



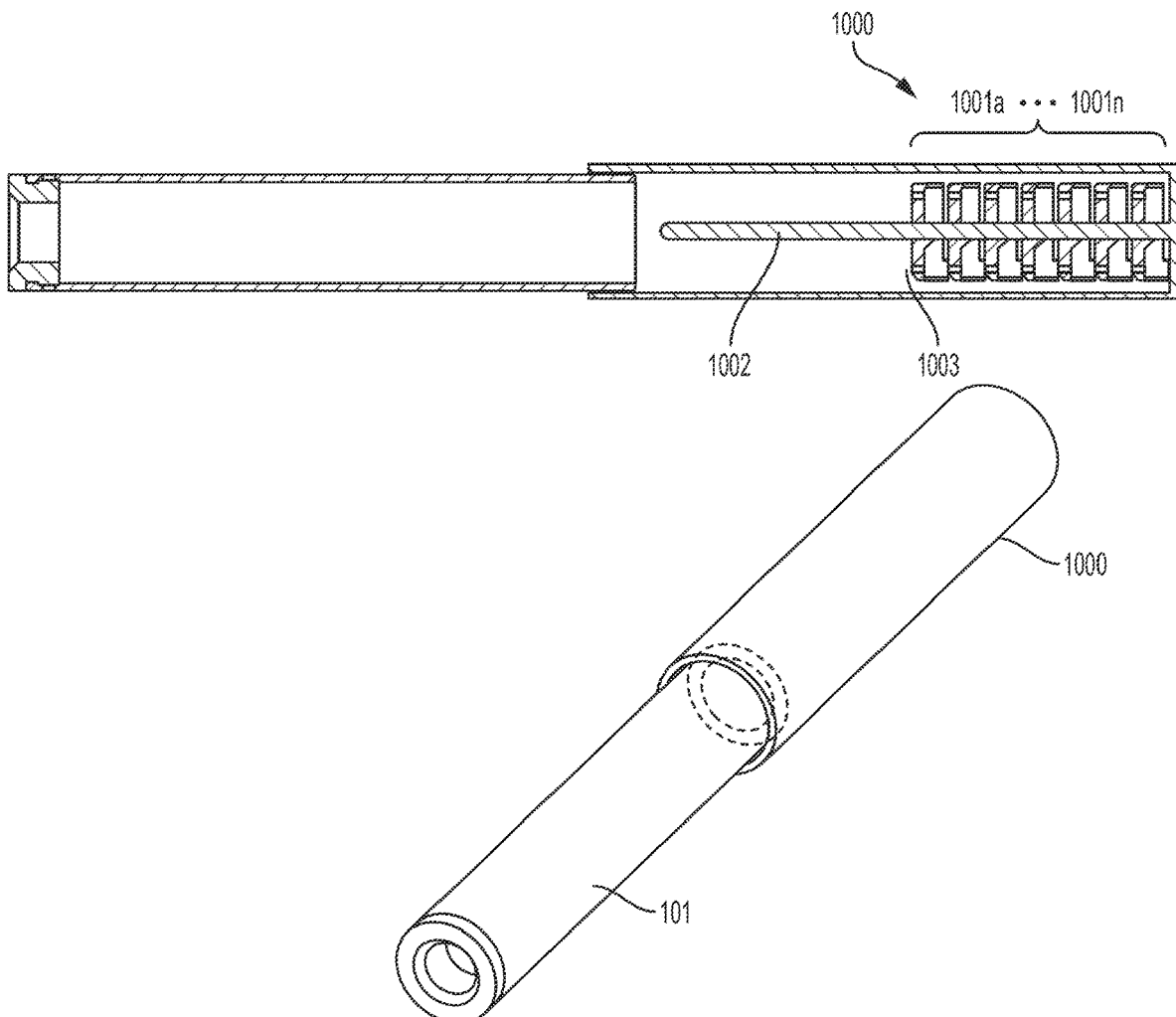
US 20210116199A1

(19) **United States**(12) **Patent Application Publication**
Bryant et al.(10) **Pub. No.: US 2021/0116199 A1**(43) **Pub. Date: Apr. 22, 2021**(54) **SOUND SUPPRESSOR SYSTEM****Publication Classification**(71) Applicants: **University of North Texas**, Denton, TX
(US); **JBryant Enterprises Inc.**,
Gunter, TX (US)(51) **Int. Cl.**
F41A 21/30 (2006.01)
F41A 21/34 (2006.01)(72) Inventors: **Jacob Bryant**, Denton, TX (US); **Scott**
H. Belshaw, Denton, TX (US)(52) **U.S. Cl.**
CPC **F41A 21/30** (2013.01); **F41A 21/36**
(2013.01); **F41A 21/34** (2013.01)(21) Appl. No.: **16/970,588**(22) PCT Filed: **Feb. 21, 2019**(86) PCT No.: **PCT/US2019/018982**

§ 371 (c)(1),

(2) Date: **Aug. 17, 2020****Related U.S. Application Data**(60) Provisional application No. 62/634,590, filed on Feb.
23, 2018, provisional application No. 62/668,179,
filed on May 7, 2018.(57) **ABSTRACT**

Sound suppression devices may include a baffle system or stack having a plurality of baffle disks where at least a first portion of the disks include a first set of gas ports and at least a second portion of the disks include a second set of gas ports. The baffle system may be configured to act as a compressing piston. When a bullet leaves a muzzle of a firearm and enters a suppression device, the baffle system acts as a compressing piston and moves forward with the gas pressure caused by the firing of the bullet. As the bullet begins to enter each baffle disk, the pressure starts to subside until there is a point where there is equalization between gas pressure and, for example, tension on a piston spring within the baffle system. After this point, the piston is driven back into place by the releasing of the spring tension.



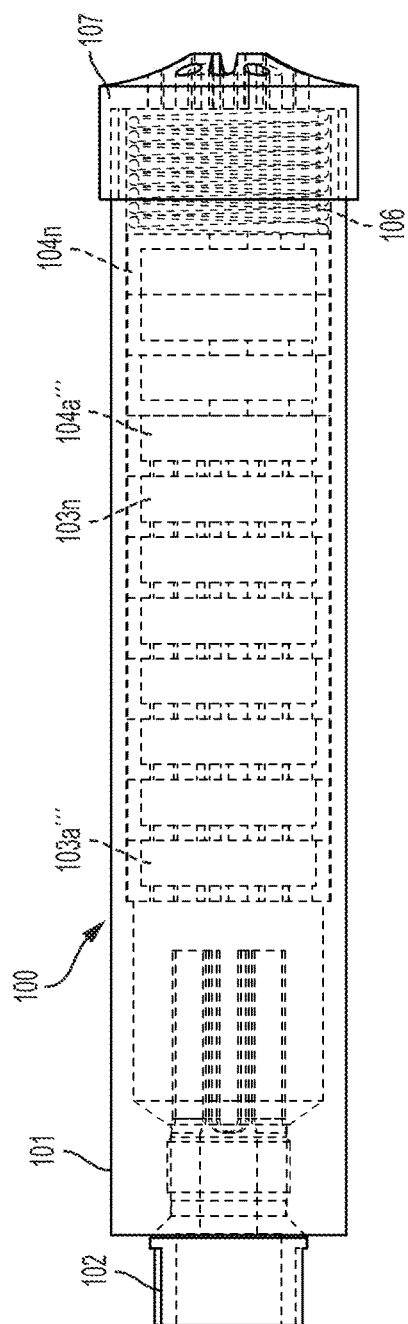


FIG. 1A

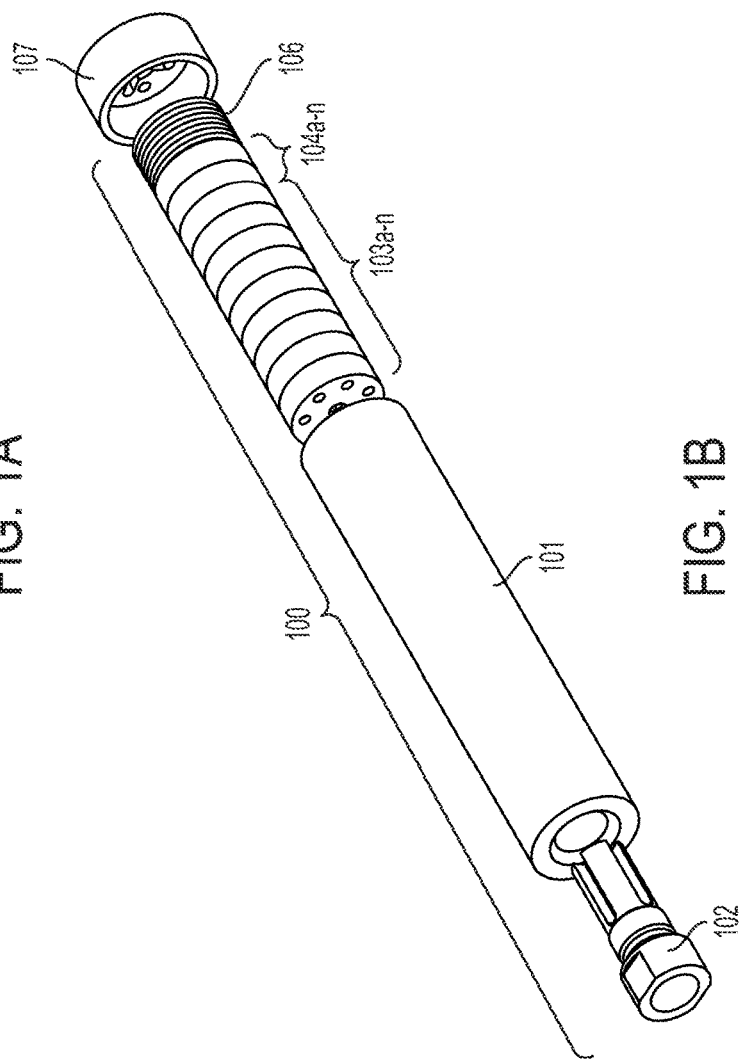


FIG. 1B

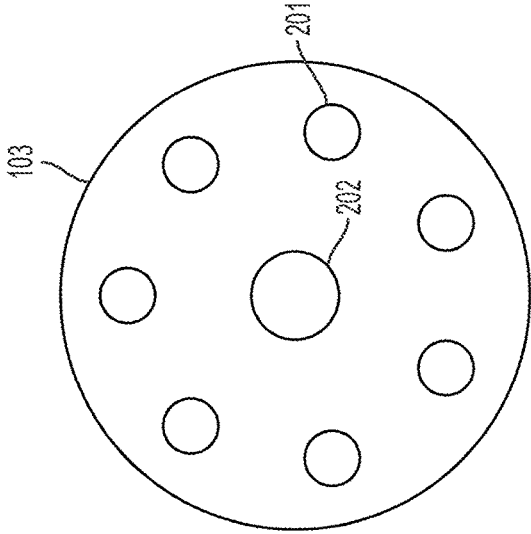


FIG. 2B

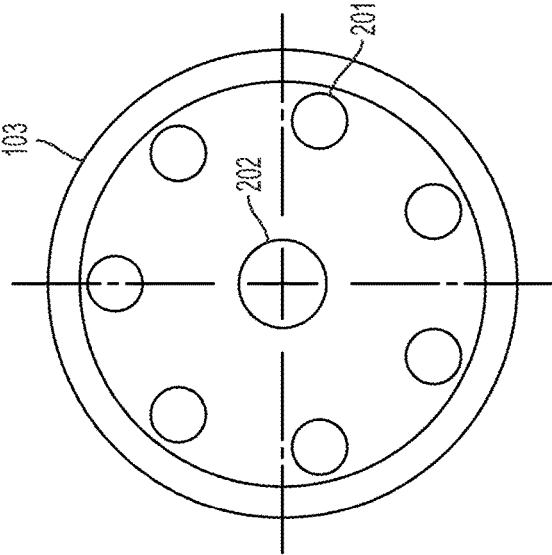


FIG. 2A

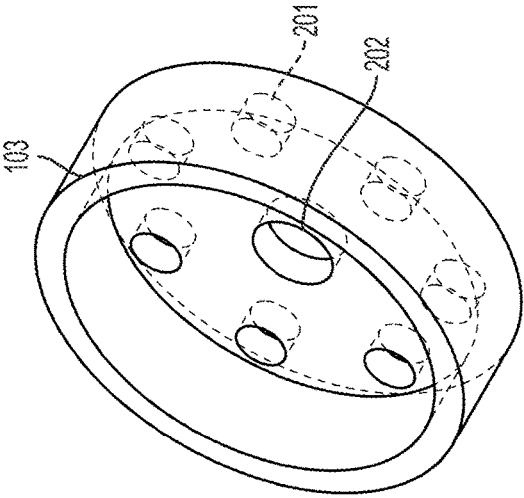


FIG. 2C

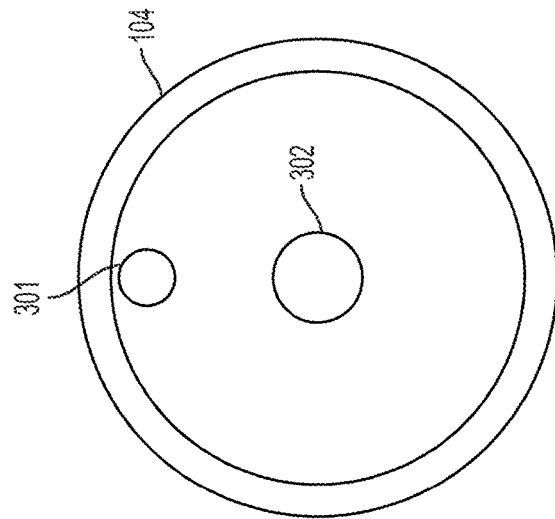


FIG. 3B

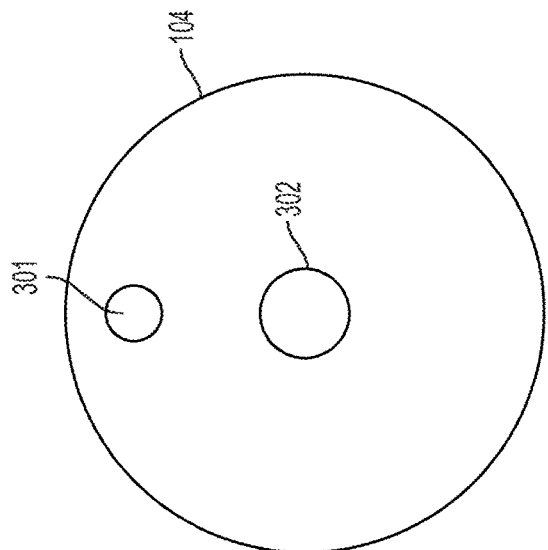


FIG. 3C

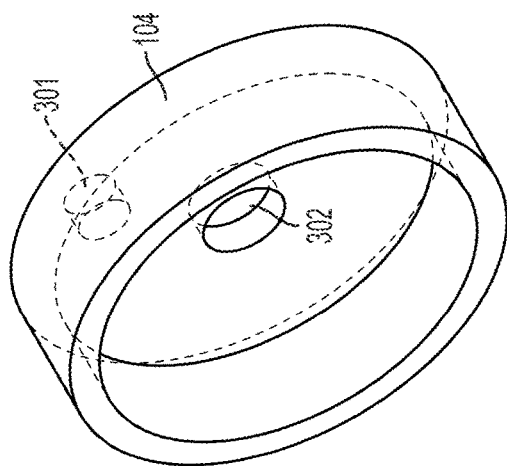


FIG. 3A

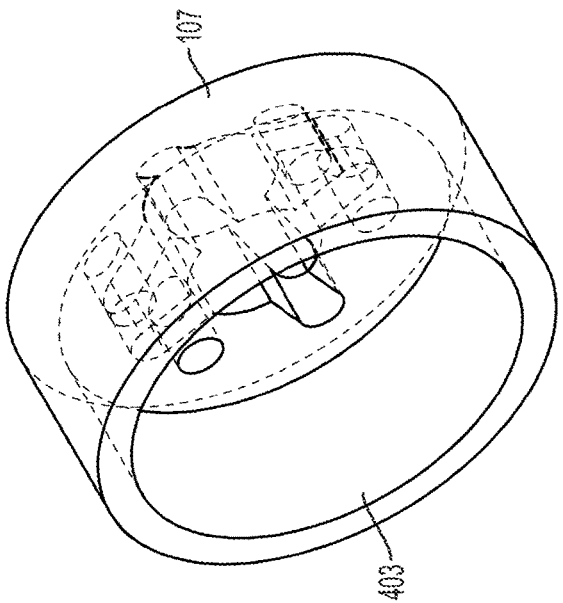


FIG. 4B

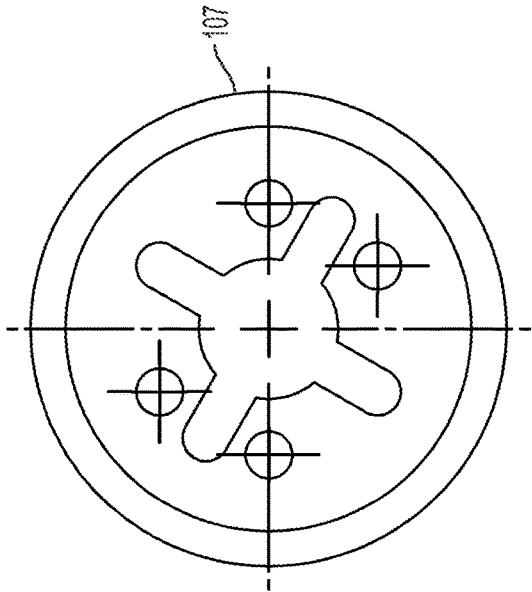


FIG. 4C

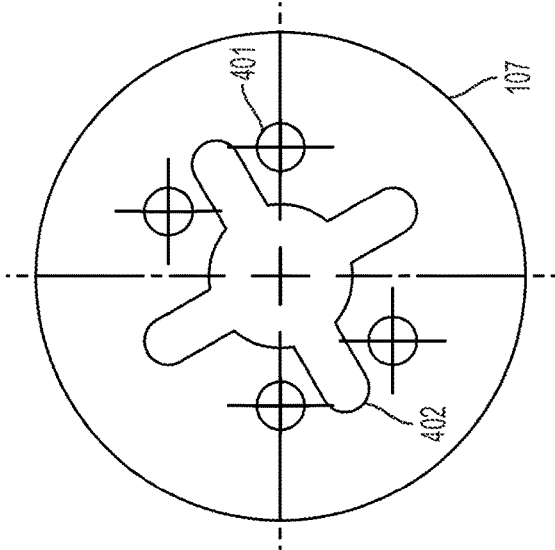


FIG. 4A

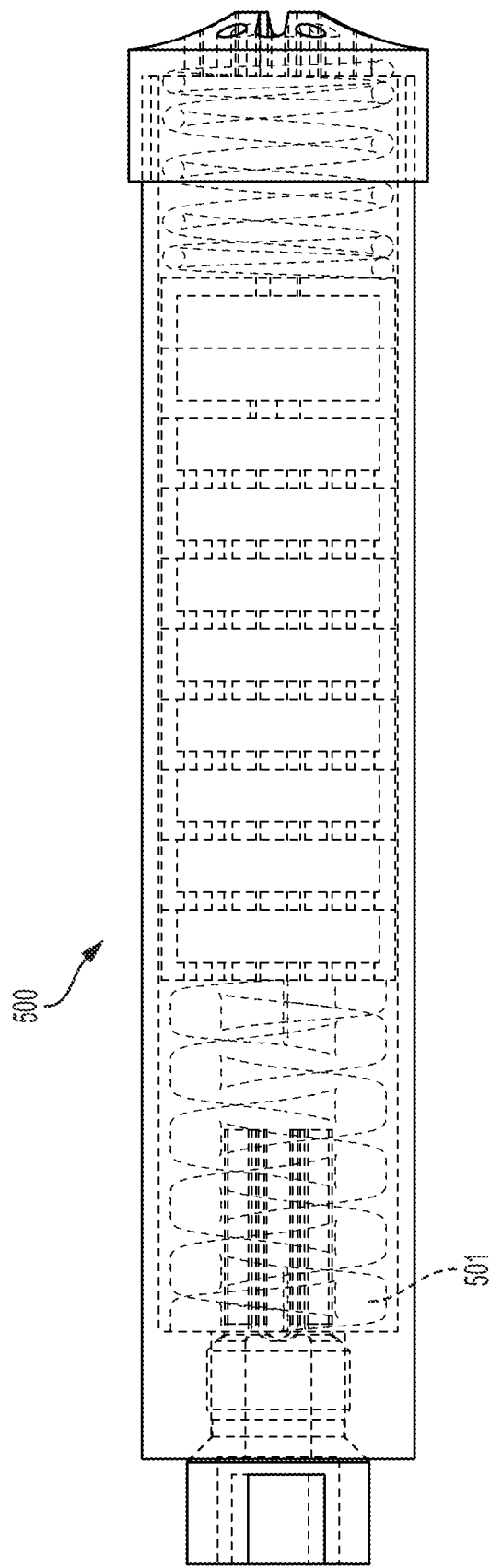
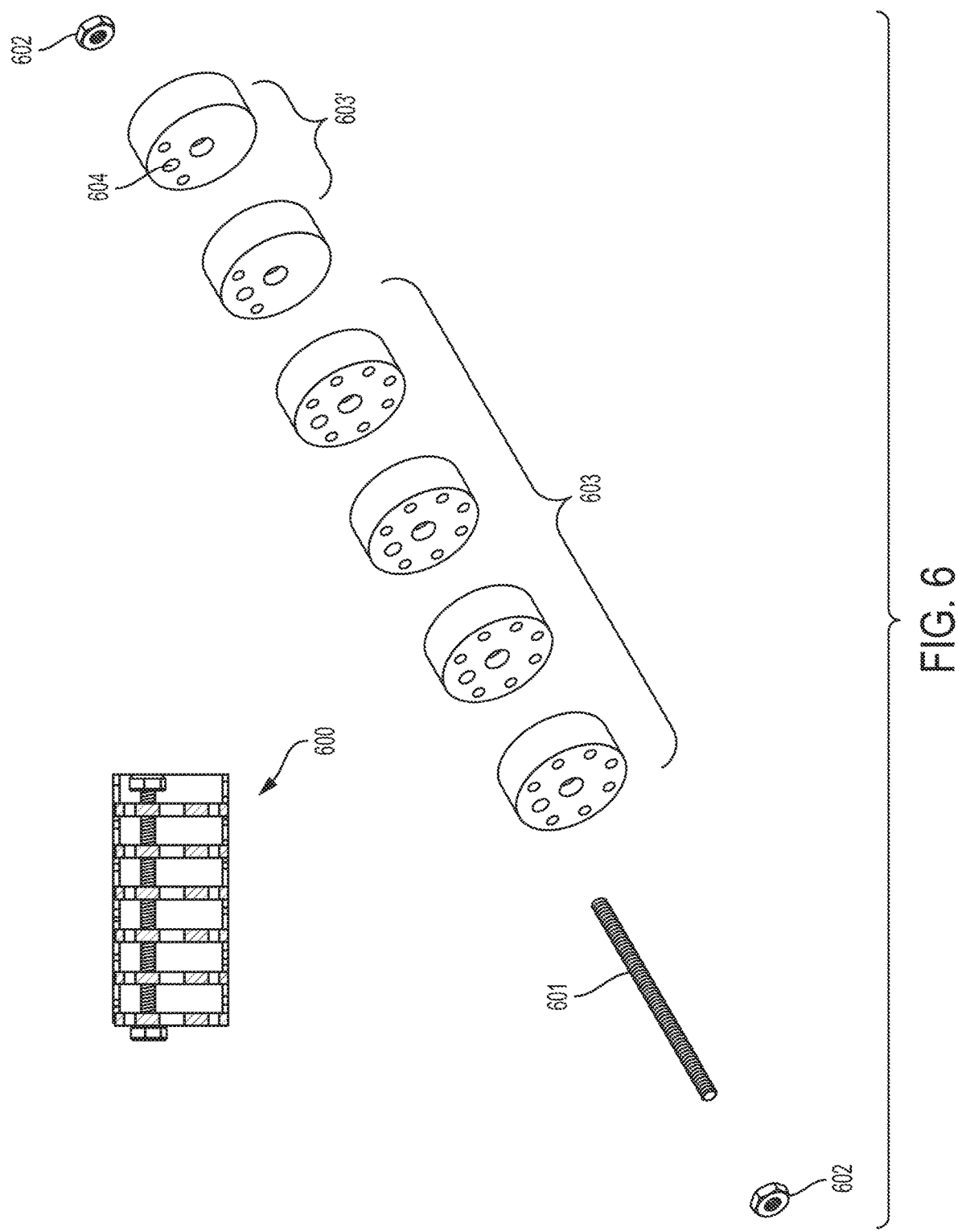
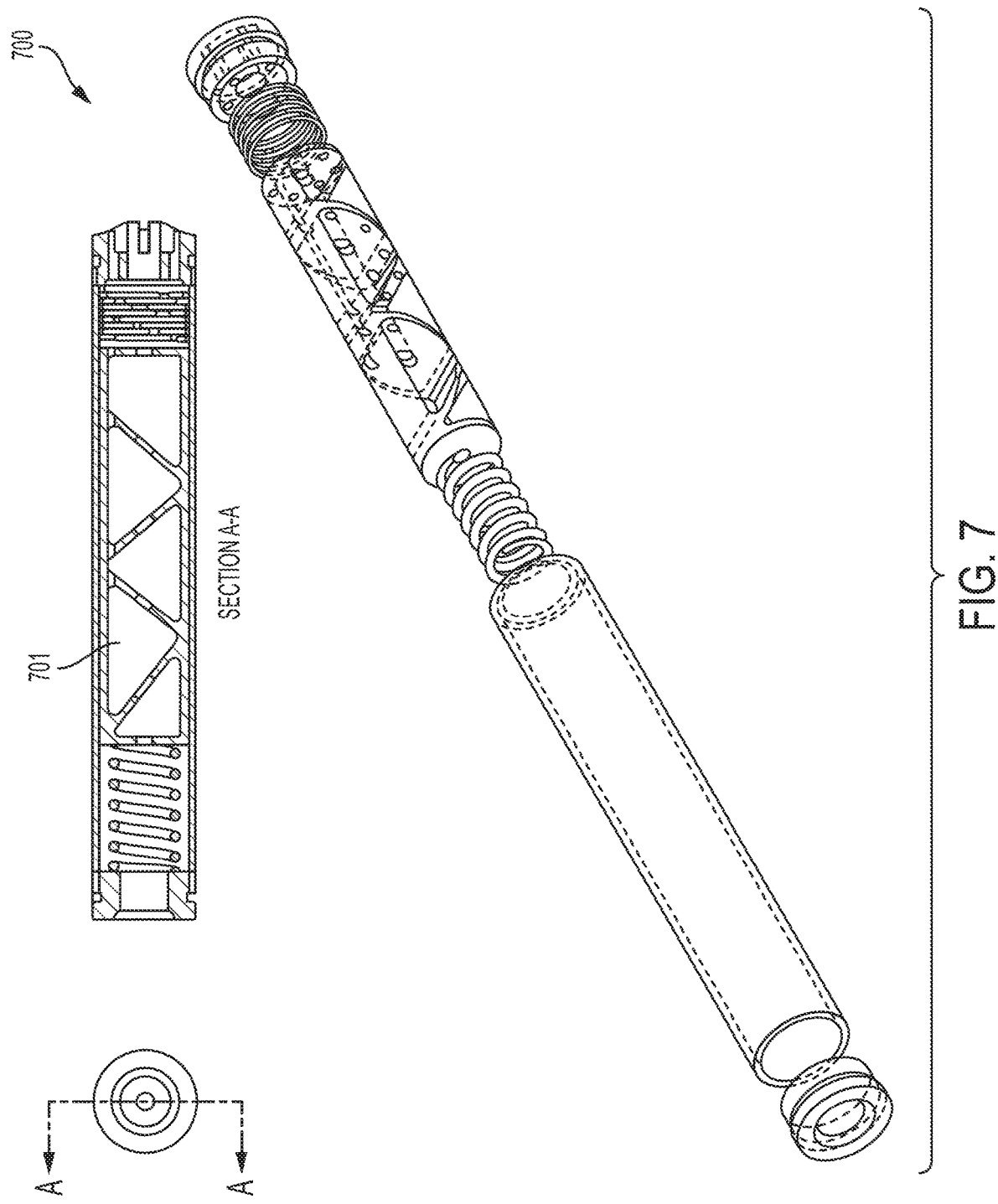
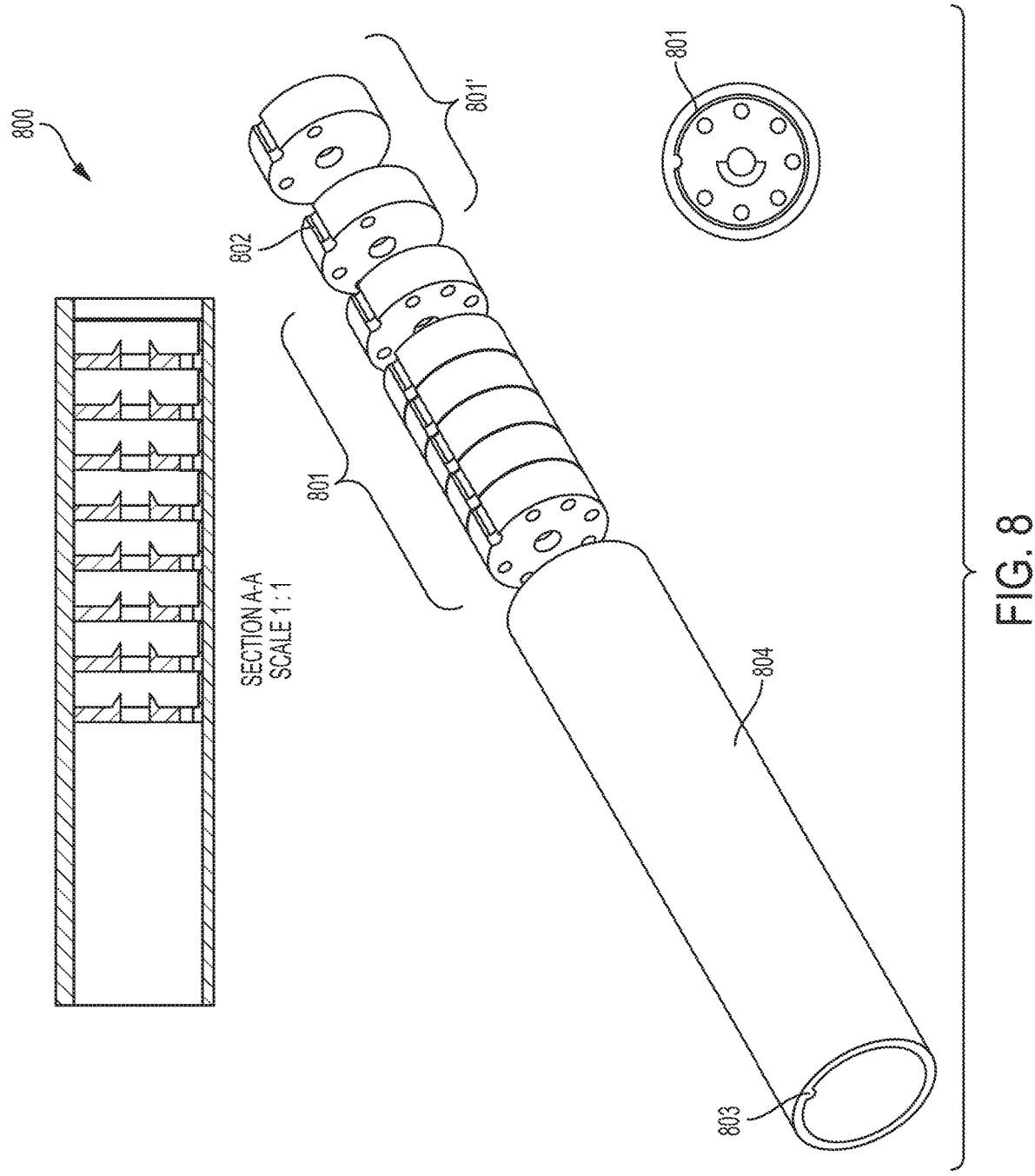
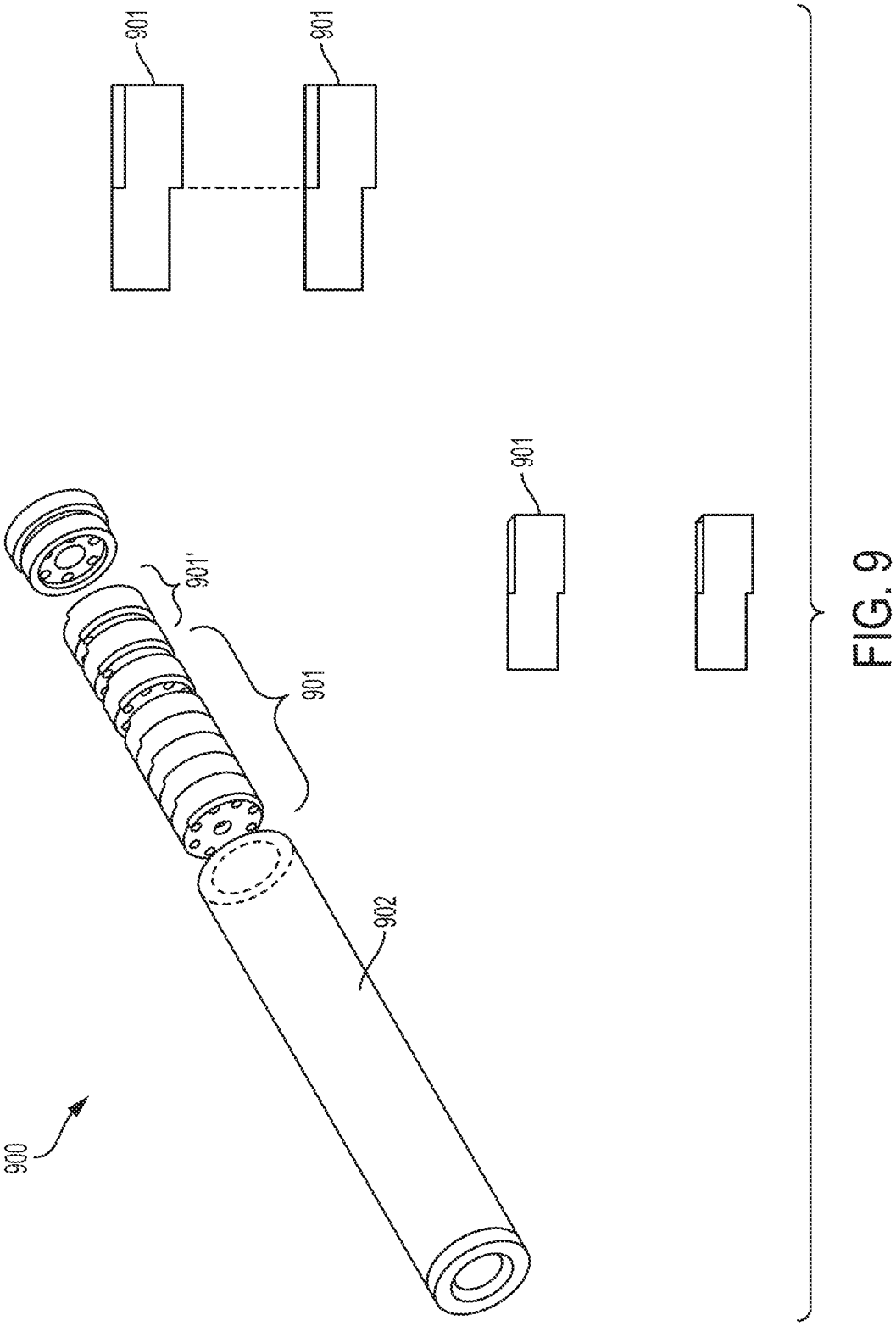


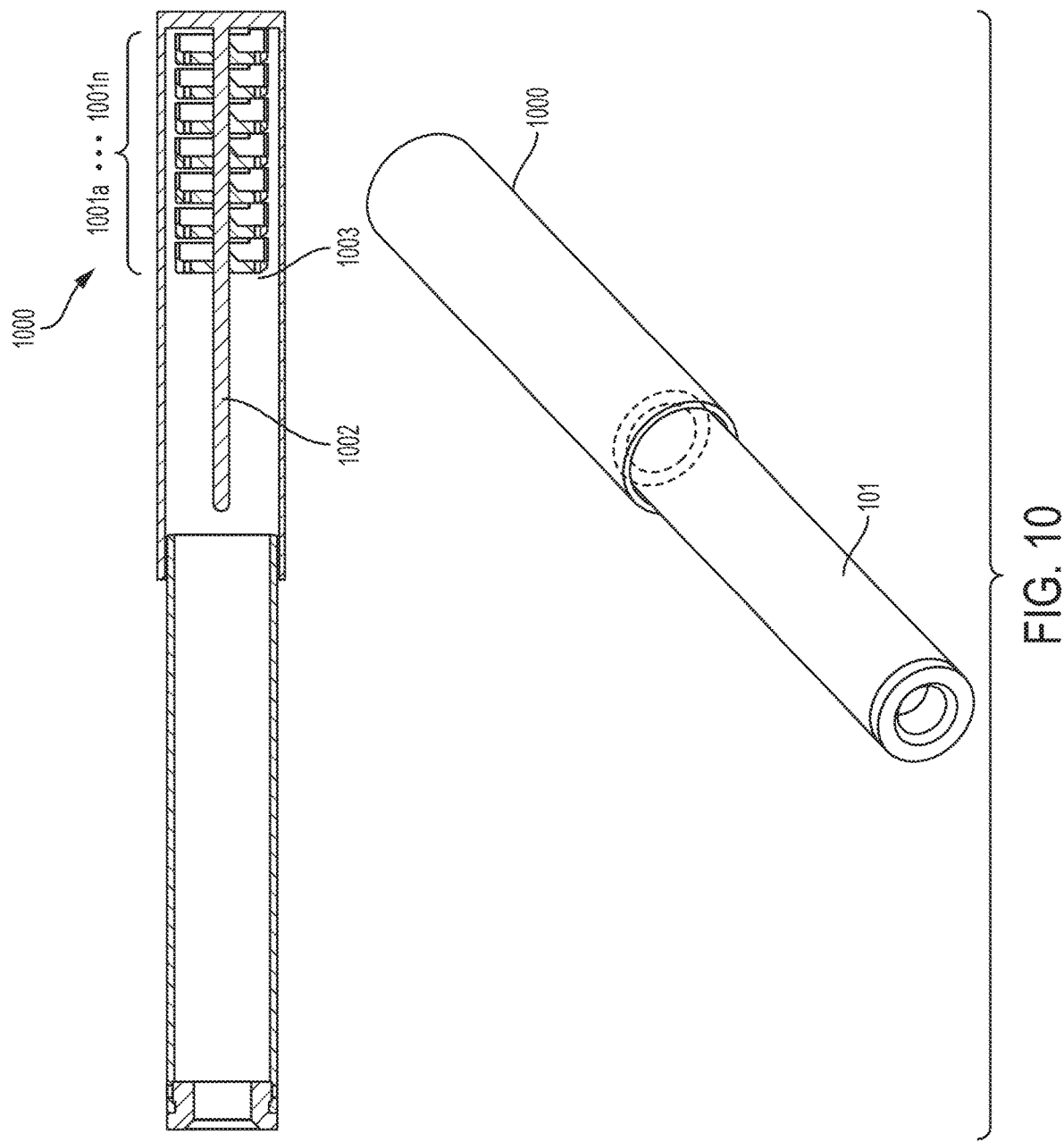
FIG. 5











SOUND SUPPRESSOR SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority of U.S. Provisional Patent Application No. 62/634,590, filed Feb. 23, 2018, and U.S. Provisional Patent Application No. 62/668,179, filed May 7, 2018, which are hereby incorporated by reference in their entirety.

TECHNICAL FIELD

[0002] The present application relates to sound suppression devices generally and is more particularly directed to devices for suppressing one or more of noise, muzzle flash and recoil of host firearms.

BACKGROUND

[0003] Firearm suppressors or “silencers” are attached to the distal end of barrels of firearms to suppress the noise associated with discharging a firearm. Generally, when a firearm is fired, the burning of the powder charge in the metal shell casing provides the pressure force to accelerate the bullet through the barrel. From there, the bullet’s kinetic energy causes the bullet to travel toward its target. The burning of the charge generates gaseous by-products that not only accelerate the bullet but also carry small particles of unburned powder and metal from the shell casing/bullet. These follow the bullet down the barrel and out the muzzle where, no longer confined, they disperse quickly.

[0004] It is desirable to conceal and/or reduce the sound of the firing of the round and the flash of still-burning powder at the muzzle for multiple reasons. For example, the noise produced by a firearm is potentially disorienting and damaging to the hearing of the user of the firearm. Further, the sound and flash give away the information that a firearm has been fired and where that firearm is located. These situations can be problematic in both a military and home defense situation where emergencies can arise that do not allow for a user to utilize additional ear protection and where it may be dangerous to highlight the position of the firearm user.

[0005] Most sound suppressors are cylindrical chambers that attach to the muzzle end of the firearm and provide a path for the bullet to travel while restricting the gasses caused by the firing of the bullet. The effectiveness of most sound suppression systems is limited due to their tendency to heat up and foul with carbon and metal particles, thereby limiting their useful life.

SUMMARY

[0006] The present application relates to sound suppression devices which include a baffle system or stack having a plurality of baffle disks where at least a first portion of the disks includes a first set of gas ports and at least a second portion of the disks includes a second set of gas ports. In some embodiments, the baffle system may be configured to act as a compressing piston. For example, when a bullet leaves a muzzle of a firearm and enters a suppression device, the baffle system acts as a compressing piston and moves forward with the gas pressure caused by the firing of the bullet. As the bullet begins to enter each baffle disk, the pressure starts to subside until there is a point where there is equalization between gas pressure and tension on a piston

spring within the baffle system. After this point, the piston is driven back into place by the releasing of the spring tension.

[0007] The arrangement of the gas ports in the first part of the baffle stack may be designed to allow the gas pressure to dissipate and to create a controlled flow around the bullet disrupting the velocity of the gases around the bullet. The design is carefully balanced to find an equilibrium around the gas pressure of a specific bullet diameter. In this case .224 caliber bullets are fired at velocities above 2,000 ft./sec. The arrangement of the gas ports in the second part of the baffle stack may be configured to have a smaller set of ports which creates pressure within the rest of the baffle stack in the reverse direction.

[0008] Gas port amounts and placement on each of the baffles as well as the design, size, expansion volume and distance may be varied in order to calibrate the suppression device for different calibers of bullets and/or different pressure ranges of cartridges. Further, different spring tensions and additional springs may be utilized in order to tune performance of a suppressor for various uses.

[0009] The original intention of designing the piston was to allow the baffles to free float so the carbon buildup would be ground to a fine powder and allow the baffles to be removed after repeated firing. Upon testing, it was discovered that there were other properties to the design that can increase the efficiency of the system. For example, by adding a front venting end cap, systems can create additional sound reduction as well as an additional reduction in flash. Allowing a larger expansion chamber at the exit end of baffle stack and then splitting the gases from one central hole to multiple expansion ports also creates crossflow outside the suppressor in the open air. In further embodiments, a sloped cut on the front end cap may be utilized which allows gases to follow the slope back into the central gas flow around the bullet as it exits. The hot gases colliding with each other eliminates any unburned powder’s access to oxygen. This eliminates most of the flash and only a small bit of powder burns in the open air around the bullet upon exit.

[0010] The foregoing has outlined rather broadly the features and technical advantages of the present invention in order that the detailed description of the invention that follows may be better understood. Additional features and advantages of the invention will be described hereinafter which form the subject of the claims of the invention. It should be appreciated by those skilled in the art that the conception and specific embodiment disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes of the present invention. It should also be realized by those skilled in the art that such equivalent constructions do not depart from the spirit and scope of the invention as set forth in the appended claims. The novel features which are believed to be characteristic of the invention, both as to its organization and method of operation, together with further objects and advantages will be better understood from the following description when considered in connection with the accompanying figures. It is to be expressly understood, however, that each of the figures is provided for the purpose of illustration and description only and is not intended as a definition of the limits of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] For a more complete understanding of the present invention, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

[0012] FIG. 1A illustrates a sound suppressor in accordance with an embodiment of the present application;

[0013] FIG. 1B illustrates an exploded view of the sound suppressor of FIG. 1A;

[0014] FIG. 2A illustrates a front view of a first baffle disk in accordance with an embodiment of the present application;

[0015] FIG. 2B illustrates a back view of a first baffle disk in accordance with an embodiment of the present application;

[0016] FIG. 2C illustrates a perspective view of a first baffle disk in accordance with an embodiment of the present application;

[0017] FIG. 3A illustrates a perspective view of a second baffle disk in accordance with an embodiment of the present application;

[0018] FIG. 3B illustrates a front view of a second baffle disk in accordance with an embodiment of the present application;

[0019] FIG. 3C illustrates a back view of a second baffle disk in accordance with an embodiment of the present application;

[0020] FIG. 4A illustrates a front view of an end cap for a suppressor in accordance with an embodiment of the present application;

[0021] FIG. 4B illustrates a perspective view of an end cap for a suppressor in accordance with an embodiment of the present application;

[0022] FIG. 4C illustrates a back view of an end cap for a suppressor in accordance with an embodiment of the present application;

[0023] FIG. 5 illustrates a sound suppressor having multiple springs in accordance with an embodiment of the present application;

[0024] FIG. 6 illustrates an attached and exploded view of a baffle stack utilizing a vent alignment technique in accordance with an embodiment of the present application;

[0025] FIG. 7 illustrates an inserted and exploded view of a suppressor having a baffle stack utilizing a vent alignment technique in accordance with an embodiment of the present application;

[0026] FIG. 8 illustrates an inserted and exploded view of a suppressor having a baffle stack utilizing a vent alignment technique in accordance with an embodiment of the present application;

[0027] FIG. 9 illustrates baffle disks and a baffle stack utilizing a vent alignment technique in accordance with an embodiment of the present application;

[0028] FIG. 10 illustrates a baffle stack loading system in accordance with an embodiment of the present application; and

[0029] FIG. 11 illustrates a sound suppressor in accordance with an embodiment of the present application.

DETAILED DESCRIPTION

[0030] Various features and advantageous details are explained more fully with reference to the non-limiting embodiments that are illustrated in the accompanying draw-

ings and detailed in the following description. Descriptions of well-known starting materials, processing techniques, components, and equipment are omitted so as not to unnecessarily obscure the invention in detail. It should be understood, however, that the detailed description and the specific examples, while indicating embodiments of the invention, are given by way of illustration only, and not by way of limitation. Various substitutions, modifications, additions, and/or rearrangements within the spirit and/or scope of the underlying inventive concept will become apparent to those skilled in the art from this disclosure.

[0031] It is also appreciated that while the following description of a sound suppressor is described in the context of the use on firearms systems, the inventive baffle systems and spring piston concepts may be utilized in other sound suppression applications. For example, such systems may be employed with the use of pneumatic tools, jet engines, or in any other application where baffles are used for sound reduction.

[0032] FIGS. 1A and 1B illustrate a sound suppressor **100** in accordance with an embodiment of the present application. Sound suppressor **100** includes a cylindrical housing **101** and attachment portion **102** which is configured allow the cylindrical housing **101** of suppressor **100** to attach to a firearm (not shown). Attachment portion **102** may be included as part of suppressor **100** (e.g. an integral or detachable component), or may be part of the firearm, and allows cylindrical housing **101** to thread onto, or otherwise attach to, the firearm.

[0033] Sound suppressor **100** includes a baffle system which may include a first type of baffle disks **103a-n**, a second type of baffle disks **104a-n** and spring **106**. Baffle disks **103a-n** include a first number of gas vent holes which allow gasses to vent within the volume of each disk. In the illustrated embodiment each disk is 0.4 inches thick and seven disks **103** are utilized. Baffle disks **104a-n** include a second number of gas vent holes. In the illustrated embodiment each disk is 0.4 inches thick and three disks **104** are utilized. The number of vent holes in disks **104** is fewer than in disks **103** to allow the pressure force to build within the baffle system and move/alter the volume properties of the suppressor. The baffle stack is configured to move laterally along a longitudinal axis defined by the length of suppressor housing **101**. In systems where a spring is utilized, such force will contribute to spring **106** compressing and building counter-tension. In some embodiments, and as illustrated in FIGS. 1A and 1B, disk **104n** may be reversed in orientation. Such an orientation allows for altered volume/pressure characteristics which may improve the performance of suppressor **100**.

[0034] Spring **106** may be optionally utilized to assist in providing improved piston compression properties. As gas pressure propagates from the muzzle end of the firearm into the entrance of suppressor **100**, the pressure forces the baffle system to compress spring **106**. This movement of the baffle system changes the volume and pressure properties of suppressor **100**, therefore altering the sound suppression characteristics. Spring **106** provides counter-pressure on the baffle system which cushions the displacement of the baffle system and assists in the volume/pressure distribution of gasses within housing **101**. As will be discussed in more detail below, some embodiments may include a plurality of springs which facilitate such cushioning and counter displacing of the baffle system.

[0035] Suppressor **100** may further include end cap **107**. End cap **107** functions to contain the baffle system within housing **101** during use. In some embodiments, end cap **107** may include internal threads which allow end cap **107** to threadably attach to an external surface of housing **101**. In alternate embodiments, end cap **107** may be externally threaded in order to thread onto an internal surface of housing **101**. However, it is noted that in the present embodiment, threading end cap **107** onto an external surface of housing **101** has provided improved performance as the threads are not exposed to as much heat under use, and therefore have been less prone to failure. Embodiments may also be configured such that the threads are self-sealing (e.g. that gasses do not escape through the threaded portion). Such a configuration helps the heat tolerance of the threads, which will also improve the overall failure tolerance of the suppressor. End cap **107** may further be configured to include flash suppression capabilities as will be described in more detail below.

[0036] The above illustrated embodiment has been optimized for suppressing sound made by firing a 5.56×45 mm NATO round. It is appreciated that different types of rounds/calibers of bullets, as well as properties of different firearms (e.g. barrel length) will impact the performance of sound suppression systems. Various modifications of suppressor **100** may be implemented to account for such differences. For example, various steps such as increasing/decreasing the total volume of suppressor **100** (e.g. such as by changing the length or diameter), changing the number of disks, changing the nature of the disks to allow for more or less gas ports, changing the alignment of gas ports, changing the tension of the spring(s), etc., may be implemented to optimize sound suppression performance.

[0037] Moreover, it is appreciated that various portions of suppressor **100** may be configured to be replaceable parts. For example, the stack of disks **103** and **104** (with or without spring **106**) may be separate parts, or may be combined as a singular replaceable part. Such an embodiment allows for easy replacement, repair, and/or cleaning of the internal components of suppressor **100**. This provides a clear advantage over previous suppressors, as such devices are prone to failure due to the high heat and pressure environments in which they operate.

[0038] Additionally, the system of FIG. 1 utilizes a first and second type of baffle disk having different sets of gas vent holes, but systems are not limited to using only two types of disks. For example, embodiments may utilize one or more further types of disks having different vent holes along the stack of disks. Moreover, while the number of vent holes will generally be reduced from the first disk to the last, it is not necessary to have the last disk have the smallest amount of vent holes. The illustrated embodiment reduces from seven vent holes to one, but embodiments may gradually reduce using multiple types of disks having different holes (e.g. from a higher number to a lower number), or may reduce and then increase (e.g. from a higher number to a lower number, to a number that is higher than the lower number). Embodiments are not necessarily limited by the arrangement of the number of vent holes. Furthermore, FIG. 1 illustrates that the vent holes from one disk to the next are aligned. Such a layout has shown to be preferable, but it is not necessary for the performance of the suppressor.

[0039] FIGS. 2A-2C illustrate a detailed view of baffle disk **103** in accordance with an embodiment of the present

application. Baffle disk **103** includes seven gas port holes **201** and a center hole **202** through which a bullet will travel. As can be seen in FIG. 2C, baffle disk **103** has a sidewall with a depth that provides a hollow space for air/gas volume to be distributed therein. It is appreciated that the number of gas port holes and locations on disk **103** may be altered in order to tune the suppression properties of an overall system based on the particular application. For example, more holes will allow more gas to pass through a particular disk and therefore cause less pressure to push on the surface of the disk than would be present in a disk with fewer holes. Additionally, as described above, when multiple disks **103** are placed together in serial, the gas vent holes may be aligned or misaligned depending on the particular design of the system.

[0040] FIGS. 3A-3C illustrate a detailed view of baffle disk **104** in accordance with an embodiment of the present application. Baffle disk **104** includes one gas port hole **301** and a center hole **302** through which a bullet will travel. As can be seen in FIG. 3A, baffle disk **104** has a sidewall with a depth that provides a hollow space for air/gas volume to be distributed therein. It is appreciated that the number of gas port holes and locations on disk **104** may also be altered in order to tune the suppression properties of an overall system based on the particular application. For example, more holes will allow more gas to pass through a particular disk and therefore cause less pressure to push on the surface of the disk than would be present in a disk with fewer holes. Additionally, as described above, when multiple disks **104** are placed together in series, the gas vent holes may be aligned or misaligned depending on the particular design of the system.

[0041] FIGS. 4A-4C illustrate an end cap **107** for a suppressor in accordance with an embodiment of the present application. End cap **107** includes a plurality of vent holes **401** and an exit opening **402**. This particular end cap utilizes four vent holes **401**, but it is appreciated that differing numbers of holes may be utilized. Exit opening **402** is cross-shaped in a manner that will assist in flash reduction properties of end cap **107**. However, it is noted that other shapes are possible to implement these flash reduction properties (e.g. star shaped, etc.). End cap **107** may further include a threaded surface located at **403** to assist in the attachment of end cap **107** to a suppressor housing, such as housing **101**. As can be seen in FIG. 1, end cap **107** may include a convex shape on its outer surface. This convex shape, along with vent holes **401** and exit opening **402** help to produce a no/low oxygen environment for excess materials exiting the suppressor in order to reduce flashing/burning of such materials.

[0042] FIG. 5 illustrates a suppressor **500** in accordance with a further embodiment of the present application. Suppressor **500** may be configured as described above with respect to FIG. 1 and its various modifications. Further, suppressor **500** may include spring **501** located on the firearm muzzle side of the internal baffle system. Spring **501** may assist in the piston movement capabilities of the plurality of disks in the baffle system and may also provide for further stabilization of the internal system. Accordingly, spring **501** may be utilized to improve the performance and durability of suppressor **500**.

[0043] FIGS. 6-9 illustrate various embodiments where vent holes in a baffle stack are aligned. As described above, in some embodiments it may be advantageous to align the

vent holes in a baffle stack. FIG. 6 illustrates an attached and exploded view of a baffle stack 600 utilizing a vent alignment technique in accordance with an embodiment of the present application. In this embodiment, at least one rod 601 is configured to be inserted through a hole 604 disposed in baffle disks 603 (including 603' which differs in the number of vent holes present on the baffle disk). Hole 604 may be similarly sized as the rest of the vent holes in a particular baffle disk 603. Alternatively, hole 604 may be sized to correspond to the size of rod 601. Rod 601 may be smooth, partially, or entirely threaded. In some embodiments, rod 601 may be disposed within baffle stack 600 and fit loosely, which would still allow for the vent holes to be aligned. In yet another embodiment, rod 601 may be secured on one or more sides of baffle stack 600 using one or more securing surfaces/devices, such as nut 602. Alternate embodiments may include using a bolt-like structure having a head on one side and nut 602 on the other.

[0044] FIG. 7 illustrates an inserted and exploded view of a suppressor having a baffle stack utilizing a vent alignment technique in accordance with an embodiment of the present application. In this embodiment, the baffle stack is made from baffle components 701 which have one or more particular shapes. This example is provided in order to illustrate that vent hole alignment may be implemented using baffle components having complementary geometry. As illustrated, baffle components 701 are approximately triangular in shape, however, is appreciated that other shapes may be utilized. As can be seen, when baffle components 701 are inserted properly within a suppressor housing, the complementary shape of each baffle component 701 causes vent holes within the baffle components to be aligned.

[0045] FIG. 8 illustrates an inserted and exploded view of a suppressor 800 having a baffle stack utilizing a vent alignment technique in accordance with an embodiment of the present application. In this example embodiment, baffle disks 801 (including 801' which differs in the number of vent holes present on the baffle disk), include notch portion 802 which has been formed such that when the respective notch portions 802 of baffle disks 801 are aligned, the corresponding vent holes are also aligned. Embodiments may utilize a mechanism to maintain this alignment during insertion and/or use of the suppressor. For example, a rod may be placed down the channel formed by respective notch portions 802. In the illustrated embodiment, suppressor housing 804 is formed with a protrusion 803 which extends longitudinally along housing 804. During insertion, the respective notches 802 on baffle disks 801 align with protrusion 803 in a manner that locks the disks such that their corresponding vent holes are aligned. It is appreciated that embodiments may utilize various methods to key portions between disks 801 and housing 804 in order to promote vent hole alignment. Such methods will generally be selected in a manner that will reduce fabrication expenses for the corresponding parts.

[0046] FIG. 9 illustrates a suppressor 900 which includes baffle disks 901 forming a baffle stack which utilizes a vent alignment technique in accordance with an embodiment of the present application. In this embodiment, baffle disks 901 (and 901' differing in the number of vent holes) are fabricated in a manner where they include complementary edges which nest within each other. When multiple disks 901 are nested in this manner the disks are configured such that the vent holes align between one disk to the next. This alignment

is maintained, despite the fact that the disks may potentially rotate within suppressor housing 902. It is appreciated that the illustrated embodiment provides an exemplary complimentary disk shape, and that any shape may be utilized to provide surfaces that fit between one disk in the next in order to maintain vent hole alignment (e.g. waves, tongue and groove, etc.).

[0047] FIG. 10 illustrates a baffle stack loading system 1000 in accordance with an embodiment of the present application. It is appreciated that in some use cases the baffle disks will need to be exchanged for repair or maintenance of the above-described suppressor systems. Accordingly, some embodiments may include a loading system 1000 which is configured to contain a replacement set of baffle disks 1001a-n. Loading system 1000 may include a central rod 1002 which is configured to extend through baffle disks 1001a-n. Loading system 1000 is shaped such that it abuts or fits around cylindrical housing 101. Upon engaging loading system 1000 with cylindrical housing 101, baffle disks 1001a-n are able to slide along central rod 1002 and into cylindrical housing 101 in order to reload the suppressor with a new baffle stack.

[0048] Loading system 1000 may further include features that will assist in the loading/reloading of a baffle stack. For example, loading system 1000 may include a disk locking mechanism 1003 which retains disks 1001a-n within system 1000 until locking mechanism 1003 is released. In this arrangement, loading system 1000 maybe turned upside down when placed onto cylindrical housing 101, whereupon locking mechanism 1003 may be released, thereby allowing baffle disks 1001a-n to slide downward into housing 101 under the force of gravity. In other embodiments loading system 1000 may utilize one or more springs to provide a spring force which acts on disks 1001a-n once a locking mechanism is released in order to load cylindrical housing 101.

[0049] It is appreciated that providing a separate loading system is both convenient and promotes safety when utilizing the suppressor system of the embodiments described herein. A loading system will preferably include mechanisms which require the correct amount of baffle disks to be inserted for the loading mechanism to function properly. For example, in the illustrated embodiment 7 baffle disks are utilized. In the event that only 6 baffle disks were present in loading system 1000, embodiments may be configured such that the functionality of locking mechanism 1003 does not work properly, or that locking mechanism 1003 is disposed in an area where a user would understand that there were too few disks because the disks would be able to freely move between the back wall of loading mechanism 1000 and locking mechanism 1003. Accordingly, embodiments may include loading systems that help to ensure that the correct number of baffle disks are loaded with each use for a particular suppressor.

[0050] As described above, embodiments provide for sound reduction improvements over previous suppressor systems. Further, embodiments allow for improved heat distribution and tolerance. Conventional thinking by those involved in suppressor manufacturing have said that each round of 5.56 mm ammunition shot out of a 14.5 inch barrel into a suppressor produces 7° F. rise in temperature. This general rule applies because the volume is static within a suppressor. Embodiments using the above-designs change its expansion volume and therefore changes heat absorption.

At least two things contribute to the reduction in heat in the present suppressor design. Referring to the embodiment of FIG. 1, the piston design and the baffles with seven vent holes allow a very large expansion chamber with minimal back pressure exerted down the barrel of the gun when firing. The volume is larger than most conventional suppressors causing a drastic reduction in heat transferred into the suppressor. At the end of the suppressor the baffle with one vent hole starts to break the pressure and cause heat generation and absorption. At some point gasses should be slowed down to create heat to reduce the sound signature. The mass of the entire baffle stack is cooler towards the front than at the back of the stack on firing. The jackets that are machined into each baffle are may be optimized to allow the most contact with the outside wall of the suppressor and with each other. This causes a heat sink effect pulling the heat from the hot back baffles into the rest of the mass of the baffle stack and tube.

[0051] Accordingly, in some embodiments, what was normally a 7° F. rise in temperatures is now about 5° F. In mounting a suppressor to a machine-gun this becomes a very important factor. Temperatures rise logarithmically with every shot. The ability for the outside air to absorb the heat from the suppressor will not be able to keep up with the rising temperatures and the metal which comprises the suppressor will reach the melting point causing a failure. Suppressors made in accordance with the embodiments disclosed herein will last longer than standard suppressors before failure.

[0052] It is appreciated that the above described suppressors and their various component parts may be made from a number of materials. Materials used may include a variety of steels, steel alloys, aluminum and titanium. Materials that handle high temperature, stress and corrosion are good candidates. There is generally a balance between cost to manufacture and strength. Nickel and chromium alloys are the toughest and most durable. They are also the hardest to fabricate and the highest raw material cost. The baffle that is the closest to the end of the barrel receives the most punishment inside the silencer. The first volume of the silencer is under the highest pressure. Higher pressure produces more friction and heat. Materials flowing are listed by baffle durability nickel and chromium alloys, stainless steels, carbon steels, titanium and aluminum. The baffle stack can either be a combination of alloys, steels, titanium or aluminum. When weight is the greatest factor and not durability, titanium and aluminum can be employed as a baffle material.

[0053] Materials used in silencer tubes and end caps are preferably to be easy to machine and/or weld. They also should be able to keep dimensionally static under both pressure and heat. Type 303 stainless and 304 stainless, titanium alloys, aluminum and 4130 and 4140 carbon steels are currently used for tubes. End caps are preferably to be both easy to fabricate and retain resistance to abrasion and thermal expansion/retraction. Materials currently used in end caps are 17-4 stainless, UNS 531635, SAE 4130, SAE 4140 carbon steels and aluminum alloy 6061. Appendix 1 contains a listing of materials that have been used or contemplated for baffles, housing tubes and end caps.

[0054] It is appreciated that in light of the description of the suppressors provided above, one of skill in the art would understand that the invention may also be described in the context of methods for making, using, and repairing/replac-

ing aspects of suppressors. For example, a method of making a suppressor in accordance with the present application may comprise providing a housing, a baffle system having a plurality of baffle disks of at least one first type and a plurality of baffle disks of at least one second type, and/or one or more springs. The method may further include placing the baffle system within the housing and securing the system with an end cap. Methods of using may include attaching a suppressor in accordance with embodiments described above to the muzzle end of a firearm and discharging the firearm such that the suppressor provides for reduction of the sound of the discharged firearm over a non-suppressed firearm.

[0055] Still further, methods for repairing/replacing suppressor systems may include obtaining a used suppressor which has been detached from a firearm, removing and end cap from a suppressor housing, removing a used baffle system and replacing it with a new baffle system, and replacing the end cap. Replacing the baffle system could include replacing only the disk stack, or could further include replacing the stack and one or more springs. Methods may also include replacing the end cap.

[0056] Although embodiments of the present application and its advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims. Moreover, the scope of the present application is not intended to be limited to the particular embodiments of the process, machine, manufacture, composition of matter, means, methods and steps described in the specification. As one of ordinary skill in the art will readily appreciate from the disclosure of the present invention, processes, machines, manufacture, compositions of matter, means, methods, or steps, presently existing or later to be developed that perform substantially the same function or achieve substantially the same result as the corresponding embodiments described herein may be utilized according to the present invention. Accordingly, the appended claims are intended to include within their scope such processes, machines, manufacture, compositions of matter, means, methods, or steps. Moreover, the scope of the present application is not intended to be limited to the particular embodiments of the process, machine, manufacture, composition of matter, means, methods and steps described in the specification.

1. A sound suppression device comprising:
 - a suppressor housing;
 - an attachment portion configured to attach the suppressor housing to the muzzle end of a firearm;
 - a baffle stack configured to be inserted within the suppressor housing, the baffle stack having a plurality of disks of a first type and a plurality of disks of a second type, wherein the plurality of disks of a first type each define a first number of vent apertures and the plurality of disks of a second type each define a second number of vent apertures; and
 - an end cap configured to attach to the suppressor housing and secure the baffle stack within the housing.
2. The sound suppression device of claim 1 wherein the baffle stack is configured to move laterally along a longitudinal axis defined by the length of the suppressor housing.
3. The sound suppression device of claim 2 further comprising a first spring configured to be disposed between the plurality of disks in the baffle stack and the end cap.

4. The sound suppression device of claim 3 further comprising a second spring configured to be disposed between the plurality of disks in the baffle stack and the muzzle end of the suppressor housing.

5. The sound suppression device of claim 1 wherein the end cap is configured to be a flash suppressor.

6. The sound suppression device of claim 5 wherein the end cap comprises a plurality of vents and a cross-shaped opening.

7. The sound suppression device of claim 1 further comprising a third type of disk having a third number of vent apertures configured to be placed within the baffle stack.

8. The sound suppression device of claim 1 wherein the baffle stack is configured to be aligned such that one or more vent apertures on the plurality of disks maintains alignment.

9. A sound suppression device comprising:

a suppressor housing;

an attachment portion configured to attach the suppressor housing to the muzzle end of a firearm;

a baffle stack configured to be inserted within the suppressor housing, the baffle stack having a plurality of disks having one or more vent apertures; and

at least one spring configured to be retained within the suppressor housing between a housing edge and the baffle stack;

an end cap configured to attach to the suppressor housing and secure the baffle stack within the housing.

10. The sound suppression device of claim 9 wherein the baffle stack is configured to move laterally along a longitudinal axis defined by the length of the suppressor housing against the spring.

11. The sound suppression device of claim 10 wherein the at least one spring comprises a first spring configured to be disposed between the plurality of disks in the baffle stack and the end cap and a second spring configured to be disposed between the plurality of disks in the baffle stack and the muzzle end of the suppressor housing.

12. The sound suppression device of claim 10 wherein the plurality of disks includes: one or more disks having a first

number of vent apertures and one or more disks having a second number of vent apertures.

13. The sound suppression device of claim 9 wherein the end cap is configured to be a flash suppressor.

14. The sound suppression device of claim 13 wherein the end cap comprises a plurality of vents and a cross-shaped opening.

16. The sound suppression device of claim 9 wherein the baffle stack is configured to be aligned such that one or more vent apertures on the plurality of disks maintains alignment.

17. The sound suppression device of claim 16 wherein the baffle stack is configured to maintain alignment using a notch portion in one or more disks of the plurality of disks.

18. The sound suppression device of claim 16 wherein the baffle stack is configured to maintain alignment using complementary nesting portions between one or more disks of the plurality of disks.

19. A method for manufacturing a sound suppression device comprising:

forming a suppressor housing having an attachment portion configured to attach the suppressor housing to the muzzle end of a firearm;

providing a baffle stack configured to be inserted within the suppressor housing, the baffle stack having a plurality of disks of a first type and a plurality of disks of a second type, wherein the plurality of disks of a first type each define a first number of vent apertures and the plurality of disks of a second type each define a second number of vent apertures; and

providing an end cap configured to attach to the suppressor housing and secure the baffle stack within the housing.

20. The method of claim 19 further comprising: providing one or more springs configured to be inserted into the suppressor housing and to be disposed between the baffle stack and one or more of the muzzle end of the housing and the end cap.

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