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FIREARMS SILENCER WITH HELICAL SUPPRESSOR ELEMENTS

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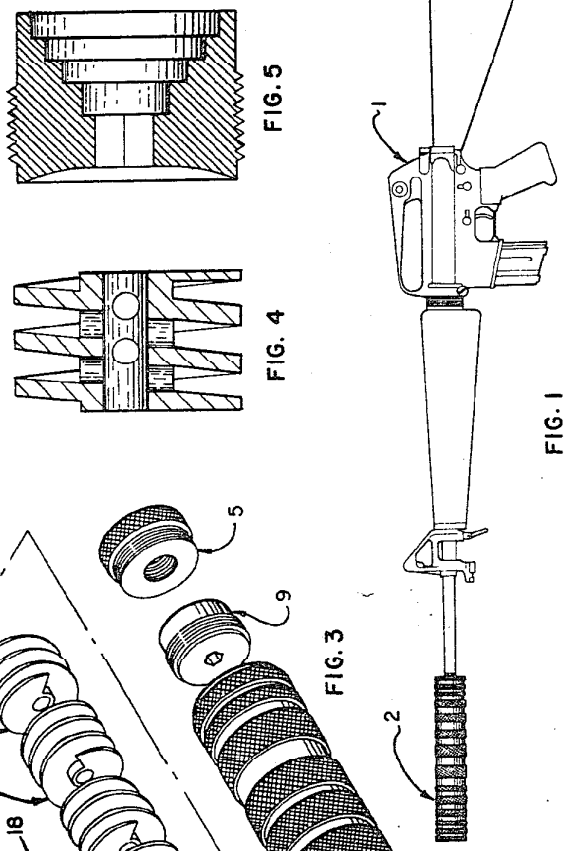

FIG. 5

FIG. 4

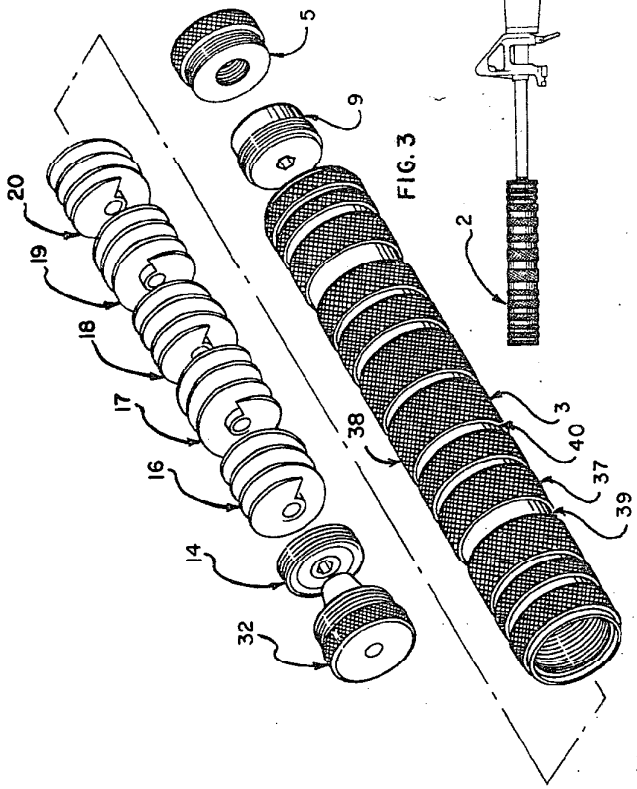

FIG. 3

FIG. 1

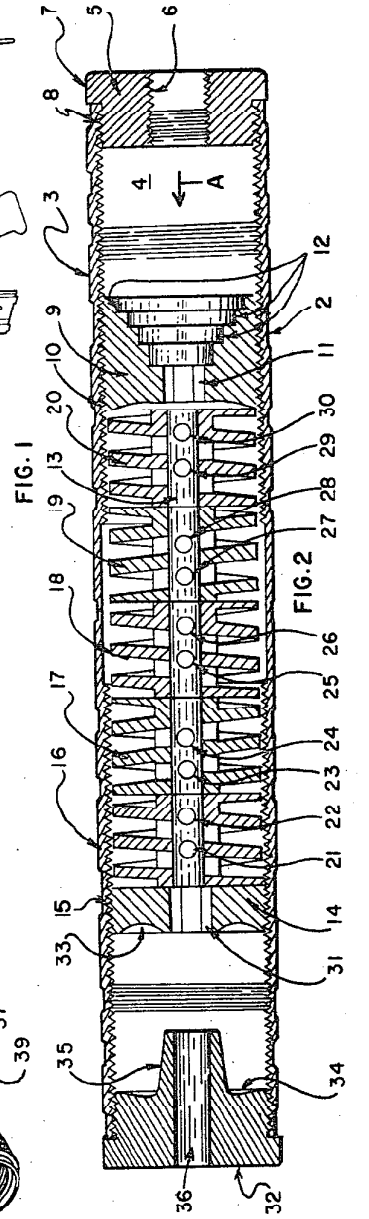

FIG. 2

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FIREARMS SILENCER WITH HELICAL SUPPRESSOR ELEMENTS

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ABSTRACT OF THE DISCLOSURE

A silencer for use in conjunction with weaponry and as a muffler for internal combustion engines and the like is disclosed wherein a hollow tubular outer housing is divided into entry, suppression and resonant chambers arranged coaxially within the tubular housing. The entry chamber is separated from the suppression chamber by an axially apertured partition of progressively diminishing size and of stepped configuration. A plurality of helical suppressor elements are axially disposed in the suppression chamber and arranged in opposition to each other. The helical suppressor elements are disposed about an axial passageway and a plurality of radial ports are utilized to establish communication from the axial passageway to the helical suppressor elements. The resonant chamber is defined by end walls whose interior surfaces are of dished concave configuration and this chamber is arranged immediately adjacent to the suppression chamber. An inwardly protruding throat portion is formed on the interior surface of the outer end wall of the resonant chamber.

A silencer constructed according to this invention may comprise a plurality of helical suppressor elements disposed about an axial passageway together with a plurality of radially disposed ports arranged to establish communication from the passageway to the suppressor elements so that out-of-phase vibrations are supplied from the axial passageway to the suppressor units in such manner as substantially to neutralize each other. A resonant chamber is disposed adjacent to and in axial alignment with the suppression chamber and is provided with end walls having concave inwardly dished inner surfaces and an inwardly protruding throat portion is formed on the inner surface of the outer end wall, the resonant chamber being effective to damp and substantially to silence any unneutralized frequencies which escape from the suppression chamber. An entry chamber, disposed within the tubular outer housing and between the muzzle of the associated gun barrel and the entry end of the suppressor chamber functions as a pressure reducing chamber for supplying gaseous material to the suppression chamber following expulsion from the muzzle of the gun barrel.

For a better understanding of the invention reference may be had to the following detailed description taken in conjunction with the accompanying drawing in which FIG. 1 is a side view of a rifle to the muzzle of which a silencer constructed according to this invention is affixed; FIG. 2 is an enlarged cross-sectional view of a silencer constructed according to the invention; FIG. 3 is an exploded view depicting the internal parts of the silencer in perspective after their removal from the tubular outer housing; FIG. 4 is an enlarged cross-sectional view of one of the suppressor elements depicted in FIGS. 2 and 3; and in which FIG. 5 is an enlarged cross-sectional view of an axially apertured partition which separates the entry chamber from the suppression chamber.

In the drawing the numeral **1** designates generally a rifle to which a silencer generally designated by the numeral **2** is affixed.

Silencer **2** as best shown in FIG. 2 comprises an outer

housing **3** which is internally threaded along a substantial portion of its inner surface and which therefore is adapted to receive the inner elements which constitute principal features of the invention.

At the entry end of tubular outer housing element **3**, an entry chamber **4** is defined by flanged end wall element **5** which is externally threaded as indicated at **8** for cooperation with the internal threads of tubular outer housing **3**. End wall **5** is internally threaded as indicated at **6** for receiving external threads formed on the exterior surface of the muzzle of the barrel of gun **1**. A flange **7** forms an abutment ledge for engagement with the end of tubular outer housing **3**.

At the opposite end of the entry chamber **4**, an axially apertured partition **9** is disposed. Partition **9** is provided with external threads **10** which cooperate with the inner threads of tubular outer housing **3**. The axial aperture **11** formed in partition **9** is of progressively diminishing diameter and is of stepped configuration as indicated at **12**.

Thus as a projectile passes through the entry chamber in the direction indicated by the arrow A, pressure fluid is admitted to the entry chamber as the projectile clears the muzzle of the gun barrel. This pressure is allowed quickly to expand and then to pass through the aperture **11** as the projectile completes its passage through partition **9**.

The suppression chamber constructed according to this invention is defined at its ends by partition **9** and by partition **14**. Partition **14** is externally threaded as designated at **15** and hence may be adjustably mounted within the tubular outer housing **10** in any desired axial position by simply rotating the partition **14** and thus causing axial movement thereof.

In order to provide for the application of out-of-phase vibrations to the oppositely disposed reversely wound helical suppressor elements **16–20** inclusive, a plurality of radial ports designated by the numerals **21–30** are spaced along passageway **13** so that these ports are progressively uncovered. Fluid is thus admitted first through radial port **30** and subsequently through radial port **29** and so on as the projectile proceeds from right to left as viewed in FIG. 2. Frequencies which are characteristic of the fluid adjacent to helical suppressor **20** must necessarily be out-of-phase with subsequently supplied vibrations adjacent to the helical suppressor **19**. Since suppressor elements **19** and **20** are reversely wound, the opposed vibrations tend to neutralize each other. Furthermore, this neutralizing action may, if desired, be emphasized by the use of more than a pair of suppressor elements such as **19** and **20** additional suppressor elements **16**, **17** and **18** being depicted in the drawing. Of course, it will be understood that more than five suppressor units may be used if desired although satisfactory results may be achieved with only two such oppositely wound units particularly if the number of helical windings is sufficiently great of the order of six or eight for example.

Any unsuppressed vibrations which pass through the aperture **31** formed axially in partition **14** are admitted to the resonant chamber defined by partition **14** and outer end wall **32**. Partition **14** is provided with a dished concave configuration as indicated by the numeral **33** about its aperture **31**. Similarly, the inner surface of end wall **32** is dished as indicated at **34** and a throat portion **35** is formed on the inner surface of end wall **32**. The throat portion **35** defines a part of the axial passageway **36** formed in end wall **32**.

A sound deadening action is achieved by variations in the thickness of the tubular outer housing **3**. Furthermore, these portions of different thicknesses are of varying lengths axially of the outer surface of tubular housing **3**. For example, thick knurled portion **37** is of less axial

length than thick knurled portion 38 as best shown for example in FIG. 3. Furthermore, thin unknurled portion 39 is of greater length axially than thin unknurled portion 40. These random variations have been found to be particularly effective as sound dampening means.

Not only does the apparatus of this invention function effectively as a silencer, it also functions as a flash inhibitor so as effectively to render the flames of the associated powder burning action invisible.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Silencer means comprising aligned suppression and resonant chambers, a plurality of helical suppressor elements disposed coaxially in said suppression chamber with adjacent helical elements arranged in opposition to each other, means defining an axial passageway through said helical elements, a plurality of radial ports by which communication is established between said passageway and said helical elements, said ports being spaced axially along said passageway whereby gaseous material in said passageway is supplied sequentially to said helical elements through said ports so that out-of-phase vibrations therein are effectively neutralized, and an entry chamber axially disposed at the entry end of said silencer means and separated from said suppression chamber by an axially apertured partition, the aperture in said partition being of progressively diminishing size in the direction of said suppression chamber.

2. An elongated silencer having an entry end and comprising aligned suppression and resonant chambers, said resonant chamber being disposed at the opposite end of the silencer from said entry end thereof and the inner surfaces of the end walls of said resonant chamber being of dished concave configuration about their peripheries and wherein coaxial apertures are formed therein in alignment with an axial passageway through said suppression chamber, a plurality of helical suppressor elements disposed coaxially in said suppression chamber with adjacent helical elements arranged in opposition to each other, means defining said axial passageway through said helical elements, and a plurality of radial ports by which communication is established between said passageway and said helical elements, said ports being spaced axially along said passageway whereby gaseous material in said passageway is supplied sequentially to said helical elements through said ports so that out-of-phase vibrations therein are effectively neutralized.

3. A silencer according to claim 2 wherein a tubular outer housing defines the outer wall of said aligned chambers and wherein the outer surfaces of said housing comprises alternate portions of different thicknesses and variable axial lengths interspersed axially therealong.

4. A silencer comprising aligned suppression and resonant chambers, a plurality of helical suppressor elements disposed coaxially in said suppression chamber with adjacent helical elements arranged in opposition to each other, means defining an axial passageway through said helical elements, the diameter of said axial passageway being of approximately the same order of magnitude as the bore of the associated gun barrel, and a plurality of radial ports by which communication is established between said passageway and said helical elements, said ports being spaced axially along said passageway whereby gaseous material in said passageway is supplied sequentially to said helical elements through said ports so that out-of-phase vibrations therein are effectively neutralized.

5. A silencer according to claim 1 wherein the aperture in said partition is of stepped configuration.

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89—14; 181—57, 67