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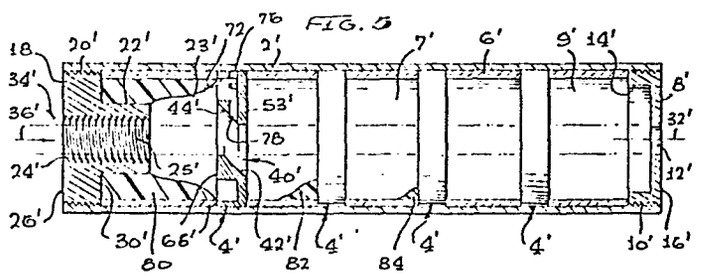
(54) Sound suppressor for a firearm.

(57) This invention relates to a sound suppressor for a firearm utilizing an improved type baffle in the interior of the sound suppressor which controls the flow of gasses in a manner to improve the sound suppression characteristics of the device.

To this end the central opening (40') in the baffle (4') has slanted sidewalls (42', 44') defining a cylinder whose axis passes at a predetermined angle to the case axis (32').

Improvement in sound suppression may further be sought by disposing a liquid or pasty substance (80) in the chambers (7', 9', 23') formed by the baffles (4').



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SOUND SUPPRESSOR FOR A FIREARM

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a sound suppressor or silencer for a firearm. More particularly, the invention relates to a firearm sound suppressor having the form of a cylindrical casing containing a plurality of baffle members which influence the expanding gasses associated with the discharge of a projectile from the muzzle of a firearm in a specific fashion to abate the noise otherwise associated with the firing of the firearm.

Brief Description of the Prior Art

Firearm silencers are well known in the art of weaponry, and a variety of constructions have been proposed for minimizing the noise associated with expanding gasses at the firing of a weapon. One type of silencer construction can be found by reference to U.S. Patent 1,111,202 to W.E. Westfall. Westfall proposes a casing accomodating a plurality of removable funnel-shaped baffle members arranged so that their smaller openings are directed toward the muzzle of the gun barrel. Outwardly curving faces of the baffle members are purported to act as deflecting surfaces for the exhausting gasses. However, such surfaces are, in fact, merely guides, and are not in the direct line of movement of the gasses. As a result, many of the gasses pass straight through the openings in the series of baffle members.

An alternate form of baffle member in a silencer can be found by reference to U.S. Patent No. 1,482,805 to H.P. Maxim. Maxim uses a similar series of baffle members faced along a cylindrical casing. However, the disc-like portion of each baffle member is

constructed of sheet metal having its center hole deformed by offsetting the opposite edges so that the plane of the apperture is inclined to the axis of the casing. With this arrangement, upon firing the gun to which the silencer is attached, the combustion gasses are deflected by the deformed portion of the disc-like member and are directed from one chamber to the succeeding one at an angle to the passage for the projectile. There are several shortcomings of the Maxim silencer, however. Of necessity, the disc-portion of each baffle member must be made thin enough to be deformed by, for example, the bending of a shaft fitted through the aperture and forced off axis of the disc. This would tend to buckle the disc, or at least weaken it, and increasing the thickness of the sheet metal baffle member would, at some point, limit the ability to deform the aperture edges. Moreover, by deforming the aperture edges in the manner described by Maxim, the deformed opposite edges of the aperture are out of the plane of the disc, and the resultant area of the opening is increased to a large extent. This is obviously undesirable when the object of the silencer is to impede the movement of gasses along the series of baffle members. Furthermore, in view of the necessity for the baffle members to be formed of thin sheet metal, the use of such silencer would be restricted to small firearms with low muzzle exit pressure. Finally, the surfaces off which the gasses deflect are in a position to direct the deflected gasses toward the apperture of the next baffle. More importantly, the gasses directed by the exit side deformation are directed into the opening in the entrance side deformation of the succeeding baffle member. As a result of these last-two-mentioned physical characteristics, the deflected gasses are affected by the deformed disc members in only a small

degree, and the gasses exiting each baffle member are directed precisely in line with either the aperture or the deformed aperture edge of the succeeding baffle member. Consequently, even with the high number of baffle members illustrated in the Maxim silencer device, the effectiveness of the noise reduction is questionable.

The silencer disclosed in U.S. Patent No. 3,748,956 to Hubner illustrates the use of a series of baffle members which have serrated edges at the passage opening in each baffle member, each serration being bent rearwardly to define a funnel which diverts the gasses flowing directly in front of, beside, and behind the projectile. The Hubner silencer thus functions to break up the shock waves produced by the projectile passing through the silencer. The serrated baffles produce a turbulence in the cylindrical column of discharged gasses following the projectile and essentially diminish the energy of the gasses by increasing the length of the path taken by the gasses before exiting to the atmosphere. The Hubner silencer thus is not adapted to direct the gasses passing through the baffle in any specified manner. Rather, Hubner proposes to merely divert the gasses prior to exiting each successive baffle member.

In the Waiser U.S. Patent No. 4,291,610, a series of conical-shaped baffle members are arranged in a manner similar to that described in connection with the Westfall patent. Waiser adds an additional dimension in causing the discharged gasses to decrease their energy level by providing a plurality of small holes in a partition member, with the axes of the holes being at an angle with respect to the axis of the silencer. This causes the gasses passing therethrough to be directed into the mainstream of gasses passing through the main aperture in the center of the silencer device.

According to Waiser, the discharged gassesare thus separated into a mainstream and into many auxiliary streams with the axes of the auxiliary streams crossing with the axis of the mainstream, resulting in a dispersion of the discharged gasses and a decrease of their energy. While the auxiliary streams of the Waiser device are directed into the mainstream of the discharged gasses, some of them are angled to direct their discharge into the aperture of the downstream baffle member. Accordingly, the gasses passing through the auxiliary apertures do not divert the gasses away from the opening of the downstream baffle member, in spite of the fact that such auxiliary streams do intersect the axis of the mainstream. Moreover, even in those embodiments which do not direct the auxiliary streams into the opening of the succeeding baffle member, only the partition member is provided with such auxiliary apertures, and the series of baffle members of the Waiser device are devoid of any auxiliary apertures.

SUMMARY OF THE INVENTION

The present invention avoids all of the above-mentioned shortcomings of the prioir art sound suppressor by providing a silencer with its baffle elements having an opening therethrough with slanted sidewalls defined by the intersection of the disc-shaped baffle element and a cylinder whose axis passes through the central axis of the baffle element at a predetermined angle so as to direct the gasses passing through the opening following the projectile at a predetermined angle out of the axis of the projectile. For a sound suppressor of given dimensions, the disclosed baffles provide approximately a 15db improvement in sound suppressor compared with conventional "washer style" baffles.

In as preferred embodiment, the baffle may be provided with one or more annular channels or elongated channels extending across one or both faces thereof to decrease the weight of the suppressor, to increase the surface area contacted by the discharging gasses, and to impose additional barriers for the moving gasses within the chambers between baffles so as to add to the turbulence of the gas flow.

In one embodiment, in addition to the primary opening for the projectile through the central portion of the baffles, elongated secondary openings are provided in each baffle element, the sidewalls of the secondary openings being disposed angularly to the axis of the baffle element so as to direct discharged gasses toward the axis of the baffle element. Preferably, the baffle elements are spaced apart a distance sufficient to cause the gas to flow from the primary and secondary openings at the predetermined angle to a position adjacent the periphery of the next baffle element in succession.

In another embodiment, secondary openings are provided between the slanted sidewalls of the primary opening and the channels in a face of the baffle.

In a further preferred embodiment of the invention, one or more of the chambers within the sound suppressor may be filled with or lined with a removable fluid or pasty substance, such as an oil, alcohol, liquid detergent, mineral oil, grease, or the like, which adds several favorable operating characteristics for the sound suppressor. It is believed that the fluids aids in slowing the rate of travel of the expanding gasses by increasing its drag coefficient, lowers its pressure by absorbing energy further, and decreases its energy by energy transfer and by converting the energy in the gas to kinetic energy in transporting particles of the

substance toward the exit end of suppressor. The use of such fluids can provide approximately an additional 15db improvement in sound suppression.

IN THE DRAWINGS

Other objects and advantages of the invention will be apparent from the following detailed description of the invention having reference to the accompanying drawings in which:

FIGURE 1 is a cross-sectional view of the casing and cylindrical spacer members with elevational side views of the baffle elements spaced along the interior of the casing and an end view of the suppressor;

FIGURE 2 is a rear face perspective view of a baffle element shown in FIGURE 1;

FIGURE 3 is a front face perspective view of one of the baffle elements shown in FIGURE 1;

FIGURE 4 is a right face elevational view of one of the baffle elements shown in FIGURE 1;

FIGURE 5 is a view similar to that of FIGURE 1, but with an alternate baffle element and showing the application of a coating of pasty substance within the chambers closest to the entrance end of the suppressor;

FIGURES 6 and 8 are front and rear views of the alternate baffle; and

FIGURE 7 is a rear face perspective view of the alternate baffle.

DETAILED DESCRIPTION OF A FIRST EMBODIMENT OF THE INVENTION

FIGURE 1 shows a first embodiment of the sound suppressor as being comprised of a hollow cyindrical casing 2 with spaced baffle elements 4 service as partitions within the csing or can 2, creating expansion chambers 7 between baffle elements 4. An entrance end

plug 18 and an exit end plug 8 are attached to the ends of the casing 2, preferably by screw threads 20 and 10, respectively.

A convenient and effective, yet inexpensive, means for maintaining baffle elements 4 in a predetermined spaced relationship is shown in FIGURE 1 in the form of cylindrical spacer members 6. Spacer members 6 are provided between baffle elements 4 as well as between the end baffle element and the respective end plug 8 or 18. In FIGURE 1, the baffle elements 4 are similarly rotationally aligned with respect to the axis 32 of the casing 2. This alignment may be ensured by the provision of mating keying elements (not shown) on the spacer members 6 which engage the channels 46, 48, 50, 54 in the surface of the elements 4. However, there is suggestion that random rotational positioning of the elements 4 may be beneficial, and that option is left to the skilled artisan. In any event, the segregated volumetric chambers within the casing 2 may be referred to as an entrance expansion chamber 23, central expansion chambers 7 between baffle elements 4, and an exit expansion chamber 9. The embodiment of FIGURES 1 and 5 have three central expansion chambers. Those skilled in the art will appreciate that the number of central expansion chambers is a matter of design choice, it being a trade off of the size of the suppressor versus its sound suppression effectiveness.

The end plug 18 is shown with internal threads 24 which may mate with external threads on the end of the firearm muzzle, or may mate with an adapter that is detachably coupled to the end of a standard firearm. It should be understood that the threaded entrance aperture 25 is merely an illustration of one form of attachment to the firearm, and any number of known attachment means can be used without affecting the effectiveness of the silencer. For example, snap-on, bayonnet, and any secure

push-and-latch arrangements can be used. In this connection, the end plugs 8 and 18 may be attached to casing 2 by any secure means, such as by welding, instead of or in addition to the screw threads shown.

A threaded boss 22 may be provided on the entrance plug to increase the gripping strength of the end plug 18 when it serves as a muzzle coupler. When the suppressor is attached to the muzzle end of a firearm (not shown) and secured against entrance end-wall 26, a longitudinal projectile passageway 34 is defined aligned with the central extremities of the primary opening 40 in each baffle element 4. The projectile travels through the sound suppressor in the direction of arrow 36 and exits the central discharge aperture 12 in the disc-shaped portion of exit end plug 8. End plug 8 has an exit end wall 16 exposed to the atmosphere, and, in the interest of minimizing weight, is hollowed to form a cylindrical peripheral flange 14 which bears the threaded attachment means in the form of screw threads 10.

FIGURES 2, 3 and 4 detail the construction of one of the baffle elements 4. In the preferred embodiment, the baffle element 4 is of solid disc-shaped construction having an opening 40 through which the projectile passes. As best seen in FIGURE 4, the opening 40 has slanted sidewalls 42, 44, defined by the intersection of the disc-shaped baffle element 4 and an imaginary cylinder whose axis passes through the central axis of the baffle element 4 at a predetermined angle. In practice, it has been found advantageous to orient the angle of the sidewalls 42 and 44 at 45 degrees with respect to the central axis 32 of the suppressor. It has also been found advantageous to choose a thickness for the baffle members such that the central extremities of the slanted sidewalls 42, 44 extend to the periphery

of the longitudinal projectile passageway 34. A facial view of the baffle member would show a substantially circular primary opening 40 for passage of the projectile, yet the angled sidewalls 42, 44 have substantial axial lengths to impart a large deflection force against the impinging gas stream.

A plurality of rectangular channels are preferably formed in the forwardand rear faces 53 and 66, respectively of elements 4. A bi-level rectangular channel is shown as being formed by a first level shallow rectangular channel 46, 50 the floor of which is recessed by a second level rectangular channel 48. Opposing rectangular channels 52 and 54 are provided on the opposite semi-circular portion of baffle element 4. These channels are judiciously located so as to reduce the weight without losing any strucural or functional characteristics of the baffle member. For example, the upper and lower extremities of the baffle element 4 are maintained at a thick axial dimension by the provision of lips 62, 64, and 68 to aid in maintaining the mechanical integrity of the baffle element. Rectangular channel 52 extends radially inwardly a distance short of inner intersecting sidewall 42 of the primary opening. The same can be seen in the bi-level channel 46 and 48, thereby leaving a substantial mechanical structure for the portion of the baffle through which the primary opening is made.

A secondary opening 56 is shown in FIGURES 2-4 in the form of a partial disc-shaped slot having a lower edge 62, an upper edge 64, and side edges 63 as viewed from the front face 53, anda linear lower edge 60 and an upper circular edge 58 as viewed from the rear face 66. The disc-shaped secondary opening 56 is of the shape shown for illustrative purpose only, and, of course, any of a

number of different elongated geometrical shapes for the opening are equally suitable for providing the secondary opening to direct the discharged gasses downwardly (in FIGURE 4) to intersect the axis 32 of the suppressor and, in fact, aid in directing the gasses passing through baffle element 4 toward the periphery of the next baffle element downstream.

In a radial cross-section of the baffle element 4 passing through the centers of the primary and secondary openings 40 and 56, the opposite sidewalls of the secondary opening 56 may be inclined at a greater angle to the axis of the baffle element 4 than those of the primary opening 40. It can be seen by reference to FIGURE 4 that the thickness of the baffle element 4 at the location of the secondary opening 56 is sufficient to avoid passage of discharge gasses therethrough in a direction parallel to the axis of the baffle element 4.

FIGURE 5 depicts a second embodiment with an alternate baffle design to be discussed subsequently in detail with respect to FIGURES 6-8 and also shows the expansion chambers nearest the entrance aperture coated with the aforementioned fluid or pasty substance 80, which is preferably a grease such as that used in bearings or gear casings. However, even lighter weight oils or other liquids, including alcohol, liquid detergents, mineral oil, or the like, may be used. I prefer the use of a pasty grease since it does not flow out or drain from the suppressor quite so easily as do the lighter weight oils and fluids. Also, more rounds may be fired before the suppressor must be recharged with grease- compared to the lighter weight fluids. However, it appears that the lighter weight fluids provide superior sound suppression compared to grease.

While it is possible to fill each chamber with the fluid, a practical procedure is to fill the suppressor to only 25% to 33% full and preferably to fill entrance chamber 23. As the suppressor is used, and the particles of the fluid 80 are picked up and carried by the exiting gasses from one chamber to the next, a deposit 82 of the fluid on the walls of successive chambers will occur as shown in FIGURE 5.

Although the fluid 80 is depicted only in FIGURE 5, it is to be understood that the fluid is also preferably employed with the sound suppressor of FIGURE 1 and, indeed, no doubt with other design sound suppressors as well.

The effectiveness of the sound suppressor in accordance with the invention is enhanced by several characteristics of the baffle elements 4, as well as the provision of the fluid in the chamber 23.

In particular, in the suppressor shown in FIGURE 1, the baffles 4 are separated by spacers 6 in order for the baffles to provide the volume in which the gasses will flow and expand in a specific fashion as they pass through the baffle into the succeeding downstream expansion chambers 7. Upon firing of the firearm, and passage of the projectile through the primary opening of the first encountered baffle element 4, the pressure of the gas in entrance chamber 23 is substantially greater than the pressure in the first central expansion chamber 7. As a result, the gasses will flow through the primary opening 40 and secondary opening 56. As explained in connection with the physical description of the baffle element 4, the openings 40 and 56 are shaped such that the gasses traveling through them will be deflected downwardly, (as seen in FIGURE 1) from the center line 32 of the suppressor. Since the gasses will tend to expand into

the area of lowest pressure, the gasses directed toward the periphery of the adjacent downstream baffle element 4 will travel away from the main flow stream along center line 32, i.e. up the sides of the baffle element 4 to equalize the pressure in the associated central expansion chamber 7. The pressure on each side of the baffle elements 4 do not, in fact, equalize until the pressure throughout the system is returned to ambient pressure. However, in the action which takes place before total atmospheric equalization, the gas flowing away from the primary opening in each baffle will take longer to exit the volume within the expansion chamber 7 downstream from that baffle.

The gasses exiting the openings in each baffle member, being directed out of the axis of the suppressor, apparently cause a turbulence within each expansion chamber 7, tending to control expansion of the gasses entering each expansion chamber 7 in such a way as to cause the gasses to take longer to get into a position to exit the volume through the next baffle element in succession.

The rectangular channels 46, 48, and 52, 54 produce a vertical offset characteristic which contributes to the establishment of a deflecting wall 44 of substantial length, and each channel contributes to the establishment of barriers for the gasses flowing past them so as to disrupt the flow, aiding in the creation of turbulence in the moving gasses. This apparently slows the moving gasses down and provides greater baffle area which, when contacting the hot gasses, increases the cooling efficiency of the baffles. This transfer of thermal energy to the large baffle area causes the gasses to lower their pressure, thus decreasing the gas flow rate.

By lowering the rate at which gasses can flow through the suppressor and providing sufficient gas cooling area, the resultant gas flow to atmosphere at the exit end of the suppressor is at a slow enough rate that the sound pressure level is kept low.

By adding an oil, grease, or other fluid or semi-fluid material 80 to the expansion chambers, especially into or on the interior surfaces of entrance chamber 23, the added material 80 may be partially vaporized by the hot propellant gasses, and the density of the gasses is thus increased substantially. These denser gasses will travel more slowly through the suppressor since they appear to have a high drag coefficient as a result, they are cooled faster, not only by the increased duration in contact with the suppressor components, but also through the heat absorbsion by and transfer to the fluid within the suppresor both, i.e. through vaporization of the fluid and also direct transfer into the fluid increasing its temperature. Moreover, carrying the particulate matter of the vaporized additive material along its flow, the energy in the initial discharge is transformed into kinetic energy to propel the particulate matter.

As mentioned, the density of the gasses is increased by the transforming of the fluid-like material 80 to a gas. This gas or smoke, since it is visible, has many suspended particles which increase the weight of the gas per unit volume. Because of the increase in the gas density, the baffles are more efficient in deflecting them from straight line travel. This, in turn, further slows the gas rate of travel through the suppressor and subsequent rate of release to the atmosphere. A lower sound pressure level will result for a suppressor of given size and construction.

While the addition of the fluid material 80 will lower the sound pressure level of any suppressor by lowering gas temperature and increasing the density of the gas thus lowering its rate of travel, it is more effective utilizing the baffle element construction 4 or 41 in accordance with the present invention due to the more efficient use of the added density to deflect gas flow away from the primry baffle opening.

In operation, the angled primary opening 40 and angled secondary opening 56 direct the gasses out of the straight line path of the suppressor. The channels 46, 48, 52, 54 cause the gasses within each expansion chamber 7 to move for a longer period of time before exiting the baffle element 4, and these two characteristics of the invention increase the length of travel of the gasses before exiting to the atmosphere, thereby contributing to the noise abatement at the discharge end of the suppressor.

The sidewalls of the rectangular channels create barriers in the path of the gas flow; the primary and secondary openings 40, 56 cause the gas to seek paths not in the direct line of the path of the projectile; and the travel of the gasses is impeded by contact with movable particulate matter. These effects all contribute to slowing the gas rate of travel through the suppressor and reduce the sound pressure at the exit end of the suppressor.

The suppressor according to the invention contains multiple expansion chambers in progression, and the misdirected flow through the primary and secondary openings produce delayed expansion following the frontal shock wave. As a result, the exit pressure is lowered by the expansion processes within the suppressor.

The pressure of the gasses is, as suggested, lowered by its cooling through the suppressor. The use of a fluid 70 in the suppressor results in an absorbtion of heat, and the vaporization of the substance produces a transfer of energy of the gasses into thermal and kinetic energy. Furthermore, the channels increase the contact area of the baffles adding to the cooling of the gasses and consequent lowering of gas pressure. The cooling effect of the increased baffle area is, as has been stated, enhanced by the vehicle of heat transfer by the pasty substance.

The energy of the propellant gas is partially absorbed by contact with the movable particulate matter, and the increased barrier wall surfaces in the path of the gas create additional turbulence to also absorb the gaseous energy by thermal and kinetic energy absorbtion.

DETAILED DESCRIPTION OF A SOUND EMBODIMENT

Turning to FIGURES 5-8, there is depicted another baffle element 4'. As is the case of the first embodiment disclosed and described with reference to FIGURES 2-4, baffle element 4' is of a solid disc-shaped construction having a primary opening 42', 44', through which the projectile passes. The opening 40' has slanted sidewalls 42', 44', defined by the intersection of the disc-shaped baffle element 4' in an imaginary cylinder whose axis passes through the central axis of the baffle element 4' at a predetermined angle thereto. As in the case of the first embodiment, it has been found advantageous to orient the angle of the sidewalls 42', 44' at about 45 degrees with respect to the central axis 32, 32' of the suppressor (see FIGURES 1 and 5).

An annular channel 72, 74 is provided in the rear face 66' of elelment 4'. Of course, additional

channels may be provided in the rear 66' or forward 53' faces if desired. Annular channel 72' finds at its outer periphery a lip 70' for supporting element 4' within cylindrical casing to between spacing members 6'.

A plurality of secondary openings 76, 78 are shown in FIGURES 5-8. Openings 76, 78 are preferably of circular cross section as they are preferably formed by drilling radially inwardly from the outer lip 70 towards the center of baffle element 4', the secondary openings 76, 78 being circumferentially positioned so that they intersect slanted side wall 44' of the primary opening 40'. The secondary openings 76 also intersect the inner periphery 74 of the annular channel 72, 74 forming apertures 78 therein.

When the baffle element 4' of Figures 6-8 is assembled into a cylindrical casing to the openings 76 in the outer lip 70 are, of course, blocked by the casing 2'. However, apertures78 in the inner periphery 74 of the annular channel 72, 74 are exposed, in use, to expanding gasses in the immediate upstream expansion chamber and provide an additional path for the flow of the gasses. Indeed, those skilled in the art will now appreciate from the foregoing discussion and explanation of the embodiment of FIGURES 1-4, that the slanted sidewalls 42', 44' cause the gasses passing through the primary opening 50' to deflect away from the axis 32' of the sound suppressor. The gasses passing through secondary openings 78 in further enhance the deflection of the gasses away from axis 32'. As previously mentioned, deflecting the gas away from the axis of the sound suppressor slows the expansion process within suppressor, which slowing reduces the amount of noise generated when a firearm attached to the suppressor is fired.

In accordance with the present invention, the suppressor comprises a hollow cylindrical casing have an entrance end and an exit end with at least one disc-shaped baffle element coaxially mounted within the casing in between the ends. Centrally aperture entrance and exit end plugs are attached to the respective entrance ends and exit ends of the casing. The baffle element has of opening therethrough with slanted sidewalls, the sidewalls defining a cylinder whose axis passes at a predetermined angle to the central axis of the sound suppressor's casing.

The slanted sidewalls deflect the expanding gasses within the suppressor from the central axis of the sound suppressor. Preferably, one or more secondary openings are provided in each baffle element between either its rearward facing surface and its forward facing surface or between its rearward facing surface and a slanted sidewall. In any event, the secondary opening or openings are also arranged at a predetermined angle to the central axis of the sound suppressor so as to assist in deflecting the expanding gasses away from the central axis of the sound suppressor.

The suppressor of the present invention and particularly the first several chambers therein may experience higher peak internal pressures than do conventional prior art suppressors if a fluid 80 is used in connection therewith, as I prefer to do. Accordingly, I select the materials and thicknesses of the components of my suppressor such that the suppressor will withstand pressures in the range of 30,000-55,000 psi (i.e. pressure also experienced in the chamber of the firearm).

When loading the suppressor with the fluid 80, I preferably fill approximately 25% to 33% of the volume of the suppressor with the fluid 80. Of course, the suppressor can be loaded with a smaller charge of fluid

80, but that only increases the frequency recharging. By using a grease for fluid 80, I need recharge the fluid only after firing approximately 100 rounds.

While a particular construction and specific advantages have been set forth in the above description, it will be obvious to those skilled in the art that modifications to the basic invention can be effected without departing from the scope and spirit of the invention. Accordingly, it is to be understood that the invention will be limited only by the appended claims.

CLAIMS

1. A sound suppressor for a firearm, comprising:

a hollow cylindrical casing having an entrance end and an exit end;

at least one disc-shaped baffle element coaxially mounted within said casing and between said ends;

a centrally apertured entrance end plug attached to the entrance end of said casing and including means for mounting said sound suppressor to the muzzle of a firearm; and

a centrally apertured exit end plug attached to the exit end of said casing;

said baffle element having an opening therethrough with slanted sidewalls, said sidewalls defining a cylinder whose axis passes at a predetermined angle to the central axis of said casing.

2. The sound suppressor as claimed in Claim 1, including

a pair of cylindrical spacer members telescopically slidable within said casing, each said spacer member extending between one of said end plugs and the outer periphery of the corresponding face of said baffle element.

3. The sound suppressor as claimed in Claim 1, including:

a plurality of said baffle elements coaxially mounted within said casing between said casing ends in spaced relationship; and

a plurality of cylindrical spacer members telescopically slidable within said casing, a pair of said spacer members extending between one of said end plugs and the other periphery of the corresponding face of the outermost baffle members, and additional ones of said spacer members extending between the outer peripheries of the faces of adjacent baffle elements.

4. The sound suppressor as claimed in Claim 1, wherein:

said opening in said baffle element is a primary opening for passage of the projectile and discharged gasses from the muzzle of the firearm therethrough; and

said baffle element has at least one off-axis secondary opening disposed angularly to the axis of said baffle element so as to direct discharged gasses toward the axis of said casing.

5. The sound suppressor as claimed in Claim 1, wherein:

the spaces within said casing between said baffle elements and between said baffle elements and said end plugs define a series of expansion chambers into which the projectile and discharged gasses from said firearm muzzle pass, and entrance expansion chamber defined between said entrance plug and its adjacent baffle element, central expansion chambers defined between adjacent baffle elements, and an exit expansion chamber defined between said exit end plug and its adjacent baffle element; and

the longitudinal spacing of said baffle elements and said predetermined angle are chosen such that the discharged gasses impinging upon said slanted

sidewalls of said baffle element opening direct the gasses toward the point of contact between said baffle elements and said casing within said central expansion chambers, and toward the point of contact between said exit end plug and said casing within said exit expansion chamber.

6. The sound suppressor as claimed in Claim 5, wherein:

said opening in said baffle element is a primary opening for passage of the projectile and discharged gasses from the muzzle of the firearm therethrough; and

said baffle element has at least one off-axis secondary opening disposed so that gasses passing therethrough impinge the gasses passing through said primary opening.

7. The sound suppressor as claimed in Claim 6, wherein:

in a radial cross-section of said baffle element passing through the centers of said primary and secondary openings, the opposite sidewalls of said at least one secondary opening are parallel to those of said primary opening.

8. The sound suppressor as claimed in Claim 6, wherein:

in a radial cross-section of said baffle element passing through the centers of said primary and secondary openings, the opposite sidewalls of said at least one secondary opening are inclined at a greater angle to the axis of said baffle element than those of said primary opening.

9. The sound suppressor of Claim 8, wherein the axis of said at least one secondary openings are disposed at approximately a right angle to the central axis of said casing.

10. The sound suppressor as claimed in Claim 6, wherein:

the thickness of said baffle element at the location of said secondary opening is sufficient to avoid passage of discharge gasses therethrough in a direction parallel to the axis of said baffle element.

11. The sound suppressor as claimed in Claim 1, wherein:

said baffle element comprises wall means defining a plurality of rectangular channels extending across at least one face of said baffle element.

12. The sound suppressor as claimed in Claim 11, wherein:

said channel wall means lie in planes perpendicular to said cylinder axis.

13. The sound suppressor as claimed in Claim 11, wherein:

a second level rectangular channel of a relatively small width is provided in the floor of a first level rectangular channel of a relatively larger width in the entrance-directed face of said baffle element;

said opening in said baffle element is a primary opening for passing the projectile and discharged gasses from the muzzle of the firearm therethrough; and

said baffle element has an off-axis elongated secondary opening therethrough with sidewalls disposed

angularly to the axis of said baffle element so as to direct discharged gasses toward the axis of said baffle element; and

said secondary opening opens into said second level rectangular channel.

14. The sound suppresssor as claimed in Claim 1, wherein said predetermined angle is 45 degrees.

15. The sound suppressor as claimed in Claim 1, further including a pasty substance disposed in said casing.

16. The sound suppressor as claimed in Claim 3, further including a fluid substance disposed in said casing at least between said entrance end plug and one of said plurality of baffle element.

17. The sound suppressor of Claim 1, wherein said baffle element comprises wall means having an annular channel therein.

18. A sound suppressor for a firearm, comprising:

a hollow cylindrical casing having an entrance end and an exit end;

at least one disc-shaped baffle element coaxially mounted within said casing and between said ends;

a centrally apertured entrance end plug attached to the entrance end of said casing and including means for mounting said sound suppressor to the muzzle of a firearm;

a centrally apertured exit end plug attached to the exit end of said casing; and

a fluid disposed within said casing.

19. The sound suppressor as claimed in Claim 18, wherein said fluid is selected from the group consisting of greases, oils, mineral oils, liquid detergents, alcohol and other fluids.

20. The sound suppressor as claimed in Claim 18, wherein said fluid is grease.

21. A method of improving the silencing capabilities of a firearm silencer comprising the step of loading a portion of interior volume of the sound suppressor with a greasy substance prior to firing the firearm.

22. The method of claim 21, wherein said substance fills approximately 25% to 33% of the entire interior volume of the sound suppressor when initially loaded therein.

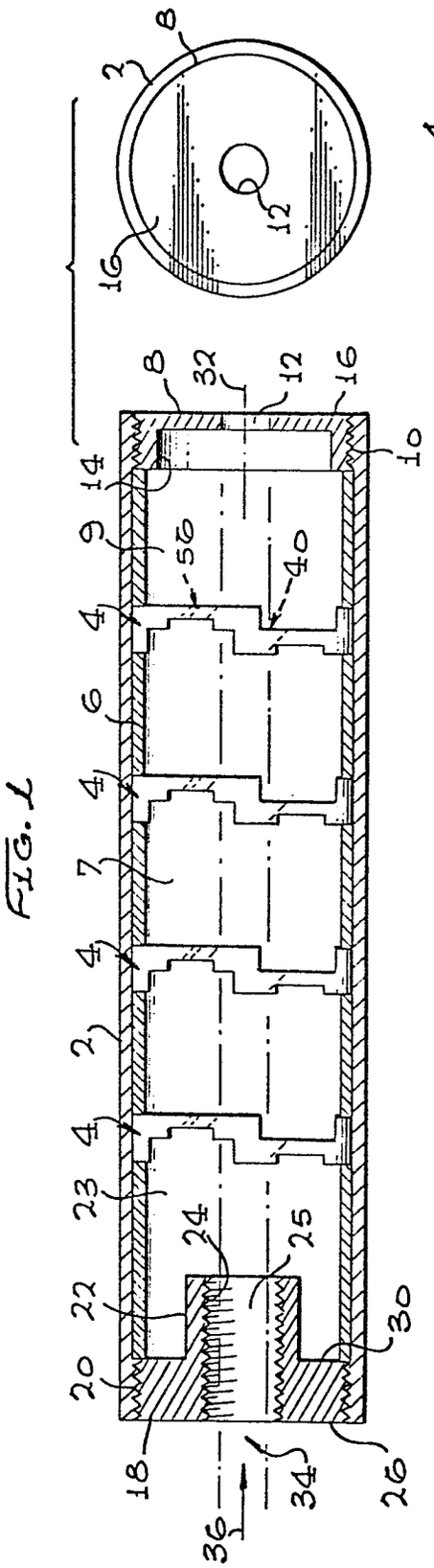


FIG. 1

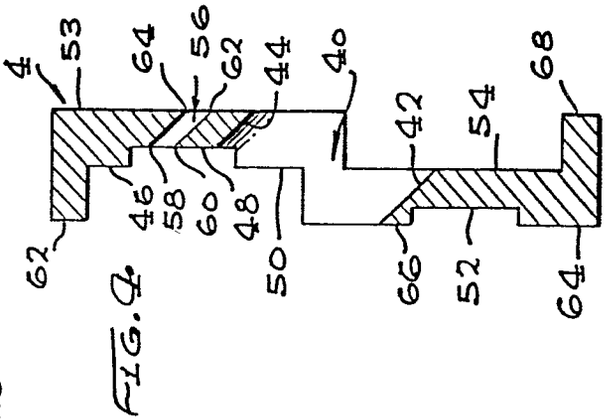


FIG. 4

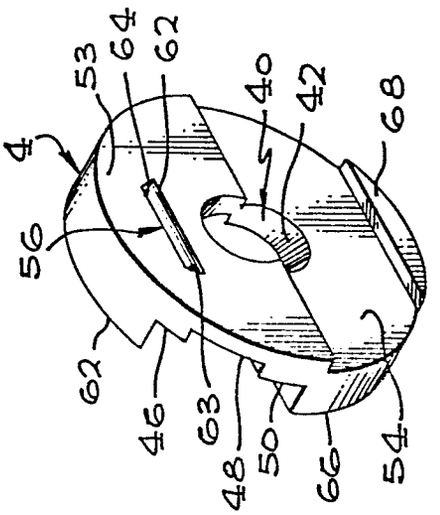


FIG. 3

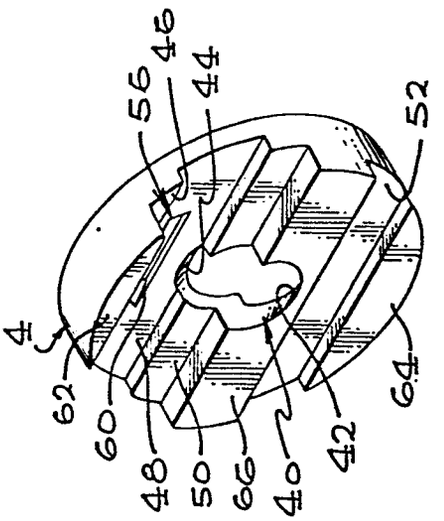


FIG. 2

FIG. 5

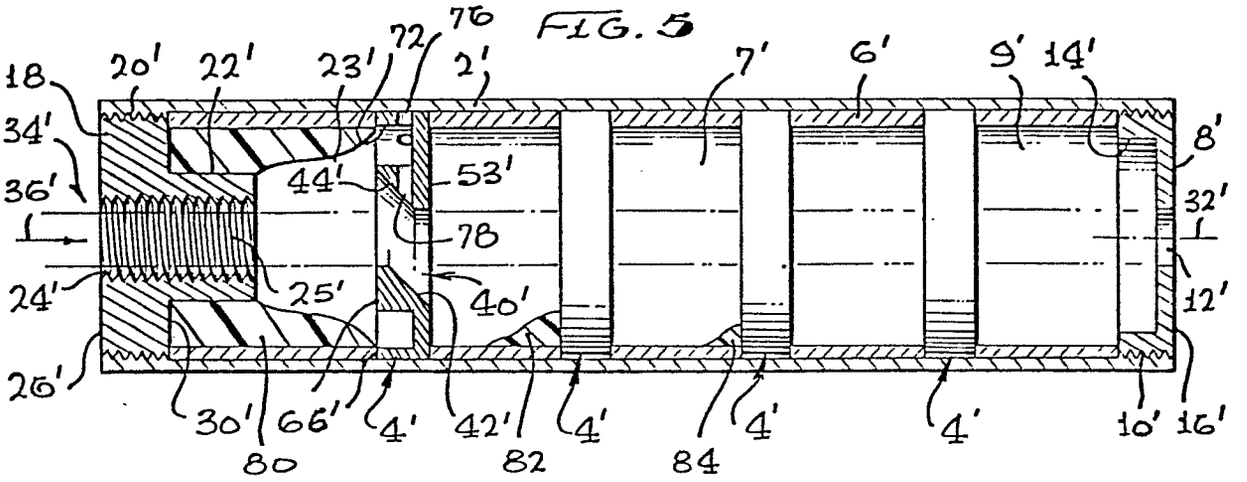


FIG. 6

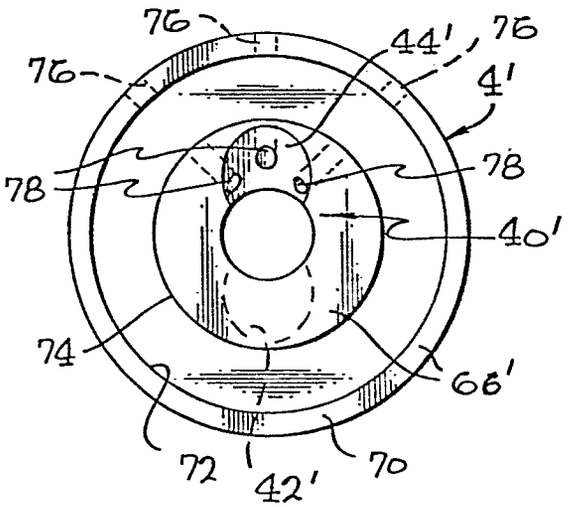
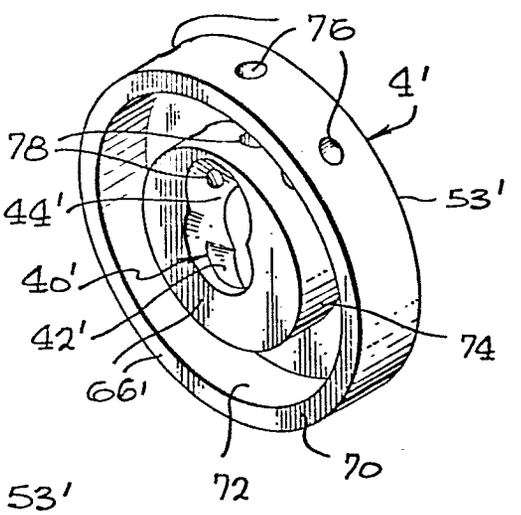


FIG. 7



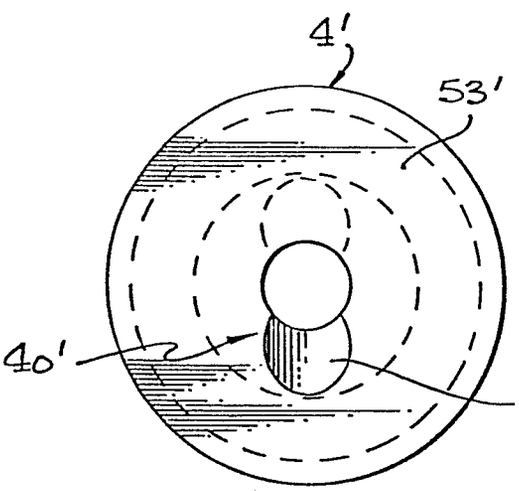


FIG. 8

European Patent Office

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0166802
Application number

EP 84 10 7788

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X,D	US-A-1 482 805 (MAXIM) * Figure 1; page 1, lines 42-58 *	1,17	F 41 C 21/18
X	FR-E- 10 160 (MAXIM) * Figures 4,5; page 3, lines 42-74 *	1-3	
Y		16	
X	US-A-4 454 798 (SHEA et al.) * Figure 2; column 1, lines 43-57; column 2, lines 9-41, 62-68; column 3, lines 1-26; column 4, line 2 *	18,19 21	
Y	DE-C- 586 569 (SOCIETA ITALIANA MIGLIORAMENTO ARMI) * Figures 1,2; page 2, lines 51-67 *	16	TECHNICAL FIELDS SEARCHED (Int. Cl.4) F 41 C F 41 F F 01 N
A	DE-A-1 916 457 (KELLER)		
A	DEUTSCHES WAFFENJOURNAL, 1970, pages 468-471; S.F. HÜBNER: "Schalldämpferprinzipe"		
A	DE-C- 626 321 (DAIMLER-BENZ)		

-/-

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28-02-1985	FISCHER G.H.

CATEGORY OF CITED DOCUMENTS

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European Patent Office

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	US-A-1 821 688 (MAXIM SILENCER CO.)		
A	US-A-3 563 029 (LOWES)		
A	US-A-3 448 824 (CONARD)		
A,D	US-A-4 291 610 (WAISER)		
A,D	FR-A-2 141 782 (WALTHER)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

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