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(54) **NOISE SUPPRESSOR FOR FIREARM**

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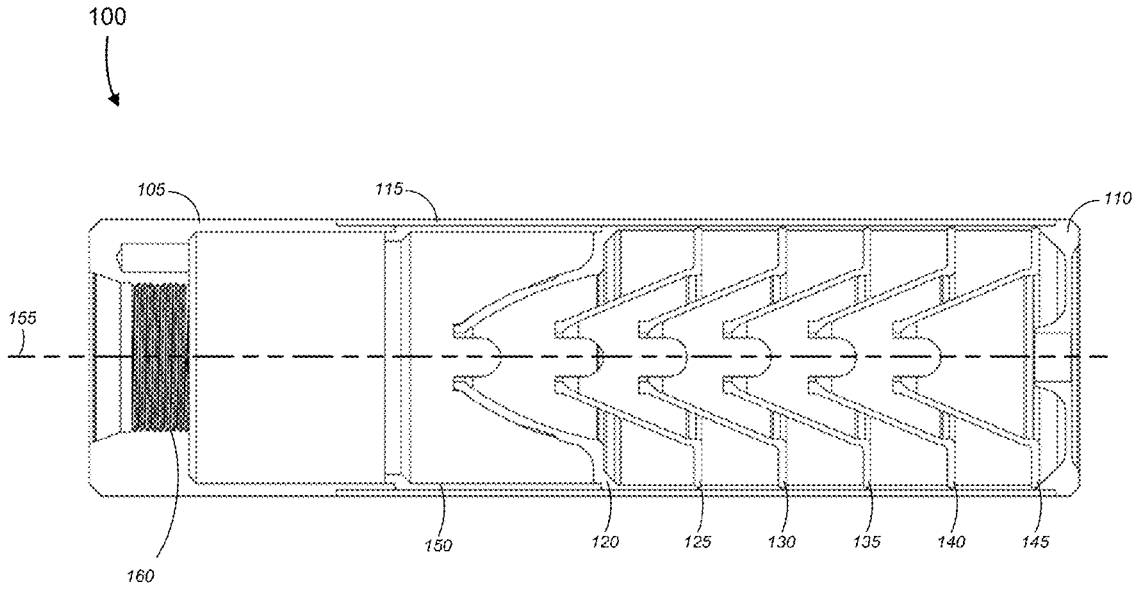
CPC ***F41A 21/30*** (2013.01)

(57) **ABSTRACT**

A noise suppressor design is provided that further reduces the weight of the suppressor, more quickly dissipates heat while maintaining structural integrity, and increases the strength of the suppressor. In various embodiments, a noise suppressor for a firearm might comprise a central axis, an outer surface, a plurality of baffles, a blast chamber, a proximal end cap, a distal end cap, and an outer wrap. The plurality of baffles might be disposed along the central axis, and the plurality of baffles might comprise a proximal baffle and a distal baffle. The proximal end cap might be coupled to the proximal baffle via the blast chamber, when the noise suppressor is assembled. The distal end cap might be affixed to the distal baffle, when the noise suppressor is assembled. The outer wrap might be affixed to at least a portion of the outer surface, when the noise suppressor is assembled.



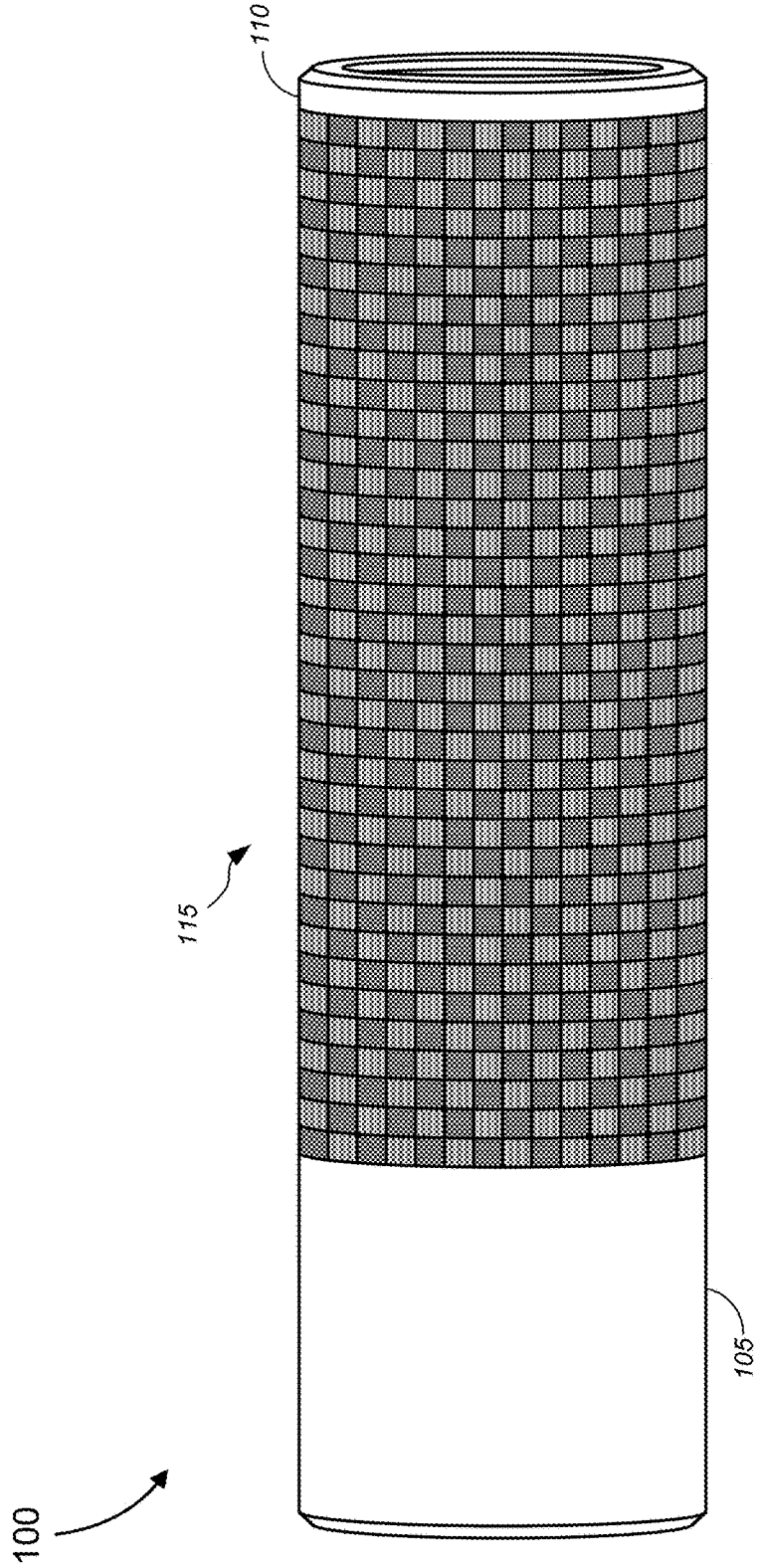


Fig. 1

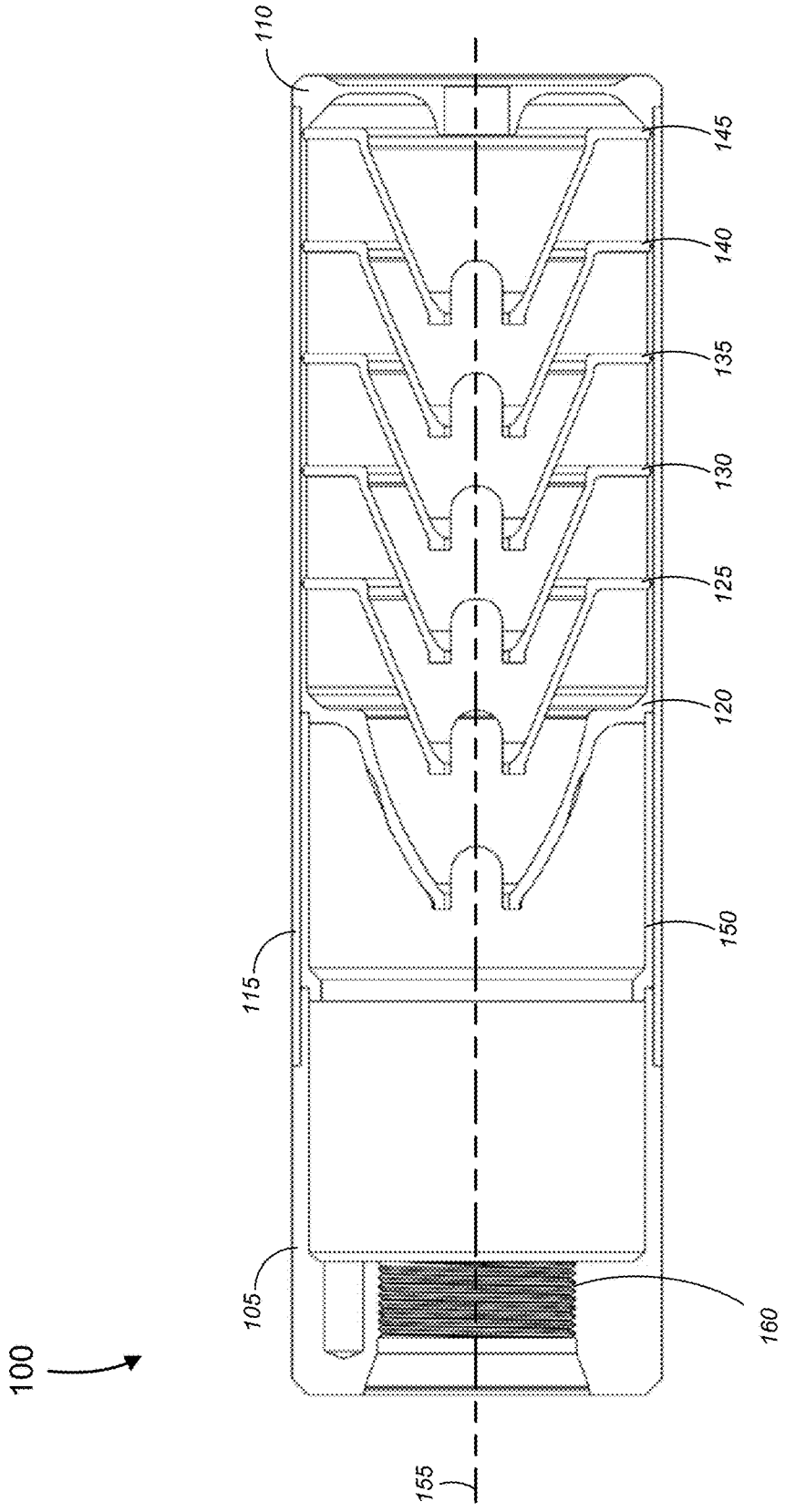


Fig. 2

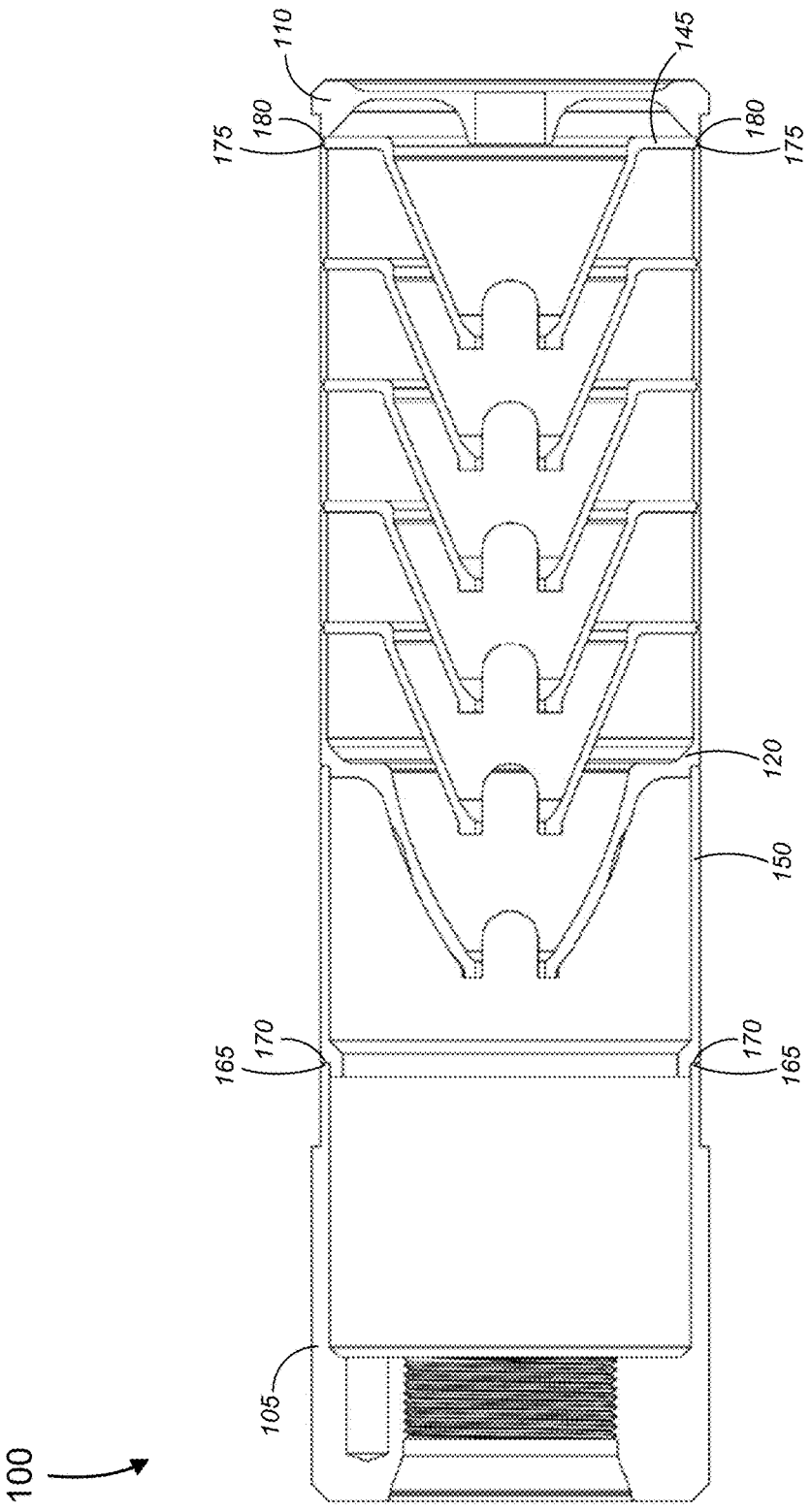


Fig. 3

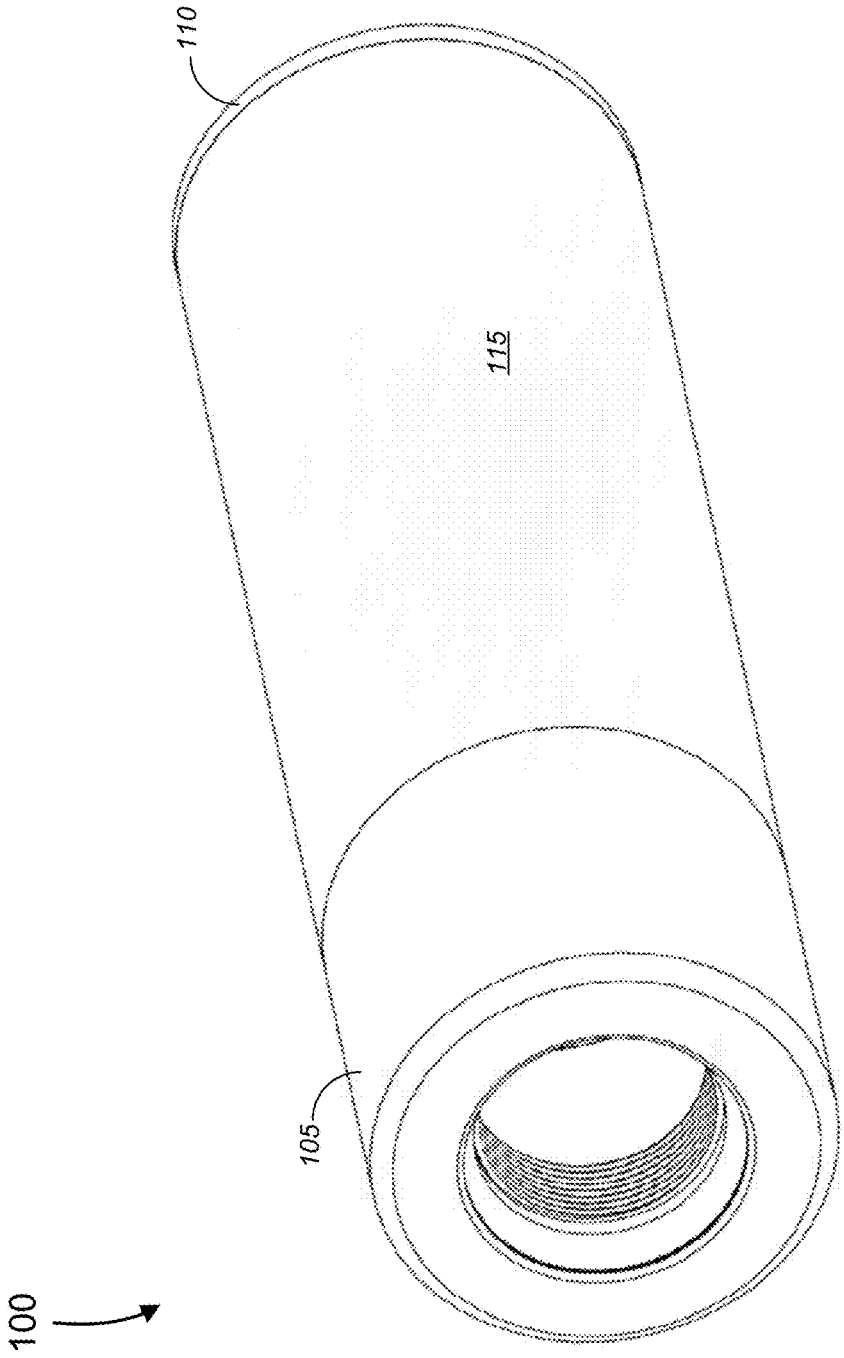


Fig. 4

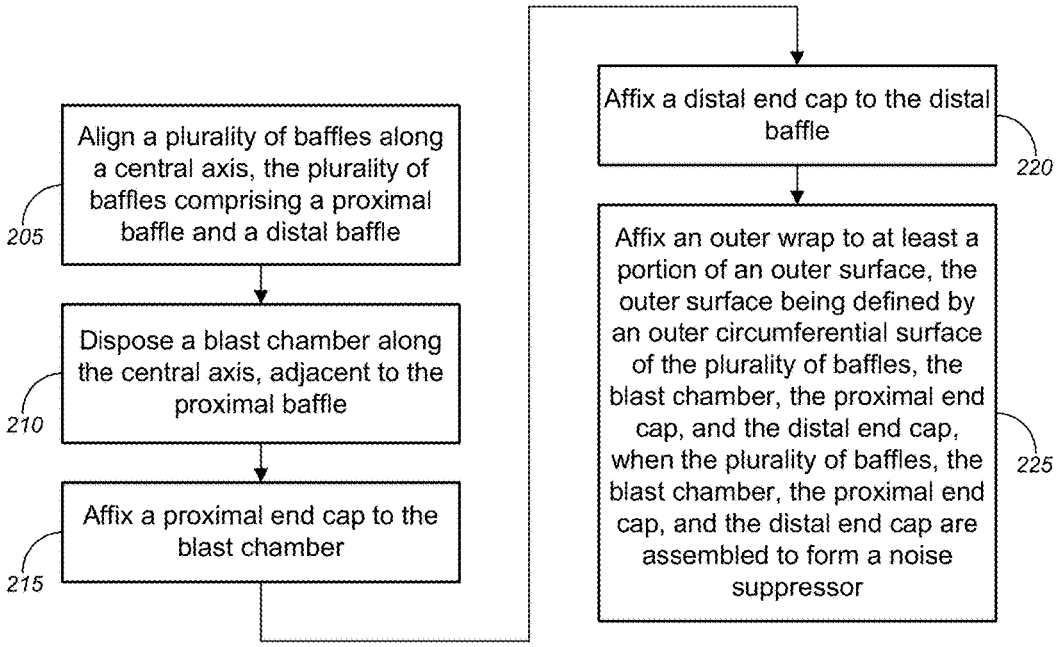

Align a plurality of baffles along a central axis, the plurality of baffles comprising a proximal baffle and a distal baffle
205
Dispose a blast chamber along the central axis, adjacent to the proximal baffle
210
Affix a proximal end cap to the blast chamber
215
Affix a distal end cap to the distal baffle
220
Affix an outer wrap to at least a portion of an outer surface, the outer surface being defined by an outer circumferential surface of the plurality of baffles, the blast chamber, the proximal end cap, and the distal end cap, when the plurality of baffles, the blast chamber, the proximal end cap, and the distal end cap are assembled to form a noise suppressor
225
200

Fig. 5

NOISE SUPPRESSOR FOR FIREARM

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Patent Application Ser. No. 62/322,063, filed Apr. 13, 2016 by Kurtis A. Palu and titled, "Noise Suppressor for Firearm" (Attorney Docket No. 0641.10PR), which is hereby incorporated by reference in its entirety.

[0002] This application may be related to the following applications (collectively, the "Related Applications"), each of which is incorporated by reference in its entirety: provisional U.S. Patent Application Ser. No. 62/470,708, filed Mar. 13, 2017 by Kurtis A. Palu et al. and titled, "Bipod for Firearm" (Attorney Docket No. 0641.11PR); U.S. patent application Ser. No. 15/404,837, filed Jan. 12, 2017 by Kurtis A. Palu et al. and titled "Noise Suppressor for Firearm" (Attorney Docket No. 0641.09), which claims the benefit of provisional U.S. Patent Application Ser. No. 62/278,270, filed Jan. 13, 2016 by Kurtis A. Palu et al. and titled, "Noise Suppressor for Firearm" (Attorney Docket No. 0641.09PR); U.S. patent application Ser. No. 15/281,323, filed Sep. 30, 2016 by Kurtis Allen Palu and titled "Locking Mechanism for Suppressor Mount" (Attorney Docket No. 0641.08), which claims the benefit of provisional U.S. Patent Application Ser. No. **62/236,487**, filed Oct. 2, 2015 by Kurtis Allen Palu and titled, "Suppressor Mount" (Attorney Docket No. 0641.08PR); U.S. patent application Ser. No. 14/816,321, filed Aug. 3, 2015 by Kurtis A. Palu et al. and titled, "Noise Suppressor for Firearm" (Attorney Docket No. 0641.07); U.S. patent application Ser. No. 14/987,984 (now U.S. Pat. No. 9,459,065), filed Jan. 5, 2016 by Kurtis A. Palu and titled, "Flash Suppressor for Firearm" (Attorney Docket No. 0641.03DIV), which is a divisional application of U.S. patent application Ser. No. 14/465,060 (now U.S. Pat. No. 9,261,319), filed Aug. 21, 2014 by Kurtis A. Palu and titled, "Flash Suppressor for Firearm" (Attorney Docket No. 0641.03); U.S. patent application Ser. No. 14/615,826 (now U.S. Pat. No. 9,366,495), filed Feb. 6, 2015 by Michael S. Coppinger et al. and titled, "Noise Suppressor for Firearm" (Attorney Docket No. 0641.02); and U.S. patent application Ser. No. 14/640,791 (now U.S. Pat. No. 9,593,899), filed Mar. 6, 2015 by Michael S. Coppinger et al. and titled, "Noise Suppressor for Firearm" (Attorney Docket No. 0641.01), which claims the benefit of provisional U.S. Patent Application Ser. No. **61/949,670**, filed Mar. 7, 2014 by Michael Shane Coppinger et al. and titled, "Sound Suppressor with Longitudinal Baffle" (Attorney Docket No. 0641.01PR).

COPYRIGHT STATEMENT

FIELD

[0004] The present disclosure relates, in general, to a firearm noise suppressor designed to minimize weight, dissipate heat, and increase strength. More particularly, the novel noise suppressor comprises one or more features including, without limitation, a carbon fiber outer wrap over a portion (i.e., an outer surface) of the noise suppressor.

BACKGROUND

[0005] In order to fire a projectile, a firearm utilizes an ignited propellant to create a high-pressure pulse of hot gases behind the projectile to force the projectile down the barrel of the firearm. When the high-pressure gases exit the barrel of the firearm, they generate a loud noise, commonly referred to as a "muzzle blast." Noise suppressors are commonly used with firearms, such as rifles and handguns, to reduce muzzle blast. To reduce muzzle blast, suppressors attach to the end of the firearm barrel and allow the high-pressure gases to expand, and thereby dissipate pressure, before exiting the firearm. By allowing the pressure behind the projectile to dissipate before exiting the firearm, a firearm suppressor can significantly reduce muzzle blast.

[0006] Two important characteristics of a noise suppressor are its weight and its ability to dissipate heat. When a noise suppressor is utilized with a high performance firearm, such as a rifle used in precision target competition, the heavier the suppressor, the more potential difficulty the user will have in maneuvering the firearm into various shooting positions. In addition, a heavy noise suppressor will also make it more difficult for the user to carry the firearm, particularly over long distances. Separately, when a noise suppressor is used, particularly with a high throughput of projectiles, the noise suppressor can be subject to temperatures often significantly exceeding 700 degrees Fahrenheit. As a result, noise suppressors must not only be able to maintain their structural integrity while being exposed to extreme operating temperatures, but must also be able to quickly dissipate heat. The ability of a noise suppressor to quickly dissipate heat is highly desirable because it can dramatically decrease the chance of the suppressor overheating and losing structural integrity. It also allows the noise suppressor to be removed from the firearm and otherwise maintained more quickly after use. Conventional noise suppressors, however, are typically made of metallic outer tubes that are not light weight and that do not dissipate heat very efficiently.

[0007] In addition, existing noise suppressors often utilize a metallic outer tube to cover the internal components of the suppressor such as baffles. When assembling such suppressors, the internal components are typically pressure fitted between two end caps and the outer tube. Because the outer tube must be slid over the internal components, both ends of the internal components are not accessible and, therefore, at least one end of the internal components cannot be permanently affixed to the applicable end cap. As a result, many existing noise suppressors are weaker at one or both of the locations where the internal components adjoin the end caps.

[0008] Accordingly, there is a need for a noise suppressor design that further reduces the weight of the suppressor, more quickly dissipates heat while maintaining structural integrity, and increases the strength of the suppressor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] A further understanding of the nature and advantages of particular embodiments may be realized by reference to the remaining portions of the specification and the drawings, in which like reference numerals are used to refer to similar components. In some instances, a sub-label is

associated with a reference numeral to denote one of multiple similar components. When reference is made to a reference numeral without specification to an existing sub-label, it is intended to refer to all such multiple similar components.

[0010] FIG. **1** shows a perspective side view of a noise suppressor that is an embodiment of the present invention.

[0011] FIG. **2** shows a cross sectional side view of the noise suppressor of FIG. **1**.

[0012] FIG. **3** shows a cross sectional side view of the noise suppressor of FIGS. **1** and **2** without the carbon fiber outer wrap of the present invention.

[0013] FIG. **4** shows a perspective view of the noise suppressor of FIGS. **1** and **2**.

[0014] FIG. **5** is a flow diagram illustrating a method for assembling a noise suppressor, in accordance with various embodiments.

DETAILED DESCRIPTION

[0015] Overview

[0016] Various embodiments provide for a noise suppressor that further reduces the weight of the suppressor, more quickly dissipates heat while maintaining structural integrity, and increases the strength of the suppressor.

[0017] In various embodiments, a noise suppressor for a firearm might comprise a central axis, an outer surface, a plurality of baffles, a blast chamber, a proximal end cap, a distal end cap, and an outer wrap. The plurality of baffles might be disposed along the central axis, and the plurality of baffles might comprise a proximal baffle and a distal baffle. The proximal end cap might be coupled to the proximal baffle via the blast chamber, when the noise suppressor is assembled. The distal end cap might be affixed to the distal baffle, when the noise suppressor is assembled. The outer wrap might be affixed to at least a portion of the outer surface, when the noise suppressor is assembled.

[0018] In alternative embodiments, a noise suppressor for a firearm might comprise a central axis, an outer surface, a proximal end cap, a distal end cap, a plurality of baffles, and an outer wrap. The plurality of baffles might be assembled adjacent to each other along the central axis between the proximal end cap and the distal end cap, the plurality of baffles, when assembled together, being disposed within the outer surface. The outer wrap might be affixed to at least a portion of the outer surface between the proximal end cap and the distal end cap, when the noise suppressor is assembled.

[0019] In either of these embodiments (or similar embodiments), the outer wrap might comprise a carbon fiber outer wrap. In some cases, the carbon fiber outer wrap might be affixed to the at least a portion of the outer surface in part with a resin (which, in some cases, might comprise a polyimide resin or an ultra-high temperature polyimide resin, or the like). In some instances, the resin has a thermal stability or thermostability of at least 700 degrees Fahrenheit. According to some embodiments, two or more of the components of the noise suppressor (i.e., two or more of the plurality of baffles, the blast chamber, the proximal end cap, and the distal end cap, etc.), being adjacent to each other, might be affixed to each other by welds. For example, the proximal end cap might be affixed to the blast chamber by a first weld, the blast chamber might be affixed to the proximal baffle by a second weld, the distal end cap might be affixed to the distal baffle by a third weld, and/or each of the plurality of baffles might be affixed to an adjacent baffle of the plurality of baffles by a fourth weld, and so on. In general, the outer wrap is of a material that can be affixed to the outer surface of the noise suppressor (or at least a portion of the outer surface of the noise suppressor) after both end caps have been affixed to adjacent components of the noise suppressor (i.e., the proximal end cap affixed to the blast chamber and the distal end cap affixed to the distal baffle, and the like), which cannot be accomplished with conventional noise suppressors that utilize a tube to slide over the outer surface prior to at least one of the end caps being welded or affixed to another component of the noise suppressor. In some cases, as with the embodiments that include carbon fiber as the material for the outer wrap, the outer wrap may be wrapped or wound around (or over) the circumferential outer surface of at least the plurality of baffles, the blast chamber, and at least portions of each end cap.

[0020] The carbon fiber outer wrap has a number of benefits for the noise suppressor, including, without limitation, a reduced weight and increased ability to dissipate heat. The carbon fiber outer wrap can also be applied (e.g., wrapped around or wound around the outer surface of at least a portion of the baffles, the blast chamber, and at least portions of each end cap) after the internal components of the noise suppressor are affixed to the external end caps, which increases the strength of the noise suppressor, as the two or more components of the noise suppressor can be welded together (as opposed to the conventional noise suppressor as discussed above). Carbon fiber and ultra-high temperature polyimide resin (such as MVK-19 ultra-high temperature polyimide resin or similar resin, or the like) have high thermal stability or thermostability, which enables the carbon fiber outer wrap and the resin to withstand the extreme operating temperatures of the noise suppressor.

[0021] The following detailed description illustrates a few exemplary embodiments in further detail to enable one of skill in the art to practice such embodiments. The described examples are provided for illustrative purposes and are not intended to limit the scope of the invention.

[0022] In the following description, for the purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the described embodiments. It will be apparent to one skilled in the art, however, that other embodiments of the present invention may be practiced without some of these specific details. In other instances, certain structures and devices are shown in block diagram form. Several embodiments are described herein, and while various features are ascribed to different embodiments, it should be appreciated that the features described with respect to one embodiment may be incorporated with other embodiments as well. By the same token, however, no single feature or features of any described embodiment should be considered essential to every embodiment of the invention, as other embodiments of the invention may omit such features.

[0023] Unless otherwise indicated, all numbers used herein to express quantities, dimensions, and so forth used should be understood as being modified in all instances by the term "about." In this application, the use of the singular includes the plural unless specifically stated otherwise, and use of the terms "and" and "or" means "and/or" unless otherwise indicated. Moreover, the use of the term "including," as well as other forms, such as "includes" and

"included," should be considered non-exclusive. Also, terms such as "element" or "component" encompass both elements and components comprising one unit and elements and components that comprise more than one unit, unless specifically stated otherwise.

[0024] In an aspect, a noise suppressor for a firearm might comprise a central axis, an outer surface, a plurality of baffles, a blast chamber, a proximal end cap, a distal end cap, and an outer wrap. The plurality of baffles might be disposed along the central axis, and the plurality of baffles might comprise a proximal baffle and a distal baffle. The proximal end cap might be coupled to the proximal baffle via the blast chamber, when the noise suppressor is assembled. The distal end cap might be affixed to the distal baffle, when the noise suppressor is assembled. The outer wrap might be affixed to at least a portion of the outer surface, when the noise suppressor is assembled.

[0025] In some embodiments, the outer wrap might comprise a carbon fiber outer wrap. In some cases, the carbon fiber outer wrap might be affixed to the at least a portion of the outer surface in part with a resin (which, in some cases, might comprise a polyimide resin or an ultra-high temperature polyimide resin, or the like). In some instances, the resin has a thermal stability of at least 700 degrees Fahrenheit.

[0026] According to some embodiments, the proximal end cap is affixed to the blast chamber by a first weld, while the blast chamber is affixed to the proximal baffle by a second weld, and the distal end cap is affixed to the distal baffle by a third weld.

[0027] In another aspect, a noise suppressor for a firearm might comprise a central axis, an outer surface, a proximal end cap, a distal end cap, a plurality of baffles, and an outer wrap. The plurality of baffles might be assembled adjacent to each other along the central axis between the proximal end cap and the distal end cap, the plurality of baffles, when assembled together, being disposed within the outer surface. The outer wrap might be affixed to at least a portion of the outer surface between the proximal end cap and the distal end cap, when the noise suppressor is assembled.

[0028] In some embodiments, the outer wrap might comprise a carbon fiber outer wrap. In some cases, the carbon fiber outer wrap might be affixed to the at least a portion of the outer surface in part with a resin (which, in some cases, might comprise a polyimide resin or an ultra-high temperature polyimide resin, or the like). In some instances, the resin has a thermal stability of at least 700 degrees Fahrenheit.

[0029] According to some embodiments, the noise suppressor might further comprise a blast chamber disposed between the proximal end cap and a first baffle of the plurality of baffles. In some cases, the proximal end cap is affixed to the blast chamber by a first weld, while the blast chamber is affixed to the first baffle by a second weld, and the distal end cap is affixed to a second baffle by a third weld. In some instances, each of the plurality of baffles is affixed to an adjacent baffle of the plurality of baffles by a fourth weld.

[0030] In yet another aspect, a method might comprise aligning a plurality of baffles along a central axis, the plurality of baffles comprising a proximal baffle and a distal baffle; disposing a blast chamber along the central axis, adjacent to the proximal baffle; affixing a proximal end cap to the blast chamber; affixing a distal end cap to the distal baffle; and affixing an outer wrap to at least a portion of an outer surface. The outer surface might be defined by an outer circumferential surface of the plurality of baffles, the blast chamber, the proximal end cap, and the distal end cap, when the plurality of baffles, the blast chamber, the proximal end cap, and the distal end cap are assembled to form a noise suppressor.

[0031] In some embodiments, the outer wrap might comprise a carbon fiber outer wrap. In some cases, affixing the outer wrap to the at least a portion of the outer surface might comprise applying a resin (which, in some cases, might comprise a polyimide resin or an ultra-high temperature polyimide resin, or the like) to the at least a portion of the outer surface; wrapping the carbon fiber outer wrap around the at least a portion of the outer surface, with the carbon fiber outer wrap in physical contact with the resin; and curing the resin, thereby affixing the carbon fiber outer wrap to the at least a portion of the outer surface. In some instances, the resin has a thermal stability of at least 700 degrees Fahrenheit.

[0032] According to some embodiments, the proximal end cap is affixed to the blast chamber by a first weld, while the blast chamber is affixed to the proximal baffle by a second weld, and the distal end cap is affixed to the distal baffle by a third weld. In some instances, each of the plurality of baffles is affixed to an adjacent baffle of the plurality of baffles by a fourth weld.

[0033] Various modifications and additions can be made to the embodiments discussed without departing from the scope of the invention. For example, while the embodiments described above refer to particular features, the scope of this invention also includes embodiments having different combination of features and embodiments that do not include all of the above described features.

SPECIFIC EXEMPLARY EMBODIMENTS

[0034] We now turn to the embodiments as illustrated by the drawings. FIGS. **1-5** illustrate some of the features of a noise suppressor that further reduces the weight of the suppressor, more quickly dissipates heat while maintaining structural integrity, and increases the strength of the suppressor, as referred to above. The apparatuses, systems, or methods illustrated by FIGS. **1-5** refer to examples of different embodiments that include various components and steps, which can be considered alternatives or which can be used in conjunction with one another in the various embodiments. The description of the illustrated apparatuses, systems, or methods shown in FIGS. **1-5** is provided for purposes of illustration and should not be considered to limit the scope of the different embodiments.

[0035] With reference to the figures, FIG. **1** shows a perspective side view of a noise suppressor **100** that is an embodiment of the present invention. As shown in the non-limiting example of FIG. **1**, noise suppressor **100** of the present invention comprises a proximal end cap **105**, a distal end cap **110**, and an outer wrap **115**. In some embodiments, the outer wrap **115** might comprise a carbon fiber outer wrap, or the like. As used herein, the term "proximal" is used to refer to the end of the component or element that is closest to the barrel of a firearm, when the suppressor is removably affixed to the barrel of the firearm, while the term "distal" is used to refer to the end of the component or element that is farthest from the barrel of the firearm, when the suppressor is removably affixed to the barrel of the firearm.

[0036] Although FIG. **1** depicts the outer wrap or carbon fiber outer wrap **115** as having a cross-weave-type texture,

the various embodiments are not so limited, and the outer wrap or carbon fiber outer wrap **115** may have any suitable texture (or structure) achievable by fabrication of the outer wrap or carbon fiber outer wrap **115**, and as desired. In some cases, the carbon fiber outer wrap **115** might be formed by weaving carbon fibers into a fabric then combined with a resin and wound or molded into the desired shape; the carbon fiber outer wrap **115**, so formed, may be referred to as a carbon-fiber-reinforced polymer. In some cases, the carbon fiber outer wrap **115** might be formed by combining carbon fibers with materials (such as graphite, or the like) to form carbon-carbon composites having very high heat tolerance.

[0037] FIG. **2** shows a cross sectional side view of the noise suppressor **100** of FIG. **1**, and shows the various components of noise suppressor **100** as the components would be assembled. As shown in the non-limiting embodiment of FIG. **2**, noise suppressor **100** comprises proximal end cap **105**, distal end cap **110**, outer wrap **115**, a plurality of baffles **120-145**, and a blast chamber **150**. Although six baffles are shown, the various embodiments are not so limited, and any suitable number of baffles may be assembled as required or as desired. When the noise suppressor **100** is assembled, baffles **120-145** and blast chamber **150** are nested inside one another (or nested one inside an adjacent one), as shown in FIG. **2**. Baffles **120-145** and blast chamber **150** are oriented or disposed along central axis **155**. The proximal end cap **105** is affixed to the blast chamber **150**, which is affixed to baffle **120** (which is also referred to herein as "the proximal baffle"). The distal end cap **110** is affixed to baffle **145** (which is also referred to herein as "the distal baffle"). According to some embodiments, the proximal end cap is affixed to the blast chamber by a first weld, while the blast chamber is affixed to the proximal baffle by a second weld, and the distal end cap is affixed to the distal baffle by a third weld. In some embodiments, each of the plurality of baffles **120-145** is affixed to an adjacent baffle of the plurality of baffles by a fourth weld. The first, second, and third welds serve to strengthen the structure of the noise suppressor **100**, when it is assembled. The fourth weld (if utilized between pairs of adjacent baffles) serves to further strengthen the structure of the noise suppressor **100**, when it is assembled. When assembled (as shown in FIGS. **1** and **2**), noise suppressor **100** can be attached to the muzzle or barrel of a firearm (not shown) via threaded interface **160**.

[0038] In some embodiments, the outer wrap or carbon fiber outer wrap **115** might be affixed to at least a portion of an outer surface of the noise suppressor **100**, in some cases, via use of a resin or the like (not shown). In some cases, the resin might include, without limitation, a polyimide resin or an ultra-high temperature polyimide resin, or the like, such as, but not limited to, MVK-19 ultra-high temperature polyimide resin sold by Maverick Corporation headquartered at 11379 Grooms Road, Blue Ash, Ohio 45242, or the like. Ideally, the resin or the like might have a thermal stability or thermostability of at least 700 degrees Fahrenheit. Here, the outer surface of the noise suppressor **100**, in some cases, might be defined by an outer circumferential surface of the plurality of baffles **120-145**, the blast chamber **150**, the proximal end cap **105**, and the distal end cap **110** (collectively, the "internal components of the noise suppressor"), when the plurality of baffles **120-145**, the blast chamber **150**, the proximal end cap **105**, and the distal end cap **110** (i.e., the internal components) are assembled to form the noise suppressor **100**. According to some embodiments, affixing the outer wrap or carbon fiber outer wrap **115** to the at least a portion of the outer surface might comprise applying a resin to the at least a portion of the outer surface, after the plurality of baffles **120-145**, the blast chamber **150**, the proximal end cap **105**, and the distal end cap **110** have been assembled and affixed to each other (or at least with each of these components having been affixed to adjacent components of the noise suppressor); wrapping the carbon fiber outer wrap around the at least a portion of the outer surface (in some cases, utilizing techniques including, but not limited to, filament winding composite structure fabrication techniques, or the like), with the carbon fiber outer wrap in physical contact with the resin; and curing the resin, thereby affixing the carbon fiber outer wrap to the at least a portion of the outer surface. The carbon fiber outer wrap **115** provides efficient heat dissipation functionality, while being light in weight and while (together with the resin that allows the carbon fiber outer wrap **115** to be affixed to the at least a portion of the outer surface of (the components of) the noise suppressor **100**) being able to withstand temperatures exceeding 700 degrees Fahrenheit without affecting its chemical or physical structure (or composition).

[0039] Generally, the outer wrap is made of a material that can be affixed to the outer surface of the noise suppressor (or at least a portion of the outer surface of the noise suppressor) after both end caps have been affixed to adjacent components of the noise suppressor (i.e., the proximal end cap affixed to the blast chamber and the distal end cap affixed to the distal baffle, and the like), which cannot be accomplished with conventional noise suppressors that utilize a tube to slide over the outer surface prior to at least one of the end caps being welded or affixed to another component of the noise suppressor. According to some embodiments, such as those that include carbon fiber as the material for the outer wrap, the outer wrap may be wrapped or wound around (or over) the circumferential outer surface of at least the plurality of baffles, the blast chamber, and at least portions of each end cap. Wrapping or winding the outer wrap around at least a portion of the outer surface of the internal components of the noise suppressor, in some cases, might comprise winding carbon fiber filaments under tension over a rotating mandrel (in this case, the assembled internal components of the noise suppressor themselves) while impregnating the wound carbon fiber filaments in the resin, and curing the resin once the carbon fiber filaments are wound to the desired thickness around the internal components in a process that is referred to as filament winding composite structure fabrication. Alternatively, the carbon fiber may be affixed (i.e., wound and/or wrapped) around (at least a portion of the outer surface of) the internal components of the noise suppressor by other techniques as understood by those skilled in the art.

[0040] FIG. **3** shows a cross sectional side view of the noise suppressor **100** of FIGS. **1** and **2** without the carbon fiber outer wrap of the present invention. When the components of noise suppressor **100** are assembled, interfaces **165** and **170** (which may, in some cases, be circular interfaces, or the like) between proximal end cap **105** and blast chamber **150** are affixed together. Similarly, interfaces **175** and **180** (which may, in some cases, also be circular interfaces, or the like) between distal end cap **110** and baffle distal baffle **145** are affixed together. In one embodiment, interfaces **165** and **170** are welded to each other, while interfaces

175 and 180 might be welded to each other. Once interfaces 165 and 170 are affixed together and interfaces 175 and 180 are likewise affixed together, carbon fiber outer wrap 115 is applied to a portion of the outer surface of noise suppressor 100 as shown in FIGS. 1, 2, and 4. FIG. 4 shows a perspective view of the noise suppressor 100 of FIGS. 1 and 2.

[0041] Because carbon fiber outer wrap 115 can be applied to the outer surface of noise suppressor 100 after the assembly of all the other components of noise suppressor 100, interfaces 165 and 170 can be welded together and interfaces 175 and 180 can likewise be welded together. Welding together the pairs of interfaces 165/170 and 175/180 significantly increases the strength of noise suppressor 100. This is a significant improvement over existing noise suppressors, which use a metal outer tube around a portion of the outer surface of the noise suppressor. During assembly of such conventional noise suppressors, the metal outer tube is slid over the internal components and then affixed to proximal and distal end caps, which covers similar interfaces 165 through 180 in these conventional noise suppressors, thereby preventing at least a portion of these interfaces from being welded together. As a result, many conventional noise suppressors are weaker at these interfaces.

[0042] After the end caps 105 and 110 are affixed to the internal components of the noise suppressor, the carbon fiber outer wrap 115 is applied to a portion of the outer surface of the suppressor. Typically, the suppressor is rotated while the carbon fiber outer wrap 115 is wrapped around the portion of the outer surface of the suppressor 100. In addition, in an embodiment of this invention, an ultra-high temperature polyimide resin is added to the carbon fiber. The resin affixes the carbon fiber outer wrap to the suppressor. The resin must have a high thermal stability or thermostability in order to withstand the extreme operating temperatures of the noise suppressor 100. By way of example, the MVK-19 ultra-high temperature polyimide resin sold by Maverick Corporation headquartered at 11379 Grooms Road, Blue Ash, Ohio 45242, has been utilized by the inventor to successfully practice an embodiment of this invention where the operating temperature of the noise suppressor was over 700 degrees Fahrenheit.

[0043] FIG. 5 is a flow diagram illustrating a method 200 for assembling a noise suppressor, in accordance with various embodiments.

[0044] While the techniques and procedures are depicted and/or described in a certain order for purposes of illustration, it should be appreciated that certain procedures may be reordered and/or omitted within the scope of various embodiments. Moreover, while the method 200 illustrated by FIG. 5 is applicable to the embodiments of noise suppressor 100 of FIGS. 1-4, such method may also be applicable to any suitable noise suppressor. Similarly, while the embodiments of noise suppressor 100 of FIGS. 1-4 may be assembled according to method 400 illustrated by FIG. 5, the embodiments of noise suppressor 100 of FIGS. 1-4 may be assembled according to other suitable methods of assembly of noise suppressors.

[0045] In the non-limiting embodiment of FIG. 5, method 200, at block 205 might comprise aligning a plurality of baffles (which might correspond to baffles 120-145 of FIG. 2 or 3, or the like) along a central axis (which might correspond to axis 155 of FIG. 2, or the like), the plurality of baffles comprising a proximal baffle (e.g., baffle 120 of FIG. 2 or 3, or the like) and a distal baffle (e.g., baffle 145 of FIG. 2 or 3, or the like). At block 210, method 200 might comprise disposing a blast chamber (which might correspond to blast chamber 150 of FIG. 2 or 3, or the like) along the central axis, adjacent to the proximal baffle (e.g., baffle 120). Method 200 might further comprise affixing a proximal end cap (which might correspond to end cap 105 of FIG. 2 or 3, or the like) to the blast chamber (e.g., blast chamber 150) (block 215) and affixing a distal end cap (which might correspond to end cap 110 of FIG. 2 or 3, or the like) to the distal baffle (e.g., baffle 145) (block 220). Method 200 might further comprise, at block 225, affixing an outer wrap (which might correspond to outer wrap 115 of FIG. 1, 2, or 4, or the like) to at least a portion of an outer surface, the outer surface being defined by an outer circumferential surface of the plurality of baffles (e.g., baffles 120-145), the blast chamber (e.g., blast chamber 150), the proximal end cap (e.g., end cap 105), and the distal end cap (e.g., end cap 110), when the plurality of baffles (e.g., baffles 120-145), the blast chamber (e.g., blast chamber 150), the proximal end cap (e.g., end cap 105), and the distal end cap (e.g., end cap 110) are assembled to form a noise suppressor (such as noise suppressor 100 of FIGS. 1-4, or the like).

[0046] According to some embodiments, the outer wrap might comprise a carbon fiber outer wrap. In some embodiments, affixing the outer wrap to the at least a portion of the outer surface (at block 225) might comprise applying a resin (such as the ultra-high temperature polyimide resin or the like, as described above) to the at least a portion of the outer surface; wrapping the carbon fiber outer wrap around the at least a portion of the outer surface, with the carbon fiber outer wrap in physical contact with the resin; and curing the resin, thereby affixing the carbon fiber outer wrap to the at least a portion of the outer surface. In some cases, these processes for affixing the outer wrap might be consistent with filament winding composite structure fabrication techniques as described above. Alternatively, the outer wrap may be affixed to the at least a portion of the outer surface by other techniques. In various embodiments, the resin has a thermal stability of at least 700 degrees Fahrenheit, in order to withstand the extreme operating temperatures of the noise suppressor.

[0047] Merely by way of example, in some aspects, affixing the proximal end cap to the blast chamber (at block 215) and affixing the distal end cap to the distal baffle (at block 220) might comprise welding the proximal end cap to the blast chamber and welding the distal end cap the distal baffle, respectively. In some embodiments, prior to affixing the outer wrap to the at least a portion of the outer surface (at block 225), method 200 might further comprise welding the blast chamber to the proximal baffle (e.g., baffle 120), and in some cases, additionally comprising welding each of the plurality of baffles to an adjacent baffle.

[0048] Some embodiments include a noise suppressor comprising an outer wrap (in some cases, a carbon fiber outer wrap) as described above and shown in the drawings. Other embodiments might provide other combinations of baffles, baffle notches, and alignment mechanisms utilized in noise suppressors with greater or less than the number of baffles disclosed above and other configurations of noise suppressors, which include, without limitation, the suppressors described in the Related Applications, which are already incorporated herein by reference in their entirety for all purposes.

[0049] While certain features and aspects have been described with respect to exemplary embodiments, one skilled in the art will recognize that numerous modifications are possible. Similarly, while certain functionality (e.g., heat distribution, thermal stability or thermostability, etc.) is ascribed to certain system or hardware components, unless the context dictates otherwise, this functionality can be distributed among various other system components in accordance with the several embodiments.

[0050] Moreover, while the procedures of the methods and processes described herein are described in a particular order for ease of description, unless the context dictates otherwise, various procedures may be reordered, added, and/or omitted in accordance with various embodiments. Moreover, the procedures described with respect to one method or process may be incorporated within other described methods or processes; likewise, system components described according to a particular structural architecture and/or with respect to one system may be organized in alternative structural architectures and/or incorporated within other described systems. Hence, while various embodiments are described with—or without—certain features for ease of description and to illustrate exemplary aspects of those embodiments, the various components and/or features described herein with respect to a particular embodiment can be substituted, added and/or subtracted from among other described embodiments, unless the context dictates otherwise. Consequently, although several exemplary embodiments are described above, it will be appreciated that the invention is intended to cover all modifications and equivalents within the scope of the following claims.

What is claimed is:

1. A noise suppressor for a firearm, comprising:

a central axis;

an outer surface;

a plurality of baffles, the plurality of baffles being disposed along the central axis, the plurality of baffles comprising a proximal baffle and a distal baffle;

a blast chamber;

a proximal end cap, the proximal end cap being coupled to the proximal baffle via the blast chamber, when the noise suppressor is assembled;

a distal end cap, the distal end cap being affixed to the distal baffle, when the noise suppressor is assembled; and

an outer wrap, the outer wrap being affixed to at least a portion of the outer surface, when the noise suppressor is assembled.

2. The noise suppressor of claim **1**, wherein the outer wrap comprises a carbon fiber outer wrap.

3. The noise suppressor of claim **2**, wherein the carbon fiber outer wrap is affixed to the at least a portion of the outer surface in part with a resin.

4. The noise suppressor of claim **3**, wherein the resin has a thermal stability of at least 700 degrees Fahrenheit.

5. The noise suppressor of claim **1**, wherein:

the proximal end cap is affixed to the blast chamber by a first weld;

the blast chamber is affixed to the proximal baffle by a second weld; and

the distal end cap is affixed to the distal baffle by a third weld.

6. A noise suppressor for a firearm, comprising:

a central axis;

an outer surface;

a proximal end cap;

a distal end cap;

a plurality of baffles, the plurality of baffles being assembled adjacent to each other along the central axis between the proximal end cap and the distal end cap, the plurality of baffles, when assembled together, being disposed within the outer surface; and

an outer wrap, the outer wrap being affixed to at least a portion of the outer surface between the proximal end cap and the distal end cap, when the noise suppressor is assembled.

7. The noise suppressor of claim **6**, wherein the outer wrap comprises a carbon fiber outer wrap.

8. The noise suppressor of claim **7**, wherein the carbon fiber outer wrap is affixed to the at least a portion of the outer surface in part with a resin.

9. The noise suppressor of claim **8**, wherein the resin has a thermal stability of at least 700 degrees Fahrenheit.

10. The noise suppressor of claim **6**, further comprising:

a blast chamber disposed between the proximal end cap and a first baffle of the plurality of baffles.

11. The noise suppressor of claim **10**, wherein:

the proximal end cap is affixed to the blast chamber by a first weld;

the blast chamber is affixed to the first baffle by a second weld; and

the distal end cap is affixed to a second baffle by a third weld.

12. The noise suppressor of claim **10**, wherein each of the plurality of baffles is affixed to an adjacent baffle of the plurality of baffles by a fourth weld.

13. A method, comprising:

aligning a plurality of baffles along a central axis, the plurality of baffles comprising a proximal baffle and a distal baffle;

disposing a blast chamber along the central axis, adjacent to the proximal baffle;

affixing a proximal end cap to the blast chamber;

affixing a distal end cap to the distal baffle; and

affixing an outer wrap to at least a portion of an outer surface, the outer surface being defined by an outer circumferential surface of the plurality of baffles, the blast chamber, the proximal end cap, and the distal end cap, when the plurality of baffles, the blast chamber, the proximal end cap, and the distal end cap are assembled to form a noise suppressor.

14. The method of claim **13**, wherein the outer wrap comprises a carbon fiber outer wrap.

15. The method of claim **14**, wherein affixing the outer wrap to the at least a portion of the outer surface comprises:

applying a resin to the at least a portion of the outer surface;

wrapping the carbon fiber outer wrap around the at least a portion of the outer surface, with the carbon fiber outer wrap in physical contact with the resin; and

curing the resin, thereby affixing the carbon fiber outer wrap to the at least a portion of the outer surface.

16. The method of claim **15**, wherein the resin has a thermal stability of at least 700 degrees Fahrenheit.

17. The method of claim **13**, wherein:

the proximal end cap is affixed to the blast chamber by a first weld;

the blast chamber is affixed to the proximal baffle by a second weld; and

the distal end cap is affixed to the distal baffle by a third weld.

18. The method of claim **13**, wherein each of the plurality of baffles is affixed to an adjacent baffle of the plurality of baffles by a fourth weld.

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