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Jarvis

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(54) **FIREARM SUPPRESSION SYSTEM**

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F41A 21/30 (2006.01)

(52) **U.S. Cl.**
CPC ***F41A 21/30*** (2013.01)

(58) **Field of Classification Search**
CPC F41A 21/30
USPC 181/223; 89/14.4
See application file for complete search history.

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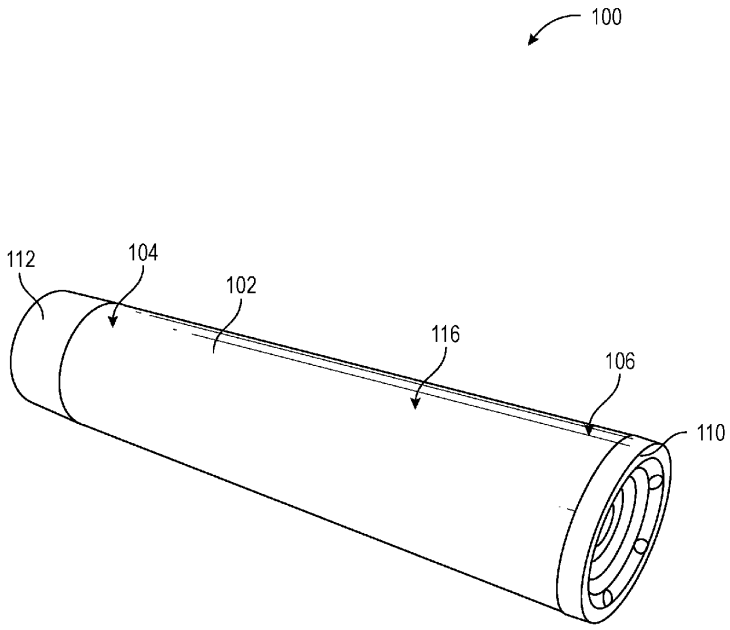
Primary Examiner — Forrest M Phillips

(57) **ABSTRACT**

A firearm suppression system includes a housing, a muzzle adapter, an end cap, and a core. The housing includes a first aperture at a first end and a second aperture at a second end. An inner compartment may be interposed between the first aperture and the second aperture. The inner compartment may be configured to receive the core. The muzzle adapter may be threadably coupled near the first end of the housing, and the end cap may be threadably coupled to the second end of the housing. The core may be removably attachable to the housing and positioned within the inner compartment of the housing. Between an outer surface of the core and the inner surface of the housing may be a channel that equalizes pressure. The outer surface of the core may comprise a plurality of apertures that lead to baffles.

17 Claims, 17 Drawing Sheets



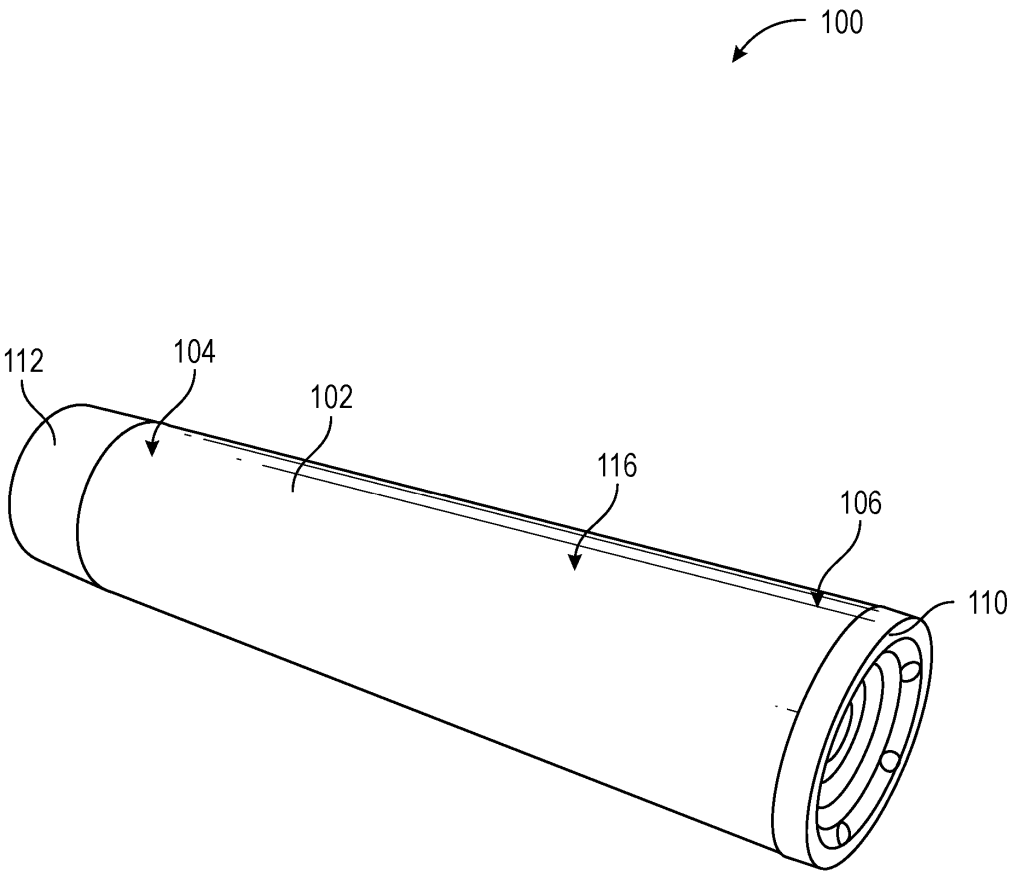


FIG. 1

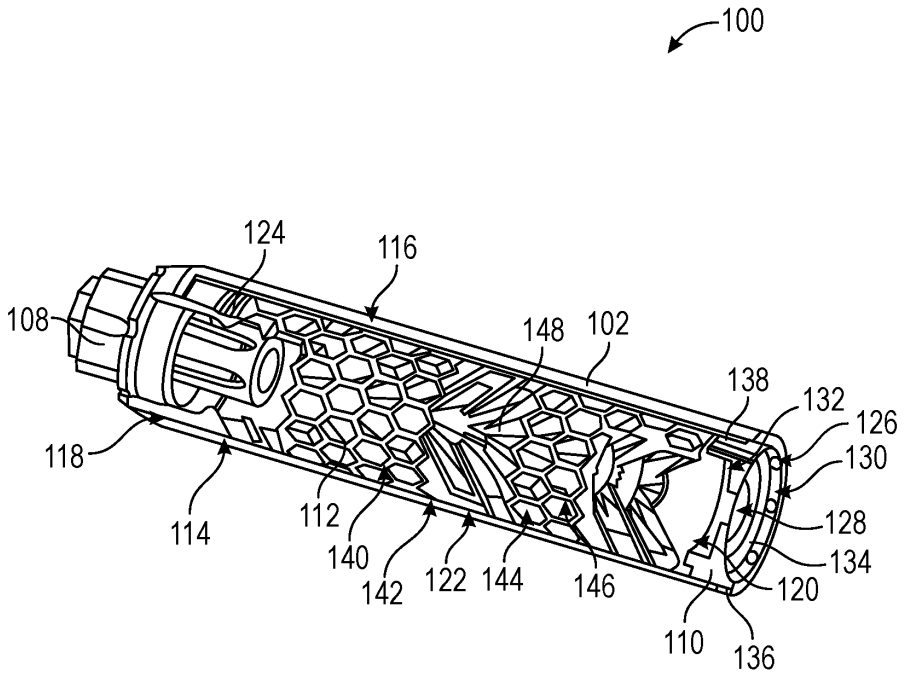

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FIG. 2

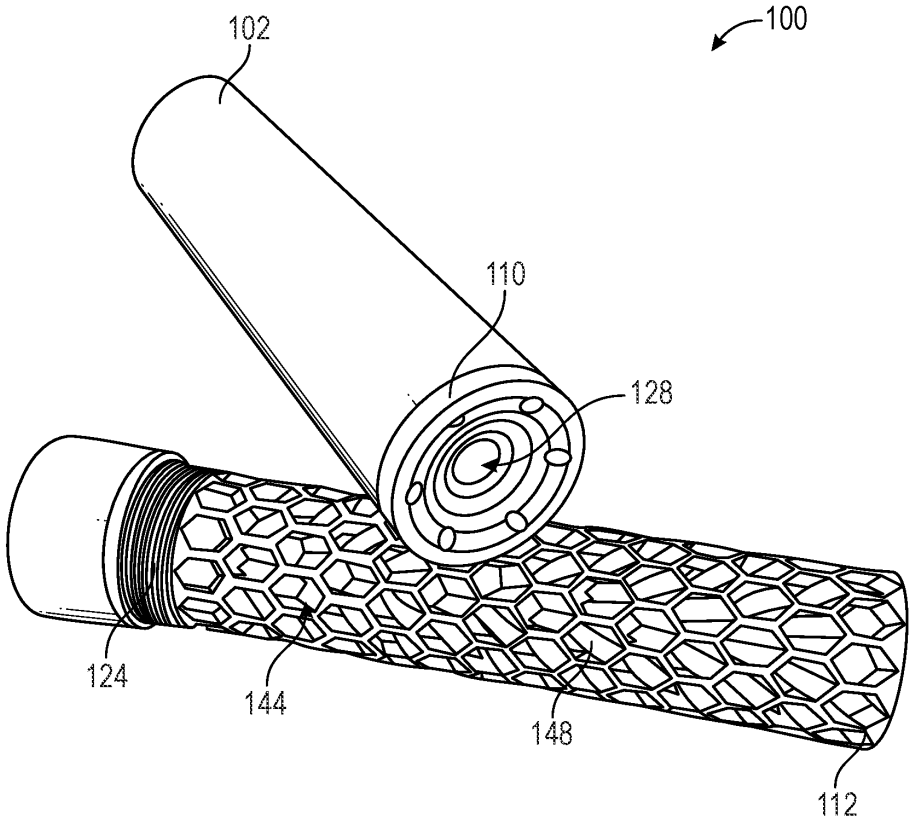

FIG. 3

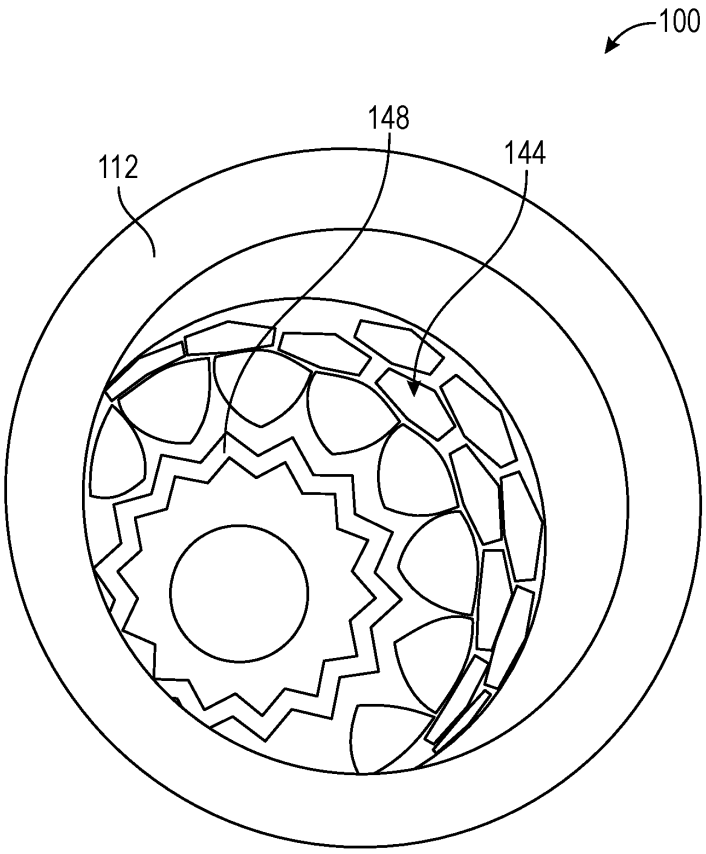

FIG. 4

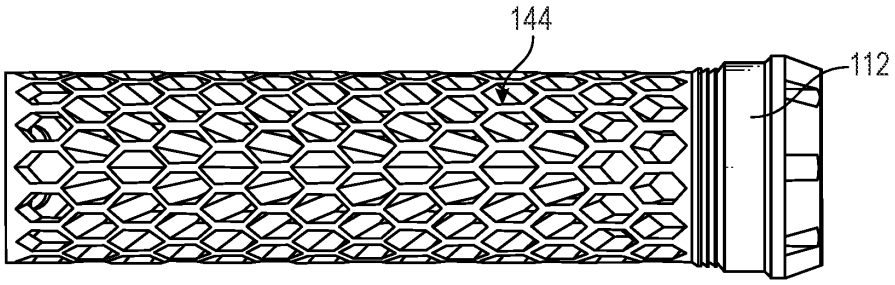

FIG. 5

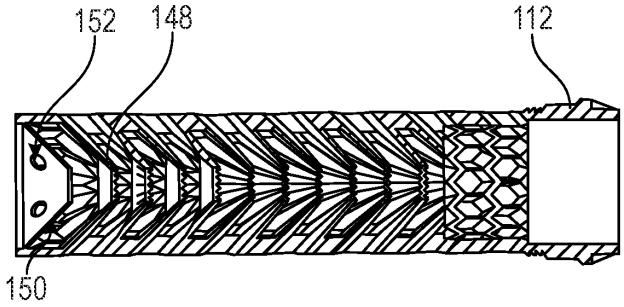

FIG. 6

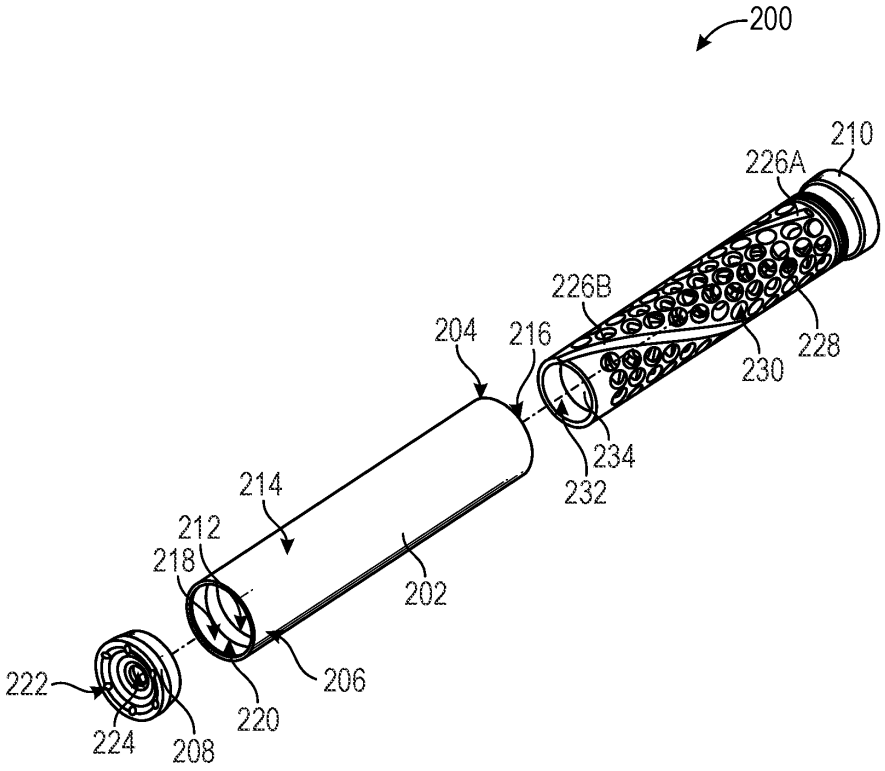
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FIG. 7

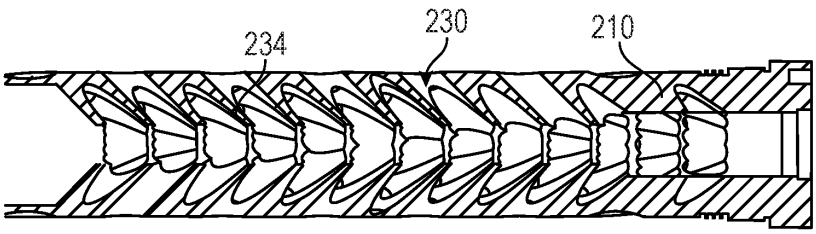

FIG. 8

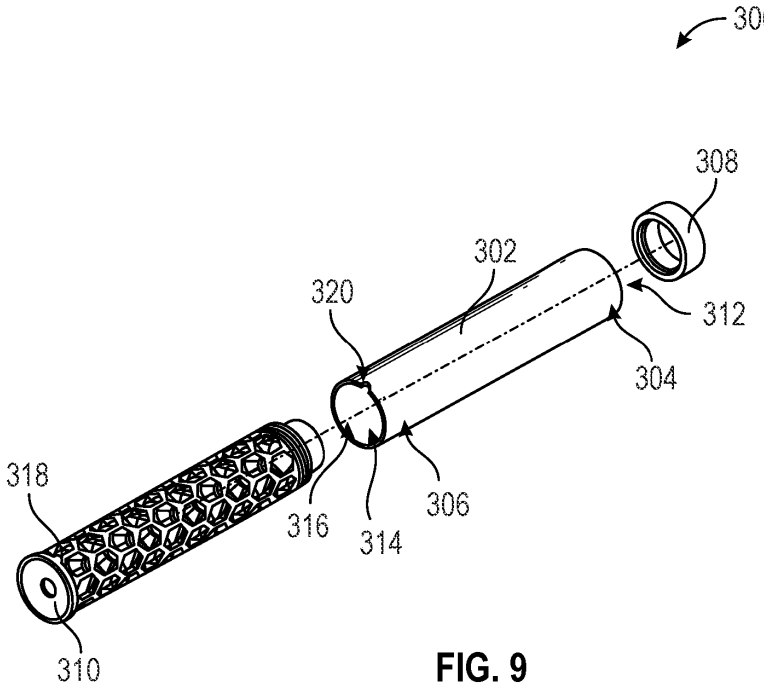
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FIG. 9

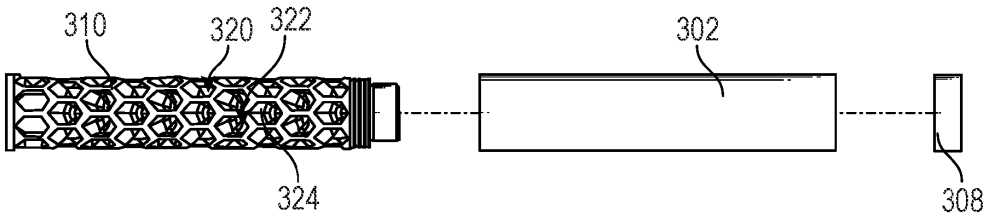
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FIG. 10

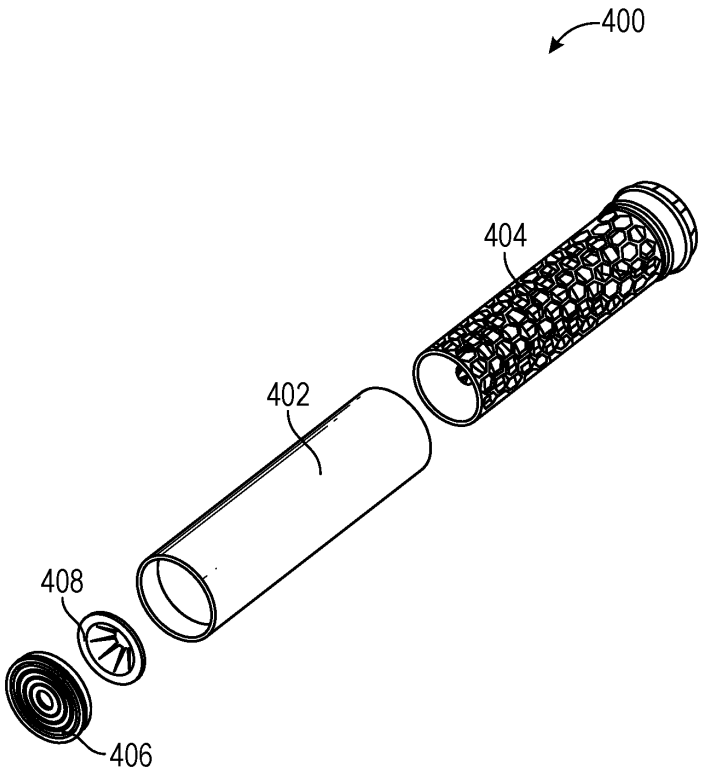

FIG. 11

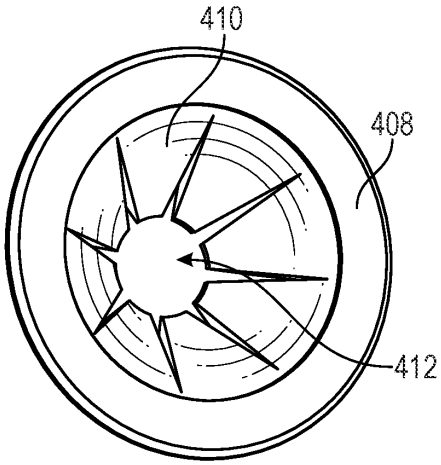

FIG. 12

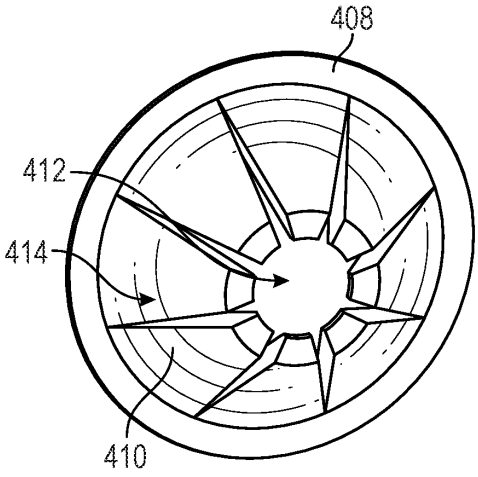

FIG. 13

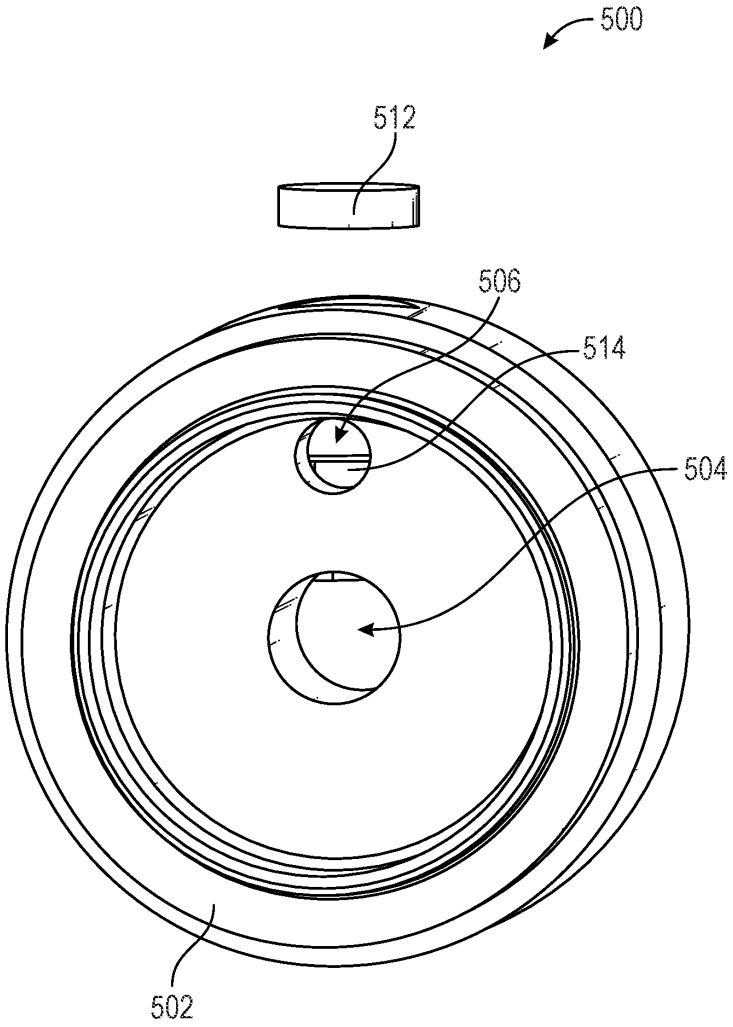

FIG. 14

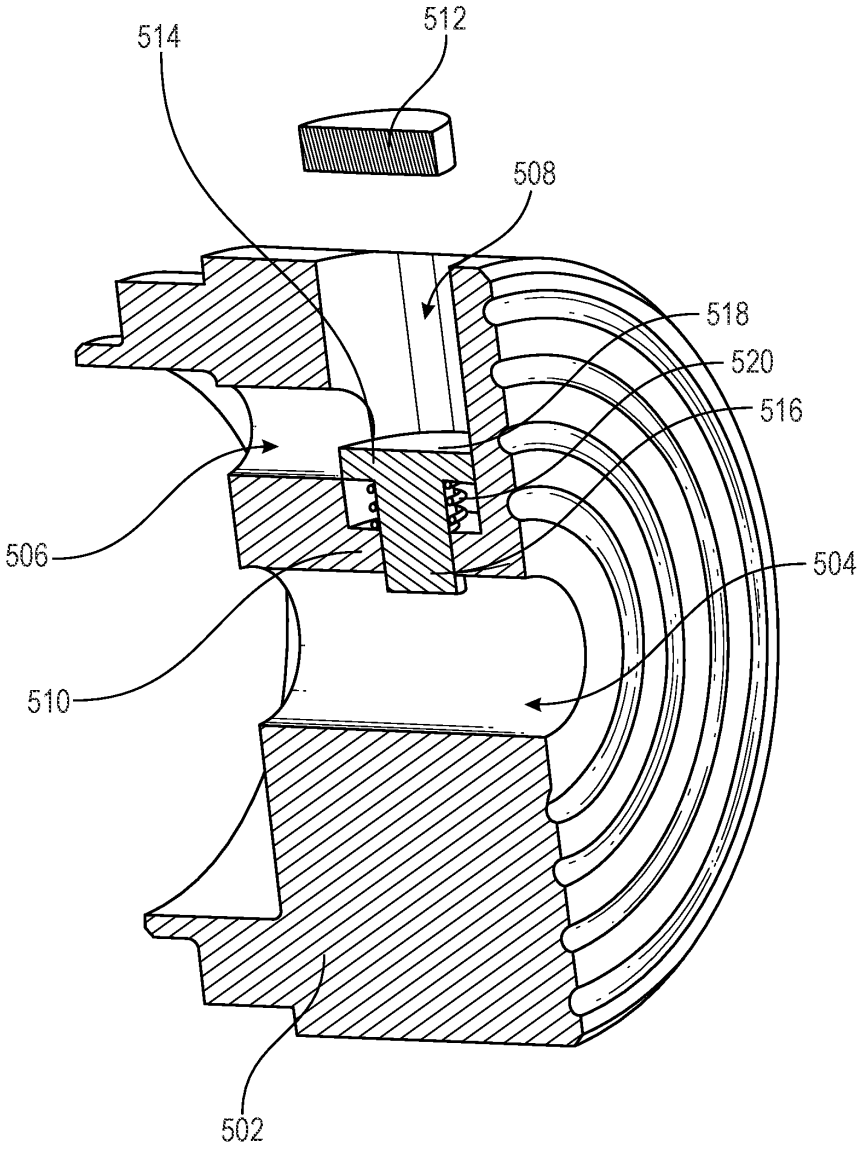

FIG. 15

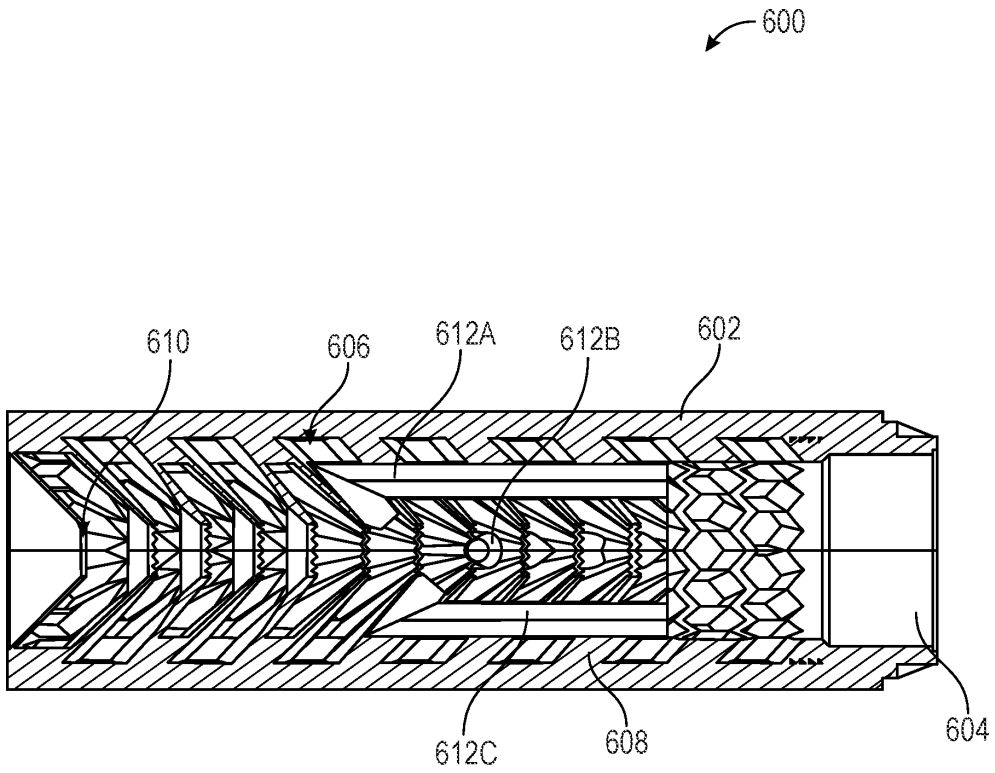

FIG. 16

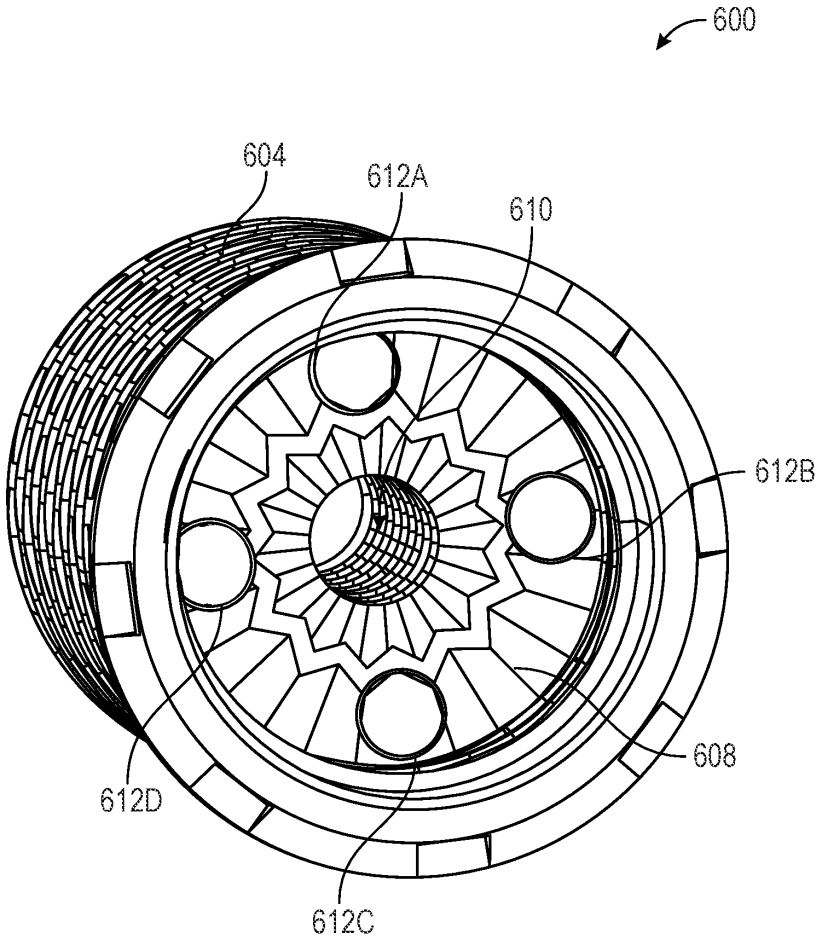

FIG. 17

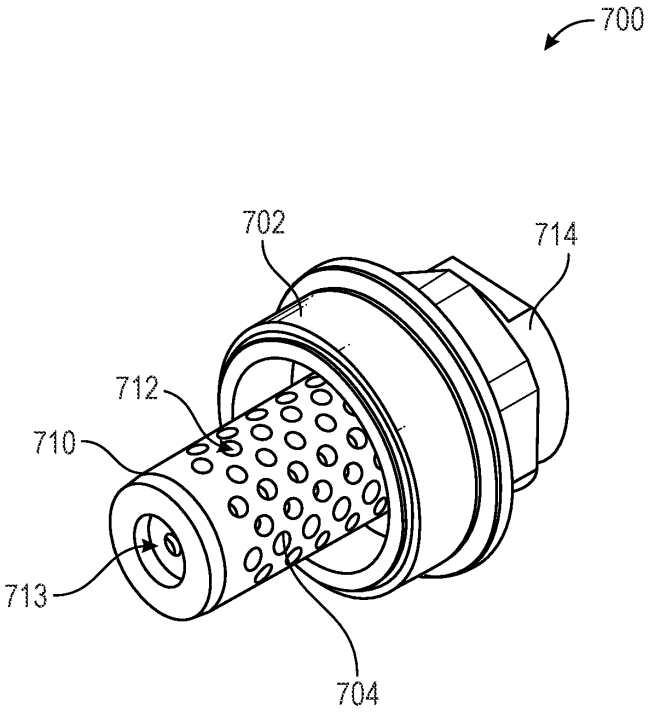

FIG. 18

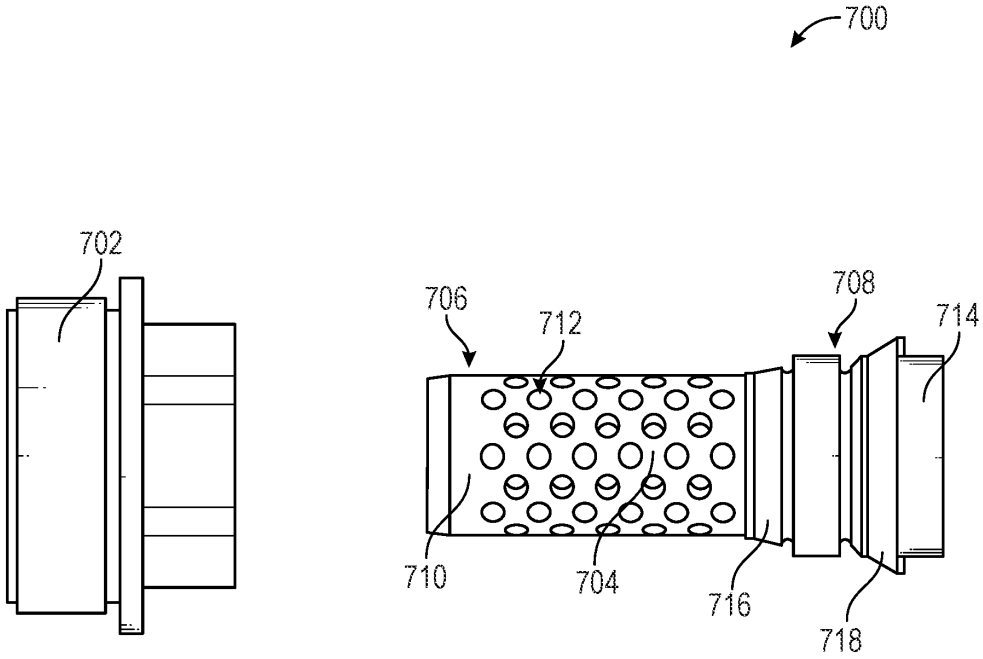

FIG. 19

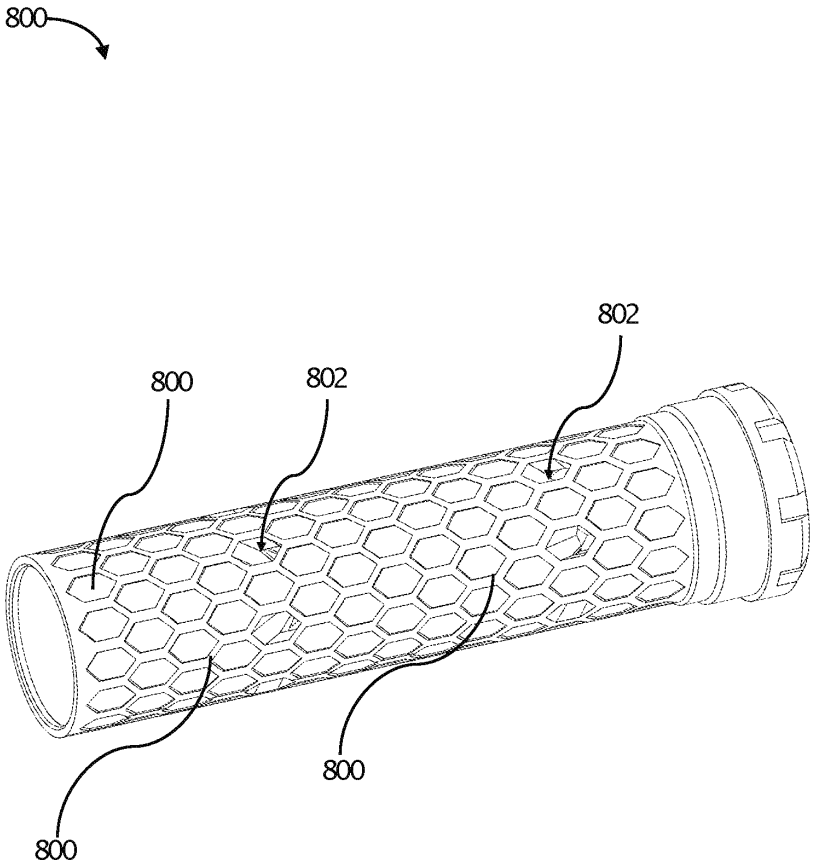

FIG. 20

FIREARM SUPPRESSION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application Ser. No. 63/419,776, filed on Oct. 27, 2022, which is incorporated herein by reference.

TECHNICAL FIELD

The present disclosure relates to firearm suppressors. More particularly, the present disclosure relates to a firearm suppression system that reduces sound, recoil, and back gassing.

BACKGROUND

Firearms have been used for many years and have been a crucial part of many societies. Throughout the centuries firearms have changed in many ways. In particular, firearms have changed in shape, in functionality, and in components used. A relatively new component in the firearm industry is a suppressor. The suppressor made its appearance in the early 1900s. Suppressors were created to reduce muzzle flash and noise. Now they have become an important part of the firearm industry. Typically, suppressors are either monocore or baffle stack and function by utilizing a series of partitions, where expanding gases are trapped and remain until slowed and cooled before exiting the suppressor. Suppressors are often made from metal alloys, such as aluminum and stainless steel.

While suppressors on the market seek to reduce muzzle flash, noise and back gassing and increase accuracy, many fall short due to their configurations. In particular, some baffle stack suppressors may have baffles that don't work properly or as intended. Others may only reduce flash, noise, or back gassing but not all three. For example, while some suppressors found on the market may reduce noise, they may fall short in reducing muzzle flash, back gassing and/or recoil.

Accordingly, there is a need for a suppression system that reduces flash, noise, recoil, and back gassing while increasing accuracy. The present invention seeks to solve these and other problems.

SUMMARY OF EXAMPLE EMBODIMENTS

In one embodiment, a firearm suppression system comprises a housing including a first end and a second end, a muzzle adapter, an end cap, and a core. The housing may be cylindrical-shaped. The housing may be manufactured from titanium. To manufacture the housing, the housing may be printed via a three-dimensional printer. The housing includes an inner surface and an outer surface. The housing includes a first aperture at a first end and a second aperture at a second end. An inner compartment may be interposed between the first aperture and the second aperture. The inner compartment may be configured to receive the core. The muzzle adapter may be coupled proximate the first end of the housing, and the second end of the housing may receive the end cap which is removably attachable. The muzzle adapter and end cap may include threaded fasteners so as to be threadably coupleable to the core and housing, respectively.

The end cap may be threadably coupled to the second end of the housing. Other fastening mechanisms may be envisioned. The end cap may comprise a plurality of vent apertures that allow gas from the fired cartridge to escape the firearm suppression system. The end cap may also comprise a projectile/bullet aperture where the bullet fired from a cartridge may leave the firearm and system.

The core may be removably attachable to the housing and positioned within the inner compartment of the housing. The core may be threadably coupled to the housing via the threaded fastener at the first end of the housing. Further, the core may be substantially cylindrical-shaped so as to fit within the housing. Between an outer surface of the core and the inner surface of the housing, may be a channel that equalizes pressure. The outer surface of the core may comprise a plurality of hexagonal apertures that lead to baffles that angle towards the projectile passage. The baffles may be positioned along the length of the core.

In one embodiment, a firearm suppression system comprises a housing including a first end and a second end, an end cap, and a core. The housing may comprise an inner surface and an outer surface. The housing includes a first aperture at the first end and a second aperture at the second end. An inner compartment may be interposed between the first aperture and the second aperture. The inner compartment may be configured to receive the core. The end cap may comprise a plurality of vent apertures that allow gas from the fired cartridge to escape the firearm suppression system. The end cap may also comprise a projectile/bullet aperture where the bullet fired from a cartridge may leave the gun and system. The core may be removably attachable to the housing and positioned within the inner compartment of the housing. The core may comprise a first channel and a second channel both of which wrap around an outer surface of the core and assist in removing gas from the system. The core may be printed via a three-dimensional printer. The core may comprise a plurality of core apertures that allow gas passing from the projectile and operating system to pass to the channels. The core may include an inner surface that comprises baffles that function in tandem with the plurality of core apertures.

In one embodiment, a firearm suppression system comprises a housing including a first end and a second end, a rear cap, and a core. The housing includes a first aperture at the first end and a second aperture at the second end. An inner compartment may be interposed between the first aperture and the second aperture. The inner compartment may be configured to receive the core. The rear cap may be configured to secure the core in the housing. The core may be removably attachable to the housing and positioned within the inner compartment of the housing. The core may comprise a protrusion that lines up with and fits into a notch in the second end of the housing, thereby providing a secure fit between the core and the housing. The core may comprise a plurality of core apertures that allow gas passing from the projectile and operating system to pass via the system. The core may include an inner surface that comprises baffles that function with the plurality of core apertures.

In one embodiment, a firearm suppression system comprises a housing, a core, an end cap, and a disc. The disc (e.g., shutter) may be placed proximate the end cap. The disc may comprise a plurality of fingers pointing inward towards a second projectile aperture and the core when assembled.

In one embodiment, an end cap system may comprise an end cap that may be used with any of the other firearm suppression systems described herein. The end cap may comprise a projectile aperture, where the projectile may exit the suppression system. The end cap may comprise a pressure channel that receives pressure from the exiting projectile. The pressure channel, running parallel to the projectile

aperture, may lead to an end cap closure channel, being perpendicular thereto. The end cap closure channel may lead to the projectile aperture and narrow proximate the projectile aperture, thereby creating a projectile ledge. The end cap closure channel may receive a closure member that is positioned therein. Further, a key comprising a shaft and a head may be placed in the end cap closure channel. The shaft may protrude into the projectile aperture to reduce gas flow exiting the system.

In one embodiment, a firearm suppression system comprises a housing and a core. The core may be removably attachable to the housing and positioned within the housing. An outer surface of the core may comprise a plurality of core apertures. The core may include an inner surface that comprises baffles that interact with the plurality of core apertures. These baffles may be extruded inward at various prescribed angles. Passing through one or more of the baffles may be one or more tubes. The one or more tubes may take pressure from the fired projectile from the high-pressure regions of the suppression system and direct that pressure to a low-pressure region in the opposite direction. This interruption slows the gases from exiting the firearm suppression system resulting in reduced sound.

In one embodiment, a firearm suppression system may include a first member coupleable to a muzzle brake. The muzzle brake may include a first portion and a second portion. The first portion may have a barrel with a plurality of vent apertures. The barrel may have a projectile passage. The second portion may comprise a first adapter that interacts with the first member and a barrel of a firearm. The muzzle brake may be manufactured by a three-dimensional printing process.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a side perspective view of a firearm suppression system;

FIG. **2** illustrates a partial cutaway view of a firearm suppression system;

FIG. **3** illustrates a side perspective view of a housing and a core of a firearm suppression system;

FIG. **4** illustrates a rear perspective view of a core of a firearm suppression system;

FIG. **5** illustrates a side elevation view of a core of a firearm suppression system;

FIG. **6** illustrates a cutaway view of a core of a firearm suppression system;

FIG. **7** illustrates an exploded view of a firearm suppression system;

FIG. **8** illustrates a cutaway view of a core of a firearm suppression system;

FIG. **9** illustrates an exploded view of a firearm suppression system;

FIG. **10** illustrates an exploded view of a firearm suppression system;

FIG. **11** illustrates an exploded view of a firearm suppression system;

FIG. **12** illustrates a front perspective view of a disc of a firearm suppression system;

FIG. **13** illustrates a rear perspective view of a disc of a firearm suppression system;

FIG. **14** illustrates a rear perspective view of an end cap of a firearm suppression system;

FIG. **15** illustrates a cutaway view of an end cap of a firearm suppression system;

FIG. **16** illustrates a cutaway view of a firearm suppression system;

FIG. **17** illustrates a rear perspective view of a core of a firearm suppression system;

FIG. **18** illustrates a perspective view of a firearm suppression system;

FIG. **19** illustrates a side elevation view of a firearm suppression system; and

FIG. **20** illustrates a side perspective view of a core of a firearm suppression system.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

While embodiments of the present disclosure may be subject to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and will be described in detail herein. However, the present disclosure is not intended to be limited to the particular features, forms, components, etc. disclosed. Rather, the present disclosure will cover all modifications, equivalents, and alternatives falling within the scope of the present disclosure.

Reference to the invention, the present disclosure, or the like are not intended to restrict or limit the invention, the present disclosure, or the like to exact features or steps of any one or more of the exemplary embodiments disclosed herein. References to "one embodiment," "an embodiment," "alternate embodiments," "some embodiments," and the like, may indicate that the embodiment(s) so described may include a particular feature, structure, or characteristic, but not every embodiment necessarily includes the particular feature, structure, or characteristic.

Any arrangements herein are meant to be illustrative and do not limit the invention's scope. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation. Unless otherwise defined herein, such terms are intended to be given their ordinary meaning not inconsistent with that applicable in the relevant industry and without restriction to any specific embodiment hereinafter described.

It will be understood that the steps of any such processes or methods are not limited to being carried out in any particular sequence, arrangement, or with any particular graphics or interface. In fact, the steps of the disclosed processes or methods generally may be carried out in various, different sequences and arrangements while still being in the scope of the present invention. Certain terms are used herein, such as "comprising" and "including," and similar terms are meant to be "open" and not "closed" terms. These terms should be understood as, for example, "including, but not limited to."

As previously described, there is a need for a suppression system that reduces flash, noise, and back gassing while increasing accuracy. The present invention seeks to solve these and other problems.

The firearm suppression system described herein is configured to optimize the relationships between sound, recoil, and back gassing. It will be understood that various embodiments of the firearm suppression system may optimize one relationship over another. For example, in one embodiment, the firearm suppression system may seek to prevent back gassing. The firearm system may comprise a housing, a core, and an end cap. The core may be a three-dimensional printed mono-core. The core may include hexagonal-shaped apertures (e.g., honey comb shaped) that connect to and function with baffles. The core may be positioned in the housing. In some embodiments, the core and housing may be printed or manufactured as a single unit. It will be understood that due

to the configuration of the core and housing, the firearm suppression system essentially eliminates back gassing. Further, the back gassing is diminished by pressure equalizing technology (PET). PET is the process in which high-pressure gases entering into the core and housing immediately fills the entire volume of the housing. By filling the entire area of the housing, the pressure from the gas operated gun is lowered and equalized.

Because of the unique configuration of the housing and the core, the firearm suppression system can manage gas flows and baffle angles in order to statistically balance sound, recoil, and back gassing to optimize performance. Other suppressors on the market have struggled to reduce sound and back gassing in a suppressor due to the inverse relationship between the two. It will be appreciated that some embodiments of the firearm suppression system are statistically balanced so as to reduce or eliminate the effects of back gassing into the user's face when operating a gas operated firearm, such as an automatic rifle, while also making it hearing safe. Because these are inverse relationships others in the past have not been able to design a product that can accomplish both items—reducing noise and back gassing.

As shown in FIGS. **1-6**, in one embodiment, a firearm suppression system **100** comprises a housing **102** including a first end **104** and a second end **106**, a muzzle adapter **108**, an end cap **110**, and a core **112**. The housing **102** may be cylindrical-shaped. In some embodiments, the housing **102** may be rectangular-shaped or any other shape may be envisioned. In some embodiments, an inner surface **114** of the housing **102** may be substantially circular in shape while an outer surface **116** of the housing **102** is, for example, rectangular shaped. It could be envisioned that the housing **102** may vary in circumference and in length. That is, different calibers, from .17 caliber to .30 caliber, may use different sizes of housings, or the same size of housing. For example, a first size of housing **102** may be used for a .22 caliber firearm while a second size of housing may be used for a .30 caliber. The housing **102** and the core **112** may be custom made, in some embodiments, for a specific caliber. It will be appreciated that there may be any number of housing sizes. The housing **102** may be manufactured from titanium. Other housing materials may include, but are not limited to, aluminum, steel, or carbon fiber. To manufacture the housing **102**, the housing **102** may be printed via a three-dimensional printer, milled, or manufactured by any other means known in the art. In some embodiments, the core and housing may be printed or manufactured as a single unit without multiple removable components.

Furthermore, the housing **102** includes the inner surface **114** and the outer surface **116**, both of which may create a cylindrically-shaped housing. The housing **102** includes a first aperture **118** at the first end **104** and a second aperture **120** at the second end **106**. An inner compartment **122** may be interposed between the first aperture **118** and the second aperture **120**. The inner compartment **122** may be substantially the same circumference from the first end **104** to the second end **106**. As shown, the inner compartment **122** may be configured to receive the core **112**.

Proximate the first end **104** of the housing **102** may be the muzzle adapter **108** that is removably attachable to the core and/or housing, and the second end **106** of the housing **102** may comprise the end cap **110** that is removably attachable thereto. In some embodiments, the muzzle adapter **108** may be present in the core **112** and/or housing **102** so as to be directly threaded onto a firearm. The muzzle adapter **108** and end cap **110** may include threaded fasteners **124** so as to be threadably coupleable to housing **102** and/or the core **112**. In some embodiments, the muzzle adapter **108** may be 1⅜"×24 Threads Per Inch, which is a universal attachment for many firearms. Accordingly, the firearm suppression system **100** may be coupled to numerous different types of firearms.

The end cap **110** may be threadably coupled to the second end **106** of the housing **102**. Other fastening mechanisms may be envisioned. The end cap **110** may rest against the second end **106** of the housing **102**. Further, the end cap **110** may have a circumference that matches the circumference of the housing **102**, thereby making the end cap **110** flush with the housing **102**. However, it will be understood that the end cap **110** may be numerous circumferences. As illustrated in FIG. **2**, the end cap **110** may comprise a plurality of vent apertures **126** that allow gas from the fired cartridge to escape the firearm suppression system **100** and, more particularly, the inner compartment **122**. The plurality of vent apertures **126** may be spaced apart and positioned in an annular formation on the end cap **110**, or may be in any other formation. The end cap **110** may also comprise a projectile/bullet aperture **128** where the bullet fired from a cartridge may leave the gun and system **100**. The end cap **110** may be machined from a solid piece of material, such as aluminum, steel, or titanium. In some embodiments, the end cap **110** may be printed via a three-dimensional printer out of titanium, plastics, or any other material. The end cap **110** includes a first side **130** facing outward away from the housing **102** and a second side **132** facing inward towards the inner compartment **122** and firearm's muzzle. The first side **130** of the end cap **110** may be concave. With the first side **130** being concave, less material is needed, which reduces the weight of the end cap **110** and the firearm suppression system **100** overall. The end cap **110** may have annular ridges **134** increasing in diameter as they move from the projectile aperture **128** outward. In some embodiments, the first side **130** may be convex. While in other embodiments, the first side **130** may be flat. The second side **132** of the end cap **110** includes a ledge **136** that rests on and is flush with the second end **106** of the housing **102**. A sidewall **138** that couples to the ledge **136** may be an annular protrusion that contacts the inner surface **114** of the housing **102**. The sidewall **138** may be threaded. To insert the end cap **110** into the housing **102**, a user may use a tool or their fingers to engage the end cap **110** with the threaded fastener **124** until the end cap **110** is tightly secured. At times, the firearm suppression system **100** may operate without an end cap **110**, thereby allowing the gasses to exit the inner compartment **122**. In some embodiments, a disc may be interposed between the end cap **110** and the core **112**. With the disc positioned thereinbetween, additional noise reduction may be experienced. The disc may be a circumference that reflects the circumference of the inner compartment **122**.

The core **112** may be removably attachable to the housing **102** and positioned within the inner compartment **122** of the housing **102**. It will be appreciated that the core **112** may easily be removed from the housing **102** and cleaned, thereby making maintenance of the firearm suppression system **100** simple. The core **112** may be threadably coupled to the housing **102** via the threaded fastener **124** at the first end **104** of the housing **102**. Further, the core **112** may be substantially cylindrical-shaped so as to fit within the housing **102**. Between an outer surface **140** of the core **112** and the inner surface **114** of the housing **102**, there may be a channel **142** that equalizes pressure. The channel **142** may surround the core 360 degrees starting at the first end **104** of the housing **102** and ending at the second end **106** of the housing **102**. The channel **142** allows the incoming high

pressure to enter into the core **112**, immediately flow to the outside of the core between the housing **102** and the core **112** and proceed down the entire length of the firearm suppression system **100**. This equalizes the high pressures gas through the entire system **100** rapidly so that high pressure is converted to low pressure, which means that the operating system of the firearm is not affected as it typically would be with high pressure. Due to this, there is a reduction or elimination of additional gases that travel back through the gun's operating system and into the user's face. As such, the pressure channel **142** equalizes pressure and moves the pressure towards and out of the vent apertures **126**. In some embodiments, the firearm suppression system **100** may lack vent apertures **126** which may, for example, achieve greater sound reduction. The core **112** may be printed via a three-dimensional printer, or manufactured by other means known in the art. The core **112** may be titanium, aluminum, ceramic, or other materials known in the art. It will be appreciated that numerous cores may be used with a single housing **102** so as to allow a user to switch cores to address a particular caliber.

The outer surface **140** of the core **112** may comprise a plurality of core apertures **144** that allow gas passing from the projectile and operating system to pass to the channel **142**. The plurality of core apertures **144** may be substantially hexagonal shaped and have the appearance of a honeycomb. However, in other embodiments, the plurality of core apertures **144** may be circular, square shape, or any other shape. As shown in FIGS. **4** and **6**, the core **112** may include an inner surface **146** that comprises baffles **148** that interact with the plurality of core apertures **144** (FIG. **5**). These baffles **148** may be extruded inward at various prescribed angles (FIG. **6**). The baffles **148** may be angled between 30 degrees to 70 degrees, but more preferably between 40 degrees to 60 degrees. With baffles **148** being set between the aforementioned ranges, the baffles **148** have additional surface area for heat transfer, thereby reducing the effects of the gasses from the fired projectile. A front end **150** of the core **112**, positioned near the end cap **110**, may include a baffle (e.g., end cap baffle) with baffle apertures **152** to allow additional gas to escape the core **112** and the firearm suppression system **100**. In some embodiments, gases moving down the length of the housing **102** may contact the end cap **110** and re-enter the last baffle so as to exit the baffle apertures **152**, which lead to the vent apertures **126**. The baffles **148** may be positioned along the length of the core **112**. The configuration of the baffles **148** may be generally conically shaped with a hexagonal-like border circumscribing the baffles **148**. In some embodiments, the baffles may be corrugated, star shaped, diamond shaped, or any other shape to maximize surface area. It will be appreciated that the configuration of the baffles **148** increases and maximizes surface area for cooling hot gases from the exiting projectile quicker while passing through the system **100**. The baffles **148** may angle downward until a projectile passage **154**, which may be located at the center of the core and center of the baffles **148** that extends from one end to the other.

Because of the design of the core **112**, the system **100** can be optimized to get the desired relationship between sound, recoil, and back gassing. In other suppressors found on the market, the gas enters at a high pressure and moves from baffle to baffle filling each area with gas. Then the gas moves to the next baffle to be filled. While the gasses are being slowed down as they move forward, until the gas fills the entire suppressor and the pressure is progressively decreased. Then high pressure is present during the operating system's cycle time. During this time, the high-pressure travels back through the gas tube and increases the gasses flowing to the operating system. This causes increased gasses in the user's face, increased bolt velocity, and increased sound to the user's ears. While this process is efficient in reducing sound on non-gas operated guns, it has a negative effect on back gassing with gas operated firearms. In another popular design, the suppressor uses "flow through technology," which does not use baffles to slow the gas but uses chambers that flow gases back and forth and out the end of the suppressor. This design is low pressure and is good for back gassing but not for sound reduction. Accordingly, the firearm suppression system **100** addresses both back-gassing and sound reduction to a hearing safe level on gas operated systems, like an AR, by statistically optimizing the relationship between them. The system **100** may also reduce first round pop based upon its configuration. It may also be appreciated that the system utilizes a monocore with baffles positioned therein to reduce sound, recoil, and back gassing.

As shown in FIGS. **7-8**, in one embodiment, a firearm suppression system **200** comprises a housing **202** including a first end **204** and a second end **206**, an end cap **208**, and a core **210**. The housing **202** may be cylindrical shaped. In some embodiments, the housing **202** may be rectangular shaped or any other shape may be envisioned. The housing **202** may comprise an inner surface **212** and an outer surface **214**. It could be envisioned that the housing **202** may vary in circumference and in length. To manufacture the housing **202**, the housing **202** may be printed via a three-dimensional printer, milled, or manufactured by any other means known in the art. The housing **202** includes a first aperture **216** at the first end **204** and a second aperture **218** at the second end **206**. An inner compartment **220** may be interposed between the first aperture **216** and the second aperture **218**. The inner compartment **220** may be configured to receive the core **210**.

The end cap **208** may be threadably coupled to the second end **206** of the housing **202**. Other fastening mechanisms may be envisioned. The end cap **208** may rest against the second end **206** of the housing **202**. Further, the end cap **208** may have a circumference that matches the circumference of the housing **202**, thereby making the end cap **208** flush with the housing **202**. The end cap **208** may comprise a plurality of vent apertures **222** that allow gas from the fired cartridge to escape the firearm suppression system **200** and, more particularly, the inner compartment **220**. The end cap **208** may also comprise a projectile/bullet aperture **224** where the bullet fired from a cartridge may leave the gun and system **200**.

The core **210** may be removably attachable to the housing **202** and positioned within the inner compartment **220** of the housing **202**. The core **210** may be threadably coupled to the housing **202** at the first end **204** of the housing **202**. Further, the core **210** may be substantially cylindrical shaped so as to fit within the housing **202**. The core **210** may comprise a first channel **226**A and a second channel **226**B both of which wrap around an outer surface **228** of the core **210** and assist in removing gas from the system **200**. The core **210** may be printed via a three-dimensional printer, or manufactured by other means known in the art. The core **210** may be titanium, aluminum, ceramic, or other materials known in the art. The outer surface **228** of the core **210** may comprise a plurality of core apertures **230** that allow gas passing from the projectile and operating system to pass to the channels **226**A, **226**B. The plurality of core apertures **230** may be ovular shaped, or any other shape. The core **210** may include an inner surface **232** that comprises baffles **234** that couple to the plurality of core apertures **230**. These baffles **234** may be extruded inward at a prescribed angle. The baffles **234**

may be positioned along the length of the core **210**. The configuration of the baffles **234** may be generally conically shaped. It will be appreciated that the configuration of the baffles **234** increase surface area for cooling hot gases from the exiting projectile quicker while passing through the system **200**.

As shown in FIGS. **9-10**, in one embodiment, a firearm suppression system **300** comprises a housing **302** including a first end **304** and a second end **306**, a rear cap **308**, and a core **310**. The housing **302** may be cylindrical shaped. The housing **302** may be printed via a three-dimensional printer, milled, or manufactured by any other means known in the art. The housing **302** includes a first aperture **312** at the first end **304** and a second aperture **314** at the second end **306**. An inner compartment **316** may be interposed between the first aperture **312** and the second aperture **314**. The inner compartment **316** may be configured to receive the core **310**. The rear cap **308** may be threadably coupled to the first end **304** of the housing **302**. The rear cap **308** may rest against the first end **304** of the housing **302**. The rear cap **308** may be configured to secure the core **310** in the housing **302**.

The core **310** may be removably attachable to the housing **302** and positioned within the inner compartment **316** of the housing **302**. The core **310** may be threadably coupled to the housing **302** via the rear cap **308**. Further, the core may comprise a protrusion **318** that lines up with and fits into a notch **320** in the second end **306** of the housing **302**, thereby providing a secure fit between the core **310** and the housing **302**. Further, the core **310** may be substantially cylindrical shaped so as to fit within the housing **302**. The core **310** may be printed via a three-dimensional printer, or manufactured by other means known in the art. The core **310** may be titanium, aluminum, ceramic, or other materials known in the art. The core **310** may comprise a plurality of core apertures **320** that allow gas passing from the projectile and operating system to pass via the system **300**. The plurality of core apertures **320** may be hexagonal shaped. The core **310** may include an inner surface **322** that comprises baffles **324** that couple to the plurality of core apertures **320**. It will be appreciated that the configuration of the baffles **324** increase surface area for cooling hot gases from the exiting projectile quicker while passing through the system **300**.

As shown in FIGS. **11-13**, in one embodiment, a firearm suppression system **400** comprises a housing **402**, a core **404**, an end cap **406**, and a disc **408**. The housing **402**, the core, **404**, and the end cap **406** may be similar to any of the previously discussed embodiments, such as embodiment **100**. The disc **408** (e.g., shutter) may be placed proximate the end cap **406**. In some embodiments, the disc **408** and its functions may be incorporated into the end cap **406**, or in other words may be the end cap **406**. In other embodiments, the disc/shutter **408** may be a single unit with the core and other limitations, being manufactured from a single piece of material. The disc **408** may comprise a plurality of fingers **410**, generally triangular shaped, pointing inward towards a second projectile aperture **412** and the core **404** when assembled. As the pressure from a bullet contacts an inner face **414** of the disc **408** and temporarily restricts the diameter of the second projectile aperture **412** to a smaller diameter. After the pressure is lowered, the second projectile aperture **412** returns to its resting diameter. It will be appreciated that the disc **408** may be produced in numerous configurations, such as any apparatus that is triggered by pressure which restricts the gas flow from exiting the aperture or apertures of the system or directly integrated with an end cap.

As shown in FIGS. **14-15**, in one embodiment, an end cap system **500** may comprise an end cap **502** that may be used with any of the other firearm suppression systems **100**, **200**, **300**, **400**. The end cap **502** may be actuated by pressure. That is, pressure from gasses after a bullet is fired may close a projectile aperture **504** a designated amount, similar to a shutter. This may happen as soon as the bullet/projectile exits the system **500**, which produces a quieter system by slowing the release of gases outside of the fire suppression system. The end cap **502** may comprise the projectile aperture **504**, where the projectile may exit the suppression system. The end cap **502** may comprise a pressure channel **506** that receives pressure from the exiting projectile. The pressure channel **506**, running parallel to the projectile aperture **504**, may lead to an end cap closure channel **508**, being perpendicular thereto. The end cap closure channel **508** may lead to the projectile aperture **504** and narrow proximate the projectile aperture **504**, thereby creating a projectile ledge **510**. The end cap closure channel **508** may receive a closure member **512** that is positioned therein. Further, a key **514** may comprise a shaft **516** and a head **518** may be placed in the end cap closure channel **508**. More particularly, the shaft **516** may comprise a spring **520** that is positioned under the head **518** and down the shaft **516**, resting on the projectile ledge **510**. The shaft **516** may protrude into the projectile aperture **504**. The pressure enters into a pathway in the end cap **502**, pushes down on the key **514**, compresses the spring **520** and moves the shaft **516** into the projectile aperture **504** to restrict the flow of gases.

As shown in FIGS. **16-17**, in one embodiment, a firearm suppression system **600** comprises a housing **602** and a core **604**. The core **604** may be removably attachable to the housing **602** and positioned within the housing **602**. It will be appreciated that the core **604** may be easily removed from the housing **602** and cleaned, thereby making maintenance of the firearm suppression system **600** simple. The core **604** may be threadably coupled to the housing **602**. Further, the core **604** may be substantially cylindrical shaped so as to fit within the housing **602**. The core **604** may be printed via a three-dimensional printer, or manufactured by other means known in the art. The core **604** may be titanium, aluminum, ceramic, or other materials known in the art. It will be appreciated that numerous cores may be used with a single housing **602** so as to allow a user to switch cores to address a particular caliber.

An outer surface of the core **604** may comprise a plurality of core apertures **606**. The plurality of core apertures **606** may be substantially hexagonal shaped and have the appearance of a honeycomb. The core **604** may include an inner surface that comprises baffles **608** that interact with the plurality of core apertures **606**. These baffles **608** may be extruded inward, toward a muzzle when coupled to a firearm, at various prescribed angles. The baffles **608** may be angled between 30 degrees to 70 degrees, but more preferably between 40 degrees to 60 degrees. With baffles **608** being set between the aforementioned ranges, the baffles **608** have additional surface area for heat transfer, thereby reducing the effects of the gasses from the fired projectile. The baffles **608** may be positioned along the length of the core **604**. The configuration of the baffles **608** may be generally conically shaped with a hexagonal-like border circumscribing the baffles **608**. In some embodiments, the baffles **608** may be corrugated, star shaped, diamond shaped, or any other shape to maximize surface area. It will be appreciated that the configuration of the baffles **608** increases and maximizes surface area for cooling hot gases from the exiting projectile quicker while passing through the system

600. The baffles 608 may angle downward until a projectile passage 610, which may be located at the center of the core 604 and center of the baffles 608 that extends from one end to the other. Passing through one or more of the baffles 608 may be one or more tubes 612A, 612B, 612C, 612D, or pressure reduction channels. That is, for example, a first tube may pass through four baffles while a second tube may pass through three baffles. In some embodiments, channels may replace the one or more tubes 612A, 612B, 612C, 612D, thereby allowing additional gasses to be released throughout the system. The one or more tubes 612A, 612B, 612C, 612D may be generally parallel with the projectile passage 610 until an end portion that may be at an angle (e.g., 70-90 degrees) so as to redirect pressure towards the baffle where the one or more tubes 612A, 612B, 612C, 612D ends and eventually towards the projectile passage 610. Accordingly, the one or more tubes 612A, 612B, 612C, 612D may take pressure from the fired projectile from the high-pressure regions of the suppression system 600 and direct that pressure to a low-pressure region in the opposite direction. For example, this high-pressure gas collides with the gases flowing down the center of the suppressor, the projectile passage 610, causing an interruption to the gas flow. This interruption slows the gases from exiting the firearm suppression system 600 resulting in reduced sound.

As shown in FIGS. 18-19, in one embodiment, a firearm suppression system 700 may include a first member 702 coupleable to a muzzle device 704 (e.g., muzzle brake or flash hider), both of which may resemble and have similar functionality to the muzzle adapter 108 in embodiment 100 and shown in FIG. 2. The muzzle brake 704 may include a first portion 706 and a second portion 708. The first portion 706 may have a barrel 710 with a plurality of vent apertures 712. The barrel 710 may have a projectile passage 713. The second portion 708 may comprise a first adapter 714 that interacts with the first member 702 and a barrel of a firearm. The first adapter 714 may comprise a first taper 716 that aligns and prevents gasses from escaping and a second taper 718 that aligns and secures the firearm suppression system 700. The first taper 716 and the second taper 718 may have corresponding tapers that they interact with in the first member 702. The firearm suppression system 700 is a fixed taper system. The muzzle brake 704 may be manufactured by a three-dimensional printing process. In some embodiments, the muzzle brake system 700 may comprise a housing/shell that is removably attachable and encases the muzzle brake 704. Length and width of the muzzle brake 704 may vary.

As shown in FIG. 20, in one embodiment, a core 800 may comprise one or more vent apertures 802 and a plurality of sealed vent apertures 804. Both the one or more vent apertures 802 and the plurality of sealed vent apertures 804 may lead to baffles, similar to the embodiments discussed above. It will be appreciated that with a few vent apertures 802 only small amounts of pressure may be released therethrough and the gasses exiting through the vent apertures 802 may be redirected through various other vent apertures 802 and back towards the projectile aperture in the core.

It will be understood that while various embodiments have been disclosed herein, other embodiments are contemplated. Further, certain embodiments of the present disclosure may include, incorporate, or otherwise comprise properties or features described in other embodiments. Consequently, various features of certain embodiments can be compatible with, combined with, included in, and/or incorporated into other embodiments of the present disclosure. Therefore, disclosure of certain features or components relative to a specific embodiment of the present disclosure should not be construed as limiting the application or inclusion of said features or components to the specific embodiment unless stated. As such, other embodiments can also include said features, components, members, elements, parts, and/or portions without necessarily departing from the scope of the present disclosure.

The embodiments described herein are examples of the present disclosure. Accordingly, unless a feature or component is described as requiring another feature or component in combination therewith, any feature herein may be combined with any other feature of a same or different embodiment disclosed herein. Although only a few of the example embodiments have been described in detail herein, those skilled in the art will appreciate that modifications are possible without materially departing from the present disclosure described herein. Accordingly, all modifications may be included within the scope of this invention.

What is claimed is:

1. A firearm suppression system comprising:

a housing comprising a first end and a second end, the housing comprising:

a first aperture at the first end,

a second aperture at the second end;

an inner compartment interposed between the first aperture and the second aperture, the inner compartment being substantially the same circumference from the first end to the second end;

an end cap with a projectile aperture; and

a core removably attachable to the housing and positioned therein, wherein the core comprises a plurality of core apertures on an outer surface that allow gas passing from a projectile and cartridge to pass to a channel between the inner surface of the housing and an outer surface of the core, the channel circumscribes the outer surface of the core and equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing.

2. The firearm suppression system of claim 1, wherein the core is printed from a three-dimensional printer.

3. The firearm suppression system of claim 1, wherein the end cap comprises a plurality of vent apertures.

4. The firearm suppression system of claim 1, further comprising a muzzle adapter.

5. The firearm suppression system of claim 1, wherein the end cap comprises a second side that comprises a ledge that rests upon and is flush with the second end.

6. The firearm suppression system of claim 1, wherein the end cap comprises a sidewall that is positioned in the inner compartment and rests against an inner surface of the housing.

7. The firearm suppression system of claim 6, wherein the sidewall comprises threads that couple to the housing.

8. The firearm suppression system of claim 1, further comprising a disc interposed between the end cap and the core.

9. The firearm suppression system of claim 1, wherein the plurality of core apertures is substantially hexagonal shaped.

10. The firearm suppression system of claim 1, wherein the core comprises an inner surface that includes baffles that interact with the plurality of core apertures.

11. The firearm suppression system of claim 10, wherein the baffles are extruded inward.

12. The firearm suppression system of claim 1, wherein the core includes an end cap baffle proximate the end cap in

the housing, the end cap baffle comprising baffle apertures that function in tandem with a plurality of vent apertures on the end cap.

13. A firearm suppression system comprising:

a housing comprising a first end and a second end, the housing comprising:

a first aperture at the first end,

a second aperture at the second end;

an inner compartment interposed between the first aperture and the second aperture, the inner compartment being substantially the same circumference from the first end to the second end;

an end cap actuated by pressure, the end cap comprising:

a projectile aperture;

a pressure channel running parallel to the projectile aperture;

a closure channel that is perpendicular to the pressure channel, the closure channel passing from an outer surface of the end cap to the projectile aperture;

a core removably attachable to the housing and positioned therein, the core comprising:

a plurality of core apertures, and

one or more baffles that interact with the plurality of core apertures;

wherein the end cap comprises a closure member that is positionable in the closure channel proximate the outer surface.

14. The firearm suppression system of claim **13**, further comprising a key placed in the closure channel.

15. The firearm suppression system of claim **14**, wherein the key comprises a head and a shaft, the shaft extendible into the projectile aperture.

16. The firearm suppression system of claim **14**, wherein the key comprises a spring positioned below the head, around the shaft, and resting on a projectile ledge in the closure channel.

17. A firearm suppression system comprising:

a housing comprising a first end and a second end, the housing comprising:

a first aperture at the first end,

a second aperture at the second end;

an inner compartment interposed between the first aperture and the second aperture, the inner compartment being substantially the same circumference from the first end to the second end;

a muzzle adapter threadably coupled to the first end and removably attachable to a barrel of a gun;

an end cap with a projectile aperture;

a core removably attachable to the housing and positioned therein, the core comprising:

a plurality of core apertures,

one or more baffles that interact with the plurality of core apertures, and

one or more pressure reduction tubes that each pass through a predetermined number of baffles, the one or more pressure reduction tubes comprise an angled end portion that angles toward the first end of the housing; and

a disc interposed between the end cap and the core.

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