, preferably in combination with a gasket or O-ring 16. The plug has an aperture of a diameter to fit the gun barrel 12. One portion of the walls of the aperture (outwardly of the casing 11) provide sealing engagement with the gun barrel, preferably by threading. A second portion of the walls of the aperture (inwardly of casing 11) are channeled, as by apertures 24, to permit passage to discharge gases from the bore of the barrel into the annular space or chamber 27 which is defined by the space surrounding barrel 12 between plug 15 and rigid member 26. Within plug 15 and abutting the channeled portion of the aperture walls thereof is a rigid ring 17 having apertures 25 which communicate with apertures or channels 24 of plug 15 and the bore of the gun barrel to permit discharge gases from the bore of the gun to pass into chamber 27. Separating plug 15 from ring 17 is a gasket or O-ring 18.

Plug 15 is shown threadably engaging a collar 14 mounted on gun barrel 12. This collar may be unitary with the gun barrel or it may be movable. Similarly, rigid ring 17 may be unitary with the gun barrel or movable, except that at least one of collar 14 and ring 17 must be unitary with the gun barrel so that the casing 11 may be securely attached thereto. Preferably, both of collar 14 and ring 17 are constructed unitary with the gun barrel.

FIG. 3 shows in detail the holder 40 relative to sealing member 28 and retaining ring 45 and FIG. 4 shows another, less preferred, embodiment of the combination of a rigid member similar to holder 40 and a sealing member similar to sealing member 28. With reference to FIG. 4, sealing member 48 has an exterior diameter slightly greater than that of sealing member 28 so as to fit snugly within casing 11. A retaining ring 50 having a central aperture 51 engages the end face of sealing member 48 to thereby securely retain sealing member 48 in the casing adjacent filtering member 30.

The material of which sealing members 28 and 48 is formed is an elastomeric material having sufficient durability, deformability and resilience to withstand the deformation by the repeated discharge of a projectile through the silencer. Among the materials suitable for the sealing members are natural rubbers, and synthetic rubbers such as polybutadiene; styrene butadiene copolymers; reaction products of sodium polysulphides and dihalides; polychloroprenes such as neoprene, polyisobutylene; polyvinyl compounds, and the like. Neoprene is the preferred elastomeric material because it appears to have the best use life. A representative useful elastomeric material is a product sold as "Armorite."

Filtering member 40 is formed of compacted metal particles, such as brass, bronze or stainless steel. Intermediate grades of particulate metals are preferred since the finer grades tend to compact too tightly, thereby reducing the porosity and filterability of the member. On the other hand, the grade of particular metal should not be too coarse as this would render the compacted member too porous for effective obstruction of the movement of the exploding gases. Generally, the grade of particulate metal should be such as to provide about 40-60 percent by volume porosity when compacted. A bronze powder providing this range of porosity is preferred. The metal particles are pressed-heated or otherwise compacted to a desirable form for insertion into the casing of the silencer. The compacting may involve sintering of the particulate metal but normally compacting with moderate heat is sufficient.

The geometrical configuration of the filtering members 28 is not critical and need be such only to permit insertion of the filtering member in the casing with its central aperture in alignment with the bore of the firearm, so that the projectile may pass therethrough, and to provide effective deceleration of the exploding discharge gases. A suitable geometrical form is shown in perspective in the exploded view of FIG. 2 and in frontal section in FIG. 5. It will be noted that the section of FIG. 5 has three projections or arms 31 extending from a tubular central member 32, said arms facilitating alignment of the filtering member in the casing 11. The number of such arms or projections is

not significant, apart from the requirement of some space between the tubular central member 32 and the interior walls of casing 11, to facilitate expansion of the gas after it passes through the filtering member from its central aperture 33.

In the operation of the silencer, a projectile passing through gun barrel 12 moves through the aperture of a first filtering member 30. A portion of the propelling gases behind the projectile is forced through apertures 25 in ring 17 and is then channeled through apertures 24 into chamber 27 where the gas expands, thus slowing the velocity of this portion of the propelling gases. Those portions of the propelling gases following the projectile expand sequentially through the filters 30, this expansion being both rearward and forward of sealing members 28 since the sealing members momentarily provide an interference fit around the projectile as it passes therethrough. The successive sealing and expansion of the discharge gases slows the gases in stages but without substantially reducing the velocity of the projectile through the silencer. Thus, the gases which follow the projectile out of the silencer expand at discharge aperture 20 with a barely discernible "pop."

Rapid reloading of the firearm is also facilitated by silencers of the invention since the force of the rearward expansion of gases through the bore of barrel 12 against a spent cartridge case or shell in the barrel rearward of plug 15 forces the bolt of the gun to a reload position, with simultaneous ejection of the spent shell. Detailed reload and ejection mechanisms facilitating this result are known and therefore are not shown in the drawing.

The invention can be embodied in other specific forms without departing from the spirit or essential characteristics thereof and the foregoing embodiments accordingly are to be considered primarily as being illustrative and not necessarily restrictive, the scope of the invention being determined by the appended claims and equivalents thereof.

What is claimed is:

1. A silencer for firearms comprising: a casing having a discharge aperture at one end and an opening at the other end for attachment to a gun barrel; a plurality of sealing members positioned within said casing at spaced intervals, each said sealing member being formed of elastomeric material and having a central aperture of diameter less than the diameter of a firearms projectile that passes through the silencer; a plurality of rigid holders for said sealing members; each said holder having a peripheral portion surrounding the periphery of a said sealing member; each said holder having a rigid flange extending inwardly from said peripheral portion and engaging an end face of a said sealing member; and a plurality of filtering members positioned within said casing at spaced intervals, each said filtering member being formed of compacted metal particles and having a central aperture for passage of a firearms projectile through the silencer; said apertures being in axial alignment within said casing.

2. A silencer according to claim 1 including a retaining ring tightly fitting within said peripheral portion and engaging an end face of a sealing member opposite the end face engaged by the flange of said holder.

3. A silencer for firearms comprising: a casing having a discharge aperture at one end and an opening at the other end for attachment to a gun barrel; a plurality of sealing members positioned within said casing at spaced intervals, each said sealing member being formed of elastomeric material and having a central aperture of diameter less than the diameter of a firearms projectile that passes through the silencer; and a plurality of filtering members positioned within said casing at spaced intervals, each said filtering member being formed of compacted metal particles and having a central aperture for passage of a firearms projectile through the silencer; said apertures being in axial alignment within said casing; a rigid member positioned in said casing adjacent the filtering member closest to the end of the casing for attachment to a gun barrel, said rigid member having a central aperture to receive the end of a gun barrel in sealing engagement therewith, said rigid member being spaced from the gun attachment end of said silencer so as to define a chamber surrounding said gun barrel within said casing; and a rear plug, said plug having a central aperture of diameter to receive said gun barrel, a portion of the walls of said aperture outwardly of said silencer providing sealing engagement with said gun barrel, a second portion of the walls of said aperture inwardly of said silencer being channeled to permit passage of gases from the bore of said barrel into said chamber surrounding said gun barrel.

4. A silencer according to claim 3 wherein said plug threadably engages the casing of said silencer.

5. A silencer for firearms comprising: a casing having a discharge aperture at one end and an opening at the other end for attachment to a gun barrel; a plurality of sealing members positioned within said casing at spaced intervals, each said sealing member being formed of elastomeric material and having a central aperture of diameter less than the diameter of a firearms projectile that passes through the silencer; and at least one filtering member positioned within said casing, said filtering member being formed of a porous compacted metal and having a central portion having an aperture for passage of a projectile therethrough, said filtering member further having a plurality of projections for centering the filter member within said casing and for defining at least one chamber between said casing and said filtering member for the expansion of gas which has passed through said filtering member.

6. A silencer as defined in claim 5 in which said filter member has three projections for centering the filter member within said casing and for defining three expansion chambers within said casing.

7. A silencer according to claim 5 wherein said filtering member has a porosity of about 40-60 percent.

8. A silencer according to claim 7 wherein the metal particles of said filtering member are brass, bronze or steel.

9. A silencer according to claim 5 including a plurality of rigid members positioned in said casing, each said rigid member being positioned parallel and adjacent to the end face of a sealing member that is closest to said discharge aperture, each said rigid member having a central aperture of diameter larger than the diameter of a projectile that passes through the silencer.

10. A silencer according to claim 5 including a rigid member positioned in said casing adjacent the filtering member closest to the end of the casing for attachment to a gun barrel, said rigid member having a central aperture to receive the end of a gun barrel in sealing engagement therewith, said rigid member being spaced from the gun attachment end of said silencer so as to define a chamber surrounding said gun barrel within said casing.

11. A silencer for firearms having a casing with a discharge aperture at one end and an opening at the other end for attachment to a gun barrel; a plurality of sealing members positioned within said casing at spaced intervals, the improvement which comprises: a plurality of porous filtering members positioned within said casing at spaced intervals between adjacent sealing members, each said filtering member being formed of compacted metal particles and having a central portion having an aperture for passage of a firearms projectile therethrough; each said filtering member having a plurality of projections for axially aligning each said filter member within said casing, and for defining a plurality of chambers between said casing and said filtering member for expansion of gas which has passed through said filtering member.

12. A silencer for firearms comprising:

a casing having a discharge aperture at one end and an opening at the other end for attachment to a gun barrel;

a plurality of sealing members positioned within said casing at spaced intervals, each said sealing member being formed of elastomeric material and having a central aperture of diameter less than the diameter of a firearms projectile that passes through the silencer;

a plurality of filtering members positioned within said casing at spaced intervals, each said filtering member being formed of compacted metal particles and having a central aperture for passage of a firearms projectile through the silencer;

a plurality of first rigid members positioned in said casing, each said rigid member being positioned parallel and adjacent to the end face of a sealing member that is closest to said discharge aperture, each said rigid member having a central aperture of diameter larger than the diameter of a projectile that passes through the silencer;

a second rigid member positioned in said casing adjacent the filtering member closest to the end of the casing for attachment to a gun barrel, said rigid member having a central aperture to receive the end of a gun barrel in sealing engagement therewith, said rigid member being spaced from the gun attachment end of said silencer so as to define a chamber surrounding said gun barrel within said casing, and

a rear plug for threadably engaging the casing of said silencer, said plug having a central aperture of diameter to receive said gun barrel, a portion of the walls of said aperture outwardly of said silencer providing sealing engagement with said gun barrel, a second portion of the walls of said aperture inwardly of said silencer being channeled to permit passage of gases from the bore of said barrel into said chamber surrounding said gun barrel;

said apertures being in axial alignment within said casing.

- 13. A silencer for firearms comprising:
  - a casing having a discharge aperture at one end and an opening at the other end for attachment to a gun barrel;
  - a plurality of sealing members positioned within said casing at spaced intervals, each said sealing member being formed of elastomeric material and having a central aperture of diameter less than the diameter of a firearms projectile that passes through the silencer;
  - a plurality of filtering members positioned within said casing at spaced intervals, each said filtering member being formed of compacted metal particles and having a central aperture for passage of a firearms projectile through the silencer;
  - a plurality of rigid holders for said sealing members; each said holder having a peripheral portion surrounding the periphery of a said sealing member; each said holder having a rigid flange extending inwardly from said peripheral portion and engaging an end face of a said sealing member;
  - a second rigid member positioned in said casing adjacent the filtering member closest to the end of

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the casing for attachment to a gun barrel, said rigid member having a central aperture to receive the end of a gun barrel in sealing engagement therewith, said rigid member being spaced from the gun attachment end of said silencer so as to define a chamber surrounding said gun barrel within said casing;

a retaining ring tightly fitting within said peripheral portion and engaging an end face of a sealing member opposite the end face engaged by the flange of said holder; and

a rear plug for threadably engaging the casing of said silencer, said plug having a central aperture of diameter to receive said gun barrel, a portion of the walls of said aperture outwardly of said silencer providing sealing engagement with said gun barrel, a second portion of the walls of said aperture inwardly of said silencer being channeled to permit passage of gases from the bore of said barrel into said chamber surrounding said gun barrel;

said apertures being in axial alignment within said casing.

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